

CHALMERS



Traffic information to persons with cognitive disabilities

A project made on behalf of the Swedish Transport Administration

*Master of Science Thesis in the Master Degree Programme Industrial
Design Engineering*

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Department of Product and Production Development
Division of Design & Human Factors
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden, 2012

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Preface

This master thesis project has been performed on behalf of the Swedish Transport Administration by a master student at the Industrial Design Engineering program at Chalmers University of Technology.

I would like to especially thank the following persons:

- > Alice Dahlstrand at the Swedish Transport Administration
- > Anna Hansson at the Swedish Transport Administration
- > Ralf Rosenberg at Chalmers University of Technology

All three has been tutors during this master thesis and has supported my work in different ways.

I would also like to thank all person involved from SRF Göteborg, HRF Göteborg, HRF Västra Götaland and RTAF region väst (former Tillgänglighetsrådet region väst).

Göteborg, June 2012

Anna Lundberg

Abstract

This report is based upon a master thesis project written at the program Industrial Design Engineering at Chalmers University of Technology. The project is carried out on behalf of the Swedish Transport Administration and aims to above all inspire the Swedish Transport Administration to new solutions of the information which is today announced by speakers at train stations all over Sweden. This type of information mainly concerns changes that have been done due to for example delays and instructions regarding how the passengers should act in those unexpected situations.

The reason this has to be improved is partly the fact that a lot of the passengers have difficulties hearing what is said in the announcements which results in unsatisfied customers but also that the Swedish Transport Administration has got a mission on behalf of the government to adapt all public transport to persons with disabilities. A part of this is the traffic information.

The work has throughout the whole process been focused at the users and their needs. The user groups given most focus have been people with hearing or visual impairments of varying degrees since those are two of the groups that are likely to have most trouble if the information does not reach them. Those are also two groups that are hardest to find solutions for, especially with aids of the same information type.

The process has consisted of a literature study and interviews by both users and professionals followed by a user study and an analysis phase. After that the requirements were established and a product development phase was started. Different methods which are commonly used at the program Industrial Design Engineering have been used and at last resulted in several concepts of solutions.

The outcome of the project consists of a combination of solutions which aims foremost at the passengers at the train stations that are concerned by the information.

Keywords: Product Development, Industrial Design Engineering, Traffic Information, Cognitive disabilities

Sammanfattning

Den här rapporten baseras på ett examensarbete från linjen Teknisk Design på Chalmers. Projektet är utfört på uppdrag av Trafikverket och syftar till att framför allt inspirera Trafikverket till nya lösningar av den typ av information som i dag ropas ut i högtalare på tågstationer över hela Sverige. Informationen rör främst ändringar som uppkommit i sista sekund på grund av till exempel förseningar samt instruktioner om hur passagerarna bör handla i dessa oförutsedda situationer.

Anledningen att denna behöver förbättras är dels att många passagerare har svårt att höra vad som sägs i utropen, vilket resulterat i onöjda kunder, samt att Trafikverket har ett uppdrag från regeringen att anpassa alla kollektivtrafikslag så att de passa personer med funktionsnedsättningar. Som en del i detta ingår trafikinformationen.

Arbetet har genom hela processen fokuserat på användarna och deras behov. De användargrupper som varit i fokus är personer med nedsatt hörsel eller nedsatt syn av olika grad eftersom detta dels är grupper som drabbas hårdast om informationen inte når ut ordentligt samt är det är svårtast att nå ut till dessa, särskilt med samma slags informationstyp.

Processen för arbetet har bestått av en litteratur studie samt intervjuer av både användare och sakkunniga följt av en användarstudie och analysfas. Därefter fastslogs kraven för en framtida lösning och en produktutvecklingsfas påbörjades. Olika metoder som är vanligt förekommande på linjen Teknisk Design har använts för att till sist resultera i flera koncept på lösningsförslag.

Resultatet av projektet består av en kombination av lösningar som riktar sig framför allt till de passagerarna på tågstationen som berörs utav informationen.

Nyckelord: Produktutveckling, Teknisk design, Trafikinformaton, Kognitiva funktionshinder

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1 Introduction

1.1 Background

The Swedish Transport Administration (Trafikverket) is a Swedish public administrative authority agency that started 2010. The agency is responsible for all modes of traffic: traffic on roads and railways, on the sea and in flight. The Swedish Transport Administration also build, maintain, and operate all national roads and railway. (*the Swedish Transport Administration's website, 2011*) They work with all modes of transport and has taken over the tasks of the National Rail administration (Banverket) and the Swedish Road administration (Vägverket), which both were phased out. (*Pocket Facts 2010*)

As a part of the tasks the Swedish Transport Administration should provide traffic information at train stations all over Sweden both in regular situations, for example time of departure, and in case of delays or other changes. The traffic information is today spread through a loudspeaker system accompanied by signs and screens.

The Swedish Transport Administration travelers' panel (Resenärspanelen Väst, 2011) show that travelers all along the line are unsatisfied with the spoken traffic information system at waiting lounges and station platforms. This is a problem all year but especially during winter when there are an increased need for traffic information due to weather related delays.

To have a well operating system for spoken traffic information is consequently of big importance to all passengers, but especially for people with hearing defects or vision impairment, which is especially common among elderly people. According to Alice Dahlstrand at the Swedish Transport Administration the amount of people over 80 years old will be more than doubled in the next 20 years.

"To be active and able to deal with your everyday activities affect the satisfaction of life."

Quotation taken from "86-åringars vardagsteknologi" issued by the Swedish Institute of assistive technology.

In excess of unsatisfied passengers when it comes to spoken traffic information, there is a mission on behalf of the government to adapt all public transport to persons with disabilities (*Från patient till medborgare, 2000*) The mission is grounded within the United Nations conventions of human rights (FN:s konventioner om mänskliga rättigheter, 2006) and says that the government and parliament has stated, within the disability politics, that accessibility is at bottom a democracy question and that every human has equal value and should be able to participate in the society. It is stated in the mission that a prioritized grid of public transportation should be accessible for disabled people at last 2010. (*KOLL framåt, 2007*) This work has been started but is still under construction.

To be able to satisfy that demand the Swedish Transport Administration have to, among other things, improve their way of getting the traffic information to reach all passengers.

1.2 Purpose and goal

The purpose of the project is to inspire The Swedish Transport Administration within the area of better solutions for traffic information, through working out user requirements and some proposals of improvements. The approach will be first to define the problem, interview users and professionals, do a comparison with similar situations, look at the quality aspect, find out why the sound today is unclear etcetera. Later on in the project will deal with how the way of thinking regarding this problem should be and also to develop possible solutions. The goal is to find solutions that work for all sorts of passengers.

1.3 Limitations

- The project is limited to train stations.
- Even if the project consist of train stations all over Sweden and should work for both small and large train stations, most observations etc. will be made in the Göteborg area.
- The traffic information has in this project been defined and divided into two categories; invariable information and variable information. Invariable information being defined as information that does not change, for example information on stationary signs, whilst variable information being defined as information that does change. The variable information is in itself divided into two categories, urgent information and not so urgent information. Focus will be on the urgent variable information, which today is mainly given by loudspeakers.
- The aspect of user benefits will be prioritized in favor of costs, material, dimensions etc.
- The possible solutions should work well for all passengers but above all focus on persons with hearing defects or vision impairment.

1.4 Expected result

- Facts of the area
- User requirements
- Guidelines
- Product concepts

1.5 Structure of the report

The report is divided into introduction, realization, research phase, concluding phase and concept generation phase. Thereafter follows result, discussion and conclusions from the project.

- The research phase contains project definition, pre study and user study.
- The concluding phase contains personas, analysis and requirement formulation.
- The concept generation phase contains concept generation and concept selection.

After several selected chapters the reader will find boxes with conclusions and highlights from previous chapter, those contains repetition of important facts. Selected documents developed during the project can be found in Appendix.

2 Realization of the project

2.1 Work phases

The master thesis has been divided into 9 work phases. These reflect how a standard project at the Industrial Design Engineering program at Chalmers University of Technology is usually realized.

Phase 1 - Project definition

Gain insight into the problem, define the project, profile users, plan the project.

Phase 2 – Pre study

Gain insight into today's traffic information system and similar systems through literature studies, observations and interviews.

Phase 3 – User study

Gain insight into the critical users' situation through interviews, focus groups and questionnaires.

Phase 4 – Personas

Describe the problem for three characteristic users.

Phase 5 – Analysis

Put together and analyze all collected data and visualize it through several analyze methods and diagrams.

Phase 6 – Requirement formulation

Visualize the problem by expression board, and sum up the result of the analyses through an requirement specification

Phase 7 – Concept generation

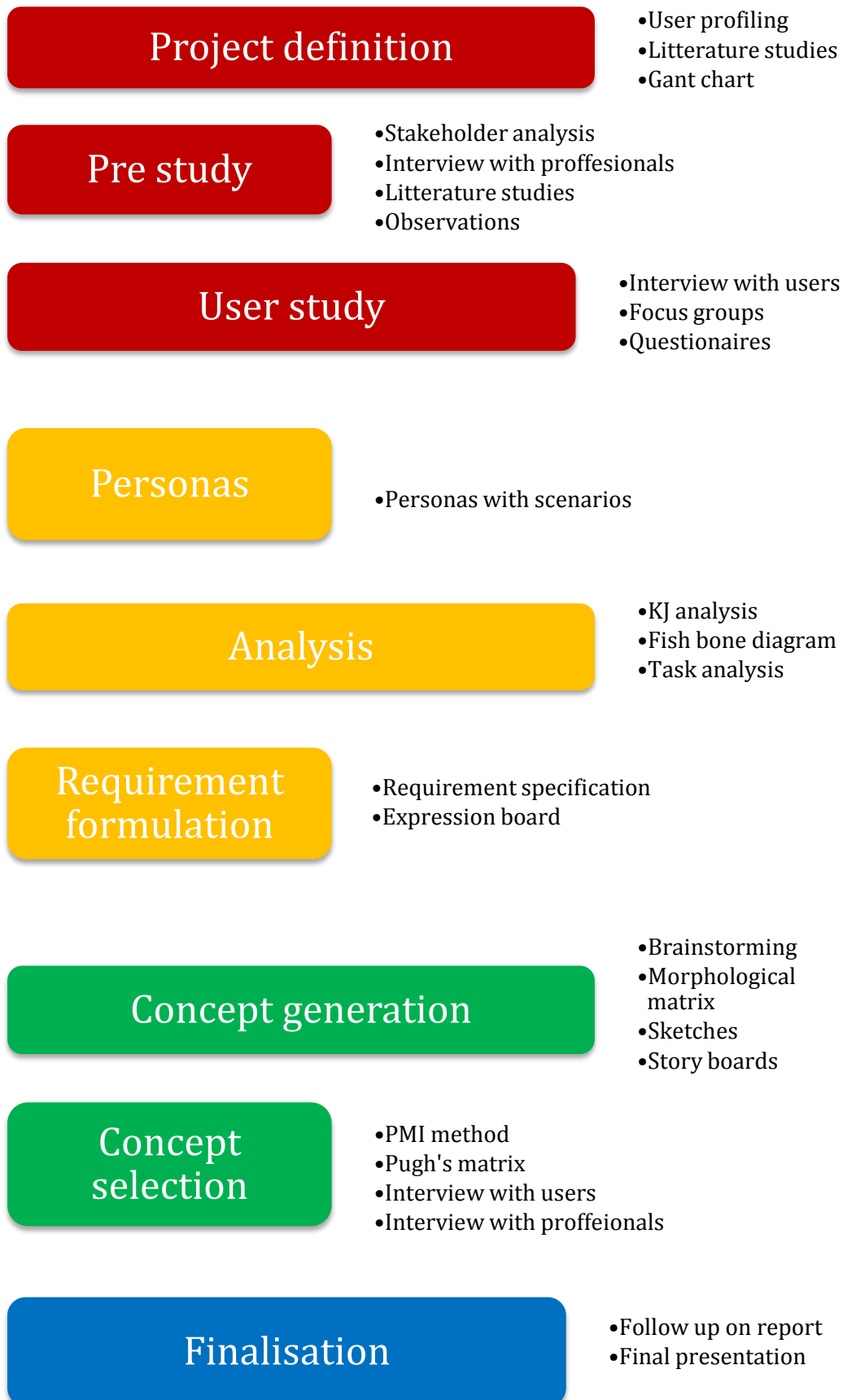
Generation of solutions with aids of personas, scenarios, morphological matrix and a brainstorming workshop with a group of students. Also visualize possible solutions through for example drawings, story boards and the PMI method.

Phase 8 – Concept selection

Evaluate the possible solutions through interviews with both users and professionals as well as through Pugh's matrix. A return to phase 6 and 7 will be necessary.

Phase 9 – Finalization

Most parts of the project report will be written throughout the project, rest of it will be finished within this phase. Final presentation will be held at Chalmers University of Technology.



2.2 Methods

Project definition

- **User profiling:** Compilation of which users there are and which groups that is most helpful to use in the study. The user groups have in this project overlapped in order to not exclude users in between.
- **Literature studies:** Gathering of information by articles and websites. Most literature was provided from the Swedish transport administration.
- **Gant chart:** Chart showing different phases in a project and when those should be performed.

Pre study

- **Stakeholder analysis:** Compilation of the actors which could possibly have wishes and requirements of the product. Since there are a lot of local public transport companies in Sweden the analysis have been narrowed to the actors which have been involved in the project.
- **Interviews with professionals:** Questions concerning the background of the project have been answered by both e-mail, phone calls and in person.
- **Literature studies:** *See above*
- **Observation:** Observation implies that the analyzer herself observes the process she studies. (Karlsson, 2006) Observations have been done at Göteborgs central station, Stockholm central station and both train stations in Uddevalla.

User study

- **Interviews with users:** Questions concerning the users have been answered in person, either in focus groups or individually. In total 56 interviews with users have been performed.
- **Focus group:** A group of users is gathered in order to capture their opinions and requirements. (Karlsson, 2006)
- **Questionnaire:** A questionnaire is a question formulary handed out to users in order to collect opinions and thoughts from an outsider perspective. (Karlsson, 2006). In total 33 users have answered a questionnaire.

Personas

- **Personas:** A persona is a user profile created in order to visualize a realistic scenario with user and product. Using personas one or a few fictive users are presented with background and what their relationship to the product is. The aim is to clarify relationship and interaction between user and product in order to use the result in the design phase of the product. Personas should be based on real user data since they are to describe a realistic case (Cooper, 2003).
- **Scenarios:** A scenario is a constructed description of a thinkable user situation, used to present examples.

Analysis

- **KJ analysis:** Method used to structure big amounts of data from a field study. (Karlsson, 2006) All quotes and other information from the research phase were written on post-its and divided into groups of similar information.
- **Fish bone diagram:** A technique for structuring and present the connection between a problem and its possible cause (Karlsson, 2006).
- **Task analysis:** The task diagram is a tool to break down, for example, a problem or a user wish into smaller components at several levels. With aids of a task diagram it is possible to describe the relation between goal and means in a systematic way.

Requirement formulation

- **Requirement specification:** Compilation of all requirements and wishes in a chart.
- **Expression board:** An expression board is a picture presentation of the desired expression of the product. It has been used as a base in the concept generation phase.

Concept generation

- **Brainstorming:** Brainstorming is a development method used to develop design proposals and ideas. The aim of the method is to generate as many ideas as possible that either single handed or in combination can solve the expressed problem. (Österlin, 2003).
- **Morphological matrix:** Matrix that, in a systematic way, helps to develop ideas of solutions to each function the new product should contain. The matrix was based on three activities which needed suggestions of solutions. After these were compiled, combinations of them formed 7 concepts.
- **Sketches:** Sketching is a quick way of representing ideas in detail as well as in whole. In this project it has been exercised by hand with pen and paper since the projects ends at a concept stage rather than a detailed finished product.
- **Story board:** The story board refers to a basic description of how the product is to be used. It is made up by basic sketches linked together to show the flow of the usage of the product.

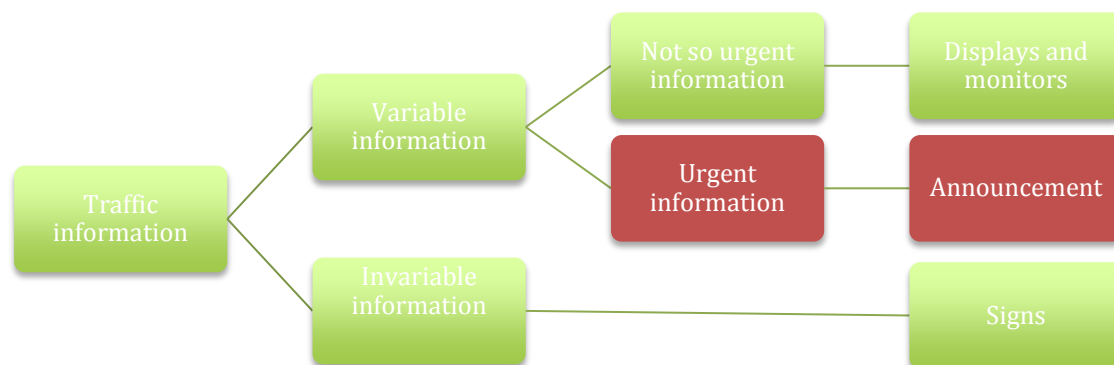
Concept selection

- **PMI method:** The PMI method was used after the concept development phase to evaluate different concepts. It lists the concepts properties that are positive, negative and interesting.
- **Pugh's matrix:** Concept evaluation method formed as a matrix. Different concepts are compared to the original solution and considered with the different requirements in mind.
- **Interviews with users and professionals:** Evaluation of the concepts have been carried out both by interviews in person and over e-mail.

3 Research phase

3.1 Project definition

The traffic information has in this project been defined and divided into two categories; invariable information and variable information. Invariable information being defined as information that does not change, for example information on stationary signs, whilst variable information being defined as information that does change. The variable information is in itself divided into two categories, urgent information and not so urgent information. Focus will be on the urgent variable information, which today is mainly given by loudspeakers. The definition and divide has been visualized below.



The problem is the users not having a good chance of receiving this kind of information, due to several reasons. The complexity of the problem is that, by definition, the users do not know in advance that they need this information so they are not expecting it. Before an ordinary train ride the passenger expects to arrive at the train station, find all needed information at the departure display and then continue the trip. When something unexpected happens and urgent information is given by loudspeakers the traveler's expectations are interrupted.

Many travelers become annoyed when expectations are interrupted but if the traveler in addition cannot hear the spoken information this leads to a very unsatisfied customer. A major portion of those customers are elderly people that might not even make their way to the train due to not hearing the information or even if hearing it, not being able to change route quickly enough.

The problem this project should solve is how to improve the conveying of urgent variable traffic information at train stations, so that most passengers are able to receive the information. The maximum focus throughout the whole process will be the user perspective. The aspect of user benefits will be prioritized in favor of costs, material, dimensions etc.

"Above all, research which consider not only technology but also the individual, the environment situated and the activities that are important to the individual is needed, substantially how the activity realization is affected."

Quotation taken from "86-åringars vardagsteknologi" issued by the Swedish Institute of assistive technology.

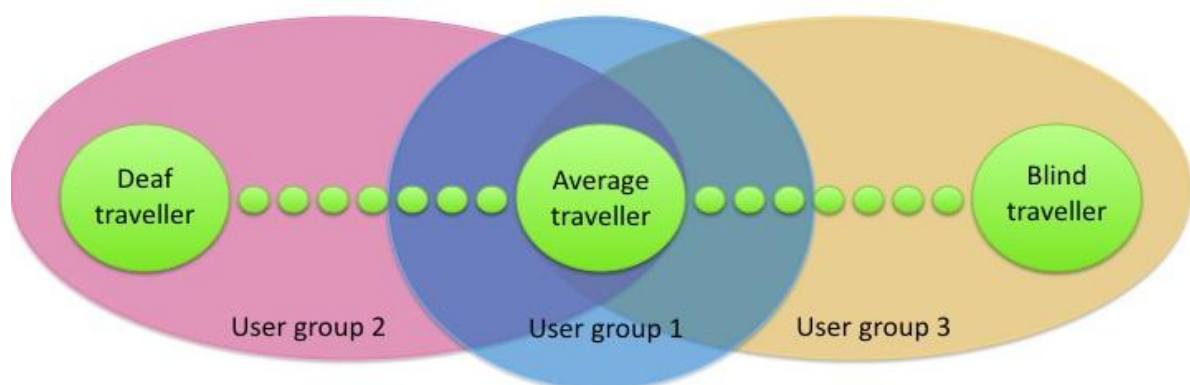
3.1.1 User profiling

Three user groups has been defined, two of them consisting, among others, of the most critical users. All user groups will be studied separately but with the hope to find a common solution in the end.

User group 1 includes the average traveler but also travelers with mild hearing- or vision impairments. This group manages quite well today but there are still many complaints regarding the spoken traffic information from this group.

User group 2 includes everyone from the average traveler to the deaf traveler that is all travelers with hearing impairments of varying extent.

User group 3 includes everyone from the average traveler to the blind traveler that is all travelers with vision impairments of varying extent.

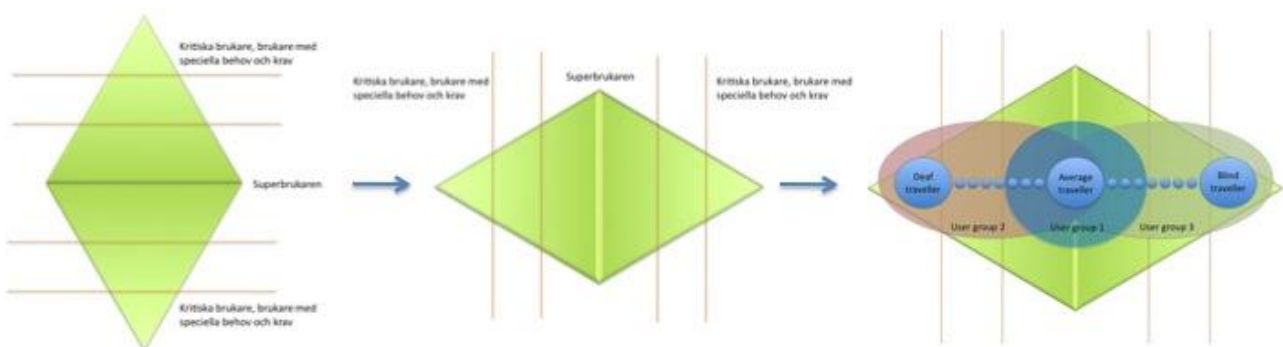


Within all three groups there are people with mental impairments, people with another native language than Swedish, children and elderly people. In fact a major portion of user group 2 and 3 are elderly people. In the present state the amount of people over 65 years increases strongly. Today there is 1,6 millions Swedish people over 65 years old, in seven years that amount will have increased to 2 millions. (*Alice Dahlstrand, the Swedish Transport Administration*) Persons which have to travel together with an attendant either way are not counted for.

The most critical users can be found in each end of the illustration above. The illustration below visualizes a pyramid of users, with the most critical users in the top and the ideal user in the bottom. There is certainly other combination of users that could have been chosen as "most critical" for the project, however those are the users decided by the project initiator at the Swedish Transport Administration. A perfect solution for one end of these users is almost bound to be a disaster for the other end so by combining both of them the hope is to find solutions working for both of them.



"Brukarpyramiden" by Ergonomi Design Gruppen



As an adaptation to this project the pyramid of users has been doubled and made into a lying rhomb to fit the user groups. It is, in this project, consequently presupposed that what is absolute necessary for some people will be useful for the generic public. However this is not entirely true, when designing only for the most critical users in the two ends of the rhomb the solution risks to fail the average traveler. Therefore, in this project, the goal is to design for travelers as far out in the ends of rhomb as possible but only while still satisfying the average traveler in the middle of the rhomb.

Conclusions and highlights of project definition:

The problem this project should solve is how to improve the conveying of urgent variable traffic information at train stations, so that most passengers are able to receive the information. This information is today given by loudspeakers. The complexity of the problem is that, by definition, the users do not know in advance that they need this information so they are not expecting it.

Three user groups has been defined, two of them consisting, among others, of the most critical users. The user groups has been illustrated in a lying rhomb where the goal is to design for travelers as far out in the ends of rhomb as possible but only while still satisfying the average traveler in the middle of the rhomb.

3.2 Pre study

The pre study consists of literature studies, interviews with professionals within the area as well as interviews with representatives from three disability unions within the Göteborg area.

3.2.1 Accessibility at train stations today

There is no commonly accepted definition of accessibility for disabled persons. Many within the disability unions mean that accessibility should be defined as a condition for full participation and equality in the society, whilst other means that accessibility is a more limited term (*Handikapprörelsens syn på tillgänglighet, 2006*). The European Union has decided upon rules regarding passengers' rights. These rules affect the work within the project "KOLL framåt" regarding arrangement for disabled persons. (*KOLL framåt, 2007*)

"KOLL framåt" is a national action program for the long term development of the public transportation system. According to "*Ett nationellt prioriterat nät av kollektivtrafik*" (2007) the goal is for more people to experience the public transportation system as facilitating the daily life, increases the accessibility to education and work as well as contributing to a better environment. For this to be accomplished it is crucial for the public transportation sector to be perceptive about the passengers' varying and changeable needs, contribute to coordinated overall solutions and be open for new ideas that contributes to a value adding sustainability. (*KOLL framåt, 2007*)

The most important aspects for fulfilling the customer's needs are (*according to KOLL framåt, 2007*) travelling time, frequency of departures, dependability, simplicity, perceptiveness, good information, a perspective of the trip as a whole and safety. Several of these aspects will be concerned in this master thesis project.

Some work of accessibility at train stations has already been done, one of these projects is called "Stationer för alla" and the goal is to, until 2015, have made 150 train stations more accessible so disabled, kids and elderly people are able to get on and off the trains. (*Stationer för alla, 2011*) Areas to be attended to are for example leading paths, Braille, signs, lifts, tactile station maps, lightning, resting places access ramps. (*Banverkets råd och riktlinjer, 2005*) There is also a passenger escort service available in several train stations.

An important issue when it comes to accessibility is that the whole trip have to be accessible. There is no point of just parts of the trip being accessible since in that case problems will arise anyway. (*Alice Dahlstrand, the Swedish Transport Administration*)

3.2.2 Spoken traffic information today

"*Resenärspanelen Väst*" (2011) emerge that there has been a lot of complaints aimed at the train traffic (The Swedish Transport Administration, Swedish Rail (SJ) and Västtrafik) the last winters. Winters in Sweden usually means cold weather and therefore a need for a lot of spoken traffic information in order to inform about delays due to bad weather.

"In spite of exhaustively opportunities to information and traffic delay information passengers thinks planning and booking is a handful and that the information is hard to find as well as uneven in quality."

(Quotation taken from KOLL framåt, 2007)

All kinds of passengers seem to be unsatisfied with both the traffic itself as well as today's spoken traffic information. The fact of many delays in the winters will not be discussed in this master thesis project but the fact that all kinds of people are having problems hearing the necessary information is crucial for this project.

The Swedish Transport Administration's project "Järda" is an investment of a digital voice synthesis that aims to acquire better quality of the sound with a more regular volume and clearer voice. *(Barbro Brehme, the Swedish Transport Administration)* The system has already been installed at some stations and more are to come during the following years.

3.2.3 Key points regarding sound and hearing impairments

Morgan Karlsson at "Västra Götalands regionen" work within the field of combined hearing- and vision impairments. Having both hearing- and vision impairments means not being able to compensate one of the impairments with the other, which is important to keep in mind in this project.

According to *Morgan Karlsson* sound is a cyclic variation of molecules in the air, when those have a high frequency many elderly people have trouble hearing the sound. Other good things to know is that sound is spread spherical out from the source, high frequency sound has a slightly more specific direction than low frequency sound and also if the distance to the source is halved the sounds becomes four times stronger. Three arrangements that can be done in order to improve hearing is to direct the sound, reduce the distance and using hearing aids.

In order to accomplish a better sound environment HRF has put together six demands for the society to comply:

- 1. Maintain action plans for better sound environments**
- 2. Legislate sound classification A in sites of communication and concentration**
- 3. Sharpen noise directions in sites of communication and concentration**
- 4. Bring in guideline values for sound in cafés, restaurants and assembly halls**
- 5. Educate key persons about sound environment**
- 6. Increase the research of the area**

Furthermore it is described that one of the arrangements is to increase the understanding for the users' situation and needs, which should be central for the way of working with those questions. *(HRF's Befria samtalet, 2011)*

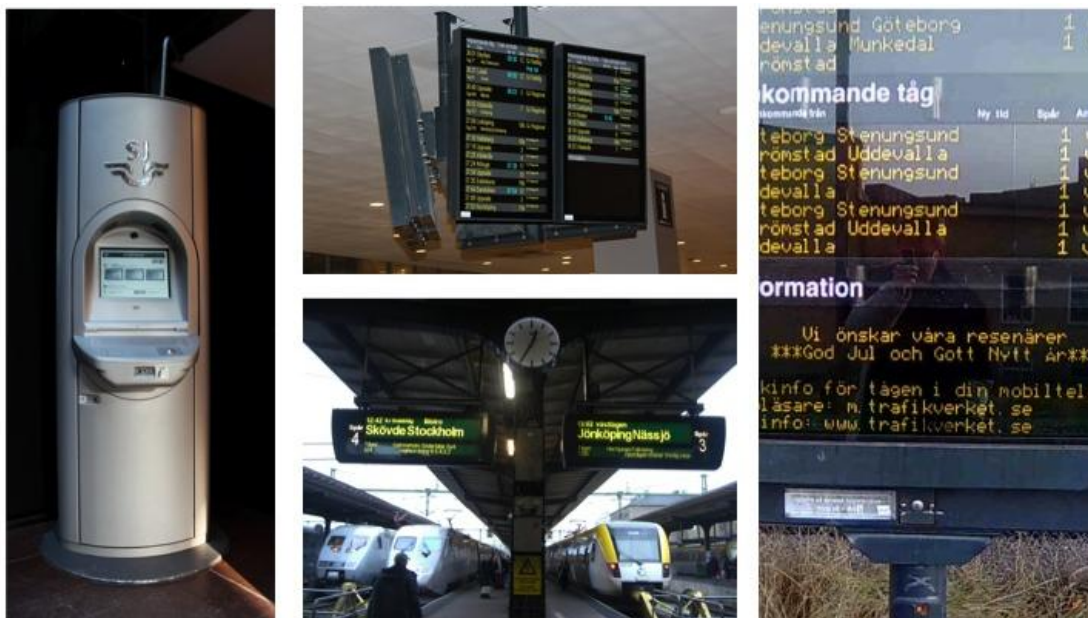
3.2.4 Stakeholder analysis

Except for the users and the Swedish Transport Administration there are others involved that will probably gain from this master thesis project, these are:

- **RTAF region väst ("Råd för tillgänglighet och användbarhet för personer med funktionsnedsättning", former "Tillgänglighetsrådet")**
Includes commissioners from both several public transport companies and several disability unions from the area. RTAF region väst will be involved in both presentations and discussions.
- **HRF Göteborg**
The local disability union for people with hearing impairments. HRF Göteborg will be involved in the user study.
- **HRF Västra Götaland**
Another disability union for people with hearing impairments. HRF Västra Götaland will be involved in the user study.
- **SRF Göteborg**
The local disability union for people with vision impairments. SRF Göteborg will be involved in the user study.
- **Västtrafik**
The local public transport company. Västtrafik will be involved in comparisons.

3.2.5 Impression of the context

The environment at the train stations gives the impression of a lot of information. There are several notice boards and texts directed at the user, even at smaller stations.



3.2.6 Similar situations and projects to take into consideration

Situations where similar problems occur:

- **Entry phones**
Problems occur when people with hearing impairment are expected to use entry phones in order to get into houses.
- **Fire alarm in common areas**
There are examples where people with hearing impairment have stayed in their hotel rooms when there was a fire since they did not hear the alarm.

Studies where similar problems are being looked at:

- **The Swedish Transport Administration's "prator"**
Another study made by the Swedish Transport Administration regarding traffic information at train stations. The considered information distributed is such to be expected in the train station.
- **Västtrafik's "pratort"**
Västtrafik are trying out five tram stations in Göteborg where the traffic information is being read to the user. These are activated by pushing a button.
- **e-Adept**
Project for electronic assistance for disabled and elderly pedestrians and travelers that works as navigational support, travelling planner and alarm. The service is offered for mobile phone as well as hand held computer with phone functions. (*E-adept, 2012*)

Conclusions and highlights of pre study:

The European Union has decided upon rules regarding passengers' rights. These rules affect, among other things, the work regarding arrangement for disabled persons. Some work of accessibility at train stations has already been done, one of these projects is called "Stationer för alla" and the goal is to, until 2015, have made 150 train stations more accessible so disabled, kids and elderly people are able to get on and off the trains.

All kinds of passengers seem to be unsatisfied with both the traffic itself as well as today's spoken traffic information. Except for the users and the Swedish Transport Administration there are others involved that will probably gain from this master thesis project, these are: RTAF region väst, HRF Göteborg, HRF Västra Götaland, SRF Göteborg and Västtrafik, which are all involved in one way or another in the project.

3.3 User study

User studies have been performed at HRF Göteborg, HRF Västra Götaland, SRF Göteborg and at Göteborg's central station. It has consisted of interviews, focus groups and questionnaires. In total 52 users have been interviewed whereof 30 separately, in total 33 persons have answered a questionnaire. Examples of both interviews and questionnaires used can be found in Appendix. The users have been divided into three user groups, as defined in chapter 3.1.1 User profiling.

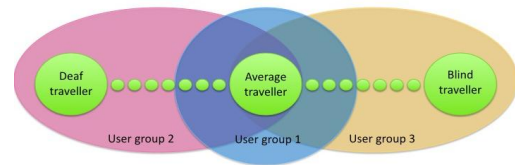


Illustration of the three user groups, larger picture can be seen in page 6.

3.3.1 User group 1

User group 1 includes the average traveler but also travelers with mild hearing- or vision impairments. This group manages quite well today but there are still many complaints regarding the spoken traffic information from this group.

Even if most people in user group 1 is able to see and hear properly there is another commonly "impairment" to be found specifically in this group: the desire to make everything at once in as little time as possible which often results in stress. The website www.pendlarstress.se is the result of a street photo project dedicated to document this phenomenon. (Pendlarstress, 2012) In addition to this many passengers in this user group wears headphones which makes them not able to hear spoken information.



Pictures taken from www.pendlarstress.se

It is a common opinion in user group 1 that it is hard to hear what is said in today's spoken traffic information. It is also considered bad service when things do not turn out to be as were planned.

3.3.2 User group 2

User group 2 includes everyone from the average traveler to the deaf traveler that is all travelers with hearing impairments of varying extent.

The general impression of group 2 is that most wishes for some kind of visual information even for the urgent traffic information. Besides the announcements their travels are working well but the possibility of missing out of necessary information leads to enervating consequences. Having to ask other passengers for help is not appreciated, several people express that they rather track a display even if that would mean walking a bit especially at the larger train stations. The same thing goes for tracking a personal device looking for urgent information, for example via SMS, as long as they are aware that it might appear. One person appoints that the tickets often are delivered to the phones anyway so he might as well have the information there also.

It appears that it is hard to get hearing devices to work properly at train stations because of magnetic fields around the trains. It is also important to have in mind that there is a huge variation of hearing impairments, for example loss of direction hearing, noise damages leading to not hearing high frequencies etcetera.

Characteristic for both user group 2 and 3 is that those users are well prepared before travelling with public transportation; in addition to that they also seem to have more presence of mind at the situation when at the platform.

3.3.3 User group 3

User group 3 includes everyone from the average traveler to the blind traveler that is all travelers with vision impairments of varying extent.

In contrast to user group 2 this group wishes for some kind of better spoken information. There are complaints about the quality of the announcements as well as the small amount of time before they have to take action and for example find the replacement bus. However, if the quality would be better they would prefer additional kind of traffic information to be announced as well. Requested information is among other things the order of the coupes. Many in this group are having trouble reading today's displays because of the text size and height of the displays. A general opinion in this group is that there is often better quality at the announcements at the trains than at the platforms.

There is a high middle age among people with visual impairments. Several people point out that they miss the personal service from the older days. The passenger escort service is therefore much appreciated. But even if the technology society of today has caused some problems it has also resulted in several clever solutions for all kinds of disabilities. There are split opinions regarding the use of mobile phones, some think it is hard to see anything at all at the screen and others very much appreciate the opportunity to zoom on the screen and to have things read out by their phones.

Conclusions and highlights of user study:

User studies have been performed at HRF Göteborg, HRF Västra Götaland, SRF Göteborg and at Göteborg's central station. It has consisted of interviews, focus groups and questionnaires. The users have been divided into three user groups, as defined in chapter 3.1.1 User profiling.

User group 1 (mostly average travelers) often have a desire to make everything at once in as little time as possible which often results in stress. In addition to this many passengers in this user group wears headphones which makes them not able to hear spoken information.

User group 2 (mostly travelers with hearing impairments) wishes in general for some kind of visual information even for the urgent traffic information. Having to ask other passengers for help is not appreciated, several people express that they rather track a display even if that would mean walking a bit especially at the larger train stations.

User group 3 (mostly travelers with vision impairments) group wishes for some kind of better spoken information. Furthermore, if the quality would be better they would prefer additional kind of traffic information to be announced as well.

Characteristic for both user group 2 and 3 is that those users are well prepared before travelling with public transportation; in addition to that they also seem to have more presence of mind at the situation when at the platform.

4 Concluding phase

4.1 Personas with scenarios

Personas is usually used as triggers for brainstorming, in this case three fictive users has been described. All three personas have trouble traveling due to an unsatisfying traffic information system, what can be done about it?

Persona 1

Alice Andersson, 30 years old, works as a management consultant in Stockholm. She takes the same train from Uppsala every weekday morning and always arrives to the train central exactly 4 minutes before departure. Imagine Alice on a Wednesday morning arriving to the train station in the same time as usual, wearing a nice fitted suit and high heels, drinking a cup of take away coffee. Alice likes to be efficient, therefore she is listening to her course of Mandarin in the same time as she are trying to browse through her key points for her morning meeting. This morning there is an announcement about her train departing from a new platform but Alice does not realize this until she is at the usual platform since she did not hear the announcement.

Persona 2

Gärda Nilsson, 75 years old, considers herself a sharp and healthy lady at her best age. She loves to take day trips discovering new things or visiting her grand kids in the big town close by. Problems can sometimes occur since she is not really hearing as good as she claims anymore. Suppose that Gärda after a lovely day with her grand kids were going back home, quite exhausted, longing to sink down in her comfortable sofa watching her favorite TV show one hour later. There are a whole lot of noisy youngsters at the train station so when there is an announcement made about a delay of her planned trip followed by a suggested trip she cannot make out the words. To be honest she is not so sure she would have been able to anyway.

Persona 3

Marek Barecki, 50 years old, is living in Malmö where he use to be a bus driver but has been prematurely retired because of his vision impairment that has become much worse the last year. Marek misses his time on the roads and wants to make his new free time into an opportunity of travelling around Sweden, since he had not seen anything outside Skåne since he moved here from Poland ten years ago. Unfortunately, on his first day of planned travelling he has a hard time to make out the announcements at the train station and since he cannot read the sign very well due to his vision impairment his confidence of being able to travel alone disappear.

4.2 Analysis

In the analysis all data collected within the research phase has been put together and visualized through three different analyze methods; KJ analysis, Fishbone diagram and Task analysis. This is to get at better picture of the collected data.

4.2.1 KJ analysis

KJ analysis is a method used to structure big amount of data from a study, here all quotes from the user study has been gathered and put together into categories. Some examples of quotations follow here:



KJ analysis made by post-its

Target group

- *"Due to my hearing impairment I always travel with my attendant."*
- *"All people have cognitive disabilities."*

Preperation

- *"If you have a disability you will prepare a lot before travelling, especially through internet."*
- *"There are no problems before I arrive to the train station, but well there sometimes something unexpected appears."*

Quality of todays speakers

- *"Today's speakers are useless. The information should be written somewhere."*
- *"Why is there a male voice in Järda? I would have preferred a distinct and clear female voice instead."*
- *"Best acoustic is achieved when there is no echoing. Today there is a time lag at several places at the station platform."*

Technological devices

- *"I think it will take probably 15-20 years before everyone has a mobile phone."*
- *"Even if you adapt the information to work well for people with an hearing aid, people with even worst hearing impairments are still excluded."*
- *"I think hearing loops can only be used inside."*

Suitabe for everyone

- *"Avoid special solutions! They are not financial defensible."*

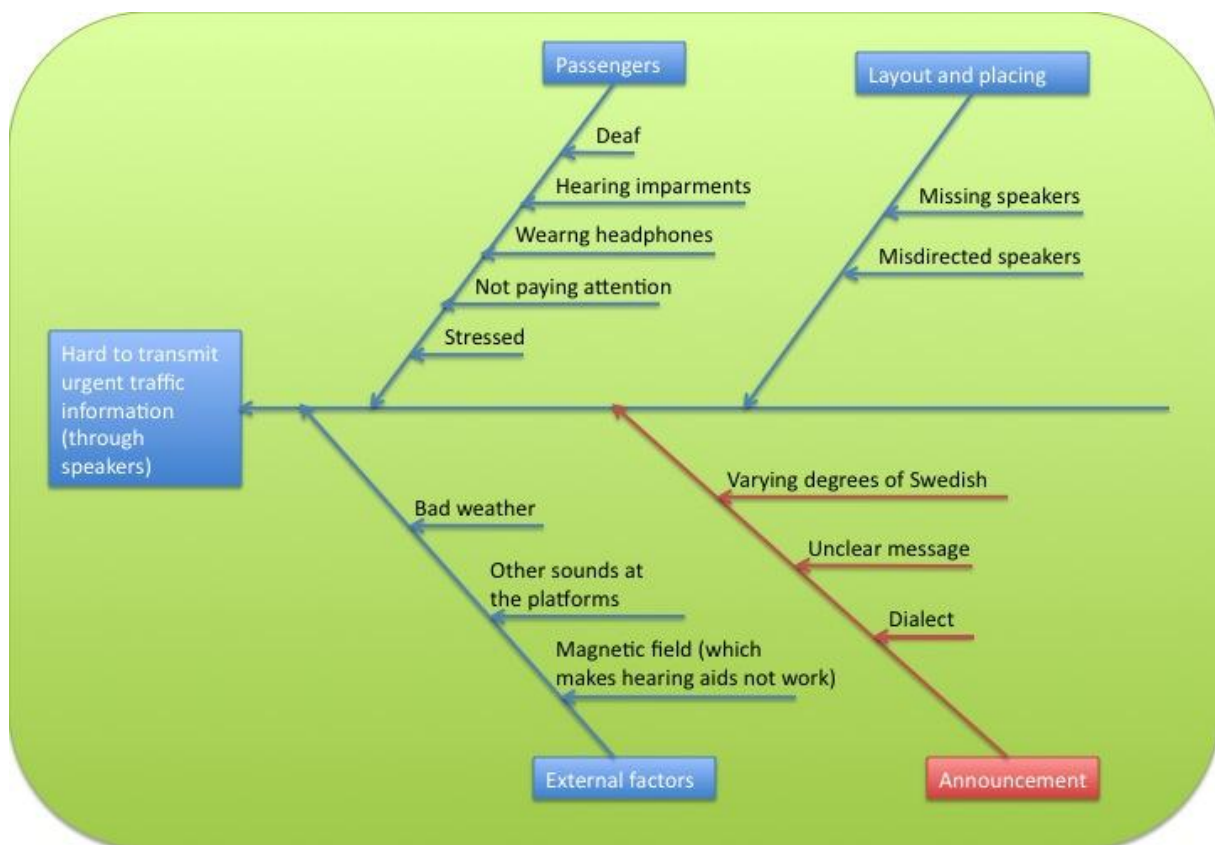
- "Stationer för alla supplies solutions only for people with vision impairments. It is a disgrace to not supply solutions for everyone"
- "The things working for the most exposed will also work for the rest of us."

Stress

- "It depends on how much stress I am willing to expose myself of, whether I am travelling by myself or not."
- "Nowadays people are expecting the trains to depart at the exact right time and that no changes should be made."

4.2.2 Fishbone diagram

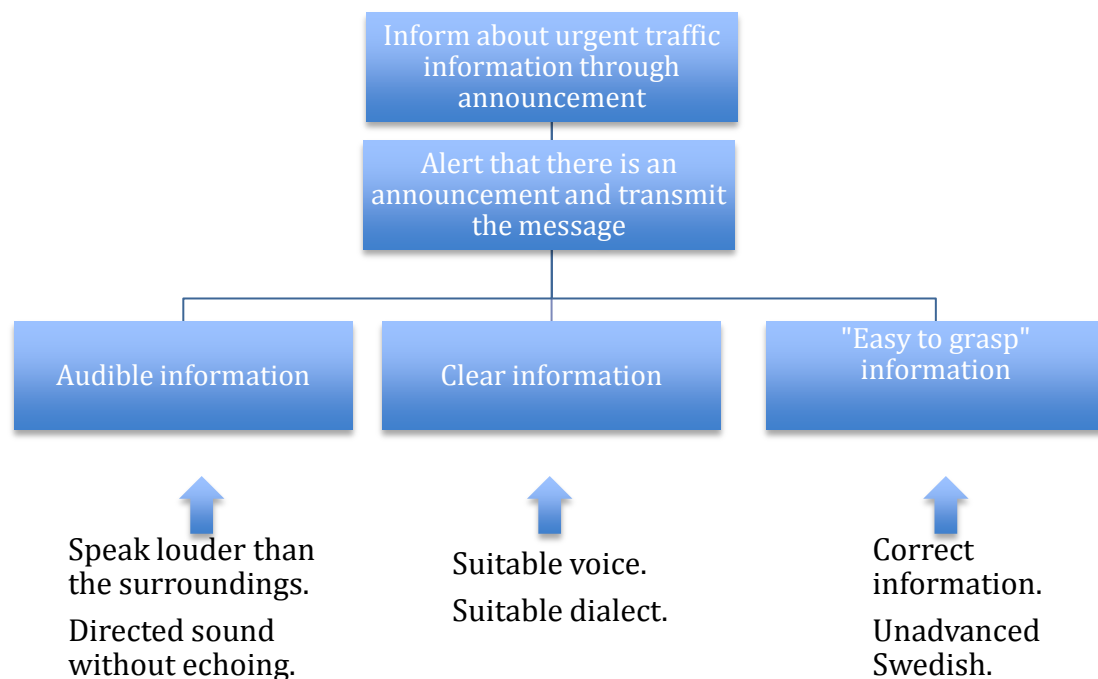
The fishbone diagram is a technique for structuring and present the connection between a problem and its possible cause. (Karlsson, 2006) The problem of today is that is hard to transmit urgent traffic information (through speakers), the reasons to the problem have been divided into four possible categories of reasons; passenger, layout and placing, external factors and announcement.



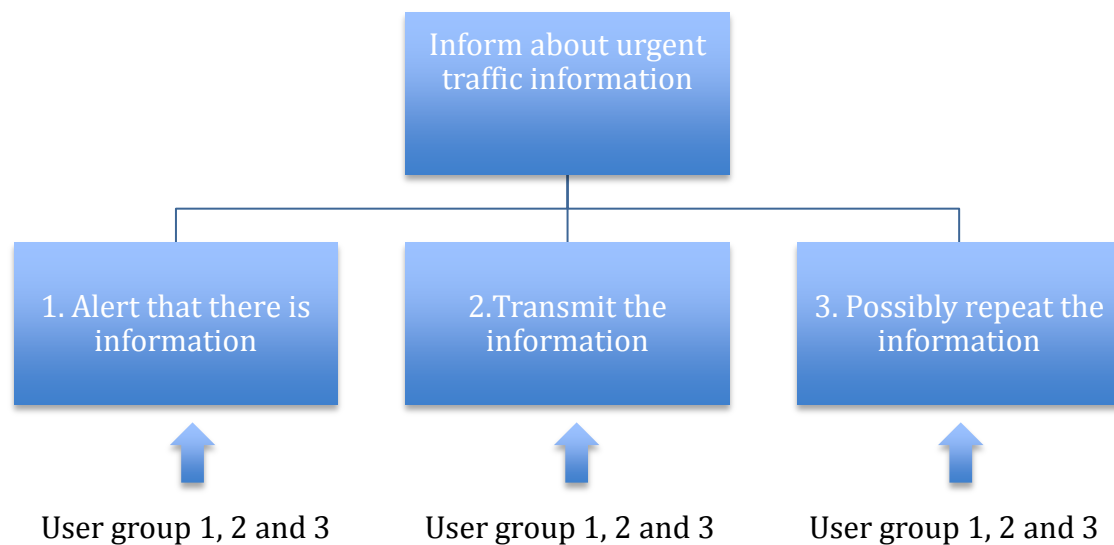
The red part in the picture stand for what the Swedish Traffic Administration is already trying to solve the voice synthesis "Järda". Consequently, this project will not try to improve the announcement. Neither the passengers nor the external factor, such as bad weather, is something this project will try to improve but if possible neutralize the troubling factors of these categories. Remaining is layout and placing which is the category where most effort can be put by this project.

4.2.3 Task analysis

Task analysis is a method that defines which subtasks each task is composed of and structures them. (Bohgard et al., 2008) The division into subtasks and their correlation is advantageous for the future work with the redesign of the product. In the first picture below the task of today's speakers is visualized in a primitive task analysis. The second one visualizes how a resulting concept should be structured.



A resulting concept should follow this structure, where either 1 and 2 or 2 and 3 can be combined:



These three activities will be used as benchmarks in the concept generation later on in the project, chapter 5.1 Morphological matrix.

Conclusions and highlights of analysis:

The problem of today is that it is hard to transmit urgent traffic information (through speakers), the reasons to the problem have been divided into four possible categories of reasons; passenger, layout and placing, external factors and announcement. Layout and placing is the category where most effort can be put by this project.

A resulting concept should follow this structure, where either 1 and 2 or 2 and 3 can be combined:

1. Alert that there is information
2. Transmit the information
3. Possibly repeat the information

4.3 Requirement formulation

In the requirement formulation phase the problem has been visualized and summed up. The result of the analyses has been made into a requirement specification and an expression board.

4.3.1 Standards and guidelines

Since people with different disabilities are at focus in this project the checklist Ergonomi Design Gruppen* are using when designing could be of use and will therefore be taken into consideration in the following concept and developing phases.

**Ergonomi Design Gruppen is a Swedish team working specifically with designing in order for everyone to be able to use their things. (Ergonomi Design gruppen, 2012)*

- **Equally possibilities of usage**
Design of products, services and environments that can be used by as many as possible without need of individual modulation.
- **Flexibility**
Design that makes it possible to use products, services or environments in alternative ways as well as modulate those in favor of individual needs.
- **As small demands as possible of physical strength and reach**
Design which makes products, services or environments easy maneuvered and also reduces wearying moments.
- **Size and space for access and usage**
Design that is balanced due to the usage in order to increase the accessibility.
- **Simpel, logical and intuitive usage**
Design that is easy to understand, and use regardless to experience, knowledge and language.
- **Understandable and easy conceivable information**
Design that mediate necessary information regardless to sight, tactility, hearing and cognition.
- **Margins for errors**
Design that lower or eliminates the risk of unexpected or dangerous results.

4.3.2 Requirement specification

With the pre study, user study and analysis in mind a requirement specification has been put together in order to clarify the demand and wishes the resulting concept should fulfill. Since it is still possible that the resulting concept could consist of one or several products as well as services the specification is general. Complimentary requirement specifications for each product or service could be necessary later on in the process.

#	Criteria	Stakeholder	Kommentar	Demand/Wish	Significance
1	Convey urgent traffic information				
1.1	* to the general public	User group 1		D	
1.2	* to people with hearing impairments	User group 2		D	
1.3	* to deaf people	User group 2		W	4
1.4	* to people with visual impairments	User group 3		D	
1.5	* to blind people	User group 3		W	4
1.6	* to citizens with another native language	User group 1,2,3		W	5
1.7	* to people having a hard time interpret information	User group 1,2,3		W	5
2	Allow space for the voice synthesis Järda	Trafikverket		W	5
3	Allow information repetition				
3.1	* through sound	User group 1,3		W	4
3.2	* through text	User group 1,2		W	4
4	The concept should express:				
4.1	* dependability	Trafikverket		D	
4.2	* quality	Trafikverket		D	
4.3	* safeness	Trafikverket		W	5
4.4	* accessibility	Trafikverket		D	
4.5	* modernity	Trafikverket		W	3
5	Allow usage for all				
5.1	No demand of special tool	User group 1,2,3	E.g. Hearing aid	D	
5.2	No demand of special knowledge	User group 1,2,3	E.g. Knowledge of braille	D	
5.3	Easy to maneuver	User group 1,2,3		D	
5.4	Demand minimal interaction at maneuvering	User group 1,2,3		W	3

Below follows some of the most important requirements, the concept should:

- Convey urgent traffic information to the general public as well as both people with hearing and vision impairments.
- Convey urgent traffic information to people with another native language as well as people having trouble with interpreting the information.
- Allow for usage by one and all, not require any special skills or devices.
- Express as well as be: reliable, high quality, substantial, accessible and contemporary

4.3.2 Expression aimed at

The expression aimed at is a combination of reliable, high quality, substantial, accessible and contemporary. The expression board will be used in the concept generation phase as a trigger and incite for ideas.



Expression board

All pictures taken from www.freedigitalphotos.net: "Train approaching at speed" - Sura Nualpradid, "Chair" - Pixomar, "Elderly woman with smart phone" - Ambro, "Unlocking the door" - Michelle Meiklejohn, "Business trip" - Ambro, "Escalator" - Graur Codrin

Conclusions and highlights of requirement formulation:

The most important requirements of the concept:

- Convey urgent traffic information to the general public as well as both people with hearing and vision impairments.
- Convey urgent traffic information to people with another native language as well as people having trouble with interpreting the information.
- Allow for usage by one and all, not require any special skills or devices.
- Express as well as be: reliable, high quality, substantial, accessible and contemporary.

5 Concept generation phase

Throughout the concept generation phase the goal is to think outside the box in order to find new angles of solutions. This in combination of a structured way of work has resulted in a number of concepts, which have all been evaluated and put together in an improved way.

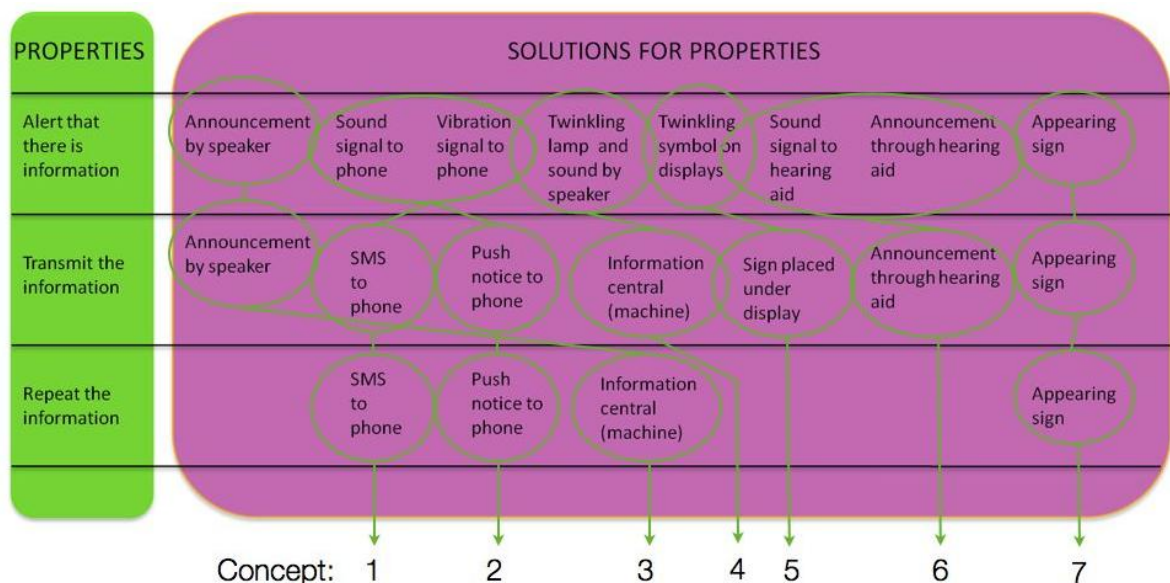
5.1 Morphological matrix

In chapter 4.2.3 Task analysis it was stated that a resulting concept should follow this structure, where either 1 and 2 or 2 and 3 can be combined:

1. Alert that there is information
2. Transmit the information
3. Possibly repeat the information

As a first step in the concept generation phase several solutions for these properties were developed in a brainstorming event. The most reasonable solutions for wanted properties were put together in a morphological matrix.

When developing solutions for these properties the human's five senses have been taken into consideration. However, no solutions including taste or smell have qualified for the matrix. The combination of solution has resulted in seven quite suitable concepts.



A full scale morphological matrix is found in Appendix.

The result of the morphological matrix is seven concepts, which will be further described in the next chapter.

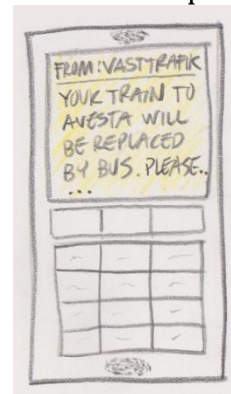
5.2 Concepts

The seven concepts from the morphological matrix will in this chapter be swiftly presented and their positive, negative and interesting features will be listed. The concepts selected in the next stage will be given more detailed descriptions and storyboards.

Concept 1 – SMS service

Passengers with any mobile phone could receive the urgent information through SMS. The service could either require passengers to register their phone numbers at for example the webpage or automatically be registered when getting the ticket by SMS. The service of ticket by SMS is already used by Swedish Rail (SJ) and amongst several local public transportation companies, such as Västtrafik. If having to register the passengers could be able to choose whether they want information regarding a certain train station or certain trip.

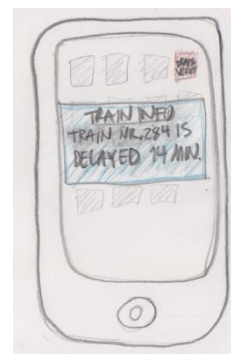
- + Possible to have SMS read to you
- + Choose sound and/or vibration signal yourself
- Passengers possibly have to register for the service
- Misses out on the people not registered



Concept 2 – Smartphone application

Passengers with smartphones could receive pushnotises from a smartphone application. The Swedish Transport Administration already have plans on develop their own smartphone application and in addition this concept could be adapted to e-Adept if that will become commonly used. Also in this concept the passengers could choose which information they would like to receive but since an application is able to know where the passenger is situated it is not necessary. As long as the passengers have the application and has the GPS turned on everyone on the platform could get the information.

- + There is already a plan of developing a smartphone application
- + Choose sound and/or vibration signal yourself
- + The application or e-Adept is able to localize the user or be connected to the specific trip
- Misses out on the people without application



Concept 3 – announcements and information centrals

An easy adoption from today's equipment would be to combine the existing announcements with information centrals which could repeat the information for those not hearing the announcements.

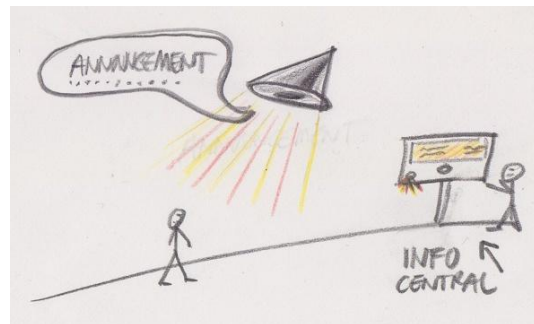
The information centrals could be developed separately but beneficially either as a small change of "pratorn" which the Swedish traffic administration is already developing or their information boards with a button for having the information read to you that is used in a few smaller train stations today. The announcement itself are hopefully going to be better with the voice synthesis "Järda" but there would also be a good idea to minimize the distance between speakers and passengers.

+ Easily adopted from today's equipment

+ Give "pratorn" even more purpose and therefore increase the amount of them

■ Tiresome having to move to the information centrals

! The reason the speakers are places far away is due to vandalism, so another solution for that have to be developed



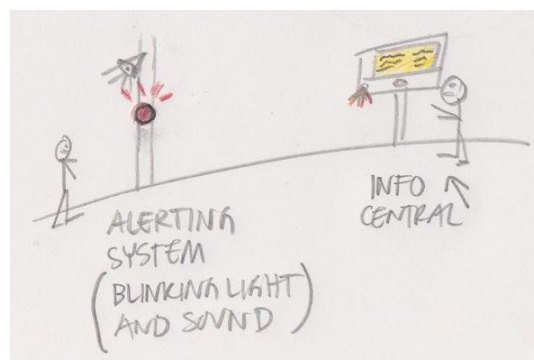
Concept 4 – alerting system and information centrals

Instead of speaker announcement which in many cases leads to annoyance of not being able to hear the message, it could be an idea to just alert the passengers that there is a message and then have the information centrals for disposal. The alerting system could consist of blinking lights, compare to a siren, and a sound alarm.

+ No annoyance of not being able to hear the announcements


■ Tricky when many have to get the information from information centrals, even if it is only the concerned passengers

! Some way of alerting only the concerned passengers have to be found out




Concept 5 – blinking symbol and sign at platform

In order to alert only the concerned passengers it could be a good idea to have a connection between the information source and the platform where the concerned passengers should be, the answer being the existing departure signs. Since this would alert only passengers with vision it might be a good idea to combine the concept with, for example, announcements.

 Directed only to concerned passengers

 Demands vision

 Is it possible to use the existing departure signs for a blinking symbol?



Concept 6 – announcement through hearing aids

One possibility would be to either first have a sound signal or immediately have an announcement sent out through a hearing loop, which would mean everyone with a hearing aid would be able to listen to the message right away.

 Demands hearing aid

 Not financial defendable with solutions aimed at a specific target group



Concept 7 – moving sign at platform

A sign at eye-level could move and just come out when there is information. The concept is not so unlike concept 5 but it might be an even more efficient way to get the passengers attention. Also this one should have to be accompanied by, for example, announcements.

 Directed only to concerned passengers

 Demands vision



5.3 Feedback from users and professionals

All seven concepts have been evaluated by both users and professionals, the evaluation have been carried out by interviews in person and over e-mail. Feedback for each concept has been put together and in the next step combinations of the concepts have been evaluated in a Pugh's matrix.

Concept 1

The SMS service has got mainly good response, the one thing to be said about it is that not everyone wants or is able to handle a mobile phone. It is also unclear whether there is a free-of-charge function available for getting your SMS read to you.

Concept 2

The same thing goes for the smartphone application service; there is an even larger group of people not wanting or not being able to handle a smartphone. However, all information needed to realize the concept is obtainable; there is merely a matter of which company that should develop it since the Swedish Transport Administration does not develop products themselves.

Concept 3

The interviews established that it would make it easier for a lot of people if it were possible to have another chance of catching the information. It is also positive that the concepts probably do not demand much new development, if none, and that the voice synthesis "Järda" can be implemented.

Concept 4

It is a common belief that this concept could implicate confusion if implemented at a large train station, since everyone would have to go to the information centrals and get the information. This would also mean long lines for waiting to get the information. Someone also express that it would be even more annoying to only hear a sound instead of an announcement, even if the announcement cannot be heard properly.

Concept 5

Concerning concept 5 information have appeared that there is already a spare row at the existing departure signs which could be used for this kind of information. Also it is possible to make either a symbol or text blink. This row is today used when warning for passing trains. The fact remains that this has to be combined with sound in any way and it could be a problem if someone arrives to the platform just before supposed departure and there is a change of platform for example.

Concept 6

Even if having announcements sent out through a hearing loop would have been appreciated of people with hearing aids does concept 6 get outside the boundaries defined for this project since it exclude everyone without a hearing aid.

Concept 7

Most think this is an interesting idea and probably the most innovative concept, however also the hardest to realize due to tough winter conditions and vandalism. The most positive factor from the users view is the sign being in eye level.

5.4 Combinations of concepts

The substance of the interviews is that there are several good concepts but that none of them acquire all demands and requirements by itself, therefore two combinations of concepts have been put together. The two combinations are based upon the size of group the included concepts is aiming at; everyone at the station or only those passengers concerned by the information.

"As a whole I find the concepts very substantial, it is hard to find more kinds of solutions, it is rather a question about finding the best combination of them."

Quotation from interviewed user

Combination 1 - aims at everyone at the station

Combination 1 consists of speaker announcement, information centrals and a smartphone application service, all aiming at everyone at the train station. The meaning is for everyone at the train station to be able to take in the urgent traffic information, in conformity with today. However, if a passenger cannot hear or understand the announcement he or she now has an opportunity to hear or read the information in one of the information centrals spread over the train stations, appropriately at spots where the passengers already are used to look for information.

Another option for the passenger is to have a look at his or hers smartphone, where he or she will have received a pushnotis regarding the urgent traffic information. This of course demands the passenger to have the smartphone application installed. The last option is that the passenger hears or feels when the pushnotis arrives to the phone and do not have to bother about any of the other ways of getting the information.

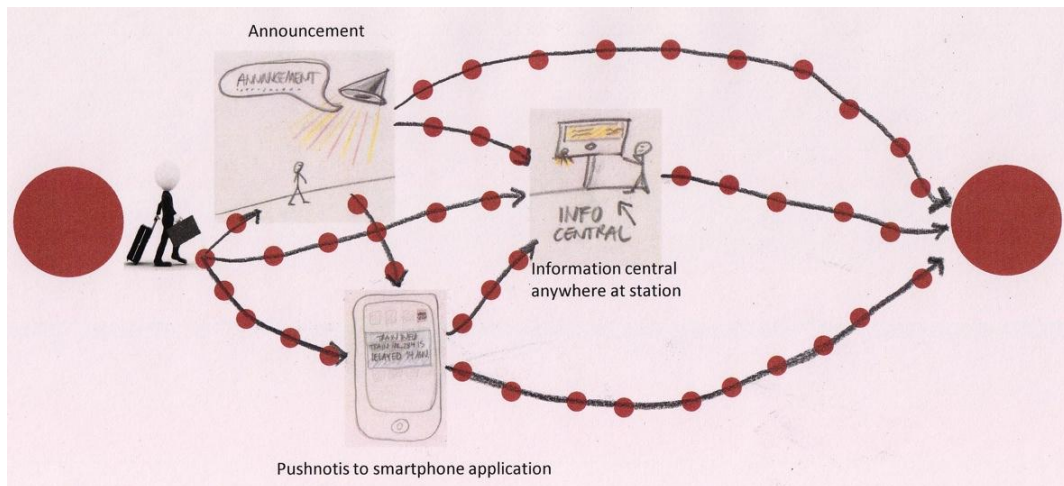


*Combination 1:
announcement and
smartphone pushnotis to
everyone on the station in
combination of
information centrals
spread over the station.*

+ The announcements are hopefully getting better with the voice synthesis.

■ Development of advanced information central has to be made.

! It is reckoned that the smartphone application service has its best potential when directed to everyone at the train station, using the GPS position. If the passengers are to register in any way the service might as well send the information by SMS, for more people to benefit from it.

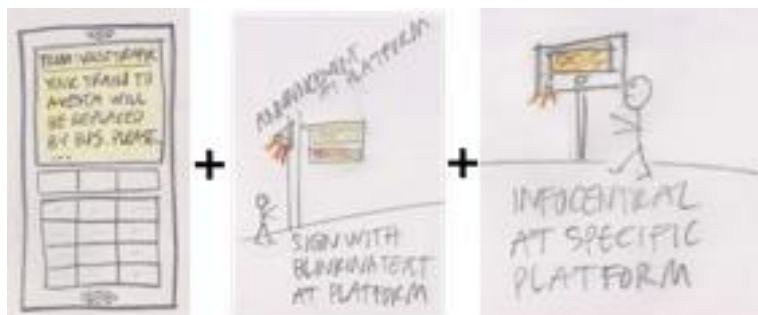


Storyboard illustration in which intermutual order the concepts in combination 1 is likely to be used

Combination 2 - aims only at passengers concerned by the information

Combination 2 consists of a sign with blinking text in combination with announcement, information centrals at the platform and a SMS service. The thought behind this is to only aim the information at passengers concerned by the new information. The passenger can with this combination of solutions see the sign and / or hear the announcement or hear and / or feel his or hers mobile phone when the SMS arrives. In either case, if the passenger has understood the information, there is no need for extra solutions to the problem.

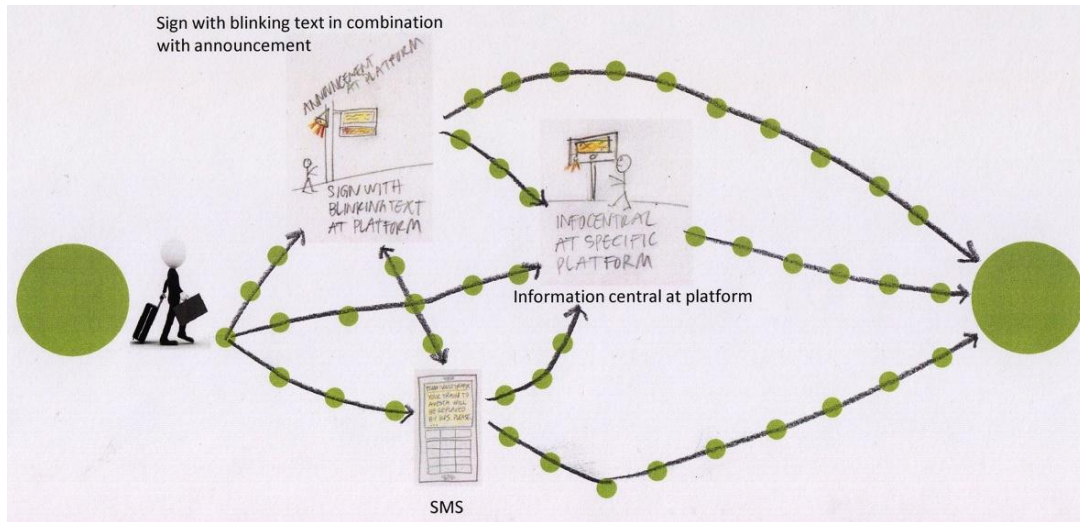
If the passenger has not received a SMS and not got the information from the rather small text at the sign or the announcement he or she has the chance of getting the information repeated in text or sound at the information central at the platform. Since this combination of concept aims only at passengers concerned by the information the sign and info central showing the urgent message is placed at the each platform. There is already place for the blinking text farthest down at the destination signs at each platform. In the smaller train stations, which often consist of only one or two platforms, it will not be as big difference between the placing of the two concepts as in the larger ones.



*Combination 2:
sign with blinking text
(and possibly an
announcement) as well as
info centrals, both at the
concerned platform, and
this in combination of
SMS to the concerned
passengers.*

+ No development of information centrals is needed since there already exist a simple information board with one button for having the information read to you in a few small train stations today.

■ It could be confusing for other passengers, not concerned by the information, if they hear announcements as well.



Storyboard illustration in which intermutual order the concepts in combination 2 is likely to be used

5.5 Pugh's matrix

The two combinations have been evaluated in a Pugh's matrix against the current solution and each other. By giving the current solution 0 points on all criteria and the evaluated concepts between -2 to +2 points for each criteria the solution best suited for the demands and wishes can be elected. First each combination is evaluated against the current solution and given between -1 to +1 point. After that the combinations is evaluated against each other and possibly given an extra -1 or +1 point.

Demands & wishes	Current solution	Combination 1	Combination 2	Comments
Convey urgent traffic information				
* to the general public	0	+1	+1	-
* to people with hearing impairments	0	+1	+2	-
* to deaf people	0	+1	+2	-
* to people with visual impairments	0	+1	+1	-
* to blind people	0	+1	+1	-
* to citizens with another native language	0	+1	+2	More chances of reading or hearing the info.
* to people having a hard time interpret information	0	0	0	Debatable wheter it makes a diffrence
Allow space for the voice synthesis Järda	0	0	0	-
Allow information repetition				
* throuh sound	0	+1	+1	-
* throuh text	0	+1	+1	-
The concept should express:				
* dependability	0	+1	+1	-
* quality	0	+1	+1	-
* safeness	0	+1	+1	-
* accessibility	0	+1	+1	-
* modernity	0	+2	+1	-
Allow usage for all:				
* no demand of special tool	0	0	0	-
* no demand of special knowledge	0	0	0	-
* easy to manouver	0	-1	-1	In contrast to the current solutioin ther is monouvering
* demand minimal interaction at manouvering	0	-1	-1	
Total:	0	+12	+14	

A full scale Pugh's matrix is found in Appendix.

The conclusion of the Pugh's matrix is that combination 2, which aims only at passengers concerned by the information, is the better option.

6 Result

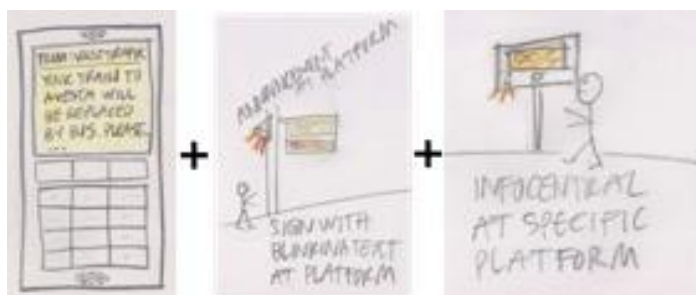
Expected results from this master thesis project have been facts of the area, user requirements, guidelines and product concepts, which all can be found within this report. Several concepts have been developed during the project, which can all be seen as triggering proposals to the Swedish Transport Administration. The best rated combination of concepts is described below.

6.1 Concept and features

The best combination with regards of the demands and wishes defined for the project is those referred at as combination number 2 in the previous chapter; consisting of a sign with blinking text in combination with announcement, information centrals at the platform and a SMS service. This is therefore the one being recommended for the Swedish Transport Administration to take into consideration when improving their way of conveying urgent traffic information at the train stations.

The thought behind this is to only aim the information at passengers concerned by the new information. The passenger can with this combination of solutions see the sign and / or hear the announcement or hear and / or feel his or hers mobile phone when the SMS arrives. In either case, if the passenger has understood the information, there is no need for extra solutions to the problem.

If the passenger has not received a SMS and not got the information from the rather small text at the sign or the announcement he or she has the chance of getting the information repeated in text or sound at the information central at the platform. Since this combination of concept aims only at passengers concerned by the information the sign and info central showing the urgent message is placed at the each platform. There is already place for the blinking text farthest down at the destination signs at each platform.



Best rated combination of concepts: sign with blinking text (and possibly an announcement) as well as info centrals, both at the concerned platform, and this in combination of SMS to the concerned passengers.



Sketches of how the result could look like.



6.2 Further development

Besides considering using the combination of concepts recommended in this thesis the Swedish Transport Administration should consider a solution for being able to place the speakers at the train stations closer to the passengers without those being vandalized. The speakers should also be put in a better position towards each other to avoid echoing. . The same thing goes for positioning the current information signs and displays, which are today installed at a high level to avoid vandalism, which leads to passengers not being able to read the text. Above all other changes the Swedish Transport Administration should when improving their way of conveying traffic information let people know that there is an improvement and what that is. Especially the two mobile phone services would need advertisement in some way but would in return gain the Swedish Transport Administration some bonus credits from their customers.

7 Discussion

7.1 Result

The expected results are achieved and the Swedish Transport Administration has got inspiration for improving their system. Whether combination 2 of concepts is the best from all perspectives could be discussed. For example it might be easier for them to send out and control the information in announcements and information centrals if those were to convey the same information at the whole train station, as in combination 1. However, this thesis project was to focus at the users.

The user focus and the distribution into the three user groups have worked very well, which hopefully is reflected in the resulting concepts. A complex matter has been the absence of measurable demands, which suited the project well but made it harder to evaluate whether the concepts fulfilled the demands.

Preferably I would like to have published this master thesis report in Swedish since a lot more persons from the user groups would have been able to take it in.

7.2 Process and methods

The master thesis has in a way worked as a repetition of the way of work and of all methods I ever learnt to use at the Industrial Design Engineering program.

An entirely new experience has been how to collect information from people not being able to use the same senses as myself. For example it turned out to be an impossibility to have an open interview with a group of people with hearing impairments, where it had to be structured questions and just one person talking at a time because of having to use a microphone and give the interpreter time to write it all down.

Some working phases had to be shortened down in comparison to what I planned in the start of the project. The user study has mainly consisted of interviews since I found it hard to run a proper user study in field with announcements so incalculable. It could have been possible to arrange a user field study with assistance of the Swedish Transport Administration at a small train station, but the question is whether that would have been representable. There were also very little literature to be found regarding spoken traffic information which made the literature study slightly trickier.

7.3 Project progress

The fact that the project was not pre defined has been both fun and demanding. The assignment was established as a suggestion on what the Swedish Transport Administration was in need of during a phone conversation regarding another master thesis project already taken. It has been good being able to shape the project but also taken a lot of time defining what to do, I have at several times returned to the project definition in order to be sure of which direction the project better go in. This also meant changing the process and methods a few times.

Since this master thesis has worked as a sort of summation of my years at the Industrial Design Engineering program it feels good to, for the first time, have

worked alone. It has been a good experience and I can state that I singlehandedly have made all the work. However, I also learnt how much I appreciate having group members to share ideas with and being braced by. My advice for others making their master thesis alone is to book a lot of meetings with tutors at both their school and the concerned company, in order to have deadlines and getting many inputs along the way.

8 Conclusion

Passengers all over Sweden has for a long time been upset and disappointed with both delays and the lack of information about these. Never having bad weather in Sweden is impossible but being good at informing about it and what is happening instead is something the Swedish Transport Administration should be able to and hopefully will in the future.

The user studies showed that passengers from all three user groups would have liked better information when unexpected happenings occur. The user study also proved that the way of distributing the users into three user groups that partly overlapped each other worked very well.

One conclusion from this master thesis is that there is a need for user focus when improving the system at train station as well as other public transport terminals all over the country. This is a fact not only suited for the traffic information but for all improvements to be done. Merely the accomplishment of giving people other expectations and fulfill these would mean a lot.

References

Written sources

Bohgard, et al. (2008). *Arbete och teknik på människans villkor*. Stockholm: Prevent.

Karlsson, M.A, (2006) *Lyssna till kundens röst* [Course compendium Produktutveckling – Behov och krav] Chalmers tekniska högskola, Göteborg.

Österlin, K., (2003) *Design i fokus för produktutveckling*. Första upplagan. Malmö: Liber.

Electronic sources

Banverkets Råd och riktlinjer (2005) Available at:

http://www.trafikverket.se/PageFiles/19734/Rad_och_riktlinjer_-_vagledning_for_utformning_av_den_fysiska_miljon_for_funktionshindre.pdf

Cooper, A. & Reimann, R. (2003) *About Face 2. 0 -The Essentials of Interaction Design*, [Electronic], Wiley publishing, Indianapolis. Available at:

<http://www.books24x7.com./books24x7.asp> [2010-09-26]

Det bästa av världar – tillgänglighet för alla, Skåne Dövas Länsförbund (2008).

Available at: http://www.sdrf.se/sdr/object/files/obj_48c78661bfca7.pdf

Ett nationellt prioriterat nät av kollektivtrafik (2007) Available at:

<http://www.sjofartsverket.se/pages/22889/Bilaga%207%20-%20Utveckling%20nationellt%20kollektivtrafik%20n%C3%A4t%20090824.pdf>

FN:s konventioner om mänskliga rättigheter (2006). Available at:

<http://www.regeringen.se/content/1/c6/06/57/07/15d0d9c8.pdf>

Från patient till medborgare – en nationell handlingsplan för handikappolitiken, Regeringens proposition 1999/2000:79 (2000). Available at:

<http://www.regeringen.se/content/1/c4/14/78/e9da3800.pdf>

Handikapprörelsens syn på tillgänglighet (2006) Available at:

<http://www.handikappforbunden.se/Global/Arbete%20och%20f%C3%B6rs%C3%B6rjning/Nationella%20handlingplanen/Rapporter/Handikappr%C3%B6relsens%20syn%20p%C3%A5%20tillg%C3%A4nglighet.pdf>

Koll framåt, Nationell handlingsprogram för kollektivtrafikens långsiktiga utveckling, bilaga 7 (2007) Available at:

<http://sjofartsverket.se/pages/22889/Bilaga%207%20-%20Utveckling%20nationellt%20kollektivtrafik%20nät%20090824.pdf>

Pocket Facts 2010, the Swedish Transport Administration (2010). Available at:

http://publikationswebbutik.vv.se/upload/5574/2010_059_pocket_facts.pdf

Resenärspanelen Väst (2011) Available at:

http://www.trafikverket.se/PageFiles/35109/2011_t1_trafikverket_resenarspanelen_vast_resultatpresentation.pdf

86-åringars vardagsteknologi (2009) Available at:
<http://www.hi.se/Global/pdf/2010/09323-86-aringars-vardagsteknologi.pdf>

Persons

Brehme, Barbro (2012) the Swedish Transport Administration

Dahlstrand, Alice (2011) the Swedish Transport Administration

Karlsson, Morgan (2012) Västra Götalands regionen

Websites

E-adept (2012) Available at: <http://www.eadept.se>

Ergonomi Design Gruppen (2012) Available at: <http://www.ergonomidesign.se>

HRF's Befria samtalet (2011) Available at: <http://www.befriasamtalet.se>

Pendlarstress (2012) Available at: <http://www.pendlarstress.se>

Stationer för alla (2011) Available at:
<http://www.trafikverket.se/stationerforalla>

The Swedish Transport Administration (2011) Available at:
<http://www.trafikverket.se>

Appendices

Appendix I – Example of interview and questionnaire questions

Appendix III – Morphological matrix

Appendix IV – Pugh's matrix

Appendix I – Example of interview and questionnaire questions

- How do you experience that the Swedish transport administration focuses on persons with vision impairments?
- Do you think it work well to travel with train within Sweden and locally? Do you experience that you get all the information you need? Is there any other problems?
- What do you think is missing? Do you have suggestions of improvements?
- Are there any special guidelines that I should know of? Can you think of anything else that you think I probably do not know within this area?
- What are your views about solutions designed for special need versus a general solution?
- What do you think about solutions via for example the passengers mobile phone? (Since that is something most passengers are carrying around with them) Is there any corresponding object that people with vision impairments are carrying with them most time?
- Do you know of any study concerning vision impairments and traffic information?
- Do you know of any other group of people that has strong views of this? Is there anyone else that you think I should talk to?
- Would you be interested in attending possible user test?
- How do you experience the voice synthesis “Järda”? Is the used language in the announcements easy to grasp?
- Would you like to be able to have the information repeated in any way?

Appendix II – Morphological matrix

PROPERTIES	SOLUTIONS FOR PROPERTIES							
Alert that there is information	Announcement by speaker	Sound signal to phone	Vibration signal to phone	Twinkling lamp and sound by speaker	Twinkling symbol on displays	Sound signal to hearing aid	Announcement through hearing aid	Appearing sign
Transmit the information	Announcement by speaker	SMS to phone	Push notice to phone	Information central (machine)	Sign placed under display	Announcement through hearing aid	Appearing sign	
Repeat the information		SMS to phone	Push notice to phone	Information central (machine)				Appearing sign

Appendix III – Pugh’s matrix

Demands & wishes	Current solution	Combination 1	Combination 2	Comments
Convey urgent traffic information * to the general public * to people with hearing impairments * to deaf people * to people with visual impairments * to blind people * to citizens with another native language * to people having a hard time interpret information	0 0 0 0 0 0 0	+1 +1 +1 +1 +1 +1 0	+1 +2 +2 +1 +1 +2 0	- - - - - More chances of reading or hearing the info. Debatable whether it makes a difference
Allow space for the voice synthesis Järda	0	0	0	-
Allow information repetition * through sound * through text	0 0	+1 +1	+1 +1	- -
The concept should express: * dependability * quality * safeness * accessibility * modernity	0 0 0 0 0	+1 +1 +1 +1 +2	+1 +1 +1 +1 +1	- - - - -
Allow usage for all: * no demand of special tool * no demand of special knowledge * easy to manoeuvre * demand minimal interaction at manoeuvring	0 0 0 0	0 0 -1 -1	0 0 -1 -1	- - In contrast to the current solution there is manoeuvring
Total:	0	+12	+14	