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Exploring VIDA search with user-centered design
Presenting two concepts for improving search usability in a vehicle
aftermarket application.

Master of Science Thesis in Interaction Design.

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Göteborg, Sweden, February 2009

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Abstract

This thesis reports on work to create user interface mock-ups based on user observations and interviews to improve Vehicle Information Diagnostics for Aftersales (VIDA). This application is managed by Volvo Cars Customer Service and is used worldwide by Volvo workshops. These mock-ups were evaluated by end-users in an iterative process in an effort to try to enhance the user experience and to eliminate problems with the user interface.

VIDA includes many different types of functionality; there are ways to communicate with the Volvo car using a Bluetooth interface, update software in the car, find and read fault-tracing documents that help diagnose the problem, descriptions of how to remove faulty parts of the car, install new parts and also documents describing the design of specific parts. In VIDA there is a search function to help the users find these different spare parts, symptom codes or repair documents. But there have been complaints from the users that the search functionality in VIDA is not very good. Problems range from users ordering the wrong spare part to that the search for documents seems slow. As a result two concepts are described as use-cases and Photoshop/PowerPoint mock-ups. The conclusion is that the proposed concepts are promising but needs more testing to see if they really are more usable than the current version. But the reaction from users at the different workshops and personnel at Volvo Cars Customer Service show that it should be an increase in user satisfaction. This thesis shows that there are much room for improvements both in usability and in performance of VIDA.

Sammanfattning

I detta arbete beskrivs skapandet av grafiska gränssnittsprototyper baserade på observationer och intervjuer för att förbättra programmet Vehicle Information Diagnostics for Aftersales ((VIDA)). Detta program administreras av Volvo Cars Customer Service (VCCS) och används världen över på Volvos eftermarknad. Dessa prototyper utvärderades av slutanvändare i en iterativ process för att stärka användarupplevelsen och för att eliminera problem kopplade till användargränssnittet.

I VIDA finns en mängd funktioner; användaren kan kommunicera med en Volvo bil med hjälp av Bluetooth, uppdatera mjukvara som finns i styrenheterna i bilen, läsa felsökningsdokument som hjälper mekaniker att diagnostisera bilens fel, man kan läsa beskrivningar av hur man byter ut delar av bilen och även beskrivningar av hur specifika delar är designade. I VIDA finns det en sökfunktion för att hitta alla dessa reparationsdokument och reservdelar. Dock har det kommit klagomål från marknaden att denna sökfunktion inte är särskilt bra. Problemen sträcker sig från att användare beställer fel reservdel till att sökandet efter dokument går långsamt.

Resultatet blev två stycken koncept som beskrevs som användarfall och Photoshop/Powerpoint prototyper. Slutsatsen är att dessa förslagna koncept är lovande men att det behövs mer användbarhetstester för att kunna avgöra om de är mer användbara än den nuvarande versionen. Men reaktionen från personal på VCCS och slutanvändare har varit mycket positiv vilket visar på konceptens potential. Rapporten visar också på att det finns förbättringar att göra både inom användbarhet och VIDAS prestation.

Preface

This magister thesis is the conclusion of my education in Interaction design at the IT-university of Gothenburg.

I want to thank everybody that helped me making this thesis possible. First I want to thank my supervisors at Diadrom , Volvo Cars Customer Service and the IT-University, Patrick Jansson, David Andersson and Staffan Björk. Your opinions were much appreciated. I also want to thank the personnel at VCCS for all the help I got and for making me feel welcome. I also want to thank all the participants in my study.

Thanks dad for letting me borrow your car so I could drive to Varberg and Borås, making it a lot easier for me.

Finally, I want to give my eternal gratitude to my wife because all her support during this thesis.

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Göteborg, 2009

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1 Introduction

Vehicle Information Diagnostics for Aftersales (VIDA) is an application that is managed by Volvo Cars Customer Service (VCCS) and is used worldwide by the Volvo aftermarket. VIDA includes many different types of functionality; there are ways to communicate with the Volvo car using a Bluetooth interface, update software in the car, find and read fault-tracing documents that help diagnose problems with the car, descriptions of how to remove faulty parts of the car, install new parts and also documents describing the design of specific parts. In VIDA there is a search function to help the users find different spare parts, symptom codes or repair documents. But there have been complaints from the Volvo's aftermarket that the search functionality in VIDA is not very effective. Problems include users ordering the wrong spare part which leads to the customer's car cannot be repaired in time which leads to bad will and possible cost for a rental car for Volvo Cars. Other problems that have been reported is that it takes very long time to search and that it is hard to find the information the user wants because of a large quantity of search results, which leads to much user frustration.

By doing improvements in VIDA and the in the search function there would be savings in both money, time and in user frustration leading to a more effective work environment. The project will use methods found in interaction design and focus on user behaviour and user goals. User-centred design should be an effective methodology to use in this project (see chapter 3.2 on page 20 for more information about User-Centred Design).

The target audience for this thesis is extensive and people without experience of usability and human-computer interaction should be able to comprehend the content with the help of the theory and methodology chapter on page 13. For those not interested in how this project was realized the implementation chapter starting at page 34 could be skipped.

1.1 Purpose

The purpose of this project is to improve the usability of VIDA by creating user interface mock-ups based upon user behaviours and user goals. These mock-ups will be evaluated by end-users of VIDA in an iterative process in an effort to try to enhance the user experience and to eliminate problems with the user interface. These mock-ups will in the end be described in use-case format for easier integration into Volvo Cars processes. The methods used and their execution will also be described. The focus of this thesis will be on the user's role, their goals for searching for information and the improvements this leads to. The focus will be on the creation of mock-ups that visualize these improvements.

1.2 Problems

When the project was discussed with personnel at VCCS there were some questions that thought to be important to be answered. This thesis will try to answer these questions:

- What kind of problems do the users have with the VIDA search function today and why?
- What kind of goals do the users have and can this knowledge of these goals improve the usability of VIDA search?
- Which usability improvements can be done to VIDA search by observing user behaviour and by letting end users evaluate suggested solutions?

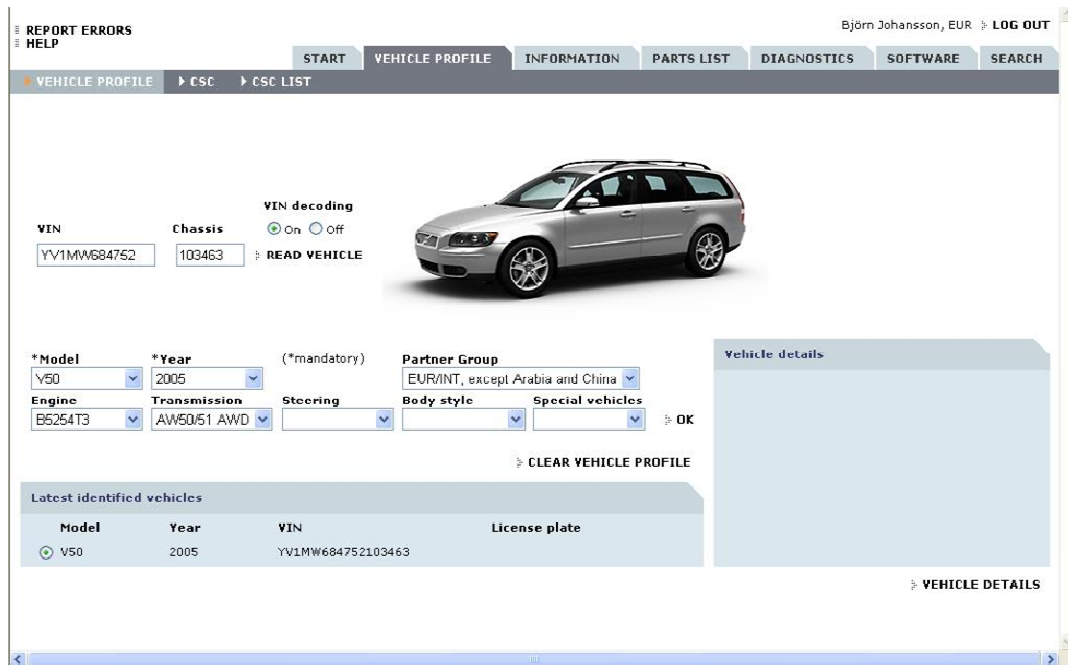
1.3 Limitations

The thesis will not include search engine technology, search algorithms or the use of metadata. Also there will be focus on searching for information with keywords in the VIDA search tab and not manual search through a hierarchy of information with the use of menus. Because this is not of interest and could be made into its own thesis. The suggested solutions will be reasonable and should be able to be created with today's technologies. But there will not be any considerations of any hardware or software requirements because this will be an explorative study where the user's needs and behaviour will be in the centre.

2 Background

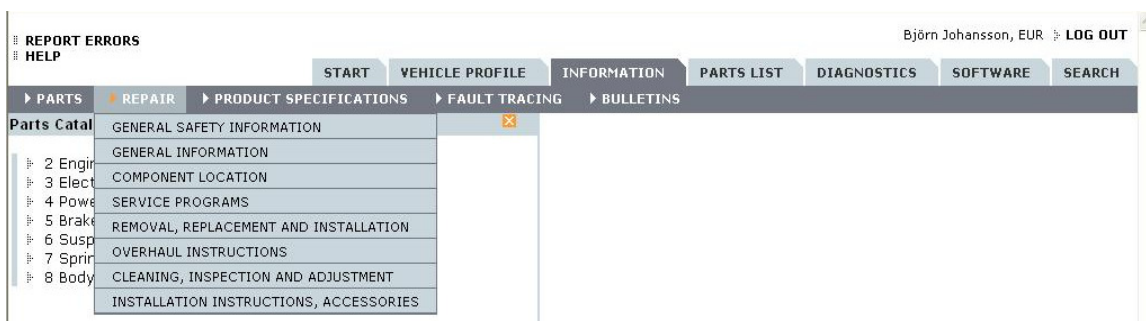
2.1 Description of VIDA

VIDA (Vehicle Information Diagnostics for Aftersales) is an application that is managed by VCCS (Volvo Cars Customer Service) and is used worldwide by the Volvo aftermarket. The VIDA application includes many different types of functionality; there are ways to communicate with the car using a Bluetooth interface, update software in the car, find and read fault-tracing documents that help diagnose the problem, descriptions of how to remove and install parts of the car and also documents describing the design of specific parts. There are also ways to classify problems with the car described by the car owner called customer symptom codes (CSC) to help mechanics get started with fault-tracing.



Picture 1, Screenshot of the Vehicle profile in VIDA.

The information in VIDA is divided into different types. These types are then also divided



Picture 2, Screenshot that shows the information types in VIDA.

into subgroups. The different information types in VIDA are Parts, Repair, Product specifications, Fault-tracing, and Bulletins. These types and subgroups are used in the navigation in VIDA for access to a specific group of documents. For an extensive list of all subgroups see the appendix.

2.1.1 Search in VIDA

In VIDA there is a search function that can be used to find information in the different information types. The interface has a search field and a number of radio buttons for different alternatives (See picture 3 below). With the different radio buttons the user can choose which type of information to look for or if VIDA should look for all kind of information. By choosing which alternative he wants and then entering keywords to search for the user activates the “search” link. The “stop” link is for aborting a search in progress and the back button is used to get back to the search alternatives from the results page. The “search for” alternatives above the search field will only be shown if they are applicable and only the information type Parts have “search for” alternatives.

REPORT ERRORS
HELP

Björn Johansson, EUR LOG OUT

START VEHICLE PROFILE INFORMATION PARTS LIST DIAGNOSTICS SOFTWARE SEARCH

Vehicle profile
 On Off

Search for:
 Part description Part number

Include notes

Select type of search

Parts
Show results by
 Part
 Section

Repair
 Product specifications
 Fault tracing
 Bulletins
 CSC
 All information except parts catalog
 VCC Id

SEARCH
STOP
BACK

Picture 3, Screenshot of the search interface in VIDA.

Result 1 - 6 of total 6							New parts list 1
Function group	Part number	Part description	Notes	PS	Vehicle profile	Title	
234	30792024	Fuel pipe	AWD MC 23,28,42,43,45,47,49,51,89,81.		V50_2005_B5254T3	Fuel lines from tank to engine 5CYL	
234	8621125	Fuel pipe			V50_2005_B5254T3_AW50/51 AWD	Fuel tank and connecting parts AWD,The code key is under group 81. Emission code 4,5	
234	8621125	Fuel pipe			V50_2005_B5254T3_AW50/51 AWD	Fuel tank and connecting parts AWD,For cars with emission code 2, see product sign.,The code key is under group 81. Emission code 2	
237	30750637	Fuel pipe			V50_2005_B5254T3	Injector and high-pressure line 5CYL TURBO	
875	30676397	Fuel pipe	REPL 1PCS 30742222-0.	SP	V50_2005_B5254T3	Auxiliary heater installation Kit	
875	30742222	Fuel pipe			V50_2005_B5254T3	Auxiliary heater installation Kit	

Picture 4, a screenshot of the search result page for parts.

The result page is a table of the different information connected to the search result. These differ depending on which information that the user was searching for. Picture 4 shows a search result after a search for parts information. From here the user can add the part to a “part list” and later order the parts on this list and get the parts delivered to the workshop. Adding parts to this list is done by clicking the part number in the result table (see picture 4). The user can also go to the section that the part belongs to for more information through the link in the vehicle profile column. The hits are automatically sorted by the number in the function group column to the left and can be sorted by the other columns by using the arrows in the columns

Result 1 - 15 of total 15					
Function group	Component/Function	Deviation	Comment 1	Comment 2	CSC
23	Fuel system	Excessive fuel consumption			3 A5
23	Fuel system	Switching fuel not possible			3 BK
38	Trip computer	Current fuel consumption faulty presentation			3 GK
38	Trip computer	Average fuel consumption	Faulty presentation		3 GL
38	Warning lights and chimes	Fuel level indication/no indication			3 HJ
83	Fuel-filler door	Hard/impossible to open			3 8H
83	Fuel-filler door	Hard/impossible to close			3 8I
83	Fuel-filler door	Locking does not work			3 UI
23	Fuel system	Slow fuel tank fill or spitback			3 BT
23	Fuel system	Fuel odor			3 A1
87	Parking heater	Fuel leakage			3 K4
38	Gauges	Fuel level not accurate	Value too high		3 X6
38	Gauges	Fuel level not accurate	Value too low		3 XA
23	Fuel system	Fuel leakage			3 XY
28	Control system, ignition and fuel supply	Readiness code not ready			3 1G

Picture 5. screenshot of the search result page for CSC.

title bar. The information that is available for the user depends on if he has used a “car profile” or not (see picture 1). A “car profile” tells VIDA what kind of car the mechanic is working on and he will only be able to find information that matches the profile. This is a feature for minimizing any errors made by the users, because it should be impossible to order

a part that does not fit the specific car. This filtering is not perfect because the VIDA system do not filter on every part of the car.

2.2 The involved companies

2.2.1 Diadrom

Diadrom was started as a result of research at the Viktoria-institute in Göteborg in 1999 and the goal was to commercialize the results from the areas wireless information technology and mobile informatics. In 2003 the company was consolidated to Göteborg and the areas of diagnostic and telematics. Today Diadrom also delivers solutions in Virtual Manufacturing. Within the area of diagnostics there are systems for fault-tracing, repair, software downloads and reconfiguration. The company executes the whole process for creating software, from requirement specification to a running system. One of Diadrom's customers is Volvo Cars and VCCS. This thesis has been performed in collaboration with Diadrom.

2.2.2 Volvo Cars Customer Service (VCCS)

Volvo Cars was founded in Göteborg 1927 and was sold to Ford Motor in 1999. Today Volvo sells cars in about 100 countries and has about 2400 sales outlets and service workshops around the world. Volvo Cars four largest markets are the USA, Sweden, Germany and Great Britain.

VCCS is a part of Volvo Cars and are responsible for the Volvo aftermarket which means it is responsible for the handling of spare parts, software and other equipment used by the aftermarket. VCCS are responsible for applications that support workshops repairing and planning repairs on Volvo cars, and they are also responsible for creating user manuals, creating and verifying requirements that affect customer expenses for repairs and more.

2.2.3 The IT-University

The IT-university in Göteborg is a joint venture by Chalmers University and Göteborg University that was started 2001 together with the industry and the public sector. IT-university is an international research and educational centre within information technology. It has today approximately 800 students and is based both at Chalmers Johanneberg and Chalmers Lindholmen in Göteborg. The IT-university is responsible for the master's programme in interaction design. Interaction design is about creating the interface between humans and IT based products. The interaction designer is the person that puts the user in the centre when developing a product; he or she tries to analyse the user's needs and how they use

similar products so he then can create the product's behaviour and aesthetics. An interaction designer could work with the development of computer software, computer games or web pages.

3 Theory and methodology

In this chapter the knowledge that was used in the thesis are presented. Some of these theories are just basic description and the references are recommended if the reader want to know more.

3.1 Usability

Usability is focused on making usable and user friendly interfaces. The focus on usability when developing new computer system will lead to less frustration and stress for the end user. Usability is part of the research field of Human-computer interaction that is a multi-disciplinary subject using knowledge from a wide range of sciences as psychology, cognitive science, ergonomics, sociology and computer science (Dix, A., Finlay, J., Abowd, G. D., Beale, R. 2005). All these areas are important if the designers want to understand the user and how the user's environment affects the usability of a system.

3.1.1 Definition

There have been many different definitions for usability over the years. In his book Usability Engineering, Jakob Nielsen (1993) defines usability as being built from five different parts. These parts are:

- **Learnability** – a system should be easily learned so the user can work with it.
- **Efficiency** - The system should be efficient to use so that a high level of productivity is possible.
- **Memorability** – the system should be easy to remember after a period of non usage.
- **Errors** – the system should have a low error rate and it should be easy to recover from error.
- **Satisfaction** – the system should be pleasant to use.

Lausen (2005) define usability as being defined by six different factors. These factors are:

- **Fit for use** – That the system can support the user's tasks
- **Ease of learning** – The system should be easy to learn
- **Task efficiency** – The frequent user should be able to use the system efficiently
- **Ease of remembering** – Should be easy for occasional users to remember
- **Subject satisfaction** – The user should be satisfied using the system.
- **Understandability** – Should be easy to understand what the system does.

In ISO 9241-11 from 1998 the definition of usability is (ISO 9241-11, 1998):

The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

Effectiveness, efficiency and satisfaction are defined as:

Effectiveness - the accuracy and completeness with which specified users can achieve specified goals in particular environments.

Efficiency - the resources expended in relation to the accuracy and completeness of goals achieved.

Satisfaction- the comfort and acceptability of the work system to its users and other people affected by its use.

As can be seen these definitions are quite similar but the ISO standard seen above encompasses more about the user's context than the other definitions and are also more specified than the other definitions. This focus on context means that usability comes from the use of a product in a specific context. If you change the context the usability of a specified product changes. Also the usability of a product depends of the type of user. This means that the ISO definition of usability is very user centred and works well with user-centred design (see chapter 3.2)

By the definition of the ISO standard it is easy to compare two systems in the same context and decide which of are more usable and it is also easier to add the ISO standard into development because of the firm definition (Gulliksen & Göransson, 2002). I have in this thesis used the ISO-definition because of its firm definition but tried to have the other definitions in mind because the different areas are important for creating good usability.

3.1.2 General rules and guidelines

Usability has some fundamental guidelines concerning how to make a usable interface. But they are not universal and must be modified for the context of the user interface. In the book “Interaction design: beyond human-computer interaction” six categories of guidelines for usability is describe (Preece, J. Rogers, T. & Sharp, H. 2002).

Visibility

According to Rogers et al. visibility is about making features accessible and not hidden in deep menus. The example in the book is about the controls in a car. The controls for the horn, warnings lights and ventilation are very visible and then also very usable.

Feedback

Feedback is something that is really important in interface design. Without feedback the users have problems knowing what the application is doing and if the user’s task has made any effect.

Constraints

With options that are not applicable at the time disabled the user interface eliminates the possibility for the user to make mistakes. For example, in most digital cameras the memory card can only be inserted one way which eliminates the error of putting it in the wrong way.

Mapping

Natural mapping can make a great difference when interacting with the world. The best example is when using the kitchen stove and often it is not known which knob turns on which plate. If the knobs are placed in the same way as the plates it takes very little thought to turn on a plate.

Consistency

One of the most important parts when designing a user interface for a application or a webpage is consistency. If Ok buttons and Cancel buttons changes places between windows in a application or if the navigation changes from top to bottom on pages within a website the users will be very confused. Also choice of words should be consistent through the application.

Affordance

Affordances can be described as an item's embedded properties. For example, it is easy to see that chairs can be sat upon, that tables will hold a cup of coffee and that a door with a plate can be pushed. In this last example we can see what happens when designers do not use affordances in the correct way because we have all pushed on doors that should be pulled. Correct affordances should be used when designing software. An example is that buttons that can be clicked should have an easily detected 3D effect.

3.1.2.1 *Schneiderman's golden rules*

In the book "*Designing the User Interface*" Ben Schneiderman defines eight rules that should be considered when designing user-interfaces (Schneiderman, B & Plaisant, C. 2004). These eight rules are the basics for creating a usable interface and by using these rules a design can come a long way to being usable.

Strive for consistency

Consistent sequences of actions should be required in similar situations which means that identical terminology should be used in prompts, menus, and help screens and consistent commands should be used through the system.

Enable frequent users to use shortcuts

As the frequency of use increases, so do the user's desires to reduce the number of interactions and to increase the pace of interaction. Function keys and short cuts are very helpful to an expert user.

Offer informative feedback

For every user action, there should be some system feedback. For frequent and minor actions, the response can be modest, while for infrequent and major actions, the response should be more substantial.

Design dialog to yield closure

Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives the operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans from their minds, and an indication that the way is clear to prepare for the next group of actions.

Offer simple error handling

As much as possible, design the system so the user cannot make a serious error. If an error is made, the system should be able to detect the error and offer simple, comprehensible mechanisms for handling the error.

Permit easy reversal of actions

This feature relieves anxiety, since the user knows that errors can be undone; it thus encourages exploration of unfamiliar options. The units of reversibility may be a single action, a data entry, or a complete group of actions.

Support internal locus of control

Experienced users strongly desire the sense that they are in charge of the system and that the system responds to their actions. Design the system to make users the initiators of actions rather than the responders.

Reduce short-term memory load

The limitation of human information processing in short-term memory requires that displays be kept simple and there should be sufficient training time be allotted for codes, mnemonics, and sequences of actions.

As seen above these guidelines are about several different things. It is about making the user interface understandable using both visual cues and information architecture so that the user does not have to think while working with the interface. It is also about making the user feel comfortable and in control of the situation and the software. This is made by incorporating easy ways to undo any action, have constraints that makes it more difficult to make mistakes, have informative feedback, and to let the user be the one who initiates actions. All these guidelines above are usable in the context of this thesis and will be used both for evaluation the existing application and developing the new version.

3.1.3 Methods for usability evaluation

3.1.3.1 Heuristic evaluation

A heuristic evaluation is when usability experts use similar usability guidelines as seen in chapter 3.1.2 to evaluate a user interface. The objective of the evaluation is to find as many usability problems as possible with the help of these guidelines. It is best if several experts evaluate the interface but they should do this separately. According to Dumas & Redish a group of five usability experts can find as many as 90% of the usability problems (Dumas J.

S. & Redish J.C. 1994). But one problem with heuristic evaluation is that of the problems found only 50% of them will result in problems or frustration for the user (Lauesen. 2005). This means that it is important not to use it as a replacement for usability testing but as a tool to find problems early in a process. It could also be used to evaluate already existing interfaces to identify problems or to make comparisons to other similar interfaces before the start of the design process (Lauesen. 2005). This method will be used in this project together with the guidelines in chapter 3.1.2.

3.2 User-centred design

User-centred system design (UCSD) or Customer-centred design as it is called in the US lets the user's goals, behaviour and problems drive the development of new systems. By having a clear user focus the IT system will have better usability and more benefits for the users. The projects will also have a larger chance of being done in time and on budget. In their book "Användarcentrerad systemdesign" Gulliksen & Göransson define UCSD as:

“A process that focus on the user and usability through the entire development process and through the entire life cycle”

Chapter 1.6, page 32 in “Användarcentrerad systemdesign”

According to Gulliksen and Göransson the UCSD process should include some key-principles to successfully capture important data about the users/customers. The following principles are the ones that were decided to be the most important for this project. A more extensive list can be found in Gulliksen and Göransson's book on pages 33-36 (Gulliksen, J. & Göransson, B., 2002).

User focus

The user's goals and the user's behaviour should be the focus of the design solutions. It is better to concentrate on what the user needs than what is technologically possible.

Active user involvement in the development

The users should be represented through the entire development process. Contact with end users should be made at different stages in the process and in the user's environment.

Evolutionary development

The system should be developed through an iterative process. In the process the evaluation of an earlier iteration should affect the subsequent iterations.

Prototyping

Using sketches created with pen and paper and mock-ups to visualize the design solutions early in the process for the users.

According to Beyer and Holtzblatt in their book *Contextual Design* it is important that a process that is user-centred uses tools for learning about the user and the user's behaviour, for example different kinds of interviews or observations. Equally important is the ability to use all the customer data in the development process and not concentrate on a few common problems that is found (Beyer, H. & Holtzblatt, K. 1997). This means that it is more important to see the “big picture” than the individual problems.

3.2.1 The User-centered process

Also according to Gulliksen and Göransson the process of developing a system should contain these phases in an iterative process:

- **Analysis** of the user's tasks and context.
- **Design proposals** using prototypes and early mock-ups.
- **Evaluation** of the usability goals.
- **Feedback** on what needs to be changed

According to Kaulio et al (Kaulio M., Karlsson M A, Rydebrink P. & Klemets M. 1996) referenced in the compendium “lyssna till kundens röst” by Karlsson (2007) the requirements engineering can be structured into the following phases (Karlsson, M. A. 2007, page 13-14). These phases are very early in the development process and only describe the initial requirement engineering.

Identifying target users and user selection

The customer that can contribute with relevant information is identified. This can include other persons other than the end users that have an interest in or is affected by the new system.

Collection of data/information

In this step the customers are interviewed or observed in his/hers context of use. Methods used in this phase are different kinds of interviews or observations.

Analysis of data/information

In this phase the gathered data is analysed with the intention to understand the customer and his/hers situation.

Generating ideas and creating customer requirements

The ideas created in this phase should be based on the understanding of the customer's situation and problems. At the same time the customer requirements should be created and it is important that these are kept through the whole process.

Choice of concept

The generation of ideas can result in many different concepts that need to be decided upon. In this phase you use different methods to support the choice of a concept.

Validating the concept

In this phase the concept and the customer requirements are validated so the developers know that they have understood the customer.

Cooper et al (Cooper, A., Reimann, R. & Cronin, D. 2007) describes the Goal-Directed design process in their book "About Face 3" which have similarities with the user-centred design process.

Research users and the domain

By interviewing stakeholders and subject matter experts the target users are identified which can later be interviewed and observed to gain knowledge about their behaviour.

Modelling users and the use of context

The analysis of the user data is converted into workflow diagrams and user models also known as personas. Each of these personas is archetypical users that often represent a whole user group or a target group. The personas have detailed description of personality, state of life, life goals and work goals. It is the role of personas to be persons the designer can design for and to evaluate requirements against (see chapter 3.4.1 for an explanation of personas.).

Requirements definition

In this stage of the Goal-Directed process the requirement definition is created which balances user, business and technical requirements. This is done by

analyse persona data and functional needs.

Framework definition

In this phase the designers create product concepts by defining system behaviour, interaction design and visual look and feel.

Refinement of behaviour

This phase is similar to the framework definition with the difference that more focus is on details and implementation.

All the presented models states that it is important to work iteratively in a development process and that it is important with early user research and prototyping. The models also describe steps that need to be done before anything is built in any real implementation so that the created concepts are easily changed. Changing a real live implementation of an application is very expensive. It is also important to frequently evaluate the result with users and against user requirements. By doing this the developers know that they are on the right track with the suggested designs and can correct errors early on before they become too big and costs a lot of money. These models all have a similar structure that will be used in the thesis and that can be summarized like this:

- Identifying target users and selecting users to use in data collection.
- Collection of data
- Analysis of data
- Creating customer requirements
- Creating concept
- Validating the concept

3.3 Methods for data collection

3.3.1 Interviews

Interviews can be a powerful tool used early in the design process. It is a good way to get information of user's opinions and feelings. It is not however a good way to get information of user behaviour because it is known that people does not have an insight in their own behaviour (Cooper et al, 2007 and Karlsson, M.A, 2007). Interviews can be done in different ways depending upon the target information and the number of users involved.

Structured

In a structured interview the person interviewed answerer a number of predefined questions with a number of predefined answers. One benefit of the structured interview is that the data found is simple to analyse but the drawback is that the interview is very inflexible. Example of a structured interview is some kind of questionnaire but this does not mean that the interviewee fills in the questions himself. An interviewer could still be present. The structured interview is often used to get the opinion of a large segment of users because it is easier to analyse a large number of interviews if the answers are structured.

Unstructured

In an unstructured interview the person interviewed is free to express his/hers answers in their own language. The interviewer is also free to make follow-up questions and the interview is more flexible. This kind of interview generates a large amount of information that could be difficult to analyse because of the answers being specific to the user. A focus group is an example of an unstructured interview. (Karlsson, M. A., 2007)

3.3.2 Mediating object

A mediating object is an object used in interviews to let the user use the object to explain behaviour and to trigger memories associated with the use of the mediating object. This means that it is easier for the interview to understand what the user talks connected to the mediating object because the user can show the interviewer and the interviewer can also show things for the interviewee. (Karlsson, M. A. 2007). These objects could be anything from a real product to hand drawn sketch. Mikael Söderman in his article "*Comparing Desktop Virtual Reality with handmade sketches and real products: Exploring key aspects for end-users' understanding of proposed products*" shows that there are not very big difference between VR-sketches and detailed hand-made sketches for understanding about a product but that the best result was given with the real product (Söderman, 2002).

3.3.3 Observations

Observations of people are a good way to get information about user behaviour. While observing the users tasks information can be learned that would be hard to find out in any other way. Observations can be structured, unstructured, hidden or open.

Structured-unstructured

As in an interview the data found can be recorded by using already defined answers (structured) or in the language of the observer (unstructured). Example of a structured

observation could be observing people and just counting the occurrence of a specific behaviour. This is inflexible but easily analysed. As in an unstructured interview the observer in an unstructured observation records what is being observed in his/hers own language. This way of observing is flexible but is more difficult to analyse.

Hidden-Open

Because of the risk that the user's behaviour could be affected by the observer's presence it is sometimes better to make a hidden observation. This could mean either that the user does not know that he is observed or that the user knows but the equipment used or the persons involved are hidden. In an open observation the equipment and the persons involved are clearly visible and the user knows he is being observed. (Karlsson, M. A. 2007)



Picture 6, observing the user.

3.3.4 Contextual inquires

One method that is introduced in marketing literature is the so called "customer visits" which is also known as "contextual inquiries" (Karlsson, M. A., 2007 and Beyer & Holtzblatt, 1997). These inquires are open and unstructured observations combined with unstructured interviews. In a contextual inquiry the designer will

observe the user in the context of his/hers workplace for about 2-3 hours. During this the observer will ask questions to better understand the user and the user's goals. The observer should be seen as an apprentice who wants to learn a trade from a master (Beyer & Holtzblatt, 1997). According to Cooper et al. (Cooper et al, 2007) 2-3 hours are too much time for an observation because users will not say yes to so long observations because it will disturb their work. They recommend one hour contextual inquires per user and observation.

By observing the users in his/hers real environment there will be a deeper understanding of the user and the user's situation. The users are also more willing to let designers observe and interview at the same time because observations do not take time from the users work while doing so. Contextual inquiries also let the user reflect upon his otherwise automated behaviour. The drawbacks with contextual inquires is that the designer with his presence and questions alter the behaviour of the users. If video recording is used one other drawback is the large amount of data that needs to be analyzed and the video camera can change the behaviour of the user even more.

3.3.4.1 Sampling

There are two common ways to choose which kind of test persons that should be in a study. These are statistical representation and theoretical representation (Karlsson, M. A. 2007). Statistical representation means that a study uses a big enough number of users so that all different groups of users are represented. In theoretical representation the users are chosen based on different criteria, for example gender, age and computer experience. This way the researches try to represent all different groups within a sample.

Number of users

Griffin & Hauser (referenced in “lyssna till kundens röst”, 2007) showed in their study that as much as 90% of user requirements was found after interviewing 30 users. That means that much of the later interviews in a sample of more than 30 users will just be about requirements that are already found. Lewis and Virzi (referenced in “lyssna till kundens röst”, 2007) found that when applied to evaluation of products a group of 12-20 users gave a result with good reliability. In their book “a practical guide to usability testing” Dumas & Redish (1994) recommends that there are between 3- 5 users in every subgroup of users and a total of 2-4 subgroups to find all requirements and problems at least once.

3.4 Methods for analysis

3.4.1 Personas

Personas were introduced by Alan Cooper in his book “The inmates are running the asylum” (Cooper and Saffo, 1999). A persona is a model of a user in much the same way as there are models of the universe or of atoms. They simplify the complex reality so that they can be used more efficiently. This means that data from contextual inquiries or interviews are presented in a way that describes a user of the system that is to be designed, a user with goals, personality and hobbies. It is important that the personas are built upon real user research and with believable motivations. The personas that are created could represent one segment of users that has been found during the data gathering. Later in the design process requirements can be compared to these personas for validation. Other benefits for the use of personas is that every person involved in a software project have their own image of what kind of user they are designing for. By using personas there is a consensus which kind of users should be prioritised when designing the product (Cooper, et al. 2007). Of course the use of personas does not remove the need to make usability tests to find problems with the software.

3.4.2 Affinity Diagram



Other ways to represent data include the affinity diagram that is described in the book contextual design (Beyer & Holzblatt. 1997). This way to organize data is derived from KJ analysis created by Jiro Kawakita in the 1980s (1982). In the affinity diagram the participants writes down the notes from user observations on post-its (or similar material) and then

they organize these notes into groups depending of what the post-it is about. Later when larger groups have been formed titles are created for these groups so that it easier to see all the connections. This way you create a hierarchy of the information with headings that communicate issues that are important for the user.

3.5 Methods for generating ideas and validation of concept

3.5.1 Prototyping



Prototyping can be used as a way for designers to communicate a design to the users, explore different concepts and validate designs.

By beginning with a prototype in paper the design solutions can be put together without much effort and evaluated with the user. This way many iterations of a prototype can be tested in a short amount of time. By using paper the focus turns away from details in the form of colours or icons and can be focused on interaction and structure. The use of paper prototypes also elicits more changes from the user because the simple design invites to making comments about interaction or structure that would not work. It is also very easy to test ideas from users directly just by sketching it on paper and exploring it.

When evaluating prototypes together with users it is also important to have a correct relationship with the user. As seen in chapter 3.3.4 about contextual design the observer should be as an apprentice to a master. When evaluating prototypes it is more important for the user to be a co-designer (Beyer & Holzblatt. 1997). This is achieved by creating an environment where the user's opinion matter so the users are not afraid to speak their mind when using the prototype. The prototype should be using real data and not be a demo of the product but something the user can use in their work. This way the user can easily make a

decision how the design would work in a real implementation and in the real context (Beyer, H. & Holzblatt, K.,1997).

Sketching with pen and paper can also be used to explore ideas that could be turned into design concepts. Working like this means that ideas can be discarded early because they do not work or they could be used for inspiration to other ideas. This way the prototype will gain more and more detail until it is ready for user evaluation.

The use of prototypes can also be a very effective communication tool between different parts of an organization, for example between designers and developers within an IT department (Beyer & Holtzblatt. 1997).

3.6 Search

3.6.1 Guidelines

In the book *Research-based web design & usability guidelines* (Health and Human Services Dept. 2006) there are some guidelines of how search functionality should be designed on websites. Because VIDA is a application that is used in a web browser some of these guidelines applies and some of these guidelines are general enough to be applicable on web and non-web applications alike.

1. Ensure usable search result
2. Provide a search option on each page
3. Design search around user's terms
4. Allow simple searches
5. Include the number of hits to improve search performance
6. Provide search templates

3.6.2 How do people use web search

When people are searching for information on the web their behaviour is decided by many different things. The two major factors are domain expertise and search expertise. Domain experts can have problems finding information if they do not understand how to make effective queries in a search engine or search experts can have problems finding information in an area where they are inexperienced. (Ferrara. 2008).

Ferrara also writes about some different user behaviour patterns that are good to design for.

1. Alternating between search and browse
 - a. Support cross-linking between pages
 - b. Include conventional navigational cues like breadcrumb trails.
 - c. Don't let pages come to a dead end without links to other resources.
2. Minimizing the results set
 - a. Allow filtering by categories
 - b. Include a numeric count of the total number of results
 - c. Use "AND" as the default operator rather than "OR" so the user gets fewer results with more words.
 - d. Do not truncate the number of results to a set number because this will make it hard to measure the quality of the search.
3. Surveying quickly
 - a. Ensure that the titles of the result are comprehensible at a glance
 - b. Highlight the terms that match the submitted words
 - c. Allow the users to change the number of results shown per page so that users can avoid navigating through many pages.
4. Making immediate judgement
 - a. Optimize the result for the most common queries
5. Agonizing over the query
 - a. Provide tools for assisting in formulating the query
 - b. Consider including a list of popular searcher or store the user's previous queries.
6. Pogosticking. Changing between searching and navigation.
 - a. Highlight search terms in the pages that the user navigates to
 - b. Make it clear which links that have been visited

3.7 Description of use cases

Use-cases are a way to describe the functionality of computer application through describing the interaction between user and the system.

Example of a use case:

- 1 USER clicks on the Search button
- 2 SYSTEM Shows result

Often there is no focus how the system answers and there is no prioritizing between the different use cases. These are two problems from the viewpoint of usability because some interaction could be more common or/and more important and it is also very important in how a systems answers in a user/system interaction (Cooper, A., Reimann, R., Cronin, D., 2007). In the example above it is important to know how the system shows the result and not only that it should.

According to Cooper et al the use cases could be a tool for determining the completeness of a system. Use cases is often the foundation when ordering a new IT-system to be developed outside the own company or by an internal IT department. This means that the use-cases need to include details of how interaction between system and user should behave (Cooper et al, 2007 and Gulliksen & Göransson, 2002). I believe that it is important to include mock-ups that show the interaction so that the developers know and do not interpret the use-cases in their own way.

4 Planning

This thesis is focused on the use of methods that belong to user centred design methodology. This means that it will involve the user early in the process and regularly through the design process. The methods used will be combinations of interviews and observations and it is done during a semester spanning 20 weeks. Below is a rough schedule over these weeks. The first four weeks is scheduled for different preparative work such as finding workshops for the user observations, talking with stakeholders, identifying user profiles, finding relevant material and deciding upon methods. The next twelve weeks will include user contact at the different workshops, analysis of the collected data, the creation of the requirements and the creation of the mock-ups. In these twelve weeks there should be two iterations of mock-up creation and user evaluation. Two iterations in a period of twelve weeks is a realistic number of iterations. The last four weeks are for the creation of the magister thesis paper. The details of these phases and the different methods will be planned right before their implementation.

Week 1-4 Prestudy:

- Contact workshops for user observations.
- Create interview guide to the interviews with personnel involved with VIDA at VCCS.
- Interview personnel involved with VIDA at VCCS
- Choose methods for the process.
- Create questionnaire to the creation of user profiles
- Identify user profiles.
- Decide how to carry out the interview-observations.
- Decide how to do the analysis of collected data.
- Decide how to do the user evaluation of the mock-up.

Week 5-10 First Iteration:

- Begin user observations.
- Analysis of data
- Generation of ideas.
- Creation of mock-ups
- User evaluation of mock-ups

Week 11-16 Second Iteration:

- Analysis of user evaluation
- The generation of ideas and changing the mock-ups.
- Evaluation of mock-up
- Analysis of user evaluation
- Changing the mock ups.

Week 17-20 Wrap-up:

- Creation of the thesis paper
- Presentation of the magister thesis.

5 Implementation

This chapter describes the work that was done during 20 weeks, how the study was planned and executed. *In this project the individual stages was first planned, prepared and then implemented.* The whole project was not planned from beginning to end before implementation. The result of the different steps will be described but sometimes there will be more detailed information in the appendix chapter. The six different phases in the development process that was identified in chapter three was used to plan the study.

The table below describes which methods were used in which phases.

- Identifying target users and user selection
 - Heuristic evaluation
 - Stakeholder interviews
 - User survey
- Collection of data
 - Contextual interviews
- Analysis of data
 - Affinity Diagram
 - Personas
- Generating ideas
 - Paper prototyping
- Choice of concept
 - User evaluation
- Validating the concept
 - User evaluation

5.1 Prestudy

5.1.1 Identifying target users and user selection

5.1.1.1 *Heuristic evaluation*

To gain an insight into VIDA and to understand the potential problems that could arise for users a heuristic evaluation was planned. See chapter 3.1.3 for a description of a heuristic evaluation. As seen in this it is known that up to 50% of the problems that heuristic evaluation finds are things that user's will not encounter as a problem. But by doing this heuristic evaluation there will be a better understanding of the application and a better communication with the users but it is important to realize that everything found is not really a problem for

the users. The evaluation was planned to be of all of VIDA and not only the search tab because this was a way to get to know how VIDA works and also VCCS is interested of usability issues for the rest of VIDA. The plan was to use basic usability guidelines presented in chapter 3 for this evaluation.

When doing the heuristic evaluation all parts of VIDA were evaluated except the diagnostic and the software download part which was not available in the VIDA-on-web version that was evaluated. Some problems were found that if corrected could make the user experience better. Most noted was the lack of keyboard shortcuts for navigation, lack of informative feedback when adding parts to the parts list and the structure of the search function. For more experienced users keyboard shortcuts are very important if they are to work efficiently. See chapter 9.1 in the appendix for a more thorough walkthrough of VIDA.

5.1.1.2 Stakeholder interviews

The next step after the heuristic evaluation was to make some interviews with product owners responsible for the information in VIDA. The goal was to gain an insight into VIDA and to identify target user groups. These product owners are responsible for different information in VIDA, for example parts information or information connected to CSC (see glossary for information of CSC). This is a way to gain an insight into VIDA and these stakeholders probably have a lot of knowledge of the Volvo aftermarket and their users which could help to better understand today's problems. This will also lead to a better understanding of the users. The interviews with the stakeholders should be carried out with access to VIDA so that the interviewees can easily refer to the application in their explanations. To support the interviewer during the interviews the interviewer should have an interview guide to support him during the interviews. It could be a very simple guide with only a few questions that need to be answered and make some follow-up questions on areas brought up by the stakeholder.

After the planning of the interviews was made an interview guide was created. See chapter 9.2 in appendix for the guide that was used during the interviews. The result of the interviews was a better insight into the use of VIDA and also a better understanding of the different areas of information. Through these interviews it was possible to list different kind of user groups classified by their role within the workshop. These classifications are based on the stakeholder's view of the different roles in the workshops. Different classifications are probably possible by using computer experience, age and domain knowledge as a classification.

Mechanic

Mechanics use VIDA to fault-trace cars and read fault-tracing documents. He will also use the parts catalogue get the article numbers for ordering of parts. The mechanic is probably under a lot of time constraints because of great work load.

Customer greeter

The customer greeter is the first to meet the customer either in person or over the phone and must try to convert the description of the problem to CSC used in VIDA. The customer greeter should be able to deliver a cost of the repairs. The greeter will be under time constraints because of other customers waiting on the phone or at the workshop.

Parts orderer

The parts orderer wants to find the correct article number to be able to order it. He will probably find it through the parts catalogue's table of content because of great domain knowledge. There are probably time pressures because there could be many mechanics at the same time wanting different parts ordered.

Service technician

The service technician has the role of all the above user groups. He is educated to have all the roles in a workshop. He will have customer contact, do the fault-tracing and repairs and ordering of parts. In all these steps there will be time constraints.

5.1.1.3 *User survey*

To get a better basis for the selection of users for the study the plan was to create a short questionnaire for the users that was willing to be in my study. The idea was that it would help in creating the user profiles and get knowledge about the users that could affect how they use VIDA. This survey would be the foundation for the selection of participants in the study. As a basis for this survey the information found about different user groups and other things that could affect the survey could be used. The questions in the survey were planned to be about computer experience, internet experience, VIDA experience and how long they had experience of the automotive industry. It would probably be good to ask about their working role because this will decide what information will be of interest to them. The goal with this kind of questionnaire is to elicit information of the different users so that the set of users chosen for the study will be as representative as possible. This means that theoretical representative sample will be used to gain a broad sample of users with different computer

experience, age and domain knowledge (see chapter 3.3). Theoretical representative sample will be used because statistical representative sample would take too much time and resources to find users and it would take too much time to analyze such quantity of data. Theoretical representation will be useful because you can get reliable data without needing the resources for a statistical selection. As seen in chapter three 12 to 20 users are enough to identify the majority of user requirements in a qualitative study. A realistic number of users to use in this study would be between 10 and 12. A short questionnaire is used because of the small amount of time it takes to answer and that it easily can be done over email.

There were problems to find enough users in comparison to what was planned above. The request of finding users that are willing to be a part of the study did go through the structure of Volvo. This procedure was very time consuming and by the date that was set as the start of the contextual inquires there were only three workshops available and contact with three end users were made. This low number of users meant that it was not possible to choose users after the user profiles, instead every user available would be observed and if available to evaluate future concepts. So the questionnaires that originally were made as a tool to identify key users was used to track which kind of users that was represented in the study in regards to computer skill, internet experience, VIDA experience, work experience and age. This could later be used to explain the result of the study and how it was affected by the low number of users. To get more users and to get a more representative study, more users should be contacted at the workshops while doing the contextual inquiries.

The user survey that was used can be seen in the appendix chapter. This survey was emailed to some of the users and in some cases it was done just before the contextual inquiry. It shows that all participants are male and the majority was mechanics, between 30-40 years of age and have a long experience of the automotive industry. They also have above average experience of computers and most of them have a broadband connection at home that they use daily. It can also be seen that these users use VIDA several times a day and some users all day.

5.1.2 Eliciting user behaviour

5.1.2.1 Contextual Inquires

For eliciting information from the end users there are many different methods one can use. There are the non-structured interviews, structured questionnaire and different kinds of observations. As described in chapter three one type of observation are the contextual inquiry that combines techniques from interviews and observation to elicit user behaviour (see

chapter 3.3.4 for information about contextual inquiry). This is a good combination that captures both what the user is doing from the viewpoint of the observer and the opinion of the user from his/her viewpoint. But a thing to remember is that the presence of an observer/interviewer alters the behaviour of the user with both by asking questions and by presence. This means that the behaviour could be changed in comparison with the behaviour of a user that does not know that he is observed.

Interviews would be an alternative way for eliciting information about the user because of the user involvement but the data would not be as reliable as in contextual inquiries because of the lack of user interaction with the working environment. To solve this problem a computer with VIDA could be present so the user could interact and refer to it if needed. Using interview as a method would still miss much important information as for example the different elements of the users work that affects his/her goals. Using a method based on only observation (not asking questions at the time of observing) could be an alternative but the observation still changes the user's behaviour to some degree as in contextual inquiries. Interviews would also be required after the observation because it would not be possible to ask questions about the user's behaviour at the moment of the observation. Questionnaires would work as a way to classify users at the start of this kind of study or be a tool for validation where the user could rank a prototype compared to the application they use today but not to elicit user behaviour.

While doing the contextual inquiries the plan was to ask questions about the user's behaviour. Examples of question that could be asked are:

- What is your goal now when you are using VIDA?
- What kind of information do you want to find? Why?
- What do you think as you see the search results?
- What is the next step? Why?

These questions should lead to more knowledge about the user goals and what kind of information the user wants at different times of the interaction with VIDA. The questions will try to promote think aloud behaviour as seen in different methods for usability testing (Beyer & Holzblatt. 1997 and Dumas & Redish. 1994). Think aloud will externalize the user's thoughts and make them available for the designer which would lead to better insight into the user's goals. Other details should also be noted as what kind of computer the user is using

(laptop or desktop), what are the events that trigger different phases of the user's work and other details.

There are a lot of different ways to record the behaviour of the user. One option is using a video camera and not making any kind of notes while observing and focus on questioning the user. The recorded material could then be analyzed and re-examined at any time. However there is a chance that the designer will miss crucial information while filming and not asking follow up questions about this. The presence of a video camera would probably also change the user's behaviour even more than just taking notes. It would also be better if one person could use the video camera and one person could interview the user but this is not possible in this study. The time it takes to analyse the video recording is much larger compared to when only taking notes, as can be seen in the table below (Lauesen. 2005. Page 423).

Time consumption for contextual inquiries with video/per interview:

Introduction	10 minutes
Observation	60-120 minutes
Closure	10 minutes
Review of video	240-480 minutes
Summarize	60-120 minutes
Total:	6-12 hours

Time consumption for contextual inquiries without video/per interview:

Introduction	10 minutes
Observation	60-120 minutes
Closure	10 minutes
Review of notes	60-120 minutes
Summarization	60-120 minutes
Total:	3-6 Hours

Only taking notes however will present other problems. While taking notes the observer can miss information and by taking short notes the richness in the data is lost. Notes can be very hard to understand after an observation if they do not include much detail. But notes are more easily analyzed than video recordings. A complement to just taking notes could be audio recording for later analysis. This way there is a record to go to if there is ambiguity about the

notes from an observation.

It was decided to make the contextual inquiries without a video camera for reasons discussed above. It was thought to be intrusive and also there would be too much information for analysis. The observations were also done without an audio recording device because no suitable device was available.

In this phase of the study, five end users were available for observation. As seen in the result of the user survey most of them were mechanics but some were persons that were responsible for ordering new parts or responsible to greet the customer. For the most part these users were observed for approximately two hours and a script with information and questions for the observation had been prepared. This script included information that the user should know about the method used and what would happen with the gathered information. This was not made as a text to be read from paper but as a bulleted list. This meant that the introduction to the contextual inquiries were much more natural which was decided to be important because the users should feel comfortable with the observer and not feel as they were part of an experiment. The drawback with this method is that the different users did not get exactly the same wording.

The most noteworthy observation during this time was that the search function was used very little. This was mostly due to the users being very experienced in VIDA so they knew where the information was. Also the users did not think that searching for the information would help and would only be a waste of time. For more information about the different observations see chapter 9.6 in the appendix.

5.1.3 Analysis of data

The plan was to change the notes that were made during the contextual inquiries and to create a summarized text about each user. These texts should include the working environment, working routines, the goals of the user and the problems encountered and also information from the questionnaires used earlier. This way it would be possible at a later time to review the information about the user and not have to reread the notes taken during the contextual inquiries.

If the contextual inquiries gives enough data about different categories of users there is other ways to represent the information from the contextual inquiries. For example, Alan Cooper

(Cooper et al, 2007) is champion of converting the information from observations to so called personas (see chapter 3.4.1). Each of these personas is archetypical users that often represent a whole user group or a target group. The personas have detailed description of personality, state of life, life goals and work goals. It is the role of personas to be persons the designer can design for and to evaluate requirements against. Other ways to represent this data include the affinity diagram that is described in the book contextual design (Beyer & Holzblatt, 1997). In the affinity diagram the participants writes down the notes from user observations on post-its (or similar material) and then they organize these notes into groups depending of what the post-it is about. Later titles are created for these different groups that are created so that it easier to see all the connections.

The next stage was to deal with the planned analysis of the contextual inquires. According to the schedule from the planning phase (see chapter 4) the data gathering should now be done and the analysis of the data and the design phase should have begun. The plan was also to have had observed at least ten different users by this time. But because of few workshops and users who used VIDA at short periods of time the number of observed users was only five. Decisions must now be made if more time should be put upon finding more users or if the design phase of the project should begin.

Because of the time already spent on the project it was decided to begin with the analysis of the contextual inquiries and to begin to create design ideas. New observations can be made during the first evaluation of the mock-up if there are more workshops willing to participate in the study. There has been contact with a technical upper secondary school that has courses in aftermarket applications. This would be a way to observe beginners of VIDA and to get a more nuanced representation of the users. If there are new observations made this new data should affect the changes made to the mock-up and the requirements from the users. Because of the low number of users it was decided that there was no need to do a KJ analysis of the data and there was not enough data for personas, instead the notes were a basis for texts about the individual users that incorporated the questionnaires and the user's goals and working conditions (see chapter 9.6 in the appendix). These texts about the user could have the same role in the design process as the personas as it will be the basis of the design.

The analysis showed that the user's thought that the search was slow, and that they had very little control of the search and that the search result could be confusing. One thing that was observed was the confusion that VIDA, although being a application run in a web browser did not support the use of the "back to previous page" button in Internet Explorer or the shortcut

for this functionality. This led to much frustration when the user wanted to be able to use the shortcut but couldn't or because that the use of this "back" button resulted in that the user was logged out from VIDA. Also there was a difference between what the users thought would be filtered away in a search and what really was filtered. The users thought that all information about the car was used when in reality only some information was used.

5.2 First iteration

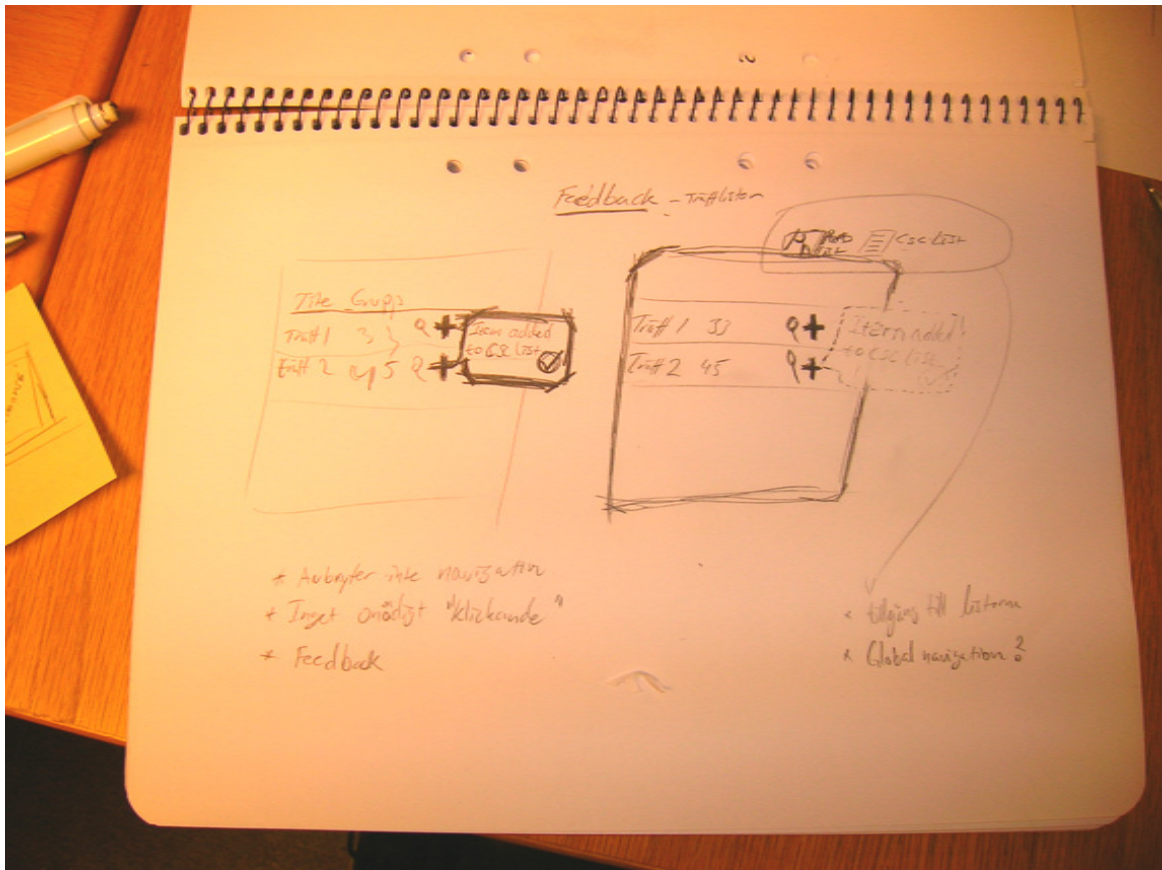
5.2.1 Generating ideas and creating mock ups

The designing and creation of concepts began after the collection and organization of data. The identified requirements and the user texts were used as inspiration to create a couple of design proposals. These design proposals was sketched with pen and paper and then created with cardboard paper and post-its. The design proposal mock-ups will then be evaluated by the user from the contextual inquiries. Their comments and opinions would affect the future direction of the concepts and the creation of more detailed mock-ups.

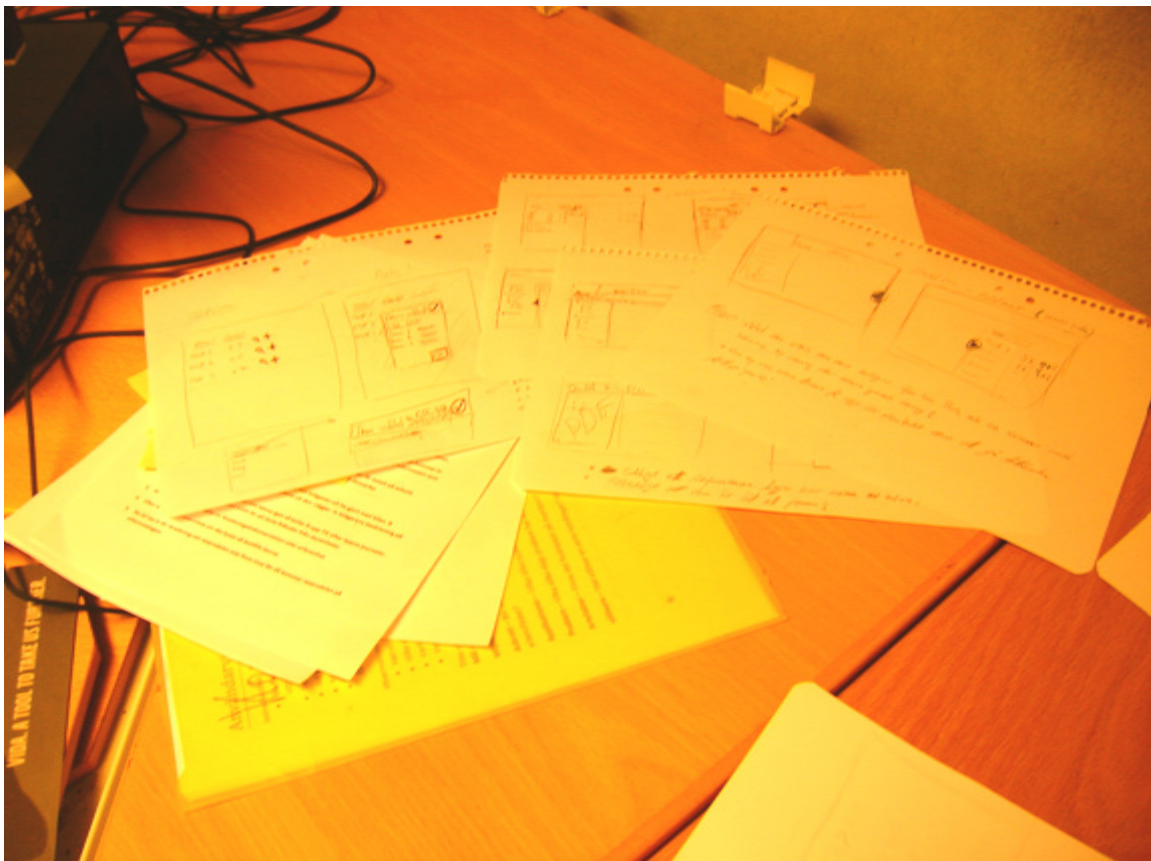
These more detailed and more interactive mock-ups was planned to be created with some simple techniques to fake interactivity. Simple html or maybe adobe flash could be used, but the author had very little knowledge in these tools. The decision of which tool to use to develop these interactive mock ups would be taken further into the project.

According to Holtzblatt and Beyer paper prototypes should be created iteratively in the development process and should be easy and quick to create and change. This was achieved in the first iteration by using different kinds of paper, pens and post-its. Users are also more inclined to offer more feedback and propose more changes when using low fidelity mock ups than high fidelity mock-ups because that the users feel that they can affect a low fidelity mock-up more (see chapter 3.6.1). The users will also identify more errors in the design.

After the analysis of the data and the creation of the user texts it was time to create some design ideas. At first pen and paper was used to do simple sketches to try different concepts and features. The summarized texts about the users were used as inspiration as was earlier sketched ideas. The sketches were used to get inspiration to new solutions to problems and new concepts. This way different features and different concepts was created and explored.



Picture 7, First sketches



Picture 8, Gathering of sketches



Picture 9, Concept sketches.

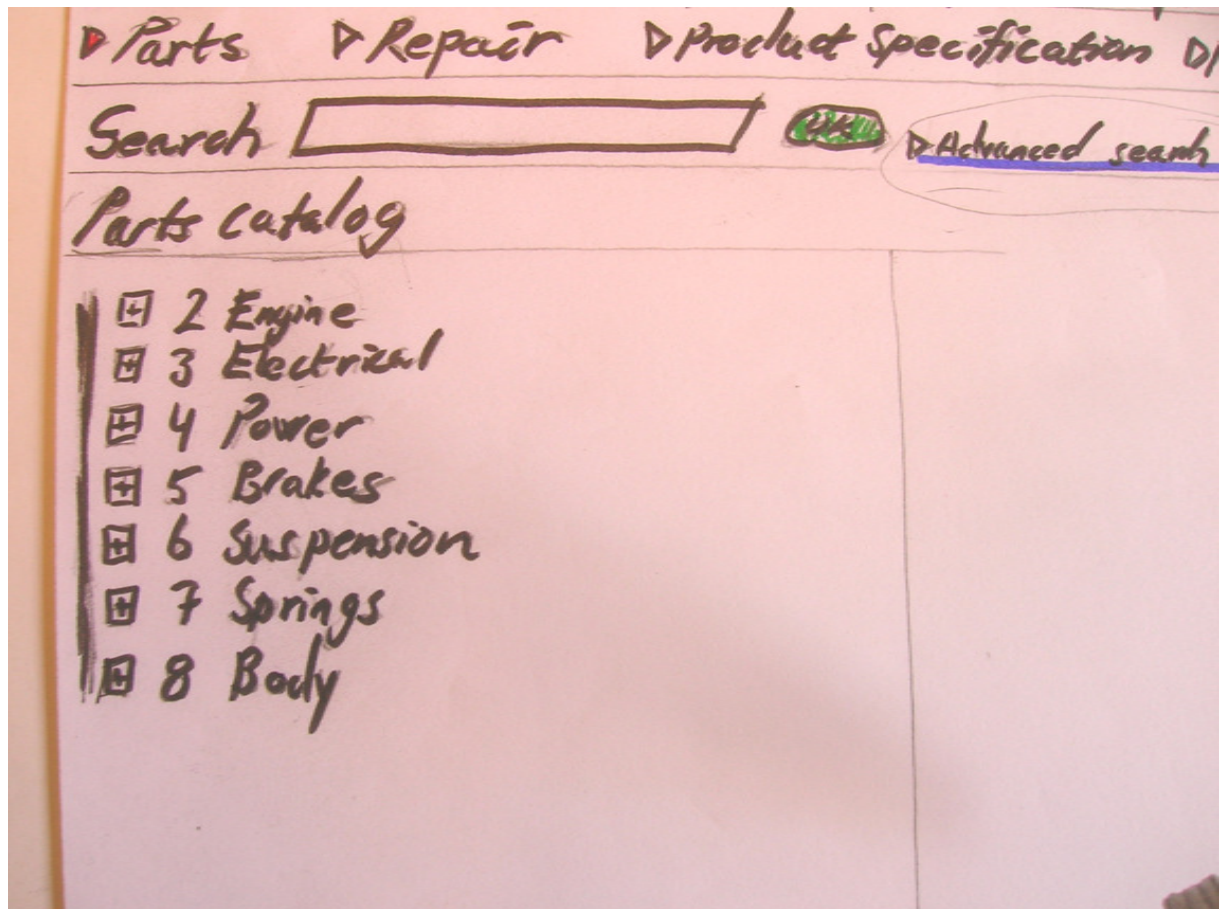
Concepts and features that was believed to fit together was fused together to create bigger concepts. These concepts were then created with paper to form what can be called story boards that show how the interaction will work with the new concept. This mock up shows how the user will begin a search, how the interaction works and how the result could look. In the next chapter the results are described.

5.2.1.1 *The concepts*

VIDA Menu search

The first concept is called “VIDA menu search” and it introduces the idea of searching for information in the hierarchical structure over the function groups. A search field is placed close to the table of content in the information part of VIDA (see picture 10 below). This way the user does not have to navigate to the search tab if he just wants to make simple searches. No special alternatives exist because it should be uncomplicated and if the user wants to make more advanced searches the regular search function should be used. Because of the nature of the navigation in VIDA the search fields will be placed in every subgroup of the information

types. This means that the searches are already narrower than the searches the user is able to make today. The user should then have fewer search hits to look through which should make it easier to find the information the user is looking for.

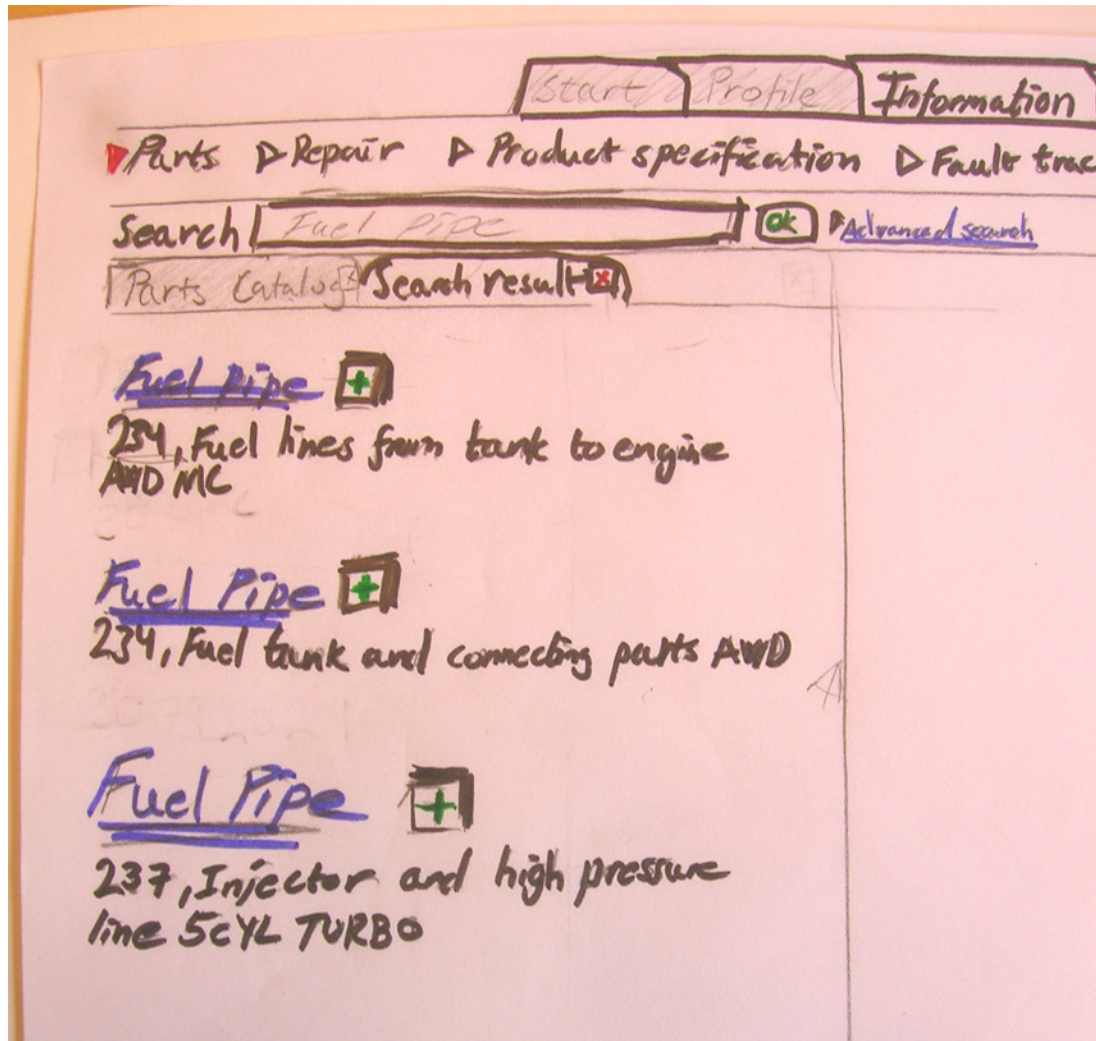


Picture 10, First mock-up, the menu search concept.

The search result will be displayed in another tab alongside the table of content (see picture 11 below) so that it is easy to navigate back to the table of content. Alongside the search hits there is buttons that add the part to the parts list. These buttons have mouse-over tips that give information about the button. The links are clearly visible and it should be easy to know where the links go to. Below the link there is more information about the hit. The information is function group number and name, notes and profile.

The search field is still present and will save the keywords so the user can add or remove some words and make another search. The search result can be closed by pressing a close button at the tab. Clicking on one of the search results will mean that the table of content tab will “fold” into the left side of the screen and the information that is linked will be shown. Pressing space or clicking on an arrow to the left will get the table of content back. The table of content will be updated to show the user’s new location in the hierarchical structure, as it is

currently in VIDA. The search result is still saved in the tab to the right of the TOC.



Picture 11, the first mock-up showing the search result in the menu search concept.

Questions that need to be answered when evaluating this mock-up are:

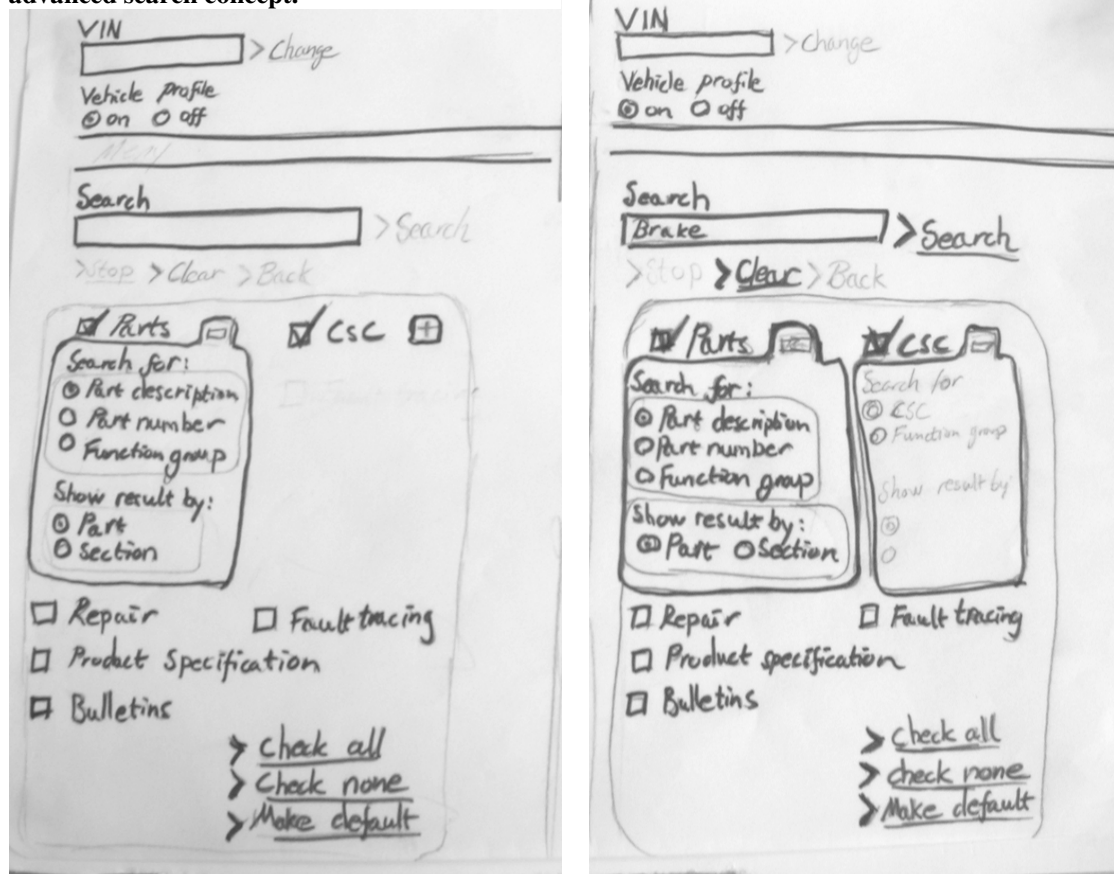
- Is a less advanced but more accessible search function something that would improve the user experience?
- Where does the user expect the search result to appear?
- Where does the user expect “menu search” to search for the information?
 - In all the different information types or only the current information type?

VIDA Advanced search

The second concept is a new version of the search tab in VIDA. It is a more advanced version with some more alternatives. Today the users have some alternatives when searching for parts but not when searching for any other information type. That the users wanted more alternatives while searching for other information types was something that was mentioned during the contextual interviews.

In this version of the search, the different information types have a checkbox associated with them. This way the users can combine where the search engine should search for the information.

Picture 12 & 13, The alternatives of the advanced search concept.

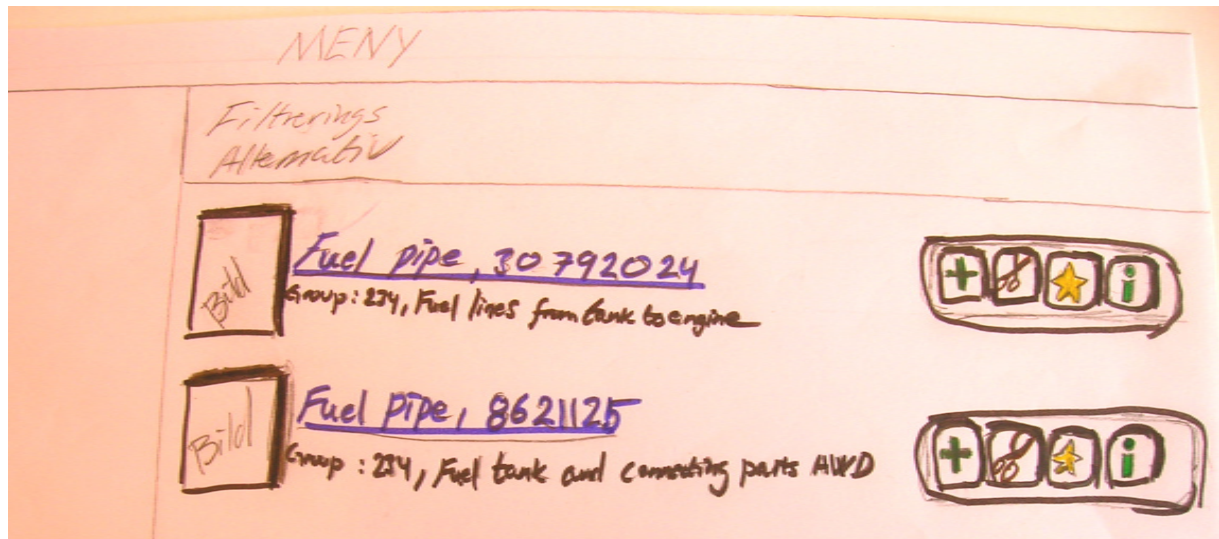


When the user checks a checkbox more alternatives is made available. These alternatives let the user change what the user is searching for. (See picture 12 & 13 above). Below the checkboxes there are links that checks all boxes, uncheck all and saves the configuration as default search. To be able to save your configuration means that if the user often searches for a specific type of information he can save this and do not need to reconfigure the search every time.

The search result is showed in a different way than in the current version of VIDA. The look is inspired from search engines on the web, for example Google.com. The link to the information is bigger than the rest of the information and works as a headline. The idea is that the headline shows the user what information is most important. Below the link there is more information about the hit, the information includes function group number and name, notes and profile. This text it is smaller in comparison with the link but should be what is normal in VIDA (11 pt, verdana). To the right of the links are buttons to add the specific part to the parts list, add the document to the bookmarks and a button to cut the article number of the part to the “clipboard” and be used by the user in other applications. Above the result the user can use filters and change the way the result is sorted. By default it is ordered by some kind of relevance so that the user knows the hits that are higher on the list of hits are more important than the hits on other pages. This means that there must be some algorithm that calculates how relevant a search hit is in comparison with other hits. Search engines can have very complex algorithms for this but there are also simple rules that can be implemented. In the information type “Parts” these rules could be based upon how many of the keywords are in the parts description or where the keywords are placed in the description.

Example: If the user searches for “brake” a hit with name “brake kit” will be above a hit with the name “something something brakes” because in the first hit 50% of the keywords are in the part description and only 33% in the later example. Also in the first example “brake” comes first in the description but only as the third word at the second example. In the information types that are more based on documents this algorithm could be based both on the title of the document and the number of keywords in the document. So if the user searches for “brakes” the document with 250 hits in will come above the document with ten hits which will show which document that is most relevant.

In one version of the paper "screenshots" there is a preview image of the document in the search result. This image can be clicked to enlarge it so the user can make a more informed decision if this is the information that he needs. In the same “screenshot” some additional information is hidden and there is a button to retrieve this information about the hit. This information could be notes or other detailed information. These features are made in a special “screenshot” because it would be easier to evaluate with the user and easier to make comparisons with the rest of the mock-up to see if these features are something the user would find useful.



Picture 14, the search results in the advanced search concept.

Questions that need to be answered about this mock-up are:

- Are more choices a good thing and would it help the user to work more effectively?
- Are checkboxes the right way to go or do users only search in one information type at a time?
- Are bookmarking and "cut article number" wanted features?
- Should the user be able to filter the search?
- Is sorting by some kind of relevance wanted?
- Is it better to show the hits more in accordance with web search engines like Google.com?
- Is it better to link the article and document names then car profile?
- Is it better to hide notes and then through an icon be able to read more detailed information?
- Should the user be able to change the car profile of the car by entering the cars VIN number?

5.2.2 Validating the concepts

The plan from chapter 4 was to have two evaluations of the mock ups. The first evaluation was with the low fidelity mock up and then later with the high fidelity mock up. The first low fidelity mock up was planned to be evaluated by showing the mock-up and discuss the different design solutions with the participants from the contextual inquiries. By doing a paper

mock-up there would be less demand on the mock-up because not all functionality would be implemented and the focus would be on the concepts and not specific details as icons, fonts or colour.

There were some difficulties to evaluate and create mock-ups for a search engine interface because of the complexity of a search application. If the mock-ups must support a scenario, the degree of complexity is quite high and it is difficult to express this complexity when working with low fidelity tools. Therefore it is probably better to show the user how a search with the mock up would be from start to finish. But it is important that the designer do not tell the user how everything works but asks the user what he expects before explaining the specific design. It is important that the user feels and acts as co designer during the evaluation and that he is not afraid to communicate her opinions (see chapter 3.6.2).

The high fidelity mock-up could be evaluated using scenarios and simple tasks for the user to complete (Cooper, Reimann, Cronin. 2007 and Lauesen. 2005). This evaluation method will demand that the mock-up contains more details and information but it means that the users will be more able to decide if the design concepts are usable and effective.

While evaluating any concept it is important to avoid bias and to gain access to the opinions of the user. It is known that users often agree with the designer and do not say what they really mean on the assumption that the designer is an “expert” and knows “best”. Because the concepts can be different than how the application works today means that users will be more positive towards these new and “better” solutions. It is also important to ask questions that make the user reflect on his/her behaviour and how the mock up could work in the user’s daily life (Karlsson, 2007).

Questions that could be asked could be:

- What do you expect will happen if you click this button?
- Where do you expect the information will be shown?
- Where would you rather have the information to be shown?

The users will be shown the same mock up, which means that there will not be any changes between the users. Because of the few numbers of users it is more important to be able to compare the comments between the user interviews than testing comments made by previous

users. If more users make the same comment about something specific in the mock-up then this has more validity on a larger scale and can be validated in the next mock-up.

The evaluation of the mock-ups was made during one week and the mock-ups were shown for three users that were observed during the contextual inquiries and other users that were available at the workshops at the time of the visits for a total of six users. All users saw the same mock-up without any changes between the users as discussed above. The use of a questionnaire was considered but not used because it was decided that it was enough to make note of the opinions of the users. The exact things to say during the evaluation were not written word for word. Instead subjects that should be discussed and questions that should be asked were written down. This meant that the meetings used a more natural language in my opinion and was not so rigid (see chapter 9.7 in the appendix for the script used). This was considered important because the user should feel relaxed and feel like he was a co-designer and less like a test subject (Beyer & Holzblatt, 1997). The users were shown the mock-ups and asked questions about what they thought specific features in the mock-up did. For example they were asked where they thought the search result would appear after they clicked the search button.

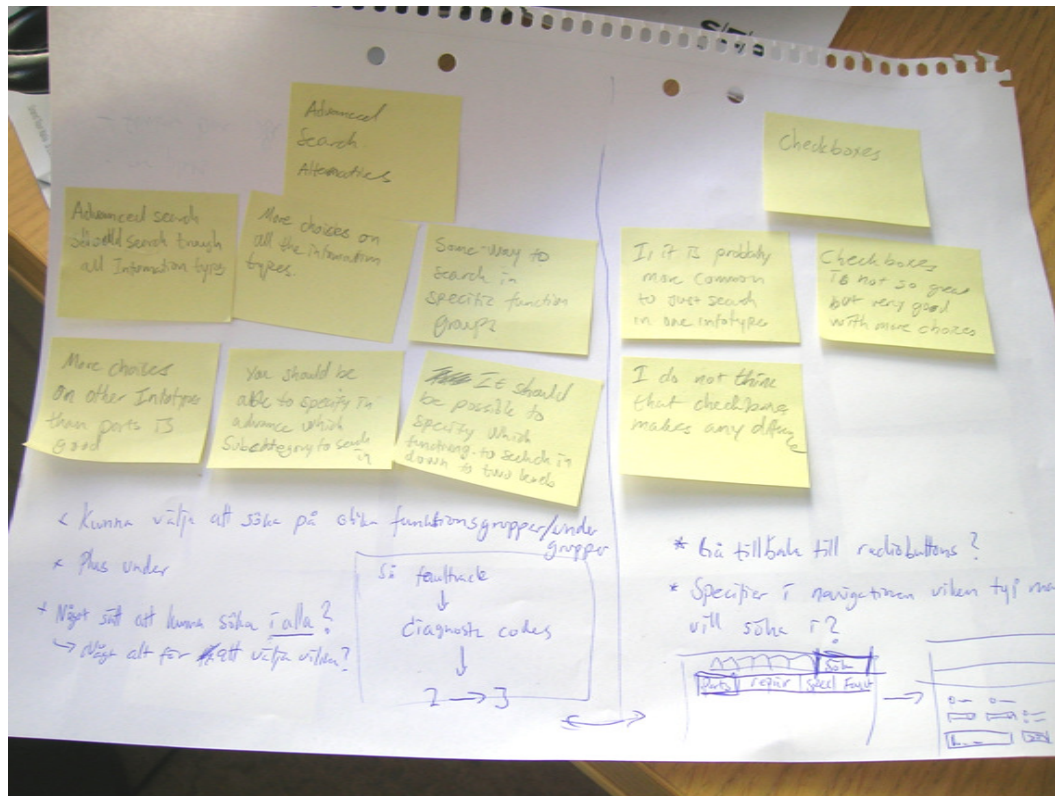
This was done to find out the user model before it was influenced by the designer's model. After the users had responded, the mock-up version was shown and the specific solution in the concept explained. This was often followed by a discussion about the differences between the user's model and the designer's model.

The meetings with the users were made in different environments. With some of the users the evaluation was made in lunchrooms away from their workstation because there was much mechanical work nearby which made evaluation difficult. The rest of the evaluations were made at the user's workstation that either was in an office or placed in a large room made for several mechanics. To get some more information about how new users use VIDA, two teachers of Aftermarket applications at a technical upper secondary school were shown the paper mock-ups which meant that a total of 8 persons evaluated the mock-up.

5.2.3 Analysis of the information

The user comments can be represented in a number of ways but for this task affinity diagrams have been chosen. It is simple to do because it uses very simple tools; all that is needed are post-its, pencils and probably a whiteboard. For more information about affinity diagrams see chapter 3.4.2. After the information from the evaluation has been structured it can be the basis for the creation of the high-fidelity mock-up.

After the evaluations the user's comments were written down on post-its and then sorted into different groups depending on feature and concept they commented upon (See photo below). This way to structure the data is very similar to an affinity diagram (Beyer & Holzblatt, 1997 and Karlsson 2007b). It was now easy to see what the users made comments about and if the comments were similar with other users.



Picture 15, analysing the data.

After the analysis some common elements were seen between the different users. As can be seen in the appendix most of the users thought that the result of the “menu search” should be shown in the table of content of the chosen information type and that most of the users thought that the search scope of the “menu search” should be influenced by the navigation. This means that it should only search through the information type that the user is currently viewing.

In the “advanced search” the users thought that it was not necessary to be able to search through multiple information types at the same time. But they thought that the idea of being able to choose which subgroup to search in was a good idea because that way they could sort out unnecessary information from the beginning.

The users were very positive to the preview function because this would enable them to take a quick look on the information before deciding if this is the information they need. The users were also positive to the new way to show the search result but they didn't think that it would be possible to hide any information and use a "more information" button because almost all information shown today is important for the users to make an informed decision. This would only add unnecessary excise for the user.

5.2.4 Result of evaluation

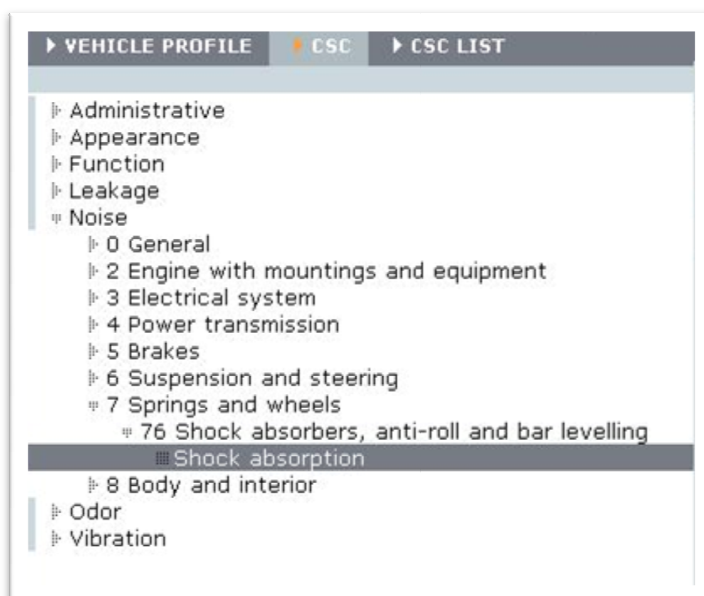
Following things will be changed between the paper mock-up and the high fidelity mock-up:

VIDA Advanced search

The checkboxes will be removed and replaced by dropdown menus. Because it was discovered in the user feedback that users often only are interested of searching in one information type at a time. But the users did want to have the choice to decide more about where to search for the information. So it will not be possible to combine different information types in a search but it will be possible to decide what kind of information that is important within an information type. The feature to change car profile by using a VIN number was removed because the user feedback indicated that this was an unnecessary feature.

The preview feature was added because of positive user feedback. The feature that allowed detailed filtering was removed because of the user's opinions that it is better to spend more

Picture 16, Table of content of the CSC information type in VIDA.



time before search so that it is not needed

to filter out unwanted data afterwards. It is enough to be able to sort the information.

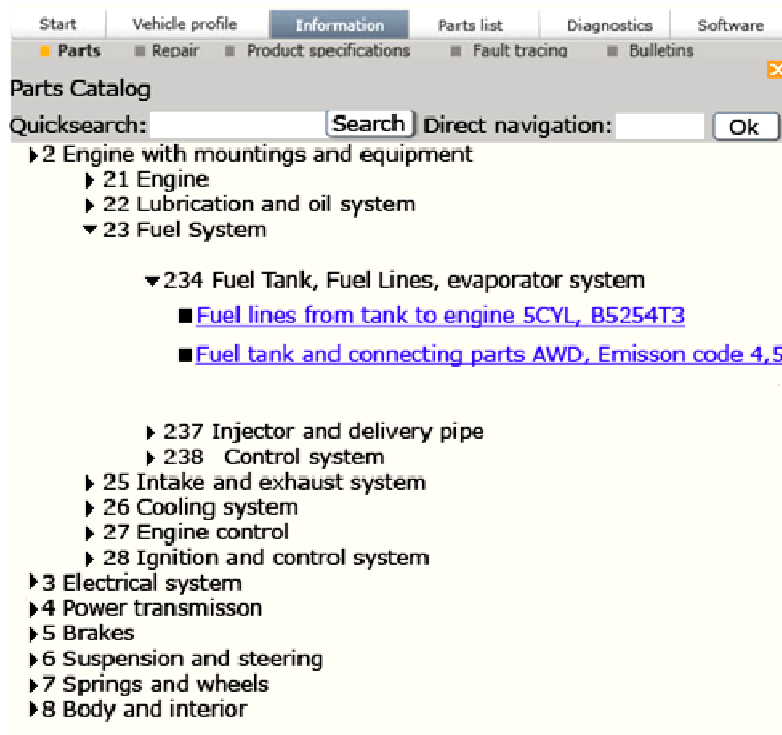
Menu search

The result is shown directly in the table of content instead of a separate tab. This was where most of the users thought that the result should be shown and because of this the idea will be explored instead of having the search result in a different tab. This

idea will use the table of content as a medium to show the search result. See picture below for an example of the Table of Content in VIDA.

When showing the results the sections that do not correspond to the searched keywords are closed and the groups containing search hits are opened up. (See picture 17 below)

The label on the button is changed to “search” instead of “ok”. The label to the left of the search field could probably be removed because of the label on the button. Also a link was added so the user will be able to clear the search result when needed. This will remove the keywords and show all the information in the table of content and not only the information that matched the keywords.



5.3 Second iteration

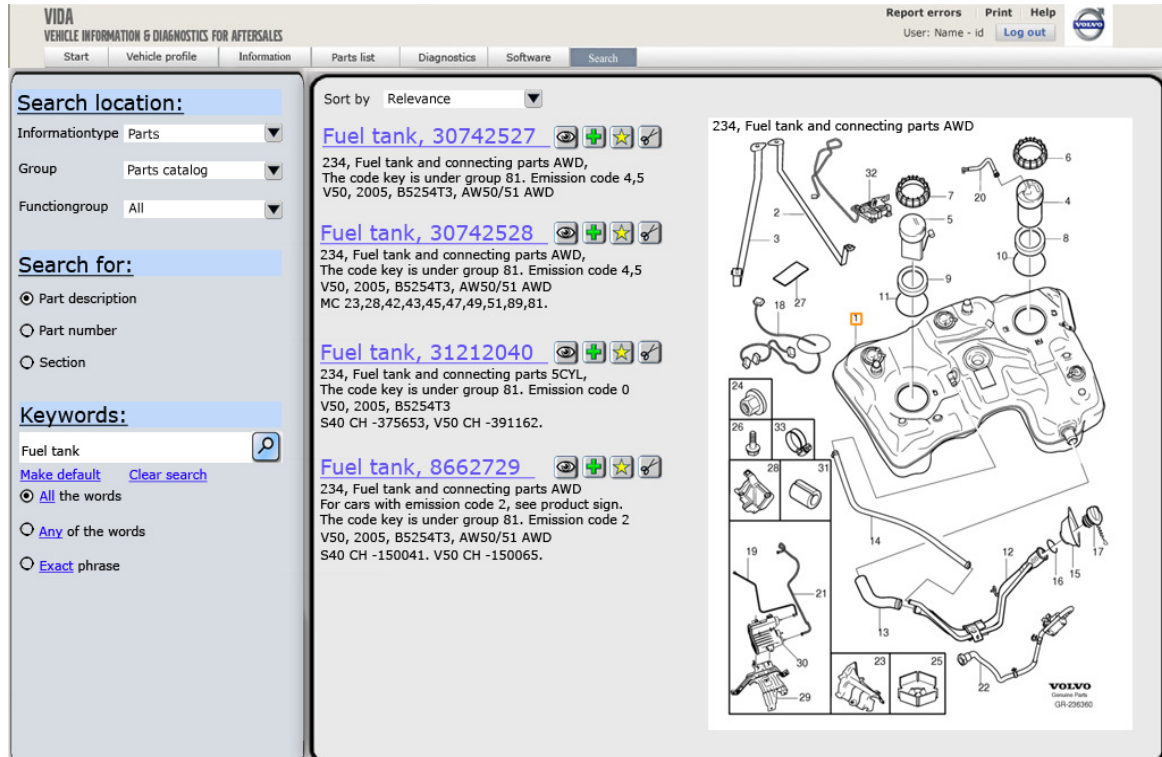
5.3.1 Creating mock-ups

The comments and opinions of the users were to decide which parts of the interaction to include and which to exclude. If more users made similar comments this would have a greater impact on the design than comments made only by one user. The next mock-up would be made with some kind of image processing

Picture 17, the search result in the “navigational search” mock-up.

application for instance The Gimp or Adobe Photoshop. These “screenshots” would then be used to fake interactivity with Microsoft PowerPoint. PowerPoint is used because of poor skills in Adobe Flash or any other web programming language. This mock-up was created with the goal to show how it would work using the real search function. It would be a chance for the users to comment about the workflow of the mock-up and how that relates to the working conditions the users face. In this iteration there would be more focus on the details of the concept. After the decisions of what to change in the mocks-ups in this second iteration, Microsoft PowerPoint 2007 was used to do a simple mock-up to emulate the interface. It was later decided to remake these screenshots using only Adobe Photoshop because of better

control of the different parts with the layers functionality in Photoshop. These screenshots were later added together into PowerPoint again and hyperlinked to fake interaction. See chapter 9.13 in the appendix for screenshots of the mock-up.



Picture 18, second iteration of the advanced search mock-up.

5.3.2 Validating the concepts

The mock-up evaluation should be done in a way so the user could use the mock-ups doing tasks that are relevant to the users work. But a search function is very complex and it would be difficult to implement even small scenarios the user could carry through because of the large number of words to search for. This means that the high fidelity mock-up will try to show more details in the interaction and the flow of the user interface than in the first iteration. Before the start of the evaluation the user should be informed of how the evaluation will be done. What their role in the evaluation is, how the gathered information will be used and make them trust the evaluator. This information should be equal for all the participants so that this is not a factor that is different between participants. A way to do this is to use a script that is read before the evaluation begins but as stated before this should not be read directly from paper. So a script with short notes about what the participant need to know should suffice.

Things that is important that the participant knows before starting is:

- That it is only the evaluator/designer that will see the gathered information in any form that can be connected to him/her as a person.
- That he is anonymous.
- That the participant is there as a co designer and their opinions are very important.
- That the design is still very changeable and that any part of it can be criticized.
- How the mock-up works. What is implemented and what is not.

The evaluation of the second mock-up was scheduled during one week and was done at four workshops. This time a Lenovo ThinkPad T60 running Windows Vista and PowerPoint 2007 was used for the presentation. The users were shown the mock-up and were invited to use it after an explanation that it was very limited compared to a real user interface. Once again people participating had very little time to set aside for the evaluation. This meant that the evaluation of the mock-up could not be done as planned with the users mostly using the interface. In most cases the evaluator was the one using the mock-up and showing it for the user. Sometimes the user would be using the mock-up and asking questions about different features or some details in the interaction. This changed between users depending on time constrains and user personality. But the mock-up was evaluated in the correct context and often close to a computer with VIDA, so the user could show how it works today if that was needed. In total six users evaluated the mock-up, which were the same end-users that evaluated the low-fi mock-up.

5.3.3 Analysis of the information

The plan was to make an affinity analysis of the gathered data from the second evaluation. But the amount of data was not enough to support this it was easiest to let the comments from the users be the basis of the changes made in the final version and not doing a affinity diagram. Below is the most important information found during the evaluation of the computer generated mock-up. The feedback was very positive and all the users thought that the design was an improvement of the old design. They thought that the workflow of both the concepts would work and that it would improve the effectiveness of their work. They had some opinions/comments about some of the interaction in both mock-ups.

5.3.3.1 Menu Search

The users thought that the search result should remain even if the user has used the search result to navigate away from the result. So when the user uses space to get the table of

content back the search result should be there, but it is also important that the user's position in the table of content are marked in an visible way. Also the link "show all" should not have the behaviour it has today. Now it removes the search keywords and removes the search results from the table of content. This behaviour should be named "clear search" or something similar. For more user comments see chapter 9.12 in the appendix.

5.3.3.2 Advanced search

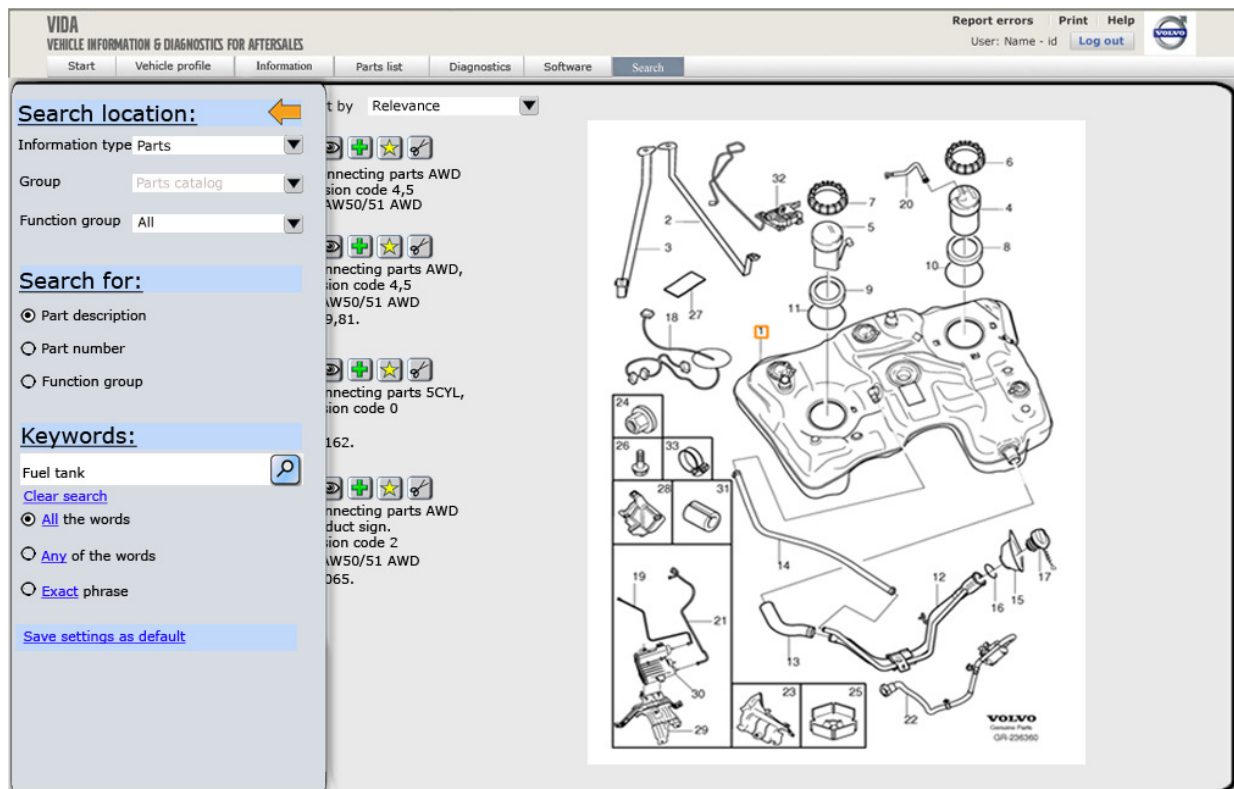
A very good idea that came from a discussion with the users is that the area for the search field and the different search alternatives could "fold" into the left of the screen. This behaviour is seen in the table of content in the information section of VIDA and would free up space that could be used for the search result. Another idea that came from user discussion was an idea about linking specific words to more information about these words. For example when reading about a specific part there can be information about an emission code in the notes. The word "emission code" would then be linked to texts how the user can find the emission code of a car. Also the preview feature got very positive feedback once again.

5.4 Final concept development

Now it was time to implement the information from the last evaluation. There should not be any big changes in this stage, only minor changes. This final version was not be validated by the users because there was no time for a last evaluation. So any new changes would be untested. The plan was to decide what can be changed in the mock-up based on the last evaluation. When the mock-up is done visually and conceptually it will be described as use-cases.

After the evaluation of the last mock-up there were some things that can be changed to the final version. The most interesting change was the idea of letting the search field and search alternatives in the "advanced search" to be minimized, which would mean that part of the interface would fold into the left of the screen. This would leave more space for the search result and also be consistent with the table of content in the information section of VIDA. This would also be consistent with the interface for the search function that VIDA uses today were the search alternatives "disappears". The biggest change to the "menu search" interface is that there are now two links besides the search field. One labelled "clear search" and one "show all". The "clear search" will remove any keywords in the search field and remove any search result in the table of content. The "show all" link will show all hidden menu items in the table of content to let the user toggle between the search results and the usual table of

content. There were also clarifications of things already described in the evaluated mock-up that could be misunderstood. There have also been visual changes to the look of the user interface. Once again all the visible changes was made with Adobe Photoshop and put together with Microsoft PowerPoint. This final version was also described as use cases as this was one of the deliverables to Volvo Cars. The use cases can be seen in the result and in chapter 9.14 in the appendix.



Picture 19, final version of the advanced search mock-up.

5.4.1 Changes to the mock-up and clarifications after the user feedback

VIDA menu search

- Selecting the suggested word in the quick search will not automatically result in a search. The user must click the "search" button because the user may want to add more words to the suggested words before making the search.
- "Clear search" link/button should remove the search words and collapse the table of content and a link/button named "show all" should be introduced. "Show all" will show all the information in the function groups and not only the information relevant to the search. This is consistent with other parts of VIDA because this behaviour can be seen when choosing software to download.

- Using a link to navigate to the correct section/document should not remove the search result because the users expect it to be there if they navigate back to the table of content tab using the spacebar or the mouse. The problem with this approach is that it could be a problem with knowing where in the hierarchical structure the user is right now. So some way to mark the chosen section apart from the other search results should be added.
- To maximize the area for the search results empty groups could be removed. In VIDA this is already done with groups that do not include any information about the current car. This could then be expanded to include groups that do not do not have any search results in them.
- The close button for “minimizing” the table of content could be confusing and in the final mock-up this will be changed to an arrow pointing left. This feels like a more natural mapping but the cross used in VIDA is probably a more widespread idiom. This is one thing that could be evaluated in the future.

Advanced search:

- The final mock-up will include that the search alternatives fold into the left of the screen. It is brought back by the space bar or by using the mouse. This is consistent with the information tab and the table of content that folds into the left. The downside is that the users must press one more button or navigate with the mouse to gain access to the search keywords. The solution to this is to have a text field in the result page with a search icon to give the users a quick way to remake a search with added keywords.
- Users and stakeholders pointed out some spelling errors that will be corrected.
- Add CSC as a choice in the menu for information types because it was missing in the mock-up.
- There should be titles on the information in the search result. This should help new users learn what the information means.

6 Result

Below I will describe the final version of the concepts that was developed after the final user evaluation. The two concepts are separate but work together to complement each other. The first concept is a more advanced search function that gives the user more power to customize his/her search and to save a default search profile. It also has some added features in the search result page as preview and added icons for easy access. The other concept is a simple search that is used to filter the navigation in the different information types. It should be a fast way for the user to remove unwanted information and in the process making it easier to find the way to the information he wants.

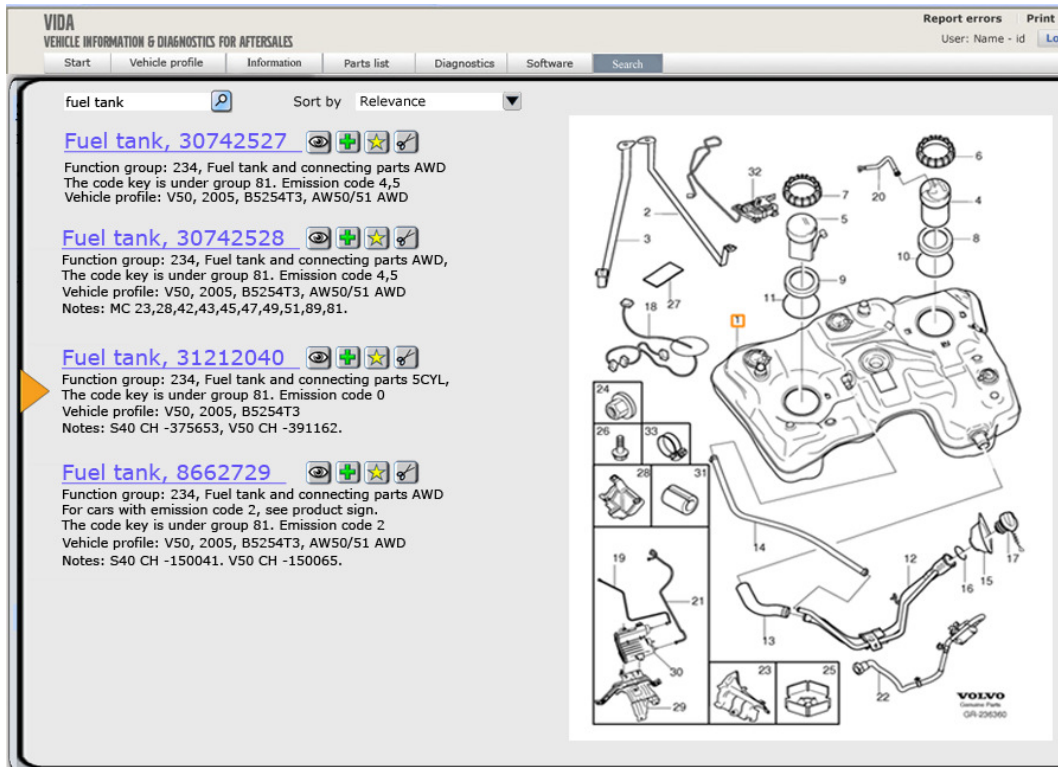
6.1 VIDA Advanced Search

As seen in the screenshot to the left (picture 20) the interface are built from dropdown menus in combination with radio buttons to let the user decide where and what he is searching for. The first dropdown menu is for choosing information type (see appendix 9.11 for the different types available), the second for deciding subgroup within the information type and the third is for Function group. The choices for the radio buttons will change depending on what kind of information type that has been chosen in the dropdown menus, which will also change depending on

Picture 20, VIDA advanced search.

the choices made. For the different variations available and the Use case description of the concepts see chapter 9.14. There are also radio buttons below the search field to change the way the keywords are combined. The default is combining the keywords with the Boolean operator AND, which will give the user less hits when adding new keywords. Other alternatives are also available. With the “any” alternative the keywords will be combined with the Boolean operator OR giving more hits when adding more keywords. The last alternative is “exact phrase” which means that the keywords must be found in the order stated in the search field.

The link at the bottom of the interface lets the user save the choices he has made to be used as a default setting, meaning that when the user resets the search function or uses it after he has logged out these are the settings that will appear.

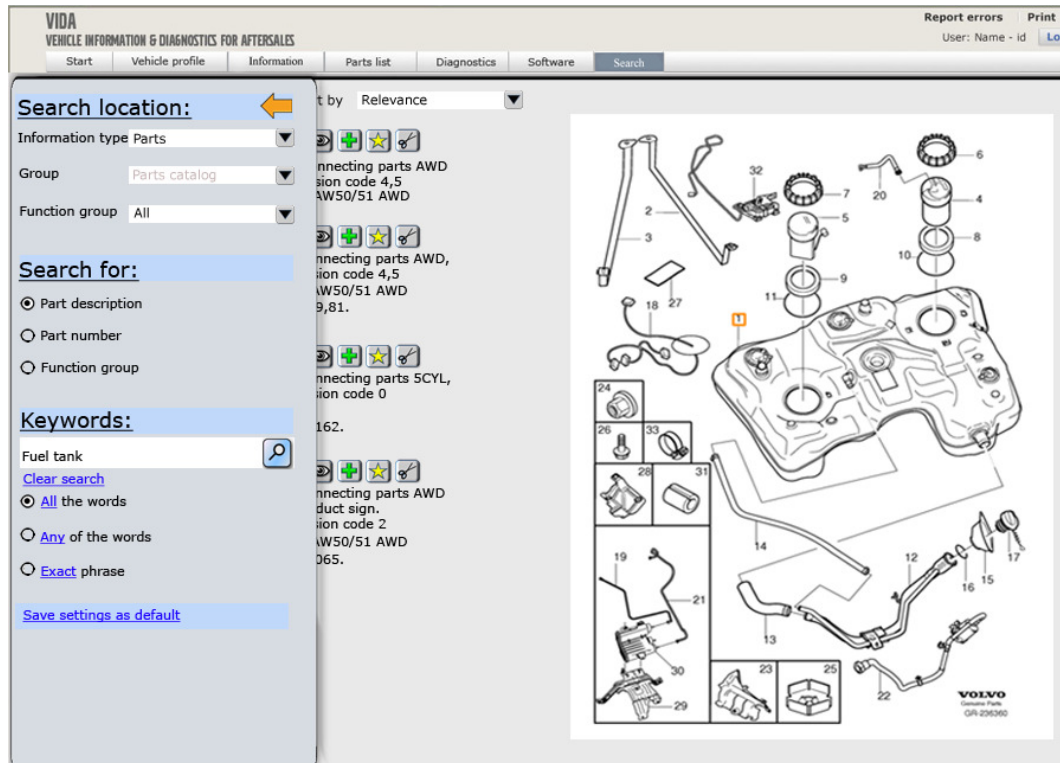


Picture 21, VIDA advanced search, results.

In the picture above (picture 21) is the look of the search result after the final iteration. When the user has made his choices and entered the keywords he wants to search for and activated the search the alternatives disappear and can be recalled by pressing Space or clicking the orange arrow that can be seen to the left in picture 21 above. Below the VIDA menus the keywords used can be seen and changed if the user wants to make a new search with the same alternatives. To the right of the keywords the user can use a dropdown menu to sort the information found in different ways. The default value here is by relevance but more choices are available (see chapter 9.14 for a more detailed description).

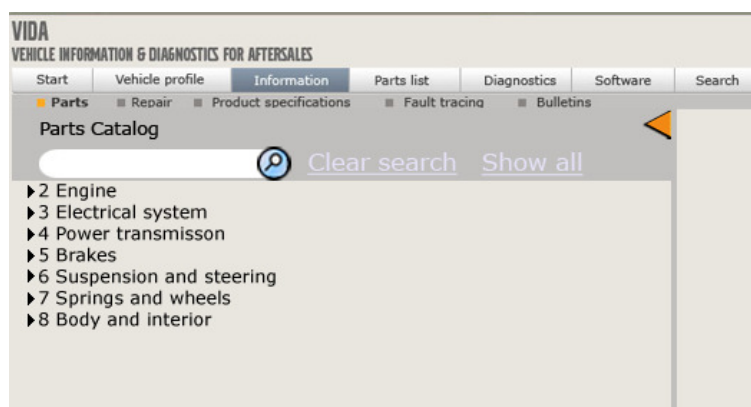
The headline of the different hits is also the link to use for navigation to the specific information in VIDA. Below this headline are more information about the hit, for different parts this information include function group number and name and the what kind of car profile the part fits to. Close to the headline and the other information is a toolbar (see picture 18). With a “eye” icon on this toolbar the user can preview graphical information about the

search hit. When the user looks for information about a Part this feature shows the section of parts the selected part belongs to (see picture 18). With other kind of information, for example CSC, this feature would be disabled because it is not applicable. The other features of this toolbar is described in chapter 9.14.



Picture 22, VIDA advanced search, results.

By pressing space the user can get the search alternatives back and can make a search with other criterias (see picture 22 above).



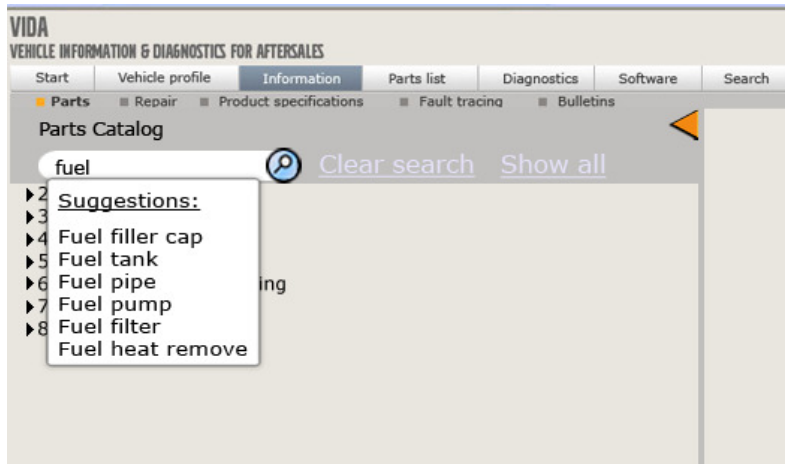
Picture 23, VIDA Menu search.

the left the information group is Parts which is the only type who has only one subgroup, which also is Parts. The different information types and subgroups are chosen in the menu

6.2 VIDA Menu Search

This version of the search functionality introduces a way to search for information within the menu system of VIDA. A search field is present at the hierarchical structures of the different subgroups. In the screenshot to

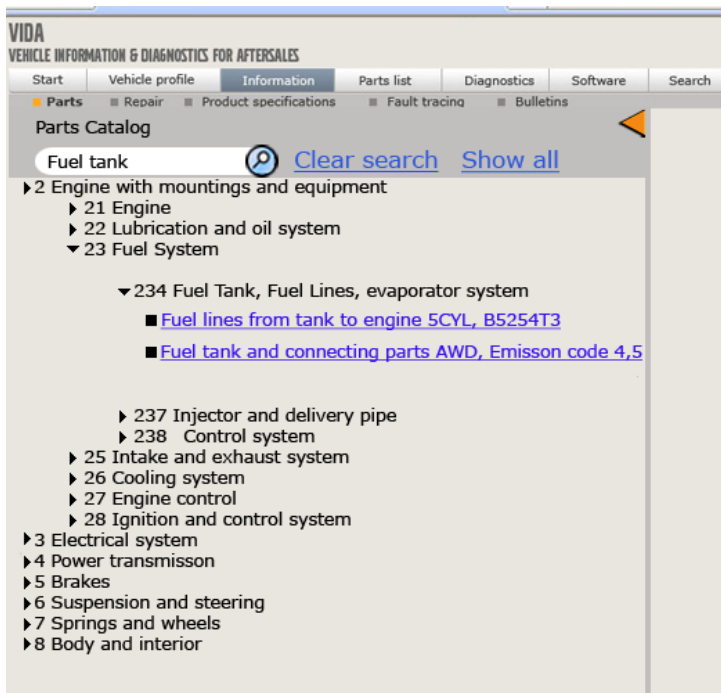
above the search field (see picture 23). The different groups in the structure are called function groups and it is in these groups the “VIDA Menu search” searches for information.



The user uses the search field to search for information, which could be a spare part, a CSC or a repair document. The search function will suggest words to search for depending on the content of the information type subgroup (see picture 24 to the left).

Picture 24, VIDA Menu search, suggestions.

The user can choose among these suggested words or search for other keywords. The result is then shown by expanding those groups that include any information that matches the query made by the user and closing or removing those groups that don't (see picture 25). For a more thorough walk-through of the concept see chapter 9.14, the Use Case description of the mock-up.



Picture 25, VIDA Menu search.

7 Discussion

In this part of the thesis there will be a discussion about the difference of what was planned and what was done and how that affected the end result. It will also include things that could be done differently, a discussion about the concepts that was presented and what I have learned by doing this thesis.

7.1 Methods

7.1.1 Planning

The schedule from chapter four was often kept. In some cases other phases was cut short in an effort to keep to the schedule. In the end of the prestudy there were not enough users participating in comparison what was planned. Instead of taking more time trying to find more users it was decided to continue with the project and start the contextual inquiries. There was no time after the contextual inquiries either to get more users so the project continued into analysis of the data and the creation of concepts. The low number of users has of course affected the result but the time it would take to get enough users would derail the schedule too much. Even with these efforts to not brake the schedule there was no time in the end to get the report done in time and the work was concentrated on finalizing the concepts and making the presentation for Volvo Cars Customer Service and Diadrom . The report was finalized during the following semester.

7.1.2 Interviews

The interviews went well because they led to better understanding of the structure around VIDA and also it was a way to meet personnel at VCCS. During these interviews I learned the different kinds of information in VIDA and the different categories of users. What could have been done differently was to prepare better interview guides and make better documentation of the result. These things are probably connected to limited experience of interviews and different interview techniques. In the end what was gained was a general understanding of the different parts of VIDA. There were also more people in VCCS that I didn't have time to interview which could have led to a better understanding.

7.1.3 Heuristic evaluation

The heuristic evaluation went well and it was a good way to gain a general view of VIDA. It was also a way to gain insight in the problems that the users could encounter. This meant a better frame of reference for discussion VIDA with the end users from a viewpoint as a user. It is my belief that it is important that the person trying to learn about the users work and

eliciting requirements are on the same "side" as the user. This leads to the users trusting the observer much faster and probably telling more about the work environment and other issues. In this phase it would have been better to be two evaluators because two persons can discuss the problems that may occur, they have a broader range of experience and the evaluation gains better accuracy.

7.1.4 Contextual inquires

It was no problem to observe the users for up to two hours but the contextual inquires suffered from one big problem and that was the limited number of users. It was planned to have a few users from different user groups for a total of ten to twelve users but the project used only a total of five users. This was due to real world constraints and was hard to foresee while planning. First it was hard to get participating workshops and it took time because there was only one contact to the workshops. This contact contacted the workshops and when someone from these workshops was interested in participating in the study he gave me the contact information to the workshop. When it was time for the Contextual Inquiries there was only contact with three different workshops and it was decided to move forward anyway so that the time schedule wasn't broken.

There was also a hard time finding more users than the ones who had agreed to participate because of people having a large workload at the workshops and not using VIDA so much during the time of the contextual inquires. The low number of users affected the redesign of the VIDA search function because it resulted in a relative low amount of data to elicit requirements from. Because VIDA is an application used worldwide with a high number of users the low number of users in this study makes the result hard to apply on a worldwide market. I should have been more aggressive when recruiting users and also made it more clear how many users that was needed.

One other problem was the recording of information. Because I was alone in this project there was only one person to record the information from the contextual inquiries and asking new questions at the same time. A video camera was not used because it would be too intrusive and there was no access to a tripod. This affected the quality of the recorded information because it was difficult to make comprehensive notes. Other things that could have affected the observations were the limited experience of creating guides for the observations which meant that the quality of the inquiry could certainly be better.

7.1.5 Creating mock-ups

Much of the time of this project went into the creation of the mock-ups. The paper mock-ups took some time to make. It took a while before the realization that paper prototyping should be fast and that the interface doesn't have to look perfect (or even should look perfect). This meant that there was some waste of time while remaking the different screenshots in the paper mock-up. The complexity to make a search engine interface with the use of paper was also discovered. This meant that the mock-ups were not as interactive as they should be according to user-centered design. Because of this complexity the paper mock-ups described how a search could be done with little interaction from the end user.

For a long time it was not known which application to use to make the high fidelity mock-up. Many different applications were considered, Adobe Flash, Microsoft Visio, Microsoft PowerPoint, Adobe Photoshop and web techniques as HTML. In the end after some testing it was decided to use Adobe Photoshop and Microsoft PowerPoint. Because of the complexity and the time it took to remake incorrect screenshots or details, time was lost from the project and there was no time to learn new skills as HTML or FLASH. Parts of the mock-up were remade several times because the screenshots were not of the quality that was wished for. In retrospect some other method could have been used that was better with handling changes and corrections in the mock-up. When any changes was done to the user interface all screenshots showed that change must be redone.

The end result is of acceptable quality but the methods used to make the mock-ups demanded much time and the mock-ups are not easily changed. The use of other techniques as Adobe Flash would probably be better because any changes made to the interface should result in required changes in one place and not in every screenshot. For example the move of a button would automatically be replicated throughout the entire interface in Adobe Flash.

7.1.6 Mock-up evaluation

The time pressure of the involved users affected other things about the project. As long as the users could do their normal work while helping with the thesis, time was not an issue. So observing the user in two hours while they were working was no problem but when evaluating the mock-ups they could not work and that affected the evaluation. The presentation of the mock-ups were hurried and the interaction was often explained to the users instead of them using it, which also was an effect of how the mock-ups were created. But how much this affected the result is not known because the feedback gained during these evaluations was rich with information and ideas for improvement. I believe that this did not affect the end

result as much as the low number of users did. What was really interesting was the difference of user feedback between the paper mock-up and computer mock-up. There was a much richer feedback and more ideas about the paper mock-up. This could have many reasons but it is well known that simpler mock-ups gain more and richer feedback because the users think they can change more of the interface than in a computer generated image. This is because the computer image already looks to be complete. But it could also be an effect of the users seeing the same graphical interface twice (but in different mediums) and they do not give feedback about things they have already seen in the paper mock-up. This effect could be tested by letting different users evaluate the different mock-ups. One group would evaluate the low-fi mock-up and another group would evaluate the high-fi mock-up. I believe that the high-fi mock-up still would generate less feedback because of the look of the user interface.

Because I was alone doing this thesis I did not use video to record the mock-up evaluations. I had access to a digital video camera but not to a tripod. It would be too distracting trying to use a video recorder, listen to the users and asking questions at the same time.

Because of the mock up's simple nature it was difficult to evaluate. It was not possible to build a search function mock-up with enough functionality so the user could interact with it unhindered. There were only a few possible ways to do a "search" in the mock-up. This meant that there were more of discussion about the way things were structured and the flow of the interaction than the user using the mock-up. But the users took the interview serious and gave constructive criticism. They thought that it sometimes was difficult knowing if something was better than something else because it would only show when the user used the application while working.

Knowing how this study turned, if I could do it again, I would do some things differently. First there should be two persons working on the thesis. This would increase the quality of the work and the scope of the study because two persons can share the workload. Two students of interaction design would bring different experiences and expertise to a project. Human-computer interaction is a multidiscipline area of research and one person cannot know everything. Also the discussion between multiple designers would lead to better design solutions. The study would have had more iterations and the mock-ups would have had more implemented features. One solution to this problem when working alone would be discussing with other people within HMI, for example classmates also doing their thesis alone. In this way everyone would have at least have someone to discuss problems and design solutions.

7.2 Comparison of the concepts

In this part there will be a comparison between the new version of VIDA search and the current version of VIDA search and also a comparison between the two different concepts presented in this thesis.

7.2.1 VIDA Advanced search vs. Current version

The main difference between the new more advanced search and the old one is that in the new the user have the power to define his/her sphere of interest before making a search. If the user has some knowledge about where the information he wants to find is, the user can use this knowledge to narrow the search. This will mean a smaller amount of data to filter through in the result. The new search function also gives the user the choice to save a default setting for all the alternatives in the search interface. This means that this search function is better suited for handling the broad set of different kinds of users in VIDA. One can criticize the choice of using dropdown menus because it forces the user to make choices and it also hides much of the interaction. These menus were designed in this way because it was the best solution to save screen space. A good default setting to begin with and the alternative to save your own default settings will probably minimise the interaction with the drop down menus.

The search result is also structured in a way that makes it easier to navigate to the correct item because of the large headlines. The new toolbar also makes it easier to see what the user can do and does not hide any of the controls. It gives the user access to new features, for example the chance to preview a document. In the current version of VIDA the different choices the user have is presented in a way that is easy to miss

One of the biggest differences is that this new advanced search sorts the search result in a relevance order based on a very basic algorithm. Because the part or the document the user wants to find should appear on the first page of the results he does not need to search through a number of pages with search results. If a wanted item is not on the first page it is easy to refine the keywords and make a new search. This of course depends on the performance of VIDA which should be improved.

Criticisms against this new advanced design is that the way it presents the search result takes up much space which means that not many hits can be displayed. This could lead to the need to change pages several times depending how many hits the user is allowed to view per page. But it is my belief that if the user does not find the information on the first page he will refine

the search until he does, up to a certain point. A fast search engine will facilitate a behaviour that is based around modifying the search query until the wanted result is achieved.

7.2.1.1 VIDA Menu search vs. Current version of VIDA

The “Menu Search” tries to present a search function that can be used both by beginners and experienced users. Beginners that do not yet know where the information is located can use this to find the information and experienced users can use it as a shortcut to the information they need. The users do not need to navigate to a different part of the application to search for information. The “menu search” is easier to reach when navigating the different information types than going to the search tab. As a drawback it is quite simple and only performs searches in the current information type. But the idea is that it should be a help for new users who doesn't know where the information is and also for expert users that looks for new information or uses it as a shortcut to get the information he wants. This new “menu search” would need more testing to determine if the result of a search is clear enough and do not show too much information which makes it difficult to find the information. The “menu search” should not be a replacement of a regular search function but an addition to it.

7.2.2 Advanced search vs. Menu search

These two different ways to search complement each other very well and the “menu search” almost needs a more powerful search function because it is so simple. The “menu search” lacks any settings for making more advanced searches or combining keywords in another way than with the Boolean operator AND. For this kind of functionality the user needs to use a more advanced search function. The result is also shown differently in these versions because the “menu search” shows the result with the help of the menus in VIDA. The “menu search” does not include any means to add the part to the part list directly from the result or other such features that exist in the more advanced search function.

7.3 End result and future work

I am pleased with the result but there are some elements of the design process that could have made the project even more successful. This result is just one of many ways that the project could have gone. By having more time and manpower different versions of the search function in VIDA could have been explored and created. It would have been fun to be able to implement more functionality even if it only would have been one more iteration of the mock-ups. This could have been an Adobe Flash mock-up or a simple version of the search function

with functionality from the mock-ups. This way more user evaluation could have been done and the concepts could have been tested even more in the users work.

There are different areas that could be the focus for future work. If there would have been time to create one more iteration, the last changes of the mock-up would be validated and a mock-up with more details would probably be made. In this iteration more common usability test could have been done were the user could use the prototype to solve different tasks to find usability problems. That would be a way to see if the mock-ups could live up the demands of the real world with the use of usability testing.

VIDA is today an application that is run in Internet Explorer and a real world implementation of the created mock-ups could also be created to be used in Microsoft Internet Explorer. Alternative implementations could be to make the application into a native Windows application, because the use of Internet Explorer as supported web browser results in that the computer must use Microsoft Windows anyway and when the VIDA all-in-one version already ships on a DVD maybe this could be a Windows application? When users use a application in a web browser the user's behaviour changes to match how he uses web browsers. For example, the user will try to use the back buttons found in Internet Explorer or the shortcut for the same feature, the backspace button. This feature is incompatible with VIDA which will stop functioning and the user is logged out.

A larger study with a larger span of different kind of users and more users from all over the world should be made to get a more representative result and a better view into the user's behaviour and requirements. All the larger aftermarkets should be represented so that the result can be applicable on the large Volvo Cars aftermarket. The methods described in this thesis could probably be used without much modification but because of the larger number of users the study should be realized by more people.

A third area for possible future work could be a usability study on the whole of VIDA with the creation of new navigational concepts for VIDA. A study with usability experts and other experts for example information architects with close participation with the end users should lead to better ways to structure the application and new innovating ideas that could be evaluated by the users.

I believe that the result from this study is hard to generalize to other applications because it has been so influenced from other already defined software. For inspiration of the menu search take a look at the search in Windows Vista that lets the user filter the control panel by

type words that should be included in the setting you are looking for. But some lessons can be learned that are useful in the future. I believe that there should be a very good reason for making a Rich Internet Application (RIA) and that it should support behaviour from both Web browsing and from desktop applications. One way for RIAs to fail is to support neither of these behaviours as it seems to be with VIDA. In VIDA the user can not use the commands of the web browser, the back button or the bookmark functionality and they do not have any keyboard commands for faster navigation.

So to sum up I believe that the concepts of this thesis need more usability testing before they are ready for implementation in VIDA. But what can be used is the knowledge that the users want more power to use VIDA and the search function in a way that are controlled by them and not by the application, that VIDA is a tool that they use as much as a wrench and that the application should be able to be adjusted to the situation and user.

The experience of working with end-users has been very positive and the users really appreciate that someone is there to listen to their opinions. So much ideas and inspiration comes from these meetings with the user. But it has also been frustrating working in close collaboration with users because it takes time finding a large number of participants.

8 Conclusion

In this study concepts for a new interface to the search function in VIDA were created and evaluated with personnel at Volvo workshops. The focus of the thesis was on the users' role, their goals for searching for information and the improvements that could be made. And also the creation of mock-ups that visualize these improvements. The thesis did not include search engine technology, search algorithms or how information is saved. Also there was focus on searching with keywords in VIDA and not the manual search through a hierarchy of information with the use of menus also known as navigating. At the end two concepts were described as use-cases and PowerPoint mock-ups. These two concepts are closely connected and work best together. The first concept is a more advanced version of the search function, which gives the users power to control their search and save their settings. It also presents the search result in a new way that resembles search engines on the web. Some new features were also introduced, the two most prominent being that the result is ordered based in relevance and the power to preview a document. The second concept introduces the search functionality to the table of content in VIDA. These menus are used by the users to find the information which is divided into different sections called function groups. The search function is a way to filter through these groups and hide those that are irrelevant.

The conclusion is that the proposed concepts would need more testing to see if they really are more usable than the old version but the initial reaction from users at the different workshops and personnel at Volvo Cars Customer Service show that there is a real potential for these ideas. This thesis also shows that there are much room for improvements both in usability but also in performance of VIDA. One of the biggest problems is the response time both in the search function and also in the rest of the interface. This decreases the usability of the whole application because the users cannot work as effectively as they should be able to. The goal of the user is to work effectively and professionally and they see VIDA as a tool that they use as much as a wrench and that the application should be able to be adjusted to the situation and user.

It is my recommendation that the problems with slow response time during a search and the interface are solved first before making changes that include changes to the user interface. The look and the behaviour of the application will not matter if the application is slow. After the performance problems are solved the focus should be on changing the presentation of the search result. The focus should be on trying to implement relevance as a part of the presentation of the search result and change the presentation to increase the readability. One

way to do this is shown in the “VIDA Advanced Search” concept that was presented in this thesis.

Other ways to find information could also be considered. In this thesis a new way to search for information is presented. This “menu search” works as a filter in the normal navigation making it easier to find a way through all unnecessary information. It will need more usability testing and it is important that the implementation of “menu search” is fast or else it will never be used.

As for recommendations for VIDA as a whole the implementations of keyboard shortcuts should be prioritized. Also by making VIDA into an application that is run in a Microsoft Internet Explorer window the user will use behaviour connected to the use of web browsers. Either the application should support the use of this behaviour, for example to be able to make bookmarks and use the “back” and “forward” buttons, or else be an ordinary Windows application.

9 Appendix

9.1 Result of heuristic evaluation

9.1.1 The login screen

The login could probably be made clearer by bigger and a more central login field with more information when using the mouse over the “login” link. It is positive that it is possible to login by just pressing Enter because more experienced user tends to use keyboard shortcuts. This information could be in a mouse-over message in the login link. The feedback by a progress bar when logging in is positive for the user experience because the user knows that something is happening.

9.1.2 Start

After the user have logged in he comes to a screen named “Start” where there are information about when the user must update VIDA and instructions how the user should continue by using a link to set what kind of car the user is working on. This means that the user must click through this screen to be able to begin working every time the user starts VIDA. This screen could be helpful for novel users but should then include more information targeting new users. The next time the user starts VIDA he could be directed to the “set car profile” screen. This could also be done through a choice at the start screen if the user wants to skip this screen next time.

This “start” screen could be the first screen those times that the application must synchronize and when informing the user about the update process. It is better to design for the probable and provide for the possible.

9.1.3 Vehicle Profile

REPORT ERRORS
HELP

Björn Johansson, EUR LOG OUT

START VEHICLE PROFILE INFORMATION PARTS LIST DIAGNOSTICS SOFTWARE SEARCH

VEHICLE PROFILE CSC CSC LIST

VIN Chassis VIN decoding
YV1MW684752 103463 On Off
READ VEHICLE

*Model *Year (*mandatory) Partner Group
V50 2005 EUR/INT, except Arabia and China
Engine Transmission Steering Body style Special vehicles
B5254T3 AW50/51 AWD OK

CLEAR VEHICLE PROFILE

Latest identified vehicles

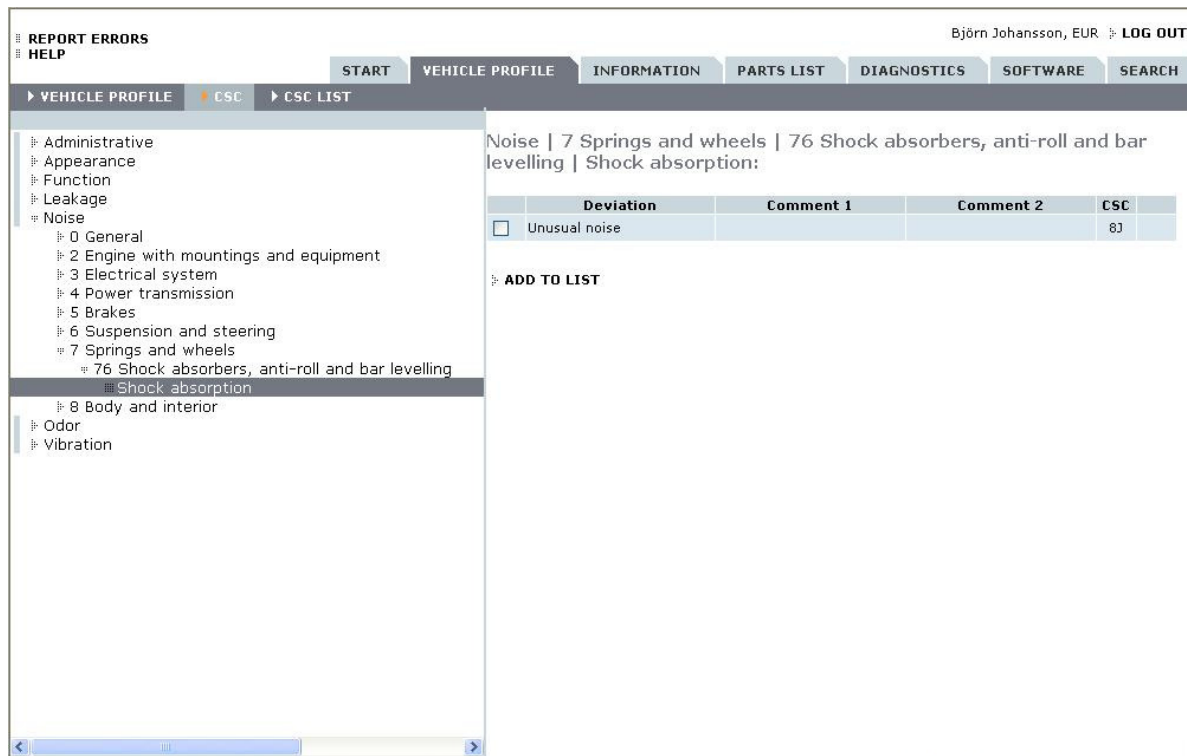
Model	Year	VIN	License plate
V50	2005	YV1MW684752103463	

VEHICLE DETAILS

Picture 26, The Vehicle profile in VIDA.

In this screen the user must set what kind of car he is working on. The users have the option to fill in the information manually or automatically with the use of VIN number or through the Bluetooth interface with the car (see glossary for information about VIN number). Not all information available is used when setting a vehicle profile through VIN number. To make the application update menus “steering” and “body style” a link in the right corner named “vehicle details” must be used (see screenshot). Some choices should be removed if not applicable. For example could the dropdown menu “special vehicle” be inactivated if the vehicle identified is not a special vehicle (ambulance, police vehicle). The vehicle details do not have any explanations for the data. Linking the information or having mouse over information could make it easier to learn.

9.1.4 CSC



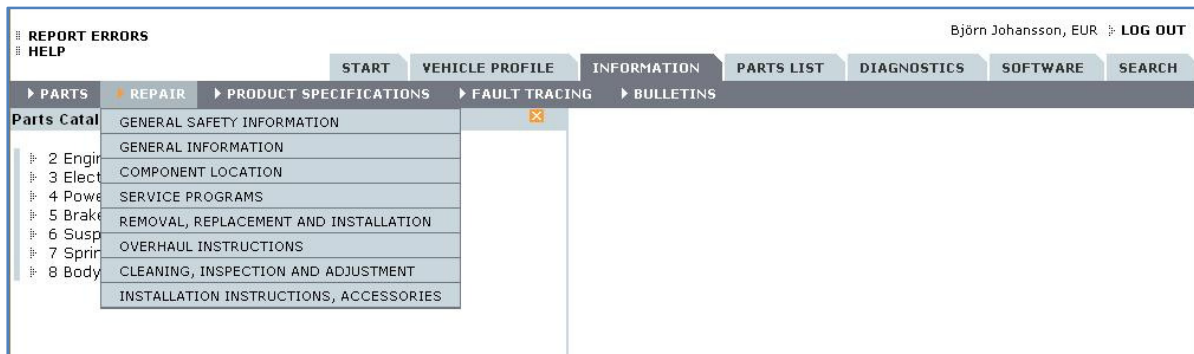
Picture 27, The information type “CSC” in VIDA.

No keyboard navigation is available when navigating through the table of content at the left of the screen. Non beginners will work more effective if more keyboard shortcuts are available. Users can mistake the title of the CSC as where they should click to add the CSC to the list. Now they must press the checkbox next to the title and then “add to list”. To decrease user excise there should be a way to add the CSC to the CSC list with one click. There is no feedback when adding a CSC to the CSC list. There should be some modeless feedback that makes the user aware that something has been done. There should also be a way to see the list of CSC that has been added without navigating away from this screen.

9.1.5 CSC list

It could be confusing with almost identical arrows in front of usable links as in the table of content. The link “add to list” is active even if the text field associated to the link is empty. The difference between the links “delete” and “delete csc” could be made clearer by changing “delete” to “delete list” or even change “delete csc” to “remove csc” and “delete” to “delete list”. Users are often under time pressure and it well known that people do not read all text that is available before deciding to use links and other navigational tools.

9.1.6 Information tab



Picture 28, The information type “Repair” and in the menu are the subgroups to this information type.

When navigating to the different information groups the dropdown menus should activate on mouse over and not on mouse click. Mouse over is the most common way used today because it eliminates excise for the user.

There seems not to be any keyboard shortcuts to navigate between the different information types.

As in the CSC table of content there is no way to use the keyboard to navigate through the table of content.

The “X” sign that hides the table of content on the left side of the screen could confuse users because the ToC is not closed but only hidden. The “x” could make new users uncertain about if the ToC can be brought back. Maybe an arrow pointing to the left is more appropriate. The table of content disappears when the user activates a link at the end of the table of content. The user could either click with the mouse at the left edge of the screen to get the table back or press spacebar on the keyboard. It is always best practice to have shortcuts to common used functions.

In the blueprint for the section it is not possible to use the scroll wheel on the mouse for easy access to the zoom function.

It is not possible to create a new parts list in the article list. The user must navigate to parts list to create a new list and then back again to add part. There is no feedback when the part is added to the parts list. There should be modeless feedback so the user can be sure that the parts were added to the parts list.

9.1.7 Search tab

After a search the back button clears all keywords and removes any choices made. I think the user expects that the settings and the keywords will remain. A better name to match the function could be "clear" or "clear search"

The parts information type have alternatives on what to search for (part description or part number), but there is no such alternatives in the other information types. The need for this could be investigated.

The link to initiate a search is far from the text field for the search keywords. The search link and the other links could be moved closer to the text field and the use of icons could make the interface clearer.

9.1.8 Search hits

When showing the search result the vehicle profile is used as a link to the documents. These links can look identical but leads to completely different documents. It should be easy to differentiate between the links and it should be easy to see what the links leads to.

The way to add csc to csc list could be made more apparent and the user feedback stronger.

The information in the search result tables are constructed in a non intuitive way. The link to go to the document is almost in the middle of the table and sometimes information that belongs together is not together (function group number and function group title).

9.2 Interview script

What's it like today?

- Describe your role in the structure around VIDA?
- Questions about specific skills / responsibilities.
- If you would divide the users of VIDA into different groups, which groups would that be?

Describe the problems with the current situation?

- Do you think that there are problems with VIDA and specifically with searching for information?
 - If yes, what?

Describe why these problems are problems?

- Why is the problem X a problem for users?

Describe possible solutions to the problems?

- What do you think could be done to solve the problem X?
- Do you think it will be able to improve the search function in VIDA?
- If you could change anything with just the search in VIDA, what would it be?

9.3 User survey

Name:

Age:

1. How would you categorize your computer skill?

(Answer between 1 and 5, where 1 is very little experience of computers and 5 are very much experience.)

2. How would you categorize your Internet experience?

(Answer between 1 and 5, where 1 is very little experience of the Internet and 5 are very much experience.)

3. How big is your experience of VIDA?

(Answer between 1 and 5, where 1 is very little experience of VIDA and 5 are very much experience.)

4. Do you have a computer at home?

4b. If yes, how much you are sitting at the computer one day?

(Answer between 1 and 5 where 1 is very little and 5 is very much)

5. Do you have broadband at home? (Yes or no)

5b. If yes: How much of your time at the computer is linked to activity on the Internet?

(Answer between 1 and 5 where 1 is very little and 5 is very much)

6. How many times would you believe that you use VIDA per day?

7. How long have you worked in the automotive industry?

9.4 Letter to workshops

Hello (insert NAME),

I received your contact information from Bernt Fridlund at Volvo Cars. I am now doing my master thesis in Interaction Design at Volvo Cars Customer Service. My education is targeted towards working with usability and to create user-friendly products. I will in my thesis create proposals that can be used to improve VIDA or can be used in the future when creating similar products. I have restricted my work to look more at how to search for information using the search function in VIDA.

The method used is called user-centred design, which means that I want to observe the users to see how they will use the product and to find out what goals they have when they use VIDA. What I find out in these observations will be the basis for my proposed designs. Then, it is also important to let the users that will use the product in the end to be a part of the design process and to be the judge of what is usable in the interface. Therefore, I will come back with my proposed ideas to get the opinions of the user so I can change my proposals based on the opinions.

So what I'm looking for now is the users that I can follow and observe in their work and ask questions. It is usually enough that I can be with each user 1-2 hours. I need so many users as possible and it should be people with different job descriptions. These users are also welcome to help me evaluate my suggestions a couple of times during the spring.

I would be interested to come down to your workshop in (insert WORKSHOP here) early next week so I could present myself. How would it work with (insert DATE)?

Best regards Björn K Johansson

9.5 Script for contextual inquiry

Introduction

- I want to get an insight into the work process and the requirements this imposes on VIDA.
- I am not here to test you but want to see how you use VIDA
- I will observe but also ask questions to understand the situation better.
- The material will only have access to be me, nobody else.
- I plan to be back two more times during the spring and get more information and show up design proposals.

Observation Questions

- What do you want to achieve now, when you use VIDA?
- What kind of information are you looking for now?
- Why did you use those specific keywords and those alternatives?
- What do you think now when you see your search results?

Look for

Goals - What goals do the users have? What kind of information are they looking for?

Environment - are there many people around? Is there a high level of sounds? What kinds of computers are used?

Interruptions – Are there many interruptions? Of what kind? How does this affect the workflow?

Applications - What are the different systems, websites, applications that are used?

Problem - What are the different kinds of problems the users have?

Artefacts – Are there any post-its on the monitor? If yes, What kind of information?

Triggers - What triggers a series of actions? Can be telephone, email, persons etc.

9.6 User summaries

9.6.1 User A

User A is a mechanic that initially was interested in to participate in the contextual inquiries but because of changes in his role at the workshop he couldn't longer contribute anything to the project. This meant that he was not participating in the contextual inquiries. He still participated in the project by introducing new users and by evaluating the new concepts.

9.6.2 User B

User B is a mechanic and has a workstation with a computer with an lcd-monitor, mouse and a keyboard. The computer is running Xp and VIDA all-in-one. He works in a large hall with eight workstations for other mechanics, which creates a lot of noise. He uses a variety of applications in his work. A work order system called Tactis, TIE (information about newly discovered problems with Volvo cars), VSTG (application for calculating time for repairs) and VIDA. Because he is a service technician he orders spare parts, put information into the work orders and deals with customers. Of the mechanics found in this workshop B is the one using VIDA the most. B uses VIDA most for diagnostics and troubleshooting. He navigates mostly with the TOC or links in the troubleshooting documents. The search function is used very rarely because B knows where the information can be found. B has not undergone any training in VIDA and has had to learn it while working. He has basic computer and Internet familiarity and he has both computer and broadband at home. He has substantial domain knowledge because he has worked in the automotive industry for 20 years.

As a mechanic he uses the "first" page in VIDA where you add new car and the diagnostic page the most. After the diagnosis of the car, he sometimes needs to have a description of the repair because he does not always know the exact procedure (when there are new cars or new kinds of errors). When ordering spare parts he needs the article number which he finds through the TOC in the spare parts catalogue. This information is then transferred to the application TACTIS that are used for tracking repairs.

So B has several goals:

- When he meets the car owner he needs to quickly get give the car owner a price and time estimate for the repairs. This information must be accurate otherwise, the customer is not satisfied. B must be able to classify the problem in order to provide the information above.
- B needs to quickly find the problems with the car to be able to order spare parts so that they

come in the same day. This means accurate troubleshooting documents and information from VIDA that is correct for the situation.

- Quickly able to change spare parts to be able to repair more cars because mechanics get paid by how much repairs they do. This means that they need accurate descriptions of the repairs and with sufficient detail.

Work Routine:

1. Receiving the car owner who describe the problem or what the car owner want done with the car. B put away the car to have the opportunity to start working on it. He adds a problem description on the work order without CSC.
2. The B takes the car in for troubleshooting. If the problem is not recognized, B will use TIE to check for the problem online. He then connects the car to VIDA with DICE to check for error codes from the control units.
3. He then begins troubleshooting with the help of troubleshooting documentation and his own experience.
4. After he has identified the part that is the problems he will order it trough tactis.
5. A new car is brought in for troubleshooting and he will repeat step 2-4 until the afternoon when spare parts will arrive.

The search function: B does not use it, under normal circumstances. He knows where the parts are in the spare parts catalogue. He will use it when fault-trace documents suggest things that B does not know so much about. Example: Replace the GSM device. If B does not know what GSM device is so can search for this information.

Problem:

- Must filter out information that is not needed by himself.
- Not enough details on the sketches of spare parts.
- It is difficult to find information with the search function because it is hard to know in which information type the information belongs to. Also poor filtration of the information based on vechilce profile makes it hard to find the information.

9.6.3 Användare C

C är beställare av reservdelar för mekaniker och sitter vid en 15-17 tums plattskärm med okänd upplösning. VIDA ”on webb” körs på en dator med XP med en vanlig mus och tangentbord. På skärmen sitter det post-it lappar och laminerade listor med artikelnummer. Dessa verkade inte användas av C vilket antingen betyder att informationen är utdaterad eller

att C är så erfaren att den informationen inte behövs (Alternativt kom jag in för sent och den informationen används tidigare på morgonen för att t.ex. logga in). I sitt arbete använder han många olika system. Ett arbetsordersystem (tactis), ett bilinformations system (qe90), Renaults reservdelssystem, Fords reservdelssystem och VIDA. C sitter i ett rum bredvid själva verkstaden med tre kollegor var av an har samma uppgift som C. Det är lysrörsbelysning och ingen hög ljudnivå men med mycket samtal med kollegor. Mekaniker kommer ofta in och beställer reservdelar eller för någon annan anledning. C arbetar nästan uteslutande i reservdelskatalogen. Han får ett reservdelsnamn som han sedan letar upp i VIDAS reservdelskatalog. Först används dock arbetsordernummer eller VIN för att filtrera bort onödig information så gott det går. Artikelnumret kopieras sen in i arbetsordersystemet för vidare beställning. Sökning efter information sker sällan och brukar då vara med ett artikelnummer för att man vet ej var i ToC artikeln ligger. C har mycket stor datorvana, stor internetvana och stor vana av VIDA. Han har både datorn och bredband hemma men anser sig inte använda datorn så mycket. Den tid han väl sitter vid datorn verkar spenderas med annat än aktivitet på Internet, vilket skulle kunna vara offlinespel.

C vill snabbt och med mycket hög korrekthet hitta den reservdel som mekaniker vill ha.

Arbetsrutin:

1. Mekaniker ger arbetsordernummer/registreringsnummer och namnet på vilken del han vill ha beställd. Om det behövs så ger han mer information t.ex. var delen sitter i bilen eller dess funktion.
2. C navigerar till rätt artikel (kollar samtidigt om något mer måste beställas) och kopierar numret på de delar som behövs till arbetsordern.
3. C rensar informationen i VIDA och Tactis för att det ska vara "rent" till nästa gång.

Sökfunktionen: Används oftast inte vid normalt arbete. C navigerar med ToC i reservdelskatalogen. Användes t.ex. då mekanikern kommer in med ett artikelnummer (t.ex. står på en reservdel). Vill kanske kolla mer information (hur den sitter, vilka andra delar som ska bytas vid byte mm) . Sökning sker då med artikelnummer.

Problem:

- Prestanda, långsam navigerar i ToC och för att byta till sökfliken.

- Tror att VIDA filtrerar mer än vad den egentligen gör och förstår inte varför viss information då kommer med.

9.6.4 Användare D

D är en av dem som använder VIDA mest av de mekaniker på verkstaden. De andra mekaniker till en viss del men inte lika mycket. VIDA All-in-one går på en laptop (ej toughbook) med Windows XP. Datorn kunde rullas runt och var uppsatt i stående arbetshöjd. Mer eller mindre inbyggt i ett skåp för att vara skyddad. Användare D är en av två som mest använder VIDA av mekanikerna. Arbetshallen delades med 3-4 andra mekaniker och det var upplyst av lysrör. Systemen som användes var VIDA all-in-one (rullande laptop), Tactis (på separat stationär dator), TIE (på separat stationär dator), VSTG (på separat stationär dator) och ett eget gjort program/websida (på separat stationär dator) med genvägar till ofta använda dokument och nyheter. Tror inte D beställde egna reservdelar. Jobbar mest med diagnos och felsökning i VIDA. Använder TIE och VSTG till viss del. TIE använts mycket vid nya bilar och nya fel för att snabbare kunna hitta kända fel. Skriver ofta ut denna information då TIE är installerat på en stationär dator och för att kunna ta med in i bilen. D är 27 år och katogiserar sin dator- och Internetvana som normala. Han har mycket stor vana av VIDA. Han har dator hemma och har mobilt bredband. Dock sitter han mycket lite tid vid datorn och hälften av denna tid kanske går åt aktivitet på Internet. Han har relativt stor domänkunskap efter 8 år i bilbranschen. Detta slags yrke är oftast kopplat till ett stort privatintresse för bilar.

När D tar in en bil så är hans mål att så snabbt som möjligt identifiera felet som rapporterats av kunden då han jobbar på ackord.

Arbetsrutin:

1. Ny bil tas in för felsökning. Felet står beskrivet på arbetsorden (inte med CSC). Kollar i TIE först efter öppna journaler om felet är okänt (vilket ofta händer med t.ex. nya bilar).
2. Kopplar sen upp bilen mot VIDA för avläsning av felkoder.
3. Försöker sen identifiera felet antingen med hjälp av VIDAS felsökningsdokument (framtaget efter CSC eller felkoder från styrenheterna) eller egen erfarenhet av liknande symptom.
4. Efter diagnos så går D och beställer reservdelen så den levereras samma dag.
5. Ny bil tas in om reservdelen inte finns inne just nu.

Sökfunktionen:

Verkar inte användas i normalt arbete. Används vid de tillfällen D inte vet vad någon slags information betyder. T.ex. en speciell felkod från en styrenhet eller då D inte vet inte vad en specifik styrenhet kontrollerar.

Svårt att hitta i dokumenten efter man har sökt för att man vet inte var i dokumentet som träffen ligger.

Problem:

- Vid nya bilmodeller så är inte felsökningsdokumenten tillräckligt detaljerade. Information saknas.
- VIDA ger förslag på felsökning som inte stämmer så bra och dessa ignoreras då mekanikern har erfarenhet som gör att han kan gå vidare på annat sätt. CSC koderna är begränsade då de många fel ignorerar frekvens på fel. Frekvensen kan vara avgörande för ställande av diagnos.
- Svårt att hitta i dokumenten efter man har sökt för att man vet inte var i dokumentet som träffen ligger.
- Måste gå fram och tillbaka mellan felsökningsdokument då dessa länkar mellan varandra i stället för att inkludera vissa beskrivningar i stället för att länka.

9.6.5 Användare E – Kundmottagare

E sitter vid en stationär dator med plattskärm (troligen 17 tum). Har headset på sig för att svara i telefon. Vid sidan av skärmen står det många plastfack staplade på varandra. Det står VSTG pärmar på en hylla och en telefon vid sidan av datorn. E är en av två stycken kundmottagare. De bokar upp mekanikerna för jobb och ger råd till kunderna. De kundmottagare som sitter i denna verkstad är mekaniker så de har stor domänkunskap. Vid mitt observationstillfälle var det inte så många kunder men brukar vara rätt många som är i kö plus att telefonen ringer. Använder inte CSC för det anses krångligt och tar för mycket tid. Då personen har stor domänkunskap skulle E nog tolka det bilägaren beskrev till en CSC och sen använda ToC för att navigera.

Kunnig mekaniker som kunde felsöka med hjälp av kunden beskrivning och komma med kostnadsförslag.

Arbetsrutin:

Tar emot kund.

1. Försöker få reda på så mycket om problemet som möjligt. Försöker klassificera problemet för att kunna räkna ut vad troligen behövs göras. Detta för att kunna ge en beräkning av tid och pengar för bilägaren.
2. Skapar ny arbetsorder och lägger in problembeskrivning. Ej csc då det anses krångligt och tar lång tid.
3. Letar upp ledig mekaniker och bokar upp en tid.

9.7 Script for evaluation of paper mock-ups

9.7.1 Information to the user

The users are there as co-designers. I need their input to make it better

I am not testing them and there is no such thing as a stupid proposal.

No one other than me will be able to identify you.

9.7.2 Questions for the users about the “menu search”

- Is a less advanced but more accessible search function something that would improve the user experience?
- Where does the user expect the search result to appear?
- Where does the user expect “menu search” to search for the information?
 - In all the different information types or only the current information type?

9.7.3 Questions for the users about the “advanced search”

- Is more choices a good thing and would help to work effectively?
- Is checkboxes the right way to go or do users only search in one information type at a time?
- Are bookmarking and "cut article number" wanted features?
- Should the user be able to filter the search?
- Is sorting by some kind of relevance wanted?
- Is it ok to show the hits more in accordance with web search engines like Google.com?
- Is it better to link the article and document names then car profile?
- Is it better to hide notes and then through an icon be able to read more detailed information?
- Should the user be able to change the car profile of the car by entering the cars VIN number?

9.8 Analysis of paper mock-up feedback

9.8.1 Comments about the menu search

The following structure of the user feedback was made:

9.8.1.1 *Trouble codes*

“I should be able to have a way to search for trouble codes in the diagnostic part of VIDA”

“Maybe some way to “quick” search for trouble codes”

9.8.1.2 *How to show the result*

“The hits should be showed in the TOC”

“The hits could be shown to the right of the TOC”

“I think the TOC will open up and show the result”

9.8.1.3 *The scope of the search*

“The navigation trough the TOC should not affect the search scope.”

“Some way to change between searching for the function groups and not”

“The navigation trough the TOC should affect the search scope”

“The ‘quick search’ should search only the current group and not all the information types”.

“the search result should still be there after I have chosen a link and I return”

9.8.2 Comments about the “advanced search”

9.8.2.1 *Change of car profile*

“Someone will probably use it”

“I would want to be able to use registration number to change car profile and not only VIN”

“I do not think it makes any difference”

“I would probably not use it”

9.8.2.2 *The organization of the search hits*

“It is a good thing to have the function group number and the title together in the results”

“It is much better that the document title of the part description is linked and not the car profile”

9.8.2.3 *Checkboxes*

“It is more common to just search for one kind of information”

“Checkboxes is not so great but very good with more choices”

“I do not think the ability to choose many information types makes any difference”

9.8.2.4 *Advanced search alternatives*

“Advanced search should search through all the information types”

“Yes, there should be more choices on all the different information types”

“There should be some way to search in a specific function group”

“I should be able in advance to specify in which information type group the information will be found”

“I want to be able to specify which function groups to search in. Down to 2 levels”

9.8.2.5 *Preview*

“The preview seems good. That way you could identify corrects parts without entering the section”.

“Clicking on the large preview should lead to the article section”

“Maybe the preview only works for the parts catalogue”

“The chosen part should be marked in the preview picture”

9.8.2.6 *Cut*

“Nice feature, but should have a keyboard command for even quicker access”

“Cut seems like a useful function for users that order parts”

9.8.2.7 *Notes*

“The notes is needed to identify the correct part”

“Very long notes could be hidden and expanded”

9.8.2.8 *Add to part list icon*

“Not very important because you need to look at the part anyway”

9.8.2.9 *Bookmarks*

“Maybe bookmarks could be saved to the specific car profile and shared between users”

“Have the last searches among the bookmarks”

“I do not see any benefit with the bookmarks”

9.8.2.10 Other

“Search words could be marked in the documents. It was like that in the a previous version before VIDA”

9.9 Script for evaluation of computer mock-up

9.9.1 Information to the users

- That it is only the evaluator/designer that will see the gathered information in any form that can be connected to you as a person. Please tell me any ideas of improvements you can think of.
- That he is anonymous.
- The participant is there as a co designer and their opinions are very important.
- That the design is still very changeable and that any part of it can be criticized.
- How the mock-up works.
 - Yellow areas in the mock-up are clickable so that you can try out the interaction.

9.10 Analysis of computer mock-up feedback

9.10.1.1 Menu search

When the user have used a link in the table of content after a search and then uses space to get the table of content back the search result should be shown. To remove the search result the users should use the “clear search” or make another search. If the search result is not saved it would generate frustration if the user uses the wrong link or want to look at the different results in more detail.

When the user navigates to a section in the parts catalogue through a link in either the search section or the quick search the part should be clearly marked and at the top of the list of parts. Otherwise the user could miss parts that have the same name but some different variations depending on the model of the car and could order the wrong part.

In the “quick search” concept they thought that the “clear search” link should remove the search keywords and collapse the table of content. The functionality that I had proposed was more like a function that should be named “show all”.

One suggestion was that it should be able to search for function group numbers with the quick search. So for example to open group 234 the user should be able to search for 234. It is probably better to implement a feature for direct navigation to a function group because the quick search should do one thing.

One opinion from a stakeholder/ my supervisor was that by showing the search result in the parts catalogue's table of content there is a gap between what you search for and the search result. Because the search is for specific parts but the result is showed by sections containing these parts. This is valid critic but is only applicable to the parts catalogue because in the other information types the document titles are the target of the search. In the user interface it should be clear what kind of information that is searched through with the “menu search”.

The search result could also include a way to show how many of the search words are included in the hit for easy reference of importance.

9.10.1.2 Advanced search

The search alternatives could after the user clicks the search button fold into the left of the screen as the table of content does. This frees up space that is used for the search result, preview and buttons. It also uses a technique that is already introduced in the other parts of VIDA. As long as it is clear how to get the alternatives back and is it clear where the

alternatives go this should not be a problem. This could be made clearer with the use of animation and a very visible way to get the navigation back.

One user suggested that there should be explanatory links in the search result. For example there could be links to how the user finds the emission code of in the VIN number of the car.

When a user changes some of the alternatives in the “advanced search” the rest of the alternatives should (if able) be the same. For example if the user have chosen to make a search in parts, parts catalogue and the engine. Then if the user changes his mind and changes the information type to the repair type the function group should still be the engine.

The preview got very positive feedback and the users thought that the feature would eliminate errors when ordering parts. But it would also useful when looking for repair documents.

Some commented about the way to show the result list and their opinion was that it was good to recognize how the information was showed from web searches like Google. The most important about this is what information is linked. It should be easy to understand where the link goes to and easy to differentiate between links. For example if you search for a part by its name the link should be the name of the parts that is found.

There could be difficulties to know that the “make default” saves everything including how to combine the keywords. That choice could be moved further down to indicate that every choice is saved.

9.11 Information types

The information is structured in different groups into the following types in VIDA:

9.11.1.1 *Parts*

- Parts catalogue

9.11.1.2 *Repair*

- General safety information
- General information
- Component location
- Service programs
- Removal, replacement and installation
- Overhaul instructions
- Cleaning, Inspection and Adjustment
- Installation instructions, accessories

9.11.1.3 *Product specification*

- Visual identification
- Design and function
- Specifications, electrical/electronic
- Specifications, mechanical
- Specifications, other
- Mechanical schematics and diagrams
- Gas, Vacuum and Fluids Schematics/Diagrams

9.11.1.4 *Fault-tracing*

- General diagnostics and tests
- Diagnostic trouble codes and associated procedures
- Symptom-related diagnostic procedures

- Wiring diagrams

9.11.1.5 *Bulletins*

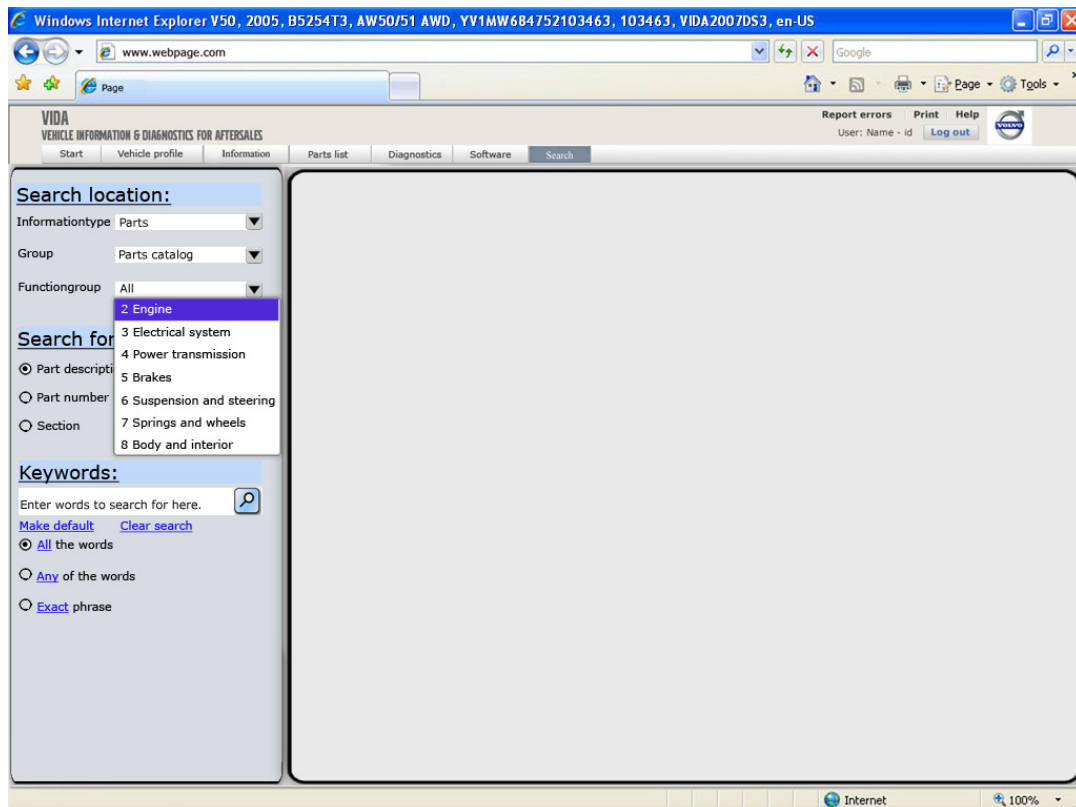
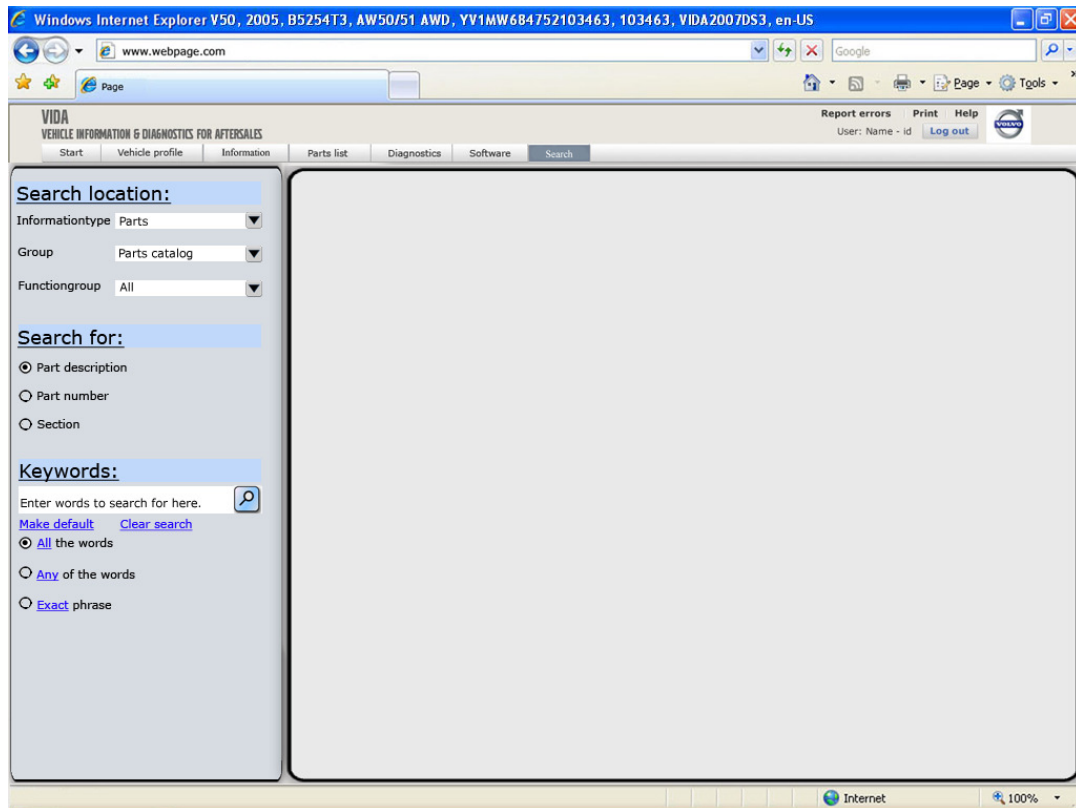
- General Information Bulletins
- Manual Update Bulletins
- Product Fix/Special Tool Bulletins
- Recall/Service Campaign Bulletins
- Emission Recall Campaign Bulletins
- Service Manager Bulletins
- Parts/Accessories Bulletins
- WB, mechanical tools

9.12 Choices in “search for” in the mock-up

- Parts
- CSC
- Repair
- Fault tracing
- Product specification
- Bulletins

9.13 Mock-up screenshots, second iteration

9.13.1 VIDA Advanced Search



The screenshot shows the VIDA search results for 'Fuel tank'. The browser window is titled 'Windows Internet Explorer V50, 2005, B5254T3, AW50/51 AWD, YV1MW684752103463, 103463, VIDA2007DS3, en-US'. The search results are sorted by Relevance and show four entries:

- Fuel tank, 30742527**: 234, Fuel tank and connecting parts AWD, The code key is under group 81. Emission code 4,5 V50, 2005, B5254T3, AW50/51 AWD
- Fuel tank, 30742528**: 234, Fuel tank and connecting parts AWD, The code key is under group 81. Emission code 4,5 V50, 2005, B5254T3, AW50/51 AWD MC 23,28,42,43,45,47,49,51,89,81.
- Fuel tank, 31212040**: 234, Fuel tank and connecting parts SCYL, The code key is under group 81. Emission code 0 V50, 2005, B5254T3 S40 CH -375653, V50 CH -391162.
- Fuel tank, 8662729**: 234, Fuel tank and connecting parts AWD, For cars with emission code 2, see product sign. The code key is under group 81. Emission code 2 V50, 2005, B5254T3, AW50/51 AWD S40 CH -150041. V50 CH -150065.

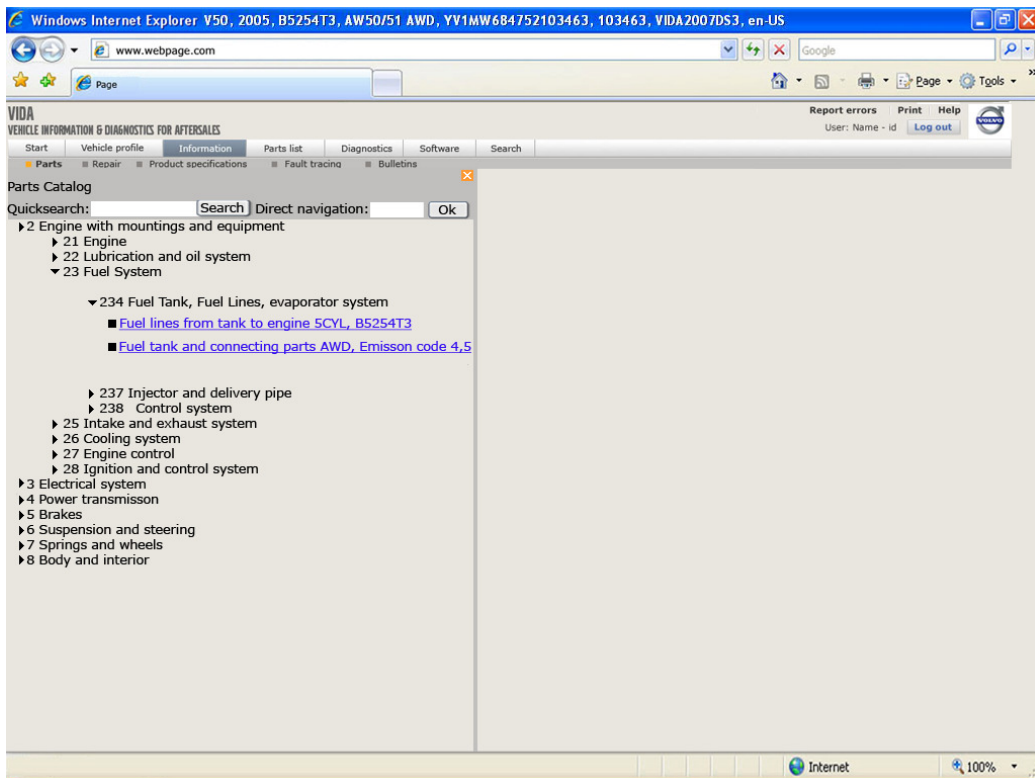
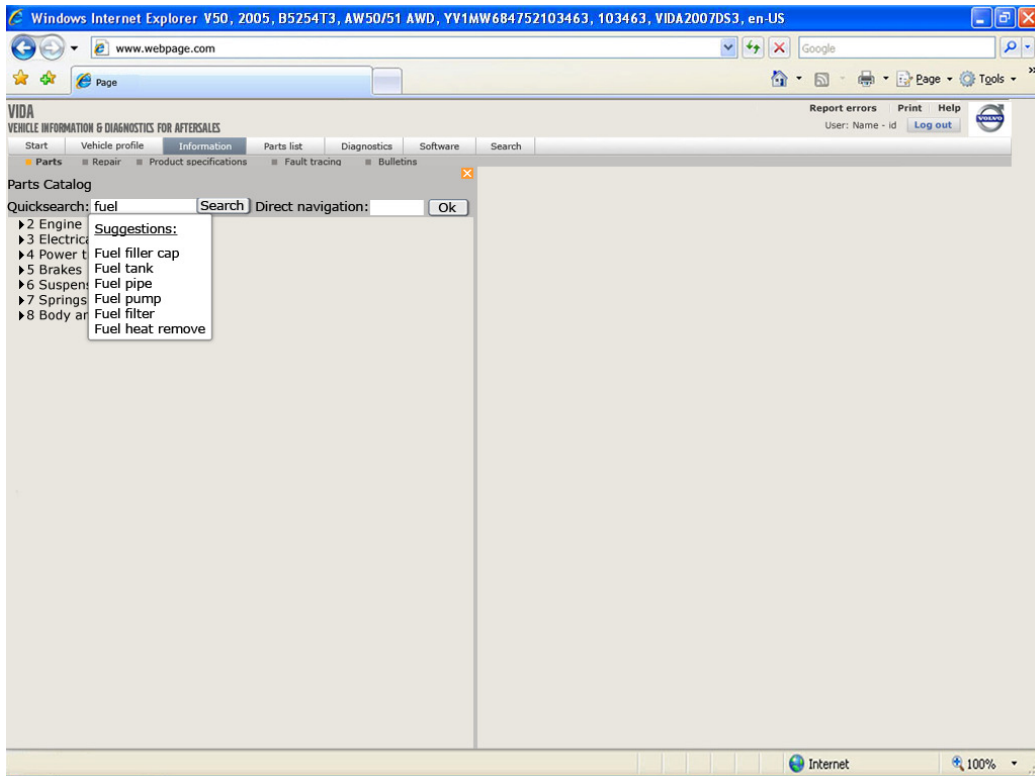
On the right side of the search results, there is a technical drawing titled '234, Fuel tank and connecting parts AWD'. The drawing shows the fuel tank assembly with various components numbered from 1 to 32. The Volvo logo and 'GR 256360' are visible at the bottom right of the drawing.

9.13.2 VIDA Menu Search

The screenshot shows the VIDA menu search interface. The browser window is titled 'Windows Internet Explorer V50, 2005, B5254T3, AW50/51 AWD, YV1MW684752103463, 103463, VIDA2007DS3, en-US'. The 'Parts Catalog' is open, showing a search bar and a list of categories:

- 2 Engine
- 3 Electrical system
- 4 Power transmission
- 5 Brakes
- 6 Suspension and steering
- 7 Springs and wheels
- 8 Body and interior

The interface includes a 'Quicksearch:' field with a 'Search' button and a 'Direct navigation:' field with an 'Ok' button. The Volvo logo and 'GR 256360' are visible at the bottom right of the page.



9.14 Use Cases

The concepts are described with use cases to be more in line with documentation at VCCS.

9.14.1 VIDA Advanced search

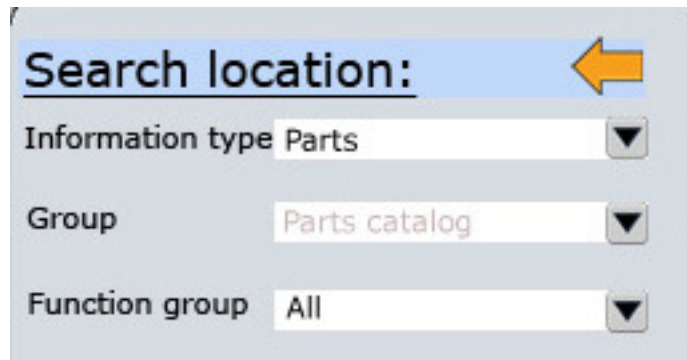
9.14.1.1 Search settings.

The user will be able to make some settings to narrow the query.

9.14.1.1.1 Defining search location

The user will be able to set search location.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	Sets the search location by specifying information type, subgroup within information type and function group of interest with drop-down menus.



NOTE! The menus can be navigated through with the keyboard using the arrows, tab and enter. The up and down arrows will navigate inside a menu, tab to change to the next menu and enter to choose an entry in the menus.

NOTE! System should remember choices made by the user. If a user specifies information type, subgroup and function group but later changes information type the function group choice should still remain if applicable.

NOTE! The default values are:

Information type – Parts.

Group – Parts catalogue.

Function group – All groups.

These default values are under the control of the user see

9.14.1.1.5.

NOTE! The subgroups and function groups available in corresponding drop down menu should update at the change of information type.

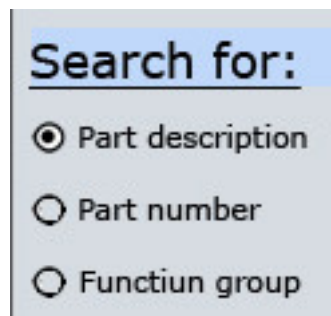
For the different information types, sub groups and function groups see chapter 9.11.

2 VIDA Limits the search depending upon the user's choices when the user activates the search.

9.14.1.1.2 Defining what the user wants to search for

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	Sets what the system should look for within the data set with radio buttons for the different choices. These choices depend upon which information type that has been chosen in 9.14.1.1.1. For the catalogue the choices are:

- Part description
- Part number
- Function group

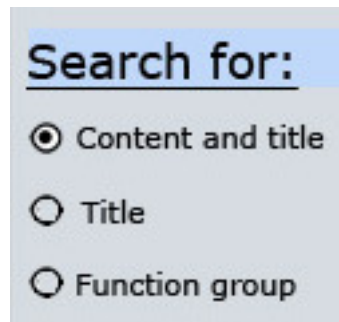


For CSC the choices will be:

- Component/Function and deviation, including comments.
- Function group.

For other information types the choices are:

- title and content
- title
- function group



2 VIDA Will look for the keywords within the data specified in 9.14.1.1.1 and will look for the information specified when the user activates the search.

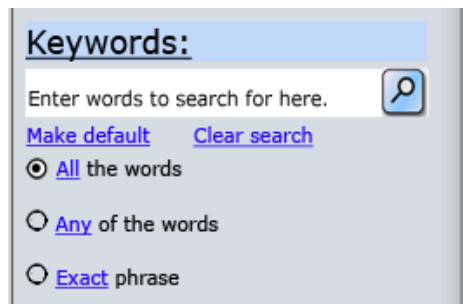
- Part description – VIDA will search for keywords in the part description.
- Part number – VIDA will search for the numbers entered by the user in the list of part numbers.
NOTE! Only number can be written in the text field for the search query. Other digits will be ignored at typing.
- Function group – VIDA will search for the keywords in the name of the function groups at the lowest level.
- Title and content – VIDA will search for the keywords in the title of the documents and within the documents.
- Title - VIDA will search for the keywords in the title of the documents.

9.14.1.1.3 Entering keywords and activation a search

The user will be able to entering keywords for the query and will be able to choose how to combine those using Boolean operators.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1 search is is	User	Will enter the keywords he wants to search for within the data specified in 9.14.1.1.1 and 9.14.1.1.2. NOTE! If the user has specified part number as target for the other digits than numbers will be ignored while typing . Exception wildcards or other symbols used in the search. That only numbers legible should be stated clearly at the text field.

- | | | |
|---|------|--|
| 2 | User | Will activate the search by pressing enter when the text field for the search have focus or by pressing the “search” button. |
| 3 | VIDA | Will move the search pane into the left to make room for the result. The keywords will be present at a text field in the upper left corner where there also will be a search button. |
| 4 | VIDA | Will search for the keywords by the settings used by the user and then present the result. For more information about the presentation of the result see 9.14.1.2. |



9.14.1.1.4 How to clear a search.

The user is able to remove all keywords and set the alternatives to default values.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	USER	Triggers the “clear search” link with the mouse or pressing enter with the link in focus. NOTE! Hovering with the mouse cursor above the link for clear search will result in a tooltip: “This will remove everything in the text field above and reset the search to default values.”
2	VIDA	Removes all keywords and resets all values to default values (see 9.14.1.1.5)

9.14.1.1.5 Settings for the combination of keywords.

The user can combine the keywords used in the query with simple Boolean operators.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	USER	Will make a choice how he wants to combine the written keywords with three radio buttons.

The available choices are:

- * All the words.
- * Any of the words.
- * The exact phrase.

2	VIDA	Will search differently depending on which choice was made. “All the words” is synonymously with the operator AND, which means that all the keywords be present in any order to result in a hit. “Any of the words” means that the presence of one of the keywords is enough to result in a hit and is synonymous to the Boolean operator OR. “The exact phrase” means that all the keywords must be present and in the written order without other information between them to result in a hit.
---	------	---

Boolean
must

NOTE! A tooltip will be presented when the user hovers with the mouse cursor above the different links.

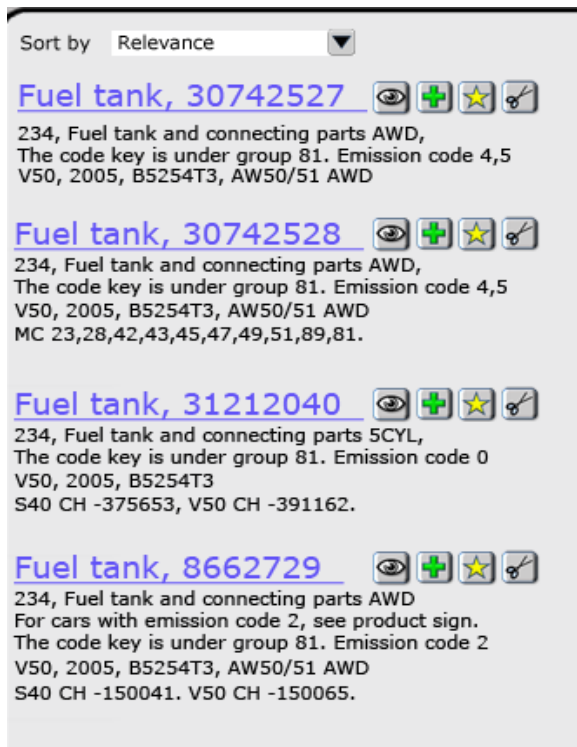
9.14.1.1.5 Setting default values.

The user can save the settings in a search as default values.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	To store the chosen values as default the user triggers the link “save as default”.
2	Vida	Shows the modeless message “Settings saved as default”
3	Vida	Saves the settings as a default search and will use these settings when the search page resets. This happens when the user clears the search or when the user navigates to the search page for the first time since logging in.

NOTE! Keywords are not saved by this.

9.14.1.2 Presentation of the result



The pane with the search settings will fold into the left as the table of content does in the information page.

9.14.1.2.1 Search again without accessing the settings.

The keywords will be accessed in a text field at the left of a menu for sorting. This can be used to remake a search with modified keywords.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1 make the	User	Will access the keywords with the mouse or the keyboard and changes he wants. The user triggers the search by pressing enter or using the icon for search.
2 specified	Vida	Will make a search query with the same settings that the user previously and show the result.



9.14.1.2.2 Sort the result

The user can use a drop down menu to sort the result.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
-------------	--------------	---------------------------

- | | | |
|---|------|---|
| 1 | User | <p>Can sort the result by activating a drop down menu with different alternatives. The different alternatives are:</p> <p>Relevance - available in all information types.</p> <p>Function group number - available in all information types.</p> <p>Function group title – available for all information types except CSC.</p> <p>Vehicle profile - available in all information types.</p> <p>Information type – Available for all information types except parts catalogue and CSC.</p> <p>Part description – Only applicable to parts.</p> <p>Part number - Only applicable to parts.</p> <p>Notes - Only applicable to parts.</p> <p>Component/function - Only applicable to CSC.</p> <p>Deviation - Only applicable to CSC.</p> <p>Comments - Only applicable to CSC.</p> <p>CSC - Only applicable to CSC.</p> |
| 2 | VIDA | <p>Will sort the result by the specifications of the user and show the result again.</p> |

9.14.1.2.3 Visualization of search result

Headline

The headline will be the link to the information the user is looking for.

Fuel tank, 30742527

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	<p>Triggers the link to navigate to the information.</p> <p>If the user has searched in the parts catalogue for a part description the headline will be the description that is found. It will be the same for a search after a part number.</p> <p>If the user has searched for a Function group the headline will be the name of the function group.</p>

If the user have search for the content in some other information type or the title of the documents the headline will be the title of the document containing the information. If the user searches for a CSC the headline will be the CSC's function and deviation or the specific function group if that is what the user have searched for (see 9.14.1.1.2).

- 2 VIDA Shows the information in the information page.
NOTE! The search result should be available when the user returns to the search page.

9.14.1.2.4 Additional information

Additional information about the part, document or CSC that is found is available below the headline.



234, Fuel tank and connecting parts AWD,
The code key is under group 81. Emission code 4,5
V50, 2005, B5254T3, AW50/51 AWD

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	VIDA	Will show the information below the headline. For parts the additional information will be Function group number and title, notes and vehicle profile. For CSC the additional information will be function group number and title, comments and the CSC. For other information types the additional information will be function group number and title, information type and vehicle profile.

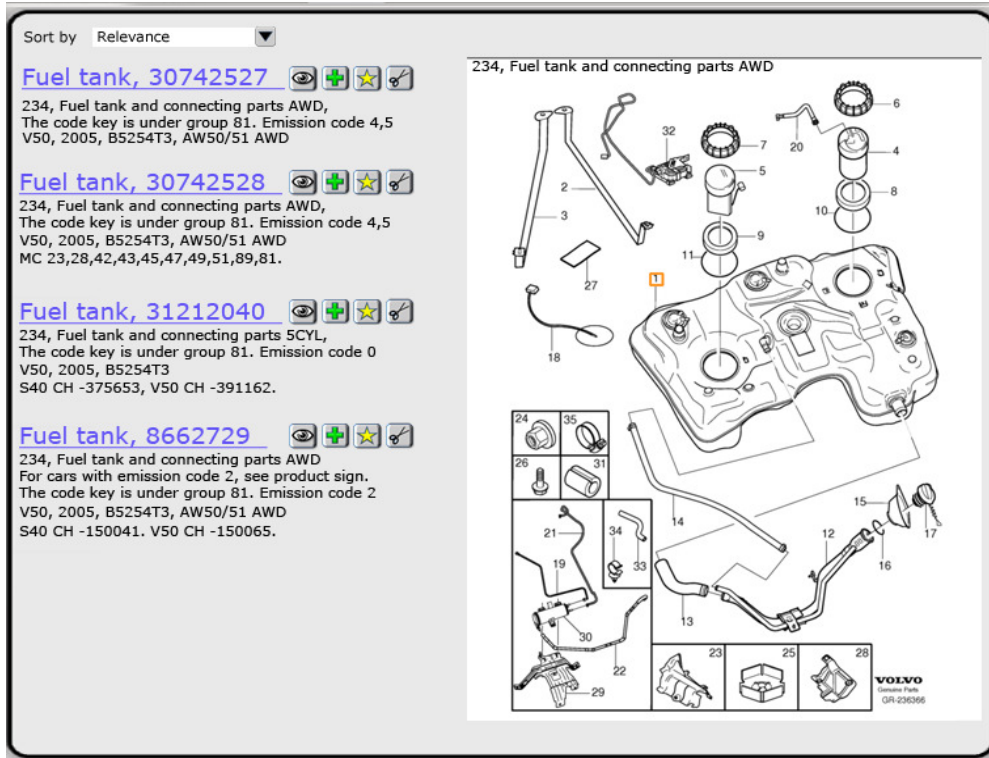


9.14.1.2.5 Preview

The user will be able to preview a section of parts or a document within the search result page.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	Triggers the preview function by using the eye icon at the different hits. NOTE! If the user hovers with the mouse pointer above the icon a tool tip will appear with the text "Preview".
2	Vida	Will show a preview of the information type available. If the information type is a part the preview is of the associated section. If the type of information is repair, product specification, fault tracing or bulletin the preview is of the first page of the document. NOTE! The picture of the preview is "clickable" and will result in navigation to the information as if the user had used the headline (see 9.14.1.2.3).
3	User	User triggers the same hit's preview function or triggers another hit's preview function.
4	VIDA	In the first case VIDA will remove the preview and in the second

case replace the old preview with the new.



9.14.1.2.6 Add part/CSC

The user will be able to add CSC and parts to the corresponding lists from the search result page. **NOTE!** This feature is only available for hits that are either a specific CSC or a specific part.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	Triggers the function by using the plus sign at the corresponding hits.
2	VIDA	Will add the CSC or part to the list of CSC or the list of parts.
3	VIDA	Will show a modeless message "The part was added to the parts list" or "The CSC was added to the CSC list".



9.14.1.2.7 Bookmark

The user will be able to bookmark parts, csc or documents.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	Triggers the function by using the star icon at the different hits.
2	VIDA	Will add the part, csc or document to a list of different bookmarks that later can be retrieved by the user.
3	VIDA	Will show a modeless message "The part was added to your bookmarks", "The CSC was added to your bookmarks" or "The document was added to your bookmarks".



9.14.1.2.8 Cut parts number to clipboard

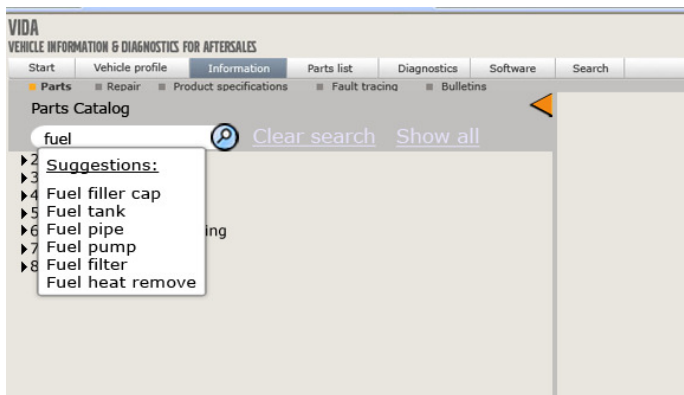
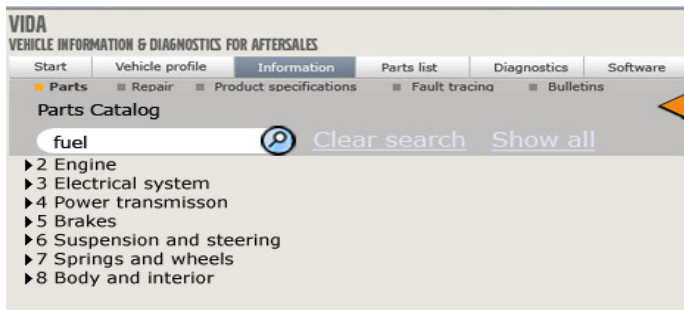
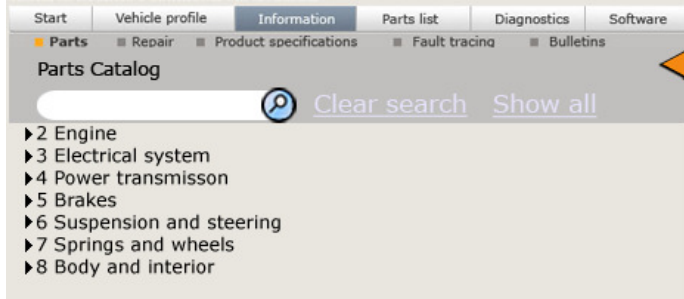
The user will be able to cut the parts number to the clipboard without needing to mark it with the mouse.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	User	Triggers the function by using the icon with pair of scissors placed at the different hits.
2	VIDA	Will put the part number of the specific part into the clipboard and making it available to other applications

9.14.2 Menu search

The user can by the use a kind of filter to remove unwanted information and making it easier to find the information that the user wants to find.

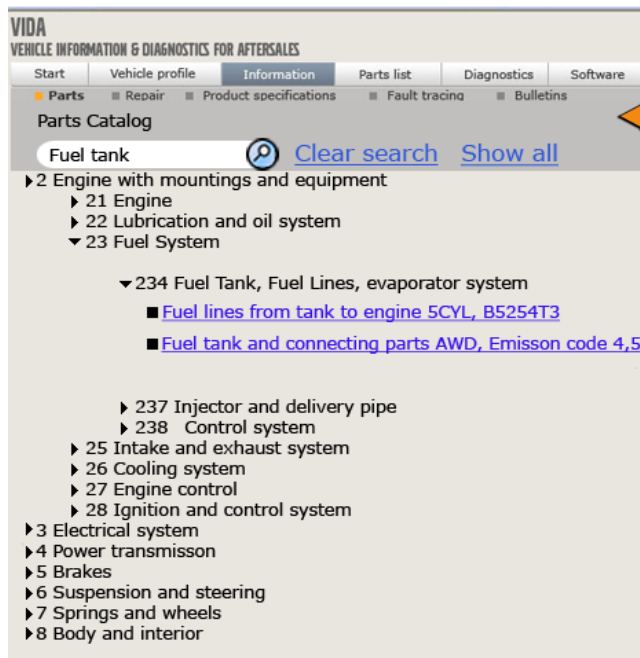
9.14.2.1 Using the search field



<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	USER	User can start writing because the search field have focus when the user navigates to the specific group of information.
2	USER	Enters the keywords he wants to search for.
3	VIDA	While user is typing VIDA lists suggested keywords to the user through a menu below the search field.

- | | | |
|---|------|--|
| 4 | USER | Will continue writing until the user is done or the user will choose one of the suggested keywords. By pressing enter or the search icon the user activates the search. |
| 5 | VIDA | Makes a search based on the user's keywords and searching for the information in the information type based on the users navigation. The keywords are combined with the Boolean operator AND by default and cannot be changed. |

9.14.3 Showing the result



Step	Actor	Action description
1	VIDA	Will after the user has activated the search close every function group that do not have any content with the chosen keywords. VIDA will also open every function group that do have content connected to the keywords. In the case of it being parts information the keywords will be connected to part description and section title.

If the information searched for are repairs documents, products specifications, fault tracing documents or bulletins the keywords will be connected to document title.

In the case of the user is searching for CSC: s the keywords are connected to the codes function- and deviation field.

- | | | |
|---|------|--|
| 2 | USER | Can choose the most relevant link to use and navigating to the information through it. |
| 3 | VIDA | Will hide the table with the table of content and show the target of the linked information. |

9.14.3.1 Show all



If the user wants to show the information that was hidden because they did not have any information connected with the keywords he can use the link show all to make this information visible.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	USER	Clicks “show all”
2	VIDA	Will remove the filter on the table of content and show all available information.
3	VIDA	Changes the link “show all” to “show hits”

9.14.3.2 Show hits



If the user wants to get back to the search result after he has hidden them the user can use the “show hits” link.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
-------------	--------------	---------------------------

- | | | |
|---|------|---|
| 1 | USER | Clicks “Show hits” |
| 2 | VIDA | Will show the search result again and hide all other information. |
| 3 | VIDA | Will change the link “show hits” to “show all” |

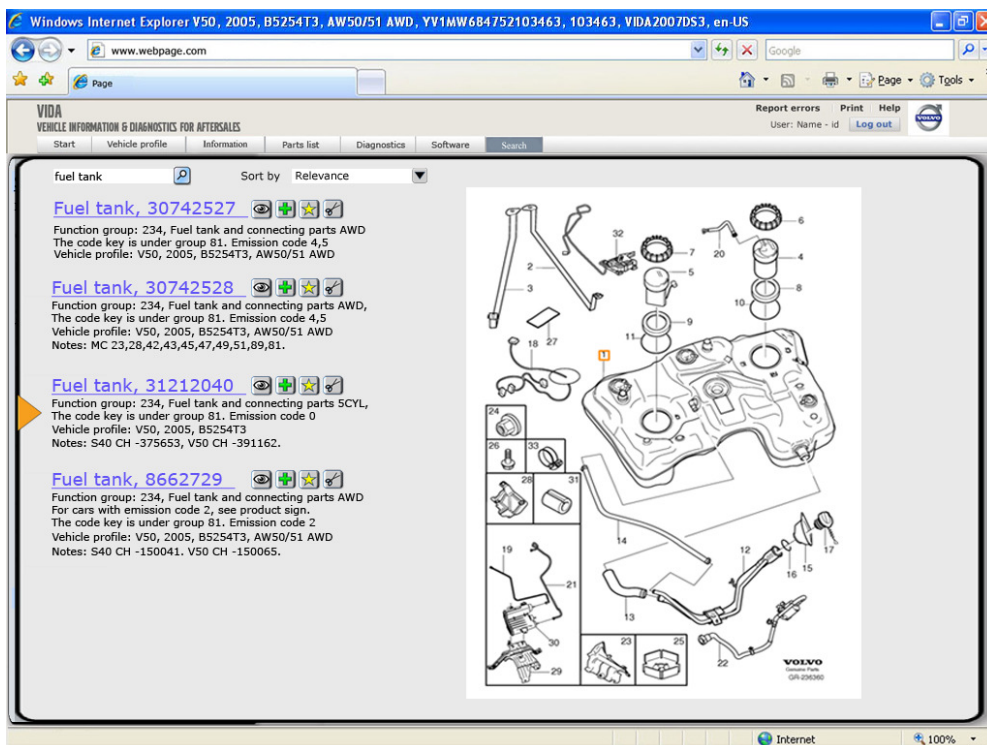
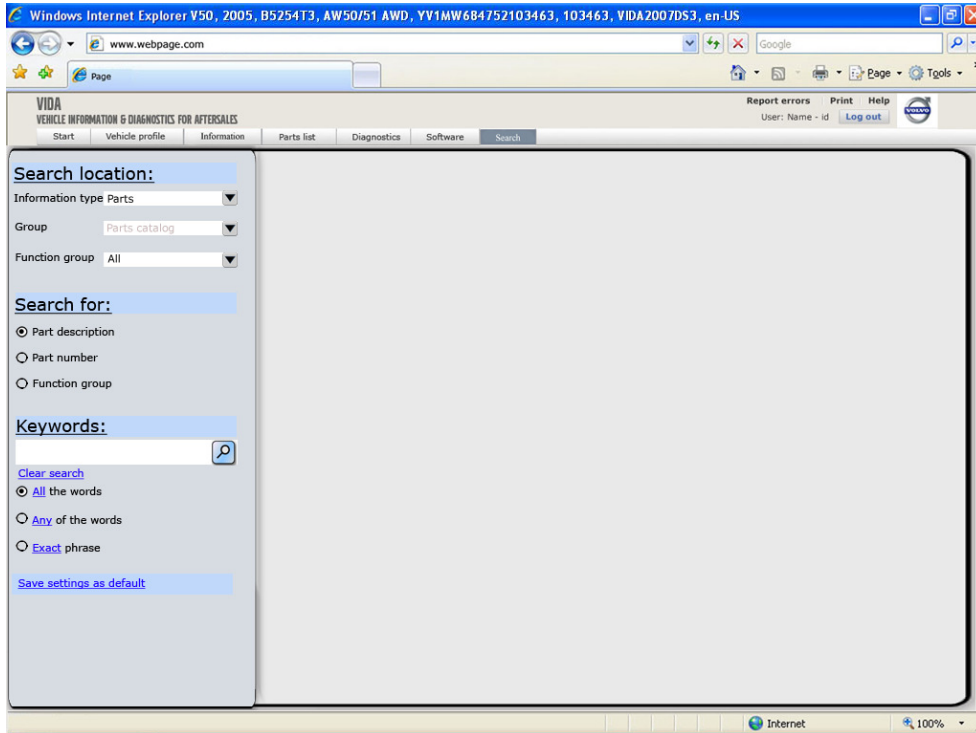
9.14.3.3 *Clear search*

When the user wants to clear the search field and show all information in the table of content he can use the link “clear search”.

<u>Step</u>	<u>Actor</u>	<u>Action description</u>
1	USER	Clicks the link “clear search”
2	VIDA	removes all keywords in the search field and shows all information in the table of content. NOTE! VIDA should set a curser in the search field so the user could start to write a new search immediately if he wants without clicking in the search field

9.15 Mock-up screenshots, Final Result

9.15.1 VIDA Advanced Search



Windows Internet Explorer V50, 2005, B5254T3, AW50/51 AWD, YV1MW684752103463, 103463, VIDA2007DS3, en-US

www.webpage.com

VIDA
VEHICLE INFORMATION & DIAGNOSTICS FOR AFTERSALES

Report errors Print Help
User: Name - id Log out

Start Vehicle profile Information Parts list Diagnostics Software Search

Search location:

Information type Parts

Group Parts catalog

Function group All

Search for:

Part description

Part number

Function group

Keywords:

Fuel tank

[Clear search](#)

All the words

Any of the words

Exact phrase

[Save settings as default](#)

Sort by Relevance

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ion code 4,5
AW50/51 AWD

Connecting parts AWD,
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W50/51 AWD
9,81.

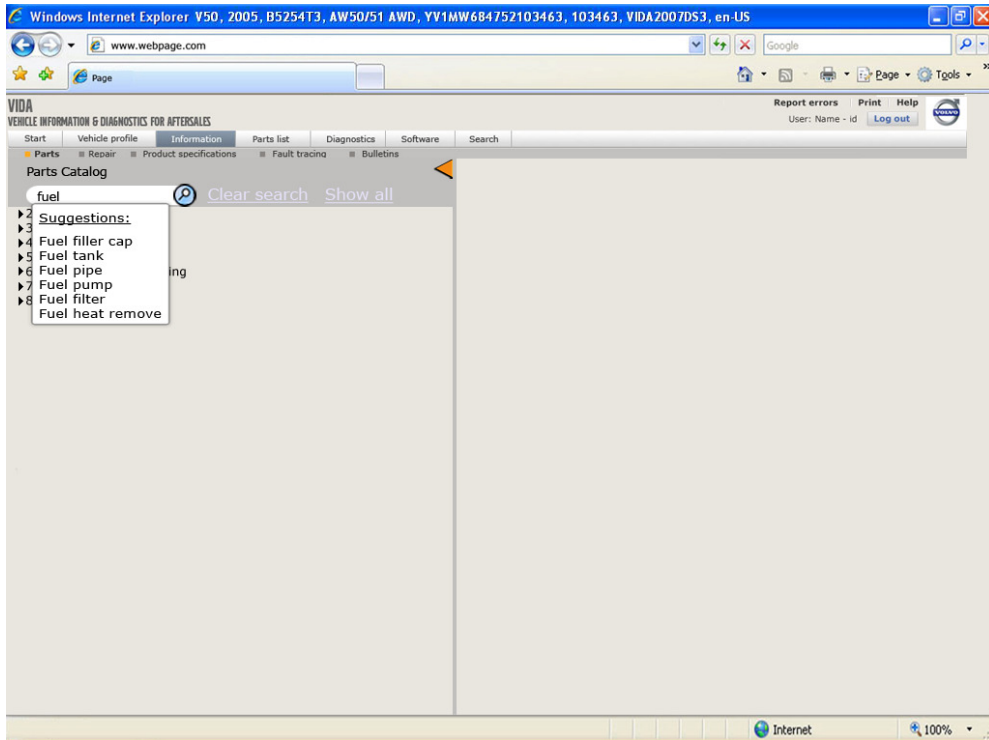
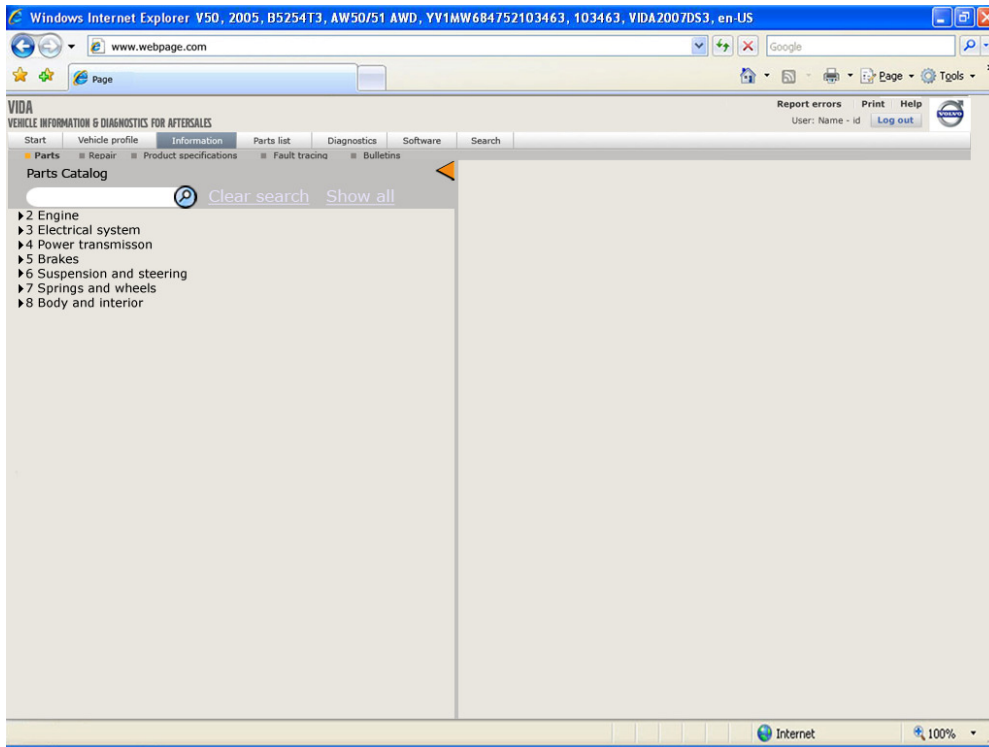
Connecting parts 5CYL,
ion code 0
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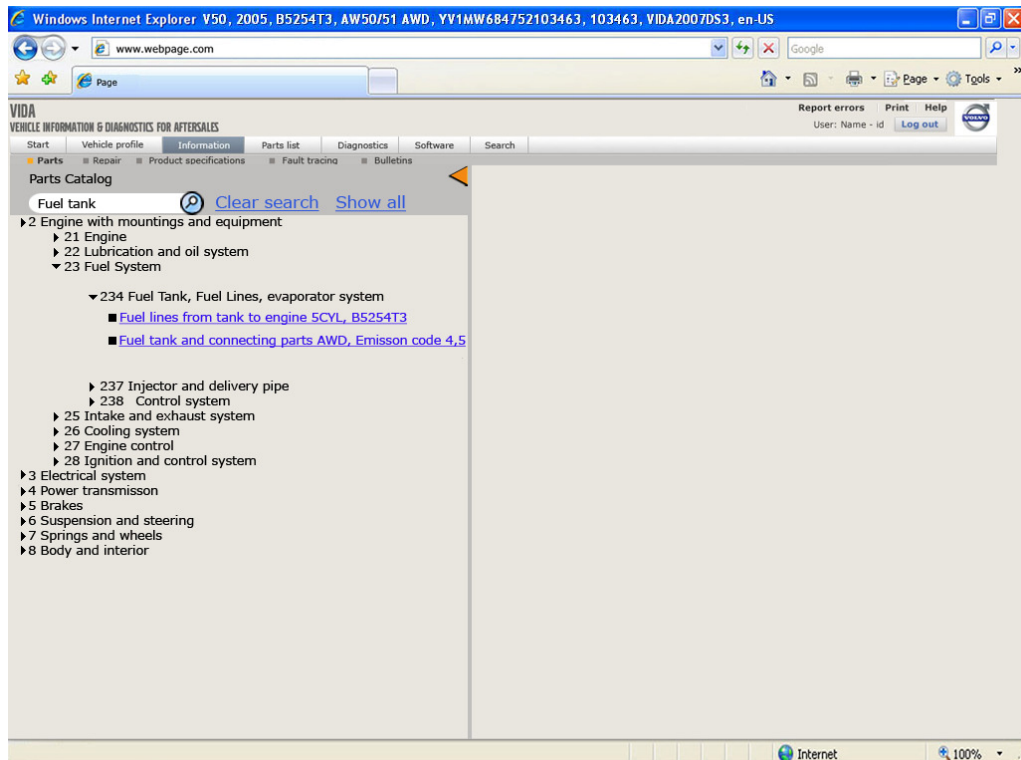
Connecting parts AWD
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VOLVO
GR 290360

9.15.2 VIDA Menu Search





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