A PERSONALIZED CAR

A STUDY ON HOW TO APPLY PERSONALIZATION TO A DRIVER ENVIRONMENT

Master Thesis in Cognitive Science
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27 November 2006
ISRN: LIU-KOGVET-D--06/18--SE
ABSTRACT

An increasing amount of technology in cars makes new ideas and solutions necessary. This study will explore the idea of a personalized driver environment and investigate possible benefits and drawbacks with such a feature. The study consists of three parts: a pre-study exploring personalization, a survey investigating the attitudes towards personal settings, and finally an interview testing a specific solution. The survey was distributed in USA and Sweden while the interviews were conducted with Swedish subjects.

Overall, the concept of a personalized car has been well received. This study has shown that the most requested settings are associated with the driver position, hi-fi system and climate. The study also suggests that feeling in control of the personalization is more important than the benefits associated with automation. The user prefers visible solutions, such as a personal button on the key before hidden (e.g. using a button sequence or a menu system). Such a button promotes the feature while allowing the user to interact with the car in a familiar way. However, since little real user experience exists with such solutions it is important to continue research when further developing personalization of a car.

Keywords: Personalization, HMI, personal settings, driver environment, customization, user experience.
ACKNOWLEDGEMENTS

This thesis started as an idea born about a year ago. Thanks to our supervisors Daniel Jungegård and Johannes Agardh we were able to apply this idea on the very exciting area of in-vehicle personalization. Without their inspiration and help this thesis had not been anything more than just an idea. We would also like to thank the other employees at Volvo Car Corporation Lindholmen for their support and company during the entire thesis work.

We would like to thank Anders Lindgren, Tobias Svenberg, Per Chaikiat, Per Amdahl, Hanna Johansson and Katarina Walter for the patience they have shown and the inspiration they have given.

Finally we would like to thank our supervisor Nils Dahlbäck at Linköping University for stepping in and encouraging our work.

Monika Nilqvist & Tomas Ericsson

Gothenburg, 29 September 2006
The information described in this segment is obtained from Volvo Car Corporation.

Volvo Car Corporation was established in 1927 in Gothenburg, Sweden. Since 1999, Volvo Car Corporation has been a subsidiary of the Ford Motor Company. Volvo, together with brands like Jaguar, Land Rover and Aston Martin are universally recognized as the leading quality brands within the Ford Motor Company. Volvo’s headquarters and most of the manufacturing are located in Gothenburg, Sweden.

Volvo Car Corporation produces almost 500,000 cars a year, and the cars are sold in over 100 countries. Volvo has about 1-2% market share in Volvo’s market segments. In their country of origin, Sweden, the market share is about 20% of total sales. Volvo’s largest markets are (in the following order): USA, Sweden, Britain and Germany.

“be the most desired and successful premium car brand by creating the safest and most exciting car experience”

(The vision of Volvo Car Corporation)

Volvo Car Corporation’s core values are safety, environment and quality. Volvo Car Corporation also puts an emphasis on design and creating an exciting driving experience.

**Safety** is, and has always been, the heart of the Volvo brand. Volvo has invented many lifesaving innovations; the most famous being the three-point safety belts in the front, Anti Lock Braking System (ABS), Driver airbag and Whiplash Protection System (WHIPS).

**Environmental** care has been one of Volvo Car Corporation’s commitments for about thirty years. Volvo’s environmental care embraces the car’s complete life cycle. Volvo’s policy on environmental issues is “clean inside, clean outside and clean all its life”.

**Quality** is a necessity for the brand. Volvo actively engages its stakeholders to measure quality satisfaction levels and to ensure they are living up to consumer expectations.

**Design** is developed and enhanced in a continuous process. The design of a Volvo car is strongly influenced by the Scandinavians origins. Scandinavian attributes such as elegance, function and cleanliness are strong design elements. Volvo’s design is also based on the customer’s needs and lifestyle.
Excitement. Volvo’s goal is to deliver both pure driving pleasure and a Volvo for everyone, with smart solutions.

Volvo has a wide supply of vehicle’s ranging from smaller car’s such as the new sporty C30 to the larger seven seats cross country vehicle XC90. The new Volvo S80 (figure 1.1) is Volvo’s latest top of the line model, described as successful, sophisticated, stylish and having the latest technology such as blind spot detector and adaptive cruise control.

Volvo’s customer demographic is very diverse. As such, the Volvo car brand has to appeal to wide range of users. A typical Volvo has to suit a younger woman in USA as well as the older man in Sweden.

Since this thesis is a result of cooperation between two students from the Linköping University and Volvo Car Corporation the study has been influenced by the values and goals of the Volvo Car Corporation.
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1 Introduction

This thesis has been carried out as a part of the Cognitive Science program at Linköping University and in cooperation with the department of Electrical & Electrics System Engineering, Driver Info & Interaction Design. The objective of the research has been to create a human-machine interaction concept of personalization.

1.1 Problem area

The interior of cars has become more and more complex, primarily because of the increased amount of technology that assists the driver. In the area of in-vehicle design there has been very little or no research about personalization. This seems strange as more and more technology has recently been developed. However, the new technology emerging in the driver-environment has not been disregarded (Aaron, 2004; Walker et al., 2001).

Another aspect of this new emerging technology is how to make it more usable and pleasurable seen from the user perspective. This question is a hot topic in Human Computer Interaction and a lot of work concerning emotion and pleasurable products has been written (Green & Jordan 2002). There has recently been some research concerning this “new approach” in the driver environment. Leder et al. (2005) has studied dimensions in car-interior appreciation and Åkesson and Nilsson (2002) has studied leisure applications for cars. However, it is important that such applications do not conflict with driver safety. Burnett and Porter (2001) concludes that “there is an urgent need for usable, integrated designs to ensure that driver’s interactions with multiple systems do not cause an increase in visual distraction and mental workload, with potential negative implications for safety” (p.529).

Human Computer Interaction (HCI) can easily be overrated and not fulfill the true needs and desires of the user. Traditionally HCI has focused on usability from a practical point of view, where the efficiency of the systems have been measured by how quick and easily understood an interaction has been. More recently the area of user experience and emotional design has emerged, where the enjoyment and satisfaction of the user is taken into consideration.

In a driver environment a specific problem that emerges is how to adapt the technology to different drivers. There are at least two ways of dealing with this problem. The first, by letting the system know the user and adapt to her, are often called adaptive systems or intelligent systems. An example of this is the way certain information is kept from the driver until it is safe to deliver the information. For more information on this area, see Engström et al. (2004),
Mariani (2002), Lavie et al. (2005), Höök (2000) or Kovordányi (2005). The second way of dealing with the problem, which will be the main focus in this thesis, is by letting the user herself customize a system to suit her individual preferences. Current research calls this customization (Nielsen, 1998) or personalization (Blom, 2003). In this thesis the term personalization will be used.

There is of course no guarantee that a personalized driver environment will fulfill all the needs and desires of different drivers. Which settings should be personalized must be carefully considered.

Today’s premium cars are equipped with profile settings connected to memory settings. The degree of profile settings that can be done varies, but most commonly some part of the interior (e.g. the driver seat, rear-view mirrors and steering wheel) are adjustable and their positions can be saved. The saved settings can be accessed through either a memory button (see Figure 1.2) or a car key.

![Figure 1.1 Seat memory Lexus RX 400h.](image)

Brands like Cadillac, BMW and Audi have implemented the profile concept a bit further and have included settings like audio, lighting, display and locking modes. In Cadillac, for instance, the user can choose between different color skins for the display or choose the accent and sex of the voice-assistance.

The authors of this thesis believe that this emerging way of dealing with the profile concept can be developed further. Through extended customization of the driver environment, a new way of enhancing the user experience can be investigated. This thesis will explore how personalization in a car could be designed by investigating the current behavior in the car and what attitudes that can be found regarding personalization. There will be a contribution in how a personalized car could be designed, discovering both a number of problems and benefits with a personalized car.
2 Previous Research

Very little research in the area of user initiated personalization has been conducted. Earlier research found investigate how people personalize their physical surroundings in an attempt to externalize their personality. As personalization has grown to influence more and more electronics, as well as internet based applications, attempts has been made to conclude why people personalize e.g. such objects as their cell phones.

The target group for the Volvo brand includes families where the car is shared between both men and women. The Volvo brand is also marketed in different countries across the world which includes different cultural groups. Therefore research in differences between cultures, as well as differences between genders, might influence the development of a personalization concept.

2.1 Personalization

Research on personalization has, first and foremost, focused on how people influence and adjust their physical surroundings to fit their specific needs and preferences. Research has been carried out on personalization of the workplace (Wells, 2000), dormitory rooms (Vinsel et al., 1980) and hospital wards (Holahan & Saegert, 1973).

Wells 2000 defines personalization of the environment as:

“the deliberate decoration or modification of an environment by its occupants to reflect their identities”

Different effects of personalization have been suggested. Donald (1994) has shown that personalization may enhance a person’s well-being, by allowing expression of one’s emotions and personality. Wells (2000) found a positive relationship between workspace personalization and employee well being, which supports their model that personalization is positively associated with satisfaction of the physical work environment. It was also found that the arrangement of the individual workspace is more highly associated with satisfaction than the rearrangement of team spaces. Based on his study, Wells suggests that being able to personalize the individual workspace is more important to employees than personalization of team spaces.

The possibility to personalize your environment, with the enhancement of technology, has grown to include a wide range of electronic devices. An example of this would be cell phones with exchangeable shells and email
applications that supply a wide range personalization options. It is not just the shell of the cell phone that can be exchanged and personalized but also such functions as identifying a caller by a certain ring tone. Dealing with your chat application it is possible to choose how it will respond to a double click on a contact (start a chat window or a call). Even though a wide range of products and applications lets the user change the appearance and functionality of the product, simply providing the possibility to personalize does not mean that users will take advantage of the feature (Mackay 1991).

In Theory of Personalization of Appearance: Why Users Personalize their PCs and Mobile Phones, Blom & Monk describe research on the reason why people personalize and how these can affect future features of applications and products (Blom & Monk 2003). Blom and Monk’s theory of personalization of appearance has been suggested to be able to support and effect design-decisions for personalization of a product or system. The object of Blom and Monk’s theory has been to investigate which factors will lead users to want to personalize features and if there is a reason to include features for personalization of appearance to a particular system or product. The disposition found by this research together with the effects of personalization (see Appendix I) has been an attempt to help investigate if personalization of a product will add value to the user.

According to Blom and Monk’s theory of personalization of appearance the combination of the user, the system and contextual dispositions lead to the personalization of appearance (Blom & Monk 2003). This personalization of appearance has cognitive, social and emotional effects on the user. The theory predicts that a high personalization disposition leads to a high scope of personalization. Three linked qualitative studies were performed to investigate why people choose to personalize the appearance of PCs and mobile phones and what effect personalization has on their perception of these objects.

In earlier research by Blom personalization is defined as:

"a process that changes the functionality, interface, information content, or distinctiveness of a system to increase its personal relevance to an individual. The effect of the changes should persist across sessions”.

(Blom, 2000)

There is a contextual difference between information and communication technology and direct physical environments (Blom 2000). In the context of information and communication technology personalization can be initialized
by the device as well as the user. Blom distinguishes between work-related and socially related motivations for personalization. There are different ways of accommodating work related goals: system initiated personalization and user initiated personalization.

System initiated personalization refers to a system that uses a user profile as a guide to provide content based on what the user is believed to be interested in. One example of this is the way the online store Amazon.com suggests books of interest based on what books the user has previously bought. System initiated personalization used in web based applications are described as a way of delivering “personally relevant information to the customer” (Karat et al., 2003). Letting the system adjust its information content as a way of designing personalized user experience is a feature which can be seen among today’s leading eCommerce sites.

User initiated personalization is described as adjustments initiated by the user to achieve a desired goal. Nielsen et al. refers to this user initiated personalization as “customization” (Nielsen 1998).

Heidmet’s (2004), as well as Blom and Monk (2003), found that the most frequent used reason for personalization was to obtain a feeling of control over the system, and that personalization of the environment is a way for the participants to externalize and display their personality.

Research on what kind of features users tend to personalize was also carried out by Stanley et al. (1996). The research investigated what kind of features users tend to personalize if they are given an option. Stanley et al. studied user-initiated personalization (referred to as customization by the authors) of a word processor and found that 92% of the participants customized their software someway. It was found that most user initiated personalization was done with the intention of increasing productivity. Tailoring the system to the work practices of the user was, by the user, seen as a way of creating a more efficient work environment. The most common changes involved easier access to custom or often-used functionality. Stanley et al. found that few participants customized the visual appearance of the interface.

Experiences with personalization of internet based application have been documented by Udi Manber, Ash Patel and John Robinson (2000). Their experiences with personalization on Yahoo.com show that it is difficult to get people to personalize. The documentation shows that most of the Yahoo-users prefer the default page. The conclusion of this study was that it is important to present the customization tools in an intuitive way and encourage the users to
experiment with the features. Manber et al. also concludes that scalability is essential for personalization.

2.2 GENDER AND CULTURAL DIFFERENCES

Adapting systems to a user, whether it is through personalization or customization, demands a well defined understanding of the expectations and preferences of the end user. The target groups for Volvo cars include a wide range of different cultures and driving styles. As well as targeting different cultures, car manufacturers such as Volvo, have to take into consideration that their cars will be shared within families. There is an ongoing research regarding differences both between genders and between cultures that might play a role in how products should be designed (Simon 2001). This research might also be of interest when it comes to designing for personalization.

There have been studies in computer science showing that there is a low confidence level among female students comparing themselves to males and that lack of self-confidence impacts attitudes toward a new software package prior to its use (Beckwith and Burnett, 2004). When failing to complete a task, females have been shown to attribute failure to their own lack of capability while males attribute the failure to the difficulty of the task. Beckwith and Burnett state that it is important to consider gender differences in HCI just because it is risky to ignore potential differences.

Attention Investment Model is a model of how users allocate their attention during problem solving and explains how a user considers the perceived cost, pay-offs, risks and benefits when deciding what action to take. If the costs and/or risk are too high compared with the benefits of the action the user may choose not to follow through with that action (Blackwell 2002). It is suggested that men and women perceive risk differently and that women perceive higher risks in everyday choices and behavior than men do (Finucane et al. 2000). These differences in risk assessment could influence men’s and women’s behavior.

A study by Beckwith et al. (2005) in which male and female users where given two spreadsheet debugging tasks showed that females had a lower self-efficacy (belief in one’s capabilities to perform a certain task) than males when it came to their abilities to debug. Female’s self-efficacy rating could be predicted by their effectiveness at using the debugging features (this was not the case for the male subjects). Females were also less likely than males to accept the new debugging features (one reason stated was that they thought the features would
take them too long to learn, even though there was no real difference in the males’ and females’ ability to learn the new feature).

Gender difference in how a system is perceived when using the Technology Acceptance Model (TAM) has been shown by Venkatesh and Morris (2000). TAM describes user acceptance and technology use as depending on two key beliefs: ease of use and perceived usefulness. Ease of use is the degree to which the user believes that using the system will be free of effort. Perceived usefulness is the degree to which a user believes that using the system will enhance their performance.

Venkatesh and Morris addressed the question “Are men and women different with respect to technology adoption?”; to answer this a longitudinal experiment using TAM was performed. Several interesting findings and conclusions regarding gender differences and technology adoption was found. Men consider the perceived usefulness (i.e. to what extent a person believes that using the technology enhances her/his job performance) higher than women when making use of technology. This applies to both short- and long-term usage. The perceived ease of use (i.e. the degree to which a person believes that using a technology will be free from effort) was in other hand more salient for women compared to men. Morris and Venkatesh also found that women are more influenced by subjective norm (the degree to which an individual believes that people who are important to her/him think she or he should perform the behavior in question) and when making technology adoption and usage decisions, men only consider productivity-related factors whereas women consider ease of use, social factors and productivity.

Weiser (2000) found that male’s and female’s usage of the internet differ. More specifically, the Internet usage of women is more driven by interpersonal communication whereas men are driven by entertainment and leisure. Weiser also found that men used the Internet more frequently and in a more flexible way.

Research in the area of personalization has shown that there might be gender differences in this area (Wells 2000). It is suggested that personalizing your home is more important for women than it is for men. In a study by Vinsel et al. (1980) it was found that female students tend to personalize their dormitory rooms in a more intimate manner than men do. Female students tended to use objects with personal relationship i.e. photos or letters when decorating and personalizing their space, while men used objects relating to a hobby, a sport or entertainment equipment.
Wells (2000) found that women personalize their workspaces significantly more than men. Wells also found that women personalize with symbols of their family, friends, trinket, plants and pets, whereas men personalize with symbols of their achievement and sport objects. There is also a difference in reason; women wanted to express their identities and emotions and to improve the feel of the workplace. Men personalized to show their status within their company.

As described above, there are some gender differences in the area of personalization with respect to technology. Cultural factors are also an area of related research. Mahemoff, M, Johnston (1998) mentions two different kind of cultural factors, overt cultural factors and covert cultural factors. Overt factors are factors such as time, measurement system, language and formatting. These factors are well defined and relatively easy to consider, if you are aware of them. The more complex factors are covert factors such as mental disposition, perception, social interaction rules and context of use. Mahemoff and Johnston conclude that there is a lack of an extensive summary, dealing with either overt or covert differences. They ask for some kind of exhaustive list collecting these more or less obvious differences. Such a list would be extremely useful for developers, ensuring that no one re-invents the wheel. Covert factors can also be documented as possible factors where the mere awareness of the possibility for such differences might provoke engineers to investigate its relevance. Mahemoff and Johnston also states that such lists never can replace the fact that you have to make local usability tests or call for local expertise when developing technology.

Nielsen (1996) concludes that the easiest way to consider culture and usability is international usability testing. He talks about five different way of doing this:

- go to the foreign country yourself
- run the test remotely
- hire a local usability consultant to run the test for you
- have staff from your local branch office run the test, even though they are not trained in usability
- build additional usability groups in your major markets

Nielsen prefers building additional usability groups in your major markets but admits this to be nearly impossible for many companies considering the cost. However, there are major concerns with local usability testing. Vatrapu investigated whether culture influences the thinking, feeling and behavior of the
users during interviews. Vatrapu concludes that “Participants respond more freely and accurately to the interviewer from the same culture than to the interviewer from a foreign culture. The participants replied more, found more usability problems, made more suggestions, made less number of positive comments, more number of negative comments and cultural related comments with the interviewer of the same culture when compared to the interviewer from a foreign culture” (Vatrapu, 2002, s69). This suggests that even though you perform local usability testing, it is very important to consider these kinds of effects. Vatrapu states that more research is needed about whether interaction techniques vary across cultural boundaries.

Some concrete results regarding cultural differences and usability have also been found, though as earlier described, no extensive summaries or results exists. Lee and Harada (1999) studied the cultural differences in microwave usage between Americans, Koreans and Japanese. They found a number of differences concerning these cultures. The American respondents appeared to just try out new products rather than to read the manual first. Lee and Harada also found differences in how the bathroom sink is handled, where the Japanese showed a high coherency to turn both faucets clockwise. There was no coherency among the Korean and American subjects however, they preferred a combination of counter clockwise & clockwise, or counter clockwise & counter clockwise before turning both faucets clockwise. A distinctive difference between the Americans and the Asians were the usage of colors on power buttons. Japanese and Korean choose red color as the power on button whereas the American chooses the green button.

Evers and Day (1997) found that there are not only differences between cultural group and their interface design preferences, but also differences in the acceptance process. Evers and Day found an interesting result regarding the Chinese subjects. When preferences for design features are met, users will be satisfied with the interface. Somehow, when the Chinese’s interface functionality is met, their demands for ease of use are met. Evers and Day further discuss that Australians separate interface satisfaction from system satisfaction, which suggests that Australians put more emphasis on the way an interface looks than the actual functionality.

The conclusion of the above research is that no comprehensive research is available concerning cultural differences and usability. Research has shown that there are cultural differences however, it can be argued that individual differences might be greater. It is because of this necessary to have a large sample when investigating questions related to cultural differences and
usability. The most common advice is to perform local usability testing and identify the most (for the local) obvious differences.

The objective of this study will be to investigate attitudes towards personal settings and personalization. It will only consider differences between cultures and possible differences between genders as possible aspects that might have to be taken into consideration.
3 Pre-study

Since there is no research on personalization in a driver environment, a pre-study was performed. The goal of the pre-study was to understand how personalization was a part of the driver environment in the cars of today and give insight to how it could be a part of the driver environment in cars of tomorrow. The pre-study was done in two parts. First, a benchmarking was performed to create an understanding of how personalization is utilized in today’s cars. Second, a genre analysis was generated to create an understanding of what the concept of personalization means in other areas and when you use personalization. The results from the genre analysis were used in two brainstorming sessions which investigated how personalization could be applied to a driver environment.

3.1 Benchmarking

In an attempt to compare features and performance of cars using some degree of personalization a benchmarking study was done. The objective of the benchmarking done in this thesis was to understand how personalization has been adopted by car manufacturers today. The objective was also to learn about how personalization have been implemented by other car manufacturers and get inspired by good practices. In addition, it was important to understand possible problem areas that needed to be considered.

3.1.1 Method

During the benchmarking, a selection of cars was investigated: Volkswagen Phaeton (05) and Toyota RAV4 (06), Cadillac STS (06), Mercedes S (06), Lexus RX 400h (06) and BMW 7 (06). These cars were selected since they had a more or less developed personalization feature.

The benchmarking proceeded from a number of questions discovered in the process of developing a personalization concept.

The benchmarking was done at car dealers located in the surrounding area of Gothenburg, Sweden. This meant limited access to the systems of the cars and the benchmarking should therefore not be seen as a complete overview of the personalization settings.

The Benchmarking was performed with these questions in mind:

- What kinds of settings are personalized and how are they saved?
- How is the driver identified and how is the profile communicated to the driver?

### 3.1.2 Results

The personalization of the cars investigated mostly concerned settings associated with the driver position. Only a few cars had included more settings in their personalization concept.

**What kind of settings are personalized and how are they saved?**

In today’s car, the driving position is the most advanced with respect to personalization settings. Cars such as Lexus RX 400h let the driver save the driving position by using memory buttons (as seen in Figure 1.2, p10). These driving positions include mainly the seat adjustments but in some case also the outer rear view mirrors. By placing the buttons associated with the positioning of the seat in the door, the driver can change the seat position before entering the car.

Cars such as, Toyota RAV4, Volkswagen Phaeton and Cadillac STS also allow the driver to save settings concerning other aspects of the car, such as the display color, navigation voice and locking settings. These settings were managed through different user profiles in the navigation systems. Other cars such as Lexus RX 400h allow the user to change the settings but the settings were not included in the driver’s profile. Another setting found was a programmable button, making it possible for the user to assign a number of predetermined settings to this button. Note that this button was not included in the driver profile.

Through the benchmarking different solutions regarding saving were found. For the most part, this included settings related to the drivers seat. The most common way of saving the position of the driver-seat is by holding a memory button and a number button. For example hold <M> and <1> and you have saved the current seat-settings to button 1. To recall a previously saved setting, just hold one of the number buttons for a second or two (or until the seat stops adjusting). This could also in some cases be done with the key. In that case, you push <M> and <Key-button> to save the current seat-setting to the current key.

Another method of saving was found associated with the display. If for example the color of the screen is changed, the setting is saved automatically to your key.
How is the driver identified and how is the profile communicated to the driver?

The benchmarking showed that there exists at least three ways of identifying a driver:

- Letting each key be connected to a specific drivers preferred., (mainly for the driver-seat)
- Using memory buttons.
- Identifying the user is through the interface in the display.

There was, in most cases, no indication of which driver’s seat-settings that were active. In some cases, a small diode on the number-button was lit. When the settings are saved in the key, the key itself works as a symbol of the current profile.

The Cadillac STS gives the driver the option of changing the color of the display and the sex of the voice. This made the current profile obvious (i.e. if the driver had changed her or his color). But since two profiles can use the same color this solution does not eliminate the possibility of confusion or error.

In the case of vehicles with more developed personalization there were two ways of managing the personalized settings. They were either found in the car’s menu system, or in the memory buttons for the seat (that existed in all cars). In the case of the memory buttons, the association is indicated by the location of the memory buttons (next to the seat). There was however a general lack of information regarding which settings were included in the profile.

Other

The general impression of how personalization is used by car manufacturers today is that it is not a highly prioritized function (except for the seat memory). It is often hidden, not very well promoted and difficult to understand. An example of why the personalization is hard to understand is the lack of clarity regarding what settings are included in the personalization.

3.2 Genre analysis and brainstorming sessions

The aim of the genre analysis is to explore what previous experiences users might have of personalization in other products. These previous experiences
might affect the attitudes and expectations of using personalization in a car environment.

According to Lundberg & Ihlström (2003), categorizing products can help the creators and users to define a product. Not only does this support the creation of the product but it also gives an insight to preexisting demands and expectations created by other domains.

3.2.1 Genre analysis

In the case of this study, the purpose of the genre analysis was to implement and adapt the concept of personalization to the driver environment. To achieve this, a wider understanding of this area was necessary and a genre analysis was carried out. According to Breure (2001) a genre analysis helps the designer look at the design problems from a different perspective. Genre analysis can not be seen as a complete description of every possible usage for personalization but brings an understanding of personalization as it is used in other areas.

Method

Personalization is being used in different ways depending on its context. Since the definition of personalization is not directly applicable to personalization of a car (see Blom’s definition in Earlier research chapter 2.1) a better understanding of the different ways personalization had been used was needed.

Design

The genre analysis was carried out in two parts; the first part surveyed the current customization possibilities in four different domains: cell phones, the windows desktop (with explorer), your home and a desktop of an office. The different domains were chosen in order to include personalization of both software and physical objects (as in the driver environment). In the second part, personalization possibilities were analyzed according to Blom’s (2001) effects of personalization (as described in Appendix I), and new categories were developed.
**Results**

The features possible to personalize in the different situations (cell phones, the windows desktop, home and a work desktop) were summarized. The result from the genre analysis broadened the concept of personalization and generated inspiration for the brainstorming sessions.

From the results of the genre analysis the following categories were defined:

**Pleasure/feeling**
Changing the visual or auditive appearance of your cell phone, desktop or windows environment to better suit your taste. Personal objects like personal decorations (photographs on your desktop) or your favorite cup also belongs to this category.

**Information storage**
One way of personalizing your things is to store different information e.g. an address book or messages. On your desktop you store information in form of documents and files.

**Efficiency**
Efficiency includes the general structure of information, and may include links, shortcuts, favorites and different ways of interacting with the information. Your computer desktop and cell phone give you the option of making shortcuts (icons and quick-buttons) to information you access frequently. On your desktop you can organize objects to create a work environment allowing you to reach information quickly.

**Ergonomics**
For the purposes of this study the ergonomics include the position of the car seat, table height, screen brightness/contrast, all of which are made to suit the users’ personal preferences and needs.
3.2.2 Brainstorming sessions

Two brainstorming sessions were conducted to gain a better understanding of what kind of settings would be of interest to include in a personalized driver environment. It is important to note that this was not restricted to already available settings. The brainstorming sessions were designed with the help of the categories from the genre analysis (pleasure/feeling, information storage, efficiency and ergonomics) described earlier.

Method

The two brainstorming sessions were carried out with five employees of Volvo Car Corporation and five participants not employed by Volvo Car Corporation. The age ranged from 25 to 40. The participants from Volvo Car Corporation all had different experiences and knowledge of the manufacturing process. For example, experts on the climate system, electrical system design, navigation system and human machine interaction were all included. Some of these participants had worked with the development of new features and settings in earlier projects. The session which included participants not employed by Volvo Car Corporation consisted of recently graduated students from Linköping University.

Settings

The brainstorming sessions were carried out in a conference room at Volvo Car Corporation, Lindholmen on a voluntary basis. The sessions were recorded by an Mp3-player to facilitate further analysis if necessary. The subjects gave their consent to the recording.

Design

The brainstorming session consisted of four parts. After an introduction the participants were asked to write down their initial ideas regarding personalization. The second part was related to the features of personalization (described in the results from the genre analysis). The reason for using features of personalization found in other areas was to help the participants think “outside the box” and come up with new ways of using personalization. They were also told not confine their ideas to existing or possible settings of the cars today. For each feature the group was divided into two parts and after a few minutes the groups presented their ideas and these was collected on a
whiteboard. The third part of the brainstorming consisted of the entire group criticizing and discussing all of the ideas found on the whiteboard. The fourth and final part was used to create a more holistic concept of the earlier scattered ideas. The entire group worked together to come up with a holistic proposal of how to personalize the driver environment. The written instructions handed out to the participants can be found in Appendix A.

**Results**

The brainstorming sessions resulted in a list of settings (Appendix B), divided into the four features of personalization. Since the features had the primary objective to inspire the brainstorming sessions, and were not based on the actual driver environment, a new list was created. Affinity diagramming was used to re-define the collected settings into three categories related to the driver environment

**Entertainment**

This category consists of settings that are connected to visual and audio stimulation. These settings are not directly connected to the primary task of driving.

**Information access**

A more abstract category that emerged was information access. This has to do with what kind of information could be interesting in a driver environment, the structure of information and how to retrieve this information.

**Driver climate & positioning**

The last category consists of settings and features within the driver environment. This included both climate related settings, lighting settings and driver position settings.
3.3 **SUMMARY FROM PRE-STUDY**

The pre-study resulted in some solutions, ideas and some questions regarding how to personalize a car. The following contributions were made:

### 3.3.1 Benchmarking

The benchmarking made it clear that personalization of the driver environment is not a prioritized area of interior and system design. This made it clear that a couple of important aspects have to be considered in designing a useful and complete personalization concept.

**Information:** There has to be some kind of information telling the driver when personalization is active, what the personalization includes and how to manage it.

**Existing logic:** Because of the limited personalization in today’s cars, the existing references of how to manage personalized settings are vague. The most developed personalized feature is the one dealing with the memory buttons for the seat.

**Number of actions:** Easy access to personalization is required for the functionality of a personalized concept. The personalization should not be buried in the system.

**Identification:** Since personalization is supposed to support different drivers, the way of identifying a driver is important. For example this identification has to be able to handle temporary drivers.

### 3.3.2 Genre analysis & brainstorming

What kind of settings might there be a need or demand to personalize? The brainstorming resulted in a number of categories of settings, which could be used in a development of a personalization concept. These categories included entertainment, information, climate and driver position. The brainstorming showed that personalization could be used on a variety of settings; however it was not possible to rank what settings would benefit the most from being included in the personalization.
4 RESEARCH FOCUS

The focus of this thesis evolved from previous research on personalization and the conducted pre-study.

This thesis will contribute to a new understanding of how personalization can be applied to the technology in the cars of tomorrow. As described, there have been different approaches and definitions of personalization over a wide range of domains. However, there has been no research on how to apply the concept of personalization to a driver environment. The area of in-vehicle design brings some interesting aspects to the development of a personalization concept. For example the driver cockpit, in contrast to internet based applications, is a physical environment. At the same time, the cars of today are highly influenced by the development of software design and user interfaces when it comes to managing the driver environment through displays and controls. This makes the driver environment interesting to investigate from a personalization point of view.

According to Wells (2002) it is less important to personalize team spaces than individual spaces. In the case of the car, the interior could be seen both as individual and as a team space, depending on the number of drivers. This means that the benefits of personalization is not evident in the case of the driver environment. Because of the multiple user situation where the effect of the changes is persistent across sessions, there has to be some way of identifying the driver when she or he enters the driver seat. A new question arises with this problem: Which settings are important enough to personalize? As of today, the driver can change a number of settings in the car. However an interesting aspect in trying to design a personalization concept is to investigate what settings are driver specific. For example, what adjustable settings have some personal relevance to the driver? In this thesis, personal relevance, regarding settings in the driver environment, is referred to as those objects/settings that the driver wants to be able to recall when managing the personalized settings.

4.1 AREAS OF INTEREST

The following areas of a personalized car will be further investigated in this thesis.

Possible personalized settings

The first area concerns what settings the driver want to personalize (i.e. what settings the driver want to have saved to his profile), and why these settings would be of interest.
By way of example, a car is different from your cell-phone. While the cell phone’s main purpose is to facilitate communication the car has the primary objective of taking you from one place to another. During the transportation the safety-risk prohibits you from showing too much interest in the system and changing the settings too often. There could therefore be some resistance or no interest in personalizing a set of settings.

The car has a mixture of settings that is both physical (such as the chair, mirrors etc.) and more software related (such as the radio settings and the display). This makes it possible to personalize in a wider definition and can give some new insights to why people personalize (cognitive, social, work-related or emotional reasons). Will there be different objectives in what and why you personalize a driver environment?

This thesis will investigate the attitude towards possible personalized settings.

**Identification of a driver**

To realize a personalized car, the driver has to identify himself in some way (i.e. in order to load his/her personal settings). As the pre-study showed, the undoubtedly most common way of identifying the driver today, is by using memory buttons. This thesis will further investigate any behavior today that can be used for designing a new way of identifying the driver. This thesis will also investigate attitudes towards identifying the driver.

**Management of Personal settings**

This area concerns how to manage the personal settings. As the pre-study showed, the current solutions regarding personal settings are somewhat difficult to understand because nothing tells the user how he or she save the settings, or which settings that are actually saved. This thesis will investigate attitudes towards different ways of handling these personal settings.

**Saving method for Personal settings**

There are mainly two ways of saving your personal settings, either the driver can actively choose when to save the settings (using a default-mode that the user can return to), or the settings can be saved automatically (when the user changes a setting, this setting is automatically stored to his/her personal settings). The latter saving method may at first sight seem to be the more comfortable way of saving, but it brings with it some problems. If adjustments
are saved automatically, it will mean that even changes meant to be temporary are saved. It’s not obvious which of these methods are the most suitable for the driver. As of this, this thesis will investigate what current behavior supports either of these saving methods, and what the attitudes are towards these two alternative ways of saving your settings.
4.2 METHOD

The above areas have been investigated through the use of both quantitative and qualitative methods. The research was based on the knowledge gained from earlier research on personalization as well as knowledge gained from the preformed pre-study.

In order to find out how to personalize the car, the current usage and behavior, in regard to different car settings, are of interest. For example, if the designer knows how the driver unlocks the car and adjusts the car seat the designer can support the design decisions made when designing the interaction used to open the car. It is also important to understand the current behavior of the user so that personalization, even though it will create a new behavior, can be used on areas where it will be the most beneficial. A survey was conducted aiming to explore how the car is used by its users. The survey also aimed to build a better understanding of what attitudes towards the proposed personalization settings which could be found among the subjects.

Using the results from the survey prototypes, describing different solutions, were generated. These solutions were evaluated through interviews. In addition, the purpose of the interviews was also to investigate attitudes towards the general concept of personalization. The prototypes helped create a common ground for understanding the concept and served as a base for the interview.

The following two chapters will explain how the research was performed as well as account for the results found.
5 Survey

The goal of the survey was two-fold. The first goal concerned the behavior regarding different settings. The disposition of the subjects was examined asking the subjects how they use the settings of the car today. The second goal concerns the attitude towards a number of suggested personalization features. This was accomplished by asking the subjects to rate their interest in the suggested settings. These goals were classified into four questions:

**How is the attitude against possible personalization settings in the car?**
By investigating the general attitude towards personalization settings, this will support the researcher in what settings to choose and how to prioritize the settings.

**How is the car and its keys shared?**
This question concerned how the keys to the car are shared. Does the driver have his/her own key or is it shared with somebody else. This result can point towards if identification through the key is a reasonable solution.

**How is the driver seat used?**
By investigating the cause for, and frequency of, changes made to the driver seat, an understanding of how to save these changes can be reached.

**Is there any irritation regarding existing settings?**
This question provided knowledge on possible sources of irritation. Does a changed setting, i.e. if someone else has changed your settings, generate irritation? If this is the case, a personalized car could help reducing this irritation by providing an easy way of accessing your preferred settings.

5.1 Method

The subjects included in this study ranged from 25 to 65 years of age. The study included subjects from both Sweden and the United States. The broad selection of subjects was chosen to cover different views on personalization.

The target group for a personalized vehicle is not clearly defined, and therefore a wide range of participants for the study was needed. Because of this, the survey was web-based and distributed through a wide variety of channels. By using a web-based survey the subjects will have a certain level of technical understanding. This benefits the study since one can assume that personalization could be a feature appreciated by a target group with a certain
level of technical understanding. The survey was spread through channels such as Internet forums, email-lists and personal connections. A problem with distributing the survey through this channel is that the dropout cases (i.e. people who have opened but not completed the survey) are impossible to consider. In this study the effect could be that only people with a certain level of interest in new technological features have answered the survey, and thereby influenced the results in a positive way. The results could be seen as misleading however, since the study is meant to be exploratory and the results by no means definitive it is not considered a problem. In an attempt to keep the distribution of the survey under control, each channel was given a different address. The ip-number was also temporarily collected to ensure that the survey was not misused.

To include possible different cultural aspects of personalization, a comparison between Sweden and the United States was chosen. Consequently the survey was distributed in both Swedish and English (see Appendix C & D).

5.1.1 Design

The complete design of the survey can be found in Appendix C and D. In an attempt to simplify the subjects’ completion of the survey, the survey was divided into two parts.

The first part considered characteristics and behavior. This part consisted of questions such as age, sex, occupation, car-usage and general interest in technical products. This data gave an indication of how representative the sample was. In addition, how the drivers’ use their settings today and if some of the settings created irritation was investigated. Irritation can imply a need for the ability to save your personal preferences. The behavior found in this part is part of the foundation for the design of a personalized vehicle.

The second part investigated attitudes regarding suggested personalized settings. This part consisted of questions regarding the attitude towards a number of settings, collected during the brainstorming and genre analysis. These settings were chosen to represent the different categories found through the analysis of the brainstorming results. Each setting were briefly described in the survey to create a general understanding of the settings; the subjects were then asked to rate their interest in the described setting, from strongly disagree to strongly agree. The subjects also had the possibility to write their own comments.
The subject’s ability to understand and relate to the different settings was also taken into consideration. Only settings that the user could relate to were investigated. All the investigated settings are available in other domains today. As Kuniavsky (2003) states it is difficult for a user to understand the future need of a totally new setting. Even though the functions might be more or less understood by the subjects, their answers are important since they give a general understanding of their attitudes towards personalization and personal settings.

**Color and appearance of display** - This setting concerned the possibility to change the color and information in the display.

**Music lists** – A music list concerned the possibility to store your own radio stations and playlists in the car.

**Driver’s log** - A driver's log could record information regarding how a car has been driven. It includes mileage, gas mileage, average speed, etc.

**Welcome message** – This feature concerned if the subject would be interested in having a welcome message with the driver’s name displayed when starting the car.

**My buttons** – The possibility to have programmable steering wheel buttons. Steering wheel buttons could be programmed to control other features available in the car. For example, a button could be used to adjust the climate control system or volume on the sound system.

**Show/hide information** - This feature allowed the driver to exclude information of less interest and include information of more interest. Examples of such information are temperature, clock, mileage and gas usage.

**Positioning of the driver** – This included settings regulating the driver position, such as positioning of the seat, steering wheel or mirrors.

**Airflow** – The possibility to adjust the intensity, temperature and angle of separate fans to accompany the specific needs and preferences of the driver.

**Address book** – A feature that made it possible for the driver to have her own address book with phone numbers, addresses and other information saved in the system of the car.

**Destination** – The possibility to store your own destination points in the vehicle, e.g. the addresses of relatives that you visit frequently.
**Driving characteristic** – This feature concerned the possibility to store your own car setup such as the chassis, suspension and steering to accompany different roads and driving styles.
5.2 RESULTS

The first part of the results shows general information about the subjects. The second part shows the attitude towards the suggested settings and the third part shows some behavioral information. As most of the data is categorical, a Pearson chi-square test has been performed when trying to establish relationships between the answers (for example a relationship between the level of irritation and gender). Chi-square tests are performed when dealing with categorical data and data that do not rely on the assumption of having normally distributed data (Field, 2005). As the purpose of this survey was of an explorative nature, no assumptions of distributions were made.

5.2.1 Background information

The data was calculated from a total of 225 subjects. Table 6.1 shows an overview of the subjects’ location, age and driving frequency. 92% (208) of the subjects drove at least once a week. The subject selection between the countries is displayed in chart 5.1.

Table 5.1. Subject overview

<table>
<thead>
<tr>
<th>Subjects (n)</th>
<th>Sweden</th>
<th>USA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>93</td>
<td>59</td>
<td>152</td>
</tr>
<tr>
<td>Women</td>
<td>36</td>
<td>37</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
<td>96</td>
<td>225</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (mean)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>35.5</td>
<td>45.0</td>
<td>39.2</td>
</tr>
<tr>
<td>Women</td>
<td>35.8</td>
<td>44.8</td>
<td>40.4</td>
</tr>
<tr>
<td>Total</td>
<td>35.6</td>
<td>44.9</td>
<td>39.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Driving frequency</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>71%</td>
<td>88%</td>
<td>78%</td>
</tr>
<tr>
<td>More than once a week</td>
<td>20%</td>
<td>7%</td>
<td>15%</td>
</tr>
<tr>
<td>More than once a month</td>
<td>5%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Less than once a month</td>
<td>4%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
<td>96</td>
<td>225</td>
</tr>
</tbody>
</table>
Chart 5.1 The distribution of men and women in Sweden and the United States (%).

5.2.2 How is the attitude against possible personalization settings in the car?

This section will present results regarding what personal settings the subjects have shown interest in. In the survey the subjects rated their interest in each personal setting (Table 5.2). Each setting consisted of a short description and a scale between strongly disagree and strongly agree. The subjects also had the possibility to write their own comments. The entire questions can be found in part II of the interview (Appendix C & D).

Table 5.2 Overview of attitudes towards possible personalization settings

<table>
<thead>
<tr>
<th>Personal settings</th>
<th>Strongly Agree (%)</th>
<th>Agree (%)</th>
<th>Neither (%)</th>
<th>Disagree (%)</th>
<th>Strongly Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Position</td>
<td>55.1</td>
<td>28.0</td>
<td>10.7</td>
<td>2.2</td>
<td>3.6</td>
</tr>
<tr>
<td>2. Music lists</td>
<td>43.1</td>
<td>28.0</td>
<td>17.3</td>
<td>7.1</td>
<td>4.4</td>
</tr>
<tr>
<td>3. Airflow</td>
<td>37.3</td>
<td>28.9</td>
<td>19.6</td>
<td>4.4</td>
<td>8.4</td>
</tr>
<tr>
<td>4. Show/Hide</td>
<td>37.3</td>
<td>27.1</td>
<td>21.3</td>
<td>5.3</td>
<td>8.0</td>
</tr>
<tr>
<td>5. Drivers log</td>
<td>38.7</td>
<td>24.9</td>
<td>20.0</td>
<td>7.6</td>
<td>8.9</td>
</tr>
<tr>
<td>6. My buttons</td>
<td>31.6</td>
<td>28.0</td>
<td>21.3</td>
<td>6.7</td>
<td>11.1</td>
</tr>
<tr>
<td>7. Driving charact.</td>
<td>32.4</td>
<td>27.1</td>
<td>25.3</td>
<td>4.9</td>
<td>9.3</td>
</tr>
<tr>
<td>8. Display</td>
<td>31.6</td>
<td>26.7</td>
<td>20.4</td>
<td>9.8</td>
<td>11.1</td>
</tr>
<tr>
<td>9. Destination</td>
<td>22.7</td>
<td>22.2</td>
<td>35.1</td>
<td>4.0</td>
<td>14.7</td>
</tr>
<tr>
<td>10. Address Book</td>
<td>17.3</td>
<td>21.7</td>
<td>29.3</td>
<td>9.8</td>
<td>20.9</td>
</tr>
<tr>
<td>11. Welcome message</td>
<td>11.1</td>
<td>10.2</td>
<td>35.6</td>
<td>8.4</td>
<td>33.3</td>
</tr>
</tbody>
</table>

The table displays frequencies (in %) of how interesting each setting is rated.
Clearly, there is a great difference between the most interesting personal setting (position) and the least interesting (welcome message). Almost all of the subjects indicated that settings related to the driver position are interesting as personal settings (83.1%), only 5.8% disagree.

A more nuanced picture is however needed before any conclusions can be made. Because the survey was distributed in two countries a comparison between these two countries was made. Possible gender differences were accounted for in an attempt to discovering any potential divergence.

Table 5.3 shows where significance was found, using a Chi-square test. To compare positive and negative attitudes the categories strongly agree and moderately agree have been merged, as well as strongly disagree and moderately disagree. For example, the table 6.3 shows that there is a significant difference between women in the United States and Sweden when it comes to their opinion regarding music lists. A specific description of these differences is explained below (see Appendix E for data).

<table>
<thead>
<tr>
<th>Personal setting</th>
<th>Sweden Women</th>
<th>USA Men</th>
<th>Sweden Men</th>
<th>USA Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Position</td>
<td>5.46</td>
<td>4.10</td>
<td>5.07</td>
<td>0.17</td>
</tr>
<tr>
<td>2. Music lists</td>
<td>13.35*</td>
<td>4.73</td>
<td>2.83</td>
<td>13.4*</td>
</tr>
<tr>
<td>3. Airflow</td>
<td>4.88</td>
<td>3.00</td>
<td>4.52</td>
<td>0.81</td>
</tr>
<tr>
<td>4. Show/Hide</td>
<td>15.49*</td>
<td>12.74*</td>
<td>3.68</td>
<td>1.76</td>
</tr>
<tr>
<td>5. Drivers log</td>
<td>8.16*</td>
<td>2.44</td>
<td>4.19</td>
<td>1.13</td>
</tr>
<tr>
<td>6. My buttons</td>
<td>6.88*</td>
<td>7.83*</td>
<td>4.86</td>
<td>0.029</td>
</tr>
<tr>
<td>7. Driving characteristics</td>
<td>9.42*</td>
<td>8.70*</td>
<td>14.25*</td>
<td>6.3*</td>
</tr>
<tr>
<td>8. Display</td>
<td>8.17*</td>
<td>8.81*</td>
<td>10.27*</td>
<td>2.25</td>
</tr>
<tr>
<td>9. Destination</td>
<td>7.76*</td>
<td>8.22*</td>
<td>6.90*</td>
<td>4.82</td>
</tr>
<tr>
<td>10. Address Book</td>
<td>10.36*</td>
<td>2.65</td>
<td>9.62*</td>
<td>0.10</td>
</tr>
<tr>
<td>11. Welcome message</td>
<td>5.57</td>
<td>10.56*</td>
<td>5.52</td>
<td>1.39</td>
</tr>
</tbody>
</table>

*Values marked with * represent where significances has been found (p<.05).
1. Driver position

Description from survey:

*Settings regulating the position of the driver can include the positioning of the seat, steering wheel, mirrors and pedals.*

There is a consensus (83% agree) that the driver position is an interesting personal setting (table 5.2), i.e. there is no discrepancies between the examined groups as shown in table 5.3.

<table>
<thead>
<tr>
<th>Language</th>
<th>Sex</th>
<th>Sweden</th>
<th></th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
<td></td>
<td>Female</td>
</tr>
</tbody>
</table>

**Chart 5.2 Driver position**

**SE comments:** This option received only positive comments. Being able to adjust your seat is seen as something you only want to do once in a while. Having the position saved is seen as efficient and convenient.

**US comments:** It is sufficient with a memory button.
2. Music lists

Description from survey:

The entertainment systems in modern cars include different parts such as radio, CD, mp3 and music lists (radio stations and play lists).

A saved music list is very popular (71% agree) though the results show that American women have a higher tendency to answer that they do not care (46% neither). There is a significant difference between the American women and men, where the men show a very positive attitude towards music lists (54% vs 81% agree).

<table>
<thead>
<tr>
<th>Language</th>
<th>Sweden</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>Male</td>
</tr>
</tbody>
</table>

![Chart 5.3 Music lists](image)

SE comments: Comments dealing with the personalization of music lists dealt first and foremost with the ability to have your own presets for radio channels. Being able to access your preset radio channels was commented on as a sought after function.

US comments: Very few comments where made at all on this function but the ones that where made did not see the use of having personal music lists at all. One possible explanation may be the use of satellite radio with American drivers. If an American car has satellite radio, the need for a music list might be diminished.
3. Airflow

Description from survey:

*It is possible to adjust the airflow and climate of the driver compartment. This includes adjusting the intensity, angle, temperature and separate fans to accompany the specific needs and preferences of the driver.*

There is a consensus (66% agree) that the airflow is an interesting personal setting, no significant differences between the examined groups were found.

<table>
<thead>
<tr>
<th>Language</th>
<th>Sweden</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Airflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disagree</td>
</tr>
<tr>
<td>Neither</td>
</tr>
<tr>
<td>Agree</td>
</tr>
</tbody>
</table>

Chart 5.4 Airflow

SE comments: This preference was seen as being context dependent however, comments where made regarding the fact that peoples preferences regarding the climate and airflow are different. This function would therefore be used by people who cared enough about the specific settings to save them to their profile. Since the function is context dependent easy access to the adjustments where requested.

US comments: Same as for SE
4. Show/hide information

Description from survey:

*The display allows for the driver to choose if information should be shown or hidden. This allows the driver to exclude information of less interest and include information of more interest. Examples of such information are temperature, clock, mileage and gas usage.*

A total of 64% agreed that the possibility to choose driver information was interesting as a personal setting. However, Swedish subjects were more interested (73% agree) in the possibility than the American subjects (55% agree). American women and men also answer *neither* to a greater extent than the Swedish women and men (38% vs. 9%).

**Chart 5.5 Show/hide information**

**SE comments:** Comments concerning the ability to save a color or appearance of the display dealt in some cases with being able to choose what information the display should show. These comments together with the comments on this specific function concerned the ability to drop information you do not find interesting. Since there is a variation of what information drivers are interested in it was seen as a way of “simplifying” the car to suit your preferences.

**US comments:** no comments
5. Driver's log

Description from survey:

A driver's log will record information regarding how a car has been driven. It includes mileage, gas mileage, average speed, etc.

A driver's log is a popular personalization setting (64% agree.) However the Swedish women are significantly less interested in this possibility (47% agree) than American women (70% agree).

SE comments: Comments regarding the drivers log dealt with the ability to track ones car usage. Two reasons for this were given. First, ease of access to a drivers log is of primary importance. Interestingly when a car is leased through work, the ability to easily report on ones car usage was seen as a positive aspect. The second reason was given by the user who aimed at driving economically. Negative comments were made and questions were raised concerning the privacy aspect of a drivers log and who would have access to such log.

US comments: Positive comments concerned the ability to monitor how ones' car was being used. For example, monitoring how your car was being used by a valet. Comments concerning law enforcement or parents using the drivers log to look up speed etc were also mentioned.
6. My buttons

Description from survey:

*A number of buttons are located on the steering wheal. Some of these buttons allow the driver to choose what function they should be associated with. For one user a button can be made to control the airflow in the compartment while for another user is made to control the navigation between radio channels.*

60% of the subjects expressed an interest in a “my button” personal setting. Some significant results were found between the examined groups. Swedish men dislikes a ‘my button’ to a higher extent then the American men (22% vs. 9% disagree). Both the Swedish and American men do think that this setting is interesting (65%). In the case of the women, Swedish women disagree where the American women answered *neither*. The Swedish women are also less interested (44%) in this setting then the American women (57%).

<table>
<thead>
<tr>
<th>Language</th>
<th>Sweden</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Chart 5.7 My buttons**

SE comments: Comments regarding the positive aspects of programmable buttons dealt with the fact that it is convenient to have buttons for certain functions on the steering wheel. Being able to use “short cuts” to frequently used functions was seen as a positive thing, however, the fact that you could program a button to your specific usage was commented on as just increasing the confusion associated with many buttons.

US comments: comments where made about it not making a difference.
7. Driving characteristics

Description from survey:

_The car gives you the option of adjusting the settings of how the car handles on the road. Different options are available such as adjusting the chassis, suspension and steering to accompany different roads and driving styles._

Table 5.2 indicates that 60% of the subjects consider this an interesting personal setting. However, there is no consensus between the examined groups. The big difference concerns the difference between men and women, where the men in general rate this setting higher (70% vs. 40% agree). The other significant difference concerns the fact that Swedish subjects disagree where the American subjects answer _neither._

<table>
<thead>
<tr>
<th>Language</th>
<th>Driving Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Male</td>
</tr>
</tbody>
</table>

SE comments: This function was commented on as being “unnecessary”. The reflections showed that while the function might fill a purpose, the ability of saving your preferences to your profile was to “overdo it”.

US comments: Same as for SE
8. Display appearance

Description from survey:

An increased amount of technology has lead to greater driver influence into the overall appearance and functionality of the display in a car. The display can show information about the climate, radio, navigation and diagnostics of the overall car.

58% agreed that this setting was an interesting personal setting. The women, both in Sweden and US, are less interested (43%) in this setting compared to the men (66%). The Swedish subjects also disagree whereas the American subjects answer neither.

Chart 5.9 Display appearance

SE comments: The majority of the comments with display appearance dealt with the ability to change the color and lighting of the display. Changing the light and color of the display allowed the subject to personalize the look and “feel” of the car interior. There were some interesting negative comments, which can best be summed up as “something you only would care about when you first got the car.”

US comments: Comments from the US survey did not show a demand for being able to change color on the display.
9. Destination

Description from survey:

*In the navigation system the driver can choose a destination. Such destinations can be the address of a relative or a sports arena that you do not visit frequently.*

45% of the subjects thought that storing your own destination would be an interesting personal setting. The women in Sweden are significantly less interested in this setting compared to the men in Sweden (25% vs. 50%). There was also a significant difference between Swedish and American subjects. This significance concerns the fact that the Swedish subjects dislike this feature to a greater extent then the American subjects (27% vs. 7% disagree).

<table>
<thead>
<tr>
<th>Language</th>
<th>Sweden</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>Male</td>
</tr>
</tbody>
</table>

Chart 5.10 Destination

SE comments: Comments regarding the function called *Destination* showed a concern of the safety of the information. The information you saved in the list of destinations was seen as information only you should be able to access. If someone unauthorized (i.e. person stealing your car etc.) accessed the information this could be a source of information regarding your life and habits. *Destination* was also commented on as being useless and unnecessary since “…if I go there more than once, I know the way and do not need instructions”. It was suggested that the navigation system should be linked to the yellow pages so that if you needed to look up an address you would be able to find and navigate to it.

US comments: comments regarding the fact that you do not need navigation to a place you have been to before were made.
10. Address book

Description from survey:

Similar to how contact information can be saved in an address book it is possible to create a list of contacts in the car where phone numbers, addresses and other information can be saved.

A shown in Table 6.2 only 39% showed an interest in address book. Swedish women showed an especially low interest (14% agree) and as many as 42% of the Swedish women disagreed with the statement.

<table>
<thead>
<tr>
<th>Language</th>
<th>Sweden</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chart 5.11 Address book

SE comments: The comments of this function dealt with the fact that most people have their address book and contact lists in their cell phones. It was suggested that instead of having to fill in yet another contact list, one should be able to synchronize a cell phone with the car to access the contact list already stored. There where also concerns regarding who has access to the information.

US comments: Same as for SE
11. Welcome message

Description from survey:

When the car starts, a welcome message is displayed in the center stack. The driver’s name will then discreetly appear in the display.

Table 6.2 shows a very low interest in the welcoming message, only 22% has agreed with the statement. There is a consensus that a welcome message is not welcome, however Swedish subjects show a higher degree of disagreement with the statement than American subjects (50% vs. 31% disagree).

<table>
<thead>
<tr>
<th>Language</th>
<th>Sweden</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>Male</td>
</tr>
</tbody>
</table>

Chart 5.12 Welcome message

SE comments: This function was commented on as being “unnecessary”. If the welcome message is used to identify whose profile is active then it was mentioned to be ok but a negative attitude regarding the function was displayed.

US comments: Comments where mostly “I don’t care” but also “I would find it annoying”.
Other comments

A common refrain from both the American and Swedish subjects was the demand for simplicity. Comments such as “Figure out a way to make this process simple. Life is complicated enough!” and concerns of how an increased amount of options would make the car less easy to understand and handle, were raised.

A concern was raised about the overall increase of electronics in the vehicle. The increased amount of electronically controlled devices in the car was seen as increasing the risk of something breaking and being complicated to fix.

Something else mentioned in the comments was the need for integration of a mp3-player in the sound system of the car.

General observations

The disagree-category is generally higher amongst the Swedish answer whereas the neither-category is mainly higher amongst the American answers. That is, the Swedes answered disagree whereas the Americans answered neither, to some extent.

The men, both in USA and Sweden, are significantly more interested in the settings then the women, with the exception of the driver position, airflow, show/hide and the welcome message.
5.2.3 How is the driver seat used?

Table 5.4 shows the responses concerning seat adjustment.

Table 5.4 Seat adjustments when arriving to the car and when driving. Number of subjects.

<table>
<thead>
<tr>
<th>Seat adjustment at arrival to car (n)</th>
<th>Never</th>
<th>Less than half the time</th>
<th>Half the time</th>
<th>More than half the time</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 regular driver</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>30</td>
<td>22</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>59</td>
</tr>
<tr>
<td>USA</td>
<td>31</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>28</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>96</td>
</tr>
<tr>
<td>2 or more regular drivers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>5</td>
<td>28</td>
<td>7</td>
<td>12</td>
<td>15</td>
<td>67</td>
</tr>
<tr>
<td>USA</td>
<td>14</td>
<td>30</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>58</td>
<td>13</td>
<td>14</td>
<td>21</td>
<td>125</td>
</tr>
<tr>
<td>All</td>
<td>80</td>
<td>86</td>
<td>16</td>
<td>15</td>
<td>24</td>
<td>221</td>
</tr>
</tbody>
</table>

Subjects, who indicate that their principal car is regularly used by others, adjust their seat more frequently at arrival than the subjects who do not share their principal car with others. It is also interesting to note that subjects not sharing their principal car with others sometimes adjust the seat upon arrival to their car. This means that even though the driver has no other regular driver to the car, she or he adjusts the seat.

To statistically compare USA and Sweden a chi-square test was performed. Because of the low frequencies in some of the categories, these were merged into three categories before the computation. The categories were: half the time or more, less than half the time and never. The test showed a significance between Sweden and USA, chart 5.13 illustrates the result (chi-square one regular driver: $\chi^2(2)=11.74$, $p<.05$ and chi-square two or more regular drivers: $\chi^2(2)=11.74$, $p<.05$).
\( \chi^2(2)=12.1, p<.05 \). As seen in chart 5.13, the Swedish subjects tend to adjust their driver seat somewhat more than the American subjects. The table concerning 1 regular driver has an expected cell count less than 5 in 33\% of the cells, making this result less statistical powerful (Field, 2005).

The Swedish subjects also answered that they changed their seat significantly more often, than the American subjects, while driving \( (\chi^2(2)=11.5, p<.05) \). In this case the cell frequencies were less than 5 in 33\% of the cells, making the result less statistical powerful. Adjusting the seat upon arrival to the car was in both groups more common than adjusting the seat while driving.

![Chart 5.13 Seat adjustment at arrival to the car. The result displays differences concerning country (USA vs. Sweden) and the number of regular driver’s. The left chart’s represent those subjects only having one regular driver to their principal car. The right chart’s represent those subjects having two or more regular drivers to their principal car.](image)

To understand the reason for this behavior, the subjects were asked to explain their reasons for adjusting the seat in the two mentioned situations.

The most frequently mentioned reason for adjusting the car seat when entering the car, dealt with the fact that the car was being shared with another person. Someone else, other than the subject, had driven the car earlier and had therefore adjusted the seat to their liking. The seat then needed to be readjusted by the subject to fit the subjects physical needs when driving.
Comments not dealing with the fact that the car was shared by two or more people dealt with reasons such as weather conditions (effecting the choice of clothes worn by the subject) consideration to other passengers (adjusting the seat to generate more legroom for a back seat passenger) and defects in the car seat mechanism (a slowly changing car seat).

Adjusting the seat while driving was done based on two main reasons. The first reason was incorrect adjustment when entering the car or a neglect to adjust the seat before starting to drive. The second reason for adjusting the car seat while driving concerned the same position being uncomfortable for a long period of time. These reasons concerned changing your seat as a way of varying your driving position to help the driver keep alert and escape a position which becomes uncomfortable over time.

5.2.4 How is the car shared?

Chart 5.14 shows a comparison between the subjects who have equal or more keys than regular drivers to their principal car and those who have less keys than regular drivers to their principal car. As shown in the results, most of the drivers has their own key (79% total). Table 5.5 shows this information in detail.

Chart 5.14 Key possession. These charts displays the key possession (i.e. if the driver’s has their own key, share the key, or borrows the key). The result displays the differences between USA and Sweden. The result also displays two other categories; the left ‘equal or more keys’ concerns those subjects having equal or
more keys to their car than they have regular drivers. The right charts concerns those subjects having less keys than regular drivers.

As of the low number of subjects borrowing a key, a chi-square test was performed with two categories; own key and shared/borrow key. A significance was found ($\chi^2(2)=8.6, p<.05$), using a chi-square test, between the American and Swedish subjects. In the category ‘equal or more keys than drivers’, the Swedish subjects shared their key to a greater extent than the American subjects (22% vs. 8% shared keys). Due to the low frequencies in the category less keys than drivers, no significance was found between Sweden and USA.

In both categories in chart 5.14, the subjects for the most part had their own key, suggesting that even though there are more drivers than keys, some of the drivers have their own keys and obviously share them with others. Less then 2% have more than three regular drivers for their car.

Table 5.5 Key possession. This table displays the key possession (i.e. if the driver’s has their own key, shares the key, or borrows the key). The result displays the differences between USA and Sweden. The result also displays two other categories; ‘equal or more keys’ concerns those subjects having equal or more keys to their car than they have regular drivers. Less keys concerns those subjects having less keys than regular drivers.

<table>
<thead>
<tr>
<th>Regular Drivers vs. keys</th>
<th>Your own</th>
<th>Shared</th>
<th>Borrow</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal or more keys than regular drivers</td>
<td>Sweden</td>
<td>85</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>72</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>157</td>
<td>31</td>
<td>2</td>
</tr>
<tr>
<td>Less keys than regular drivers</td>
<td>Sweden</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>8</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>12</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>All</td>
<td></td>
<td>169</td>
<td>40</td>
<td>4</td>
</tr>
</tbody>
</table>
5.2.5 Is there any irritation regarding existing settings?

A question regarding how often the subjects thought they became irritated because of changed settings was asked. The survey concerned five settings: driver seat, radio, sound settings, climate and navigation. Table 5.6 summarizes these answers.

Table 5.6 Irritation of changed settings. Displaying whether the subjects experienced any irritation of changed settings (i.e. that someone else has changed the settings).

<table>
<thead>
<tr>
<th>Setting</th>
<th>Never</th>
<th>Less than half the time</th>
<th>Half the time</th>
<th>More than half the time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver seat</td>
<td>65%</td>
<td>16%</td>
<td>4.9%</td>
<td>0.9%</td>
<td>12%</td>
</tr>
<tr>
<td>Radio settings</td>
<td>65%</td>
<td>19%</td>
<td>3.6%</td>
<td>2.7%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Climate settings</td>
<td>73%</td>
<td>16%</td>
<td>3.6%</td>
<td>1.8%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Sound settings</td>
<td>68%</td>
<td>15%</td>
<td>4.4%</td>
<td>1.3%</td>
<td>9.8%</td>
</tr>
<tr>
<td>Navigation settings*</td>
<td>71%</td>
<td>6.5%</td>
<td>3.2%</td>
<td>3.2%</td>
<td>16.1%</td>
</tr>
</tbody>
</table>

Total number of subjects = 225.
* Only 31 subjects had access to a navigation system.

The total distribution of the answers is about the same with all settings. Most of the subjects perceived no irritation regarding any of the settings, though 1/3 perceived irritation sometimes or more. A comparison between men, women, Swedes and Americans was also made. This comparison was performed with two categories; those irritated half the time or more, and those less than half the time. An overview of this result is presented below, for more detailed information please refer to Appendix F.

Irritation of the driver seat - No significance was found between female and male subjects or between American and Swedish subjects.

Irritation of the climate settings - No significance was found between female and male subjects or between American and Swedish subjects.

No chi-square test was possible concerning the navigation system due to the low number of subjects with a navigation system. Only 31 subjects had a navigation setting.
There was a significant difference between the men and women in USA concerning irritation of the radio settings ($\chi^2(1)=7.29, p<.05$). As displayed in chart 5.15, American women experience more irritation than the men.

**Chart 5.15. Irritation of changed RADIO settings.**

Irritation of the sound settings: There was a significant difference between the men and women in USA concerning sound ($\chi^2(1)=5.8, p<.05$). As displayed in chart 5.16, American women experience more irritation than the men.

**Chart 5.16. Irritation of changed SOUND settings.**
5.3 General Findings

There was no significant difference regarding any setting between the younger (below 40) and the older (above 40) generations. This means that the attitude towards the suggested settings did not differ between the two age groups.

There was no significant difference between age and how much you adjust your technical gadgets.

The results showed no significance between weather or not the subject’s principal car was equipped with seat memory, and irritation. That is, those who have seat memory are not less irritated than the subjects without access to seat memory in their principle car.

As mentioned earlier, there could be a difference between a subject’s subjective opinion and a subject’s actual behavior. Some of the subjects in this survey may have thought that “this could be useful” for almost all features. What they actually have a need for (or will create a need for) might be something quite different. The result actually showed that some settings were not of interest, indicating that the subjects considered their answers. The only way to find out how these features is to apply the features in a car.

The subjects was also asked to rate how often they adjusted their car seat when entering their principal car. The intention of the question was to understand how often people, who did not use seat memory, adjusted their seat. However, this was not stated as the intention of the question. There is therefore no way of knowing if the subjects adjusting the seat when entering their car did so with the help of the seat memory or not.

When performing some of the chi-square tests, some categories had few subjects, making these results less statistical powerful. To further explore the relationship of these questions a larger sample has to be studied.
5.4 Survey Discussion

The survey was conducted through a broad range of target-groups, and therefore some precaution has to be taken when conclusions are made. There might be a specific target group for some of the personal settings within this sample; but as this survey has stated, there are some results uniform for almost all drivers investigated, suggesting that some aspects of a personalized car applies for the most drivers.

This part will discuss the results of the survey together with some aspects of the survey methodology. The summarized findings from the entire thesis will be found at the end of the document.

5.4.1 Possible personalized settings

The result regarding attitudes towards possible personal settings showed some interesting results. Because of the similarity in attitudes towards the different settings it is difficult to distinguish a single setting that clearly should be personalized. A personalization concept could in other words benefit from making the included settings optional.

Some differences were observed and should be taken into consider.

- The most favored setting in this survey was the possibility to have a personalized driver position (including the mirrors and other physical adjustments). The result showed a high agreement rate and a consensus between the examined groups.

- It seems as though the women are more skeptical towards some of the personal settings. This also supports the suggestion that the included settings should be optional. The highest rated settings amongst women are the driver position and airflow settings, whereas the highest rated settings amongst men are the driver position, music position and driving characteristics. The implication that women are somewhat more skeptical towards new features supports the findings of Beckwith et al. (2005).

- Some negative attitudes were expressed regarding some of the settings. For example, comments such as annoying, unnecessary and confusing indicate that it is important to make the personalization seem simple.
- The survey showed that there is no need for a separate address book instead it implies that an integration of already existing address books should be made possible.

- It seems that many of the subjects believes that a welcome message would be annoying in some way, either because of the assumption that a welcome message will delay the system or because that they do not see the purpose of a car that greets them. The purpose with a welcome message could be to ensure that the right personal settings are activated. It is clear that if a confirmation of the currently activated personal settings should be implemented, this will need to be done in a very discrete, efficient and non-intrusive way.

Even though none of the investigated settings were the source of high irritation, this would not exclude the possible benefits of using personal settings. This only shows that the vehicle settings of today are either not that important or sufficiently easy to adjust. There are a few discrepancies between the groups investigated, which suggest that cultural and sexual differences might exist regarding this question. The results indicated that American women became somewhat more irritated. However, one can speculate that an increased amount of settings will either mean that settings will not be used or generate a higher degree of irritation. In both cases, personal settings might mean an advantage; either it could assert a simpler setting management or the possibility of excluding unwished settings. Personalization could even mean a total unawareness of other people’s adjustments.

### 5.4.2 Personal settings identification

Because most of the subjects in the survey claim to have their own key, it is conceivable that the key can be used as a source for identification. Some cultural differences were found concerning answers of how the key is shared. The results showed that the Swedish subjects shared their key to a higher extent than the American subjects do. The results regarding the use of car keys and amount of regular drivers of their principal car also shows that the drivers share their own keys with others. This needs to be taken into consideration when developing a tool for driver identification.

### 5.4.3 Personal settings saving method

As shown in chart 6.13, the subjects whose principal car is driven by more than one regular driver change their seat at arrival more often. This is not a surprising result since the amount of people sharing the car increases the
amount of adjustments made for the seat. The result regarding seat adjustments also indicate that even though there only exists one regular driver, this driver could benefit from saving his/her personal preferences. The reason for this is that the settings made by the driver can be temporary, such as when the driver has a lot of clothes or when adjusting the space for the back seat. In other words, all seat adjustments made should not necessarily be saved. Although, the results indicate that some kind of personal default setting should be supported.

The results also show a difference between USA and Sweden, in that the Swedish subjects changed their seat more often. This means that the Swedish subject may benefit somewhat more in a personalized driver seat.
6 Interview

The primary goal of the interviews was to better understand how designing for personalized settings could be carried out. A secondary goal of the interviews was to discuss general attitudes and ideas regarding personalization.

An important aspect of data collection is the order in which the interview and survey is conducted. In this study the purpose of the survey has been to generate a general understanding of attitudes and ideas regarding personalization of the car environment and has therefore been conducted before the interviews.

6.1 Method

The subjects were five women and six men between 30-57 years old. The subjects had voluntarily signed up for general experiments at Volvo Car Corporation. The restrictions for selecting the subjects were age (30-60) and frequent usage of a car with a remote key. These restrictions were based on the fact that the two design proposals would involve different variations of such a remote key, and as such, a reference to remote keys is essential. In addition, a broad sample set was necessary as the thesis is of an explorative nature.

The choice of interviewing employees of Volvo Car Corporation was made because of the nature of the subject and because of lack of resources. This might result in a misleading result since working at a car manufacturer might have made the subjects more knowledgeable, and more interested in different car settings and options. Working for Volvo Car Corporation, it could be argued, that their knowledge of the companies’ particular culture and values affected their attitudes towards personalization. Perhaps they considered more about how Volvos customers would react instead of only discussing personal opinions.

6.1.1 Design

The interviews were held at Volvo Car Corporations headquarters in Gothenburg. An inquiry was made approximately a week before the interview. The subjects received no compensation beyond the light refreshments being served during the interview. All subjects were interviewed by the same researcher. The outline of the interview was divided into two parts. The first part consisted of general background information and information regarding behavior in the car. The second part consisted of a discussion around two design proposals developed by the researchers (described below). The outline for the interviews can be found in Appendix G.
**Part 1 - General information and behavior**

This part was conducted by asking the subjects to answer short questions on background information (i.e. age and driving experience). It also included questions about how the subject shared his/her primary car with others.

**Part 2 - Personalization and settings**

The second part of the interview consisted of discussions based on the concepts of personalization and different ways of handling personalization of the driver environment. Two design proposals (described below) were generated from the results of the pre-study and the survey. The areas where the design proposals distinguished themselves from each other were discussed. The features of the design proposals where explained through sketched low-fidelity prototypes and described by the interviewer. The low-fidelity prototypes were intended to give the subject a clear understanding of the different aspects of personalization. The choice of using low-fidelity prototypes was made with the intent to avoid discussion regarding the graphic design and layout of the system while still clearly explaining the different proposals. (Low-fidelity prototypes are a common tool when developing new products, for more information see Rogers et al. 2002).

### 6.2 Design concepts

In the survey (chapter 6) general attitudes towards personal settings and car usage was investigated. To further explore how to design for a personalized car, two concepts were designed for the interview. The process of designing new features is an iterative process, and the concepts and their goals were therefore iteratively developed during the pre-study and survey. What you see below is a conclusion of these concepts, adapted for the interview.

The concepts were developed by using scenarios (Carrol, 2000) and objectives (Jones, 1992). Both the scenarios and objectives were developed over time during the pre-study and survey. Scenarios were used with the intent to design a holistic solution that supported as many user situations as possible. When an objective was found during the design process it generated a possibility of investigating other ways of solving the objective. Every new objective therefore helped to explore the design-space further. The objectives found through out the research helped guide the process of sorting out solutions which were better then others.

To give some understanding of these objectives they are summarized below.
6.2.1 Design Objectives

In the process of developing two personal setting concepts, a number of objectives emerged. These were mainly derived from the pre-study and the survey.

Visual & Discreet

A personalized car has to have some kind of visual feedback or lead that informs the user of the existence of personal settings. As described in the pre-study this was something other manufactures lacked. The system must not, however, obstruct customary usage of the car.

Optional settings

The survey found that there are differences between age and culture when it comes to which settings are of interest to personalize. Some settings were also more popular than others (see Survey result, chapter 5.2). This suggests that the settings should be optional.

Support error/temporary actions

Personalized settings must allow the user to make errors and make changes temporarily. The survey also indicated that differences in clothing as well as subjects inconsistent seating preferences strengthened this objective.

Support change of driver

A personalized car has to support a smooth change of drivers and help facilitate a change of driver during a long trip. A personalized car also has to support temporary drivers. For example, when someone borrows the car and has no desire to use the primary owner’s personal settings.

Require few actions

Today, opening a car consists, in most cases, of opening the vehicle by pressing a button on the remote control and then open the door on the driver side. To use the seat memory a seat memory button located on the side of the driver seat is pressed down until the car seat is in the preferred position. This procedure must not be extended. The survey indicated that there exists some reluctance towards adding more settings and technology to the car. Therefore it is important that new technology must not further complicate the simple procedures of today.

Evident identification

There must be some way of letting the driver understand how to identify herself. The benchmarking showed that other car manufacturers have not fulfilled this objective successfully.
**Evident personal settings**

The user must understand which of the settings included in the cockpit of the car allow for personalization, and which preferences are already personalized (i.e. saved). This objective was derived from the pre-study where it was clear that some car manufacturers did not supply this information and it was therefore hard to understand their personalization concept.

**Easy to use while driving / Reduce use while driving**

The personalized system should not invite the driver to change settings while driving since this could have an affect on the security of the driver. Settings necessary for driving should be given easy access.

### 6.2.2 Design 1 & 2

The preconditions regarding the design concepts are as follows.

- The car is opened by using a key including a remote control. The driver is identified through this key, i.e. the personal settings are connected to the key.

- The car has a large (approx. 10”) color display in the center stack that handles the CD, radio, navigation and other car settings. The climate is handled through separate controls in the center stack.

The designs had different solutions concerning the areas of interest, described earlier (see *Thesis question* chapter 4.1).

**Personal settings - Identification**

Both design proposals identify the driver through the key, i.e. the personal settings are connected to the key, and allow the user to choose whether to open the car with or without personal settings. However, how this is handled differs between the two designs (see figure 6.1). **Design 1** includes a solution where the user can choose to open the car in two ways. To open the car *without* the driver’s personal settings, the driver presses the open-button once. To open the car *with* the driver’s personal settings, the driver presses the open-button twice. In **design 2** the user can choose to open the car in two ways, but this is handled by a switch on the side of the key. If the switch is in position A, the car opens with the driver’s personal settings when the driver presses the open-button. If the switch is in position B, the car opens without the driver’s personal settings.
Both designs manage the personal settings through a display in the car. The driver can choose what settings to save. Design 1 manages the settings through a list, where the user can select the settings that should be connected to the driver’s key. However, the user cannot change the settings in the list, only which preferences are to be saved. The second solution, design 2, is based on distributing personal settings throughout the system. The driver chooses if he wants to save the radio settings to the key in the same place as he changes the radio setting (i.e., in the radio menu, the option to “save the radio settings to the current profile” is given).

**Personal settings - Saving**

There are two ways of saving the personal settings. Design 1 lets the driver actively choose when to save his/her personal settings, i.e., the driver adjusts the desired settings and then saves these settings. Each time the driver returns to the car, the saved settings are loaded. Design 2 proposes another solution where adjustments to the settings are saved automatically. The driver adjusts a setting according to her/his preferences, and then these adjustments are saved every time the driver leaves the car. This means that when the driver opens the car, the settings are in the same way as when the driver left the car.

**Memory buttons**

The most extensively developed and currently used personal setting, are the memory buttons and settings dealing with the driver seat. Our concepts therefore include proposals on how to deal with the driver position. Design 1 proposed that the memory buttons are used in the same way as today, i.e., three buttons (1, 2, 3) plus one memory button. The driver saves the current driver position by simultaneously pressing one of the number-buttons and the memory button. The driver position is recalled by continuously pressing down the
number-button. To integrate this with other personal settings, the driver has the possibility to connect one of these memory buttons to his/her profile. That is, when the driver opens the car with his/her personal settings (using the key), the saved driver position is loaded. **Design 2** has removed the memory buttons, thereby only allowing the driver to save the driver position through the personal settings menu.
6.3 Results

This section describes the results from the different areas of personalization which have been studied. The data collected were not fully transcribed and coded; instead the data was analyzed through the use of a number of questions (described below). These questions were produced with help from Kuniavsky’s (2003) recommendation on how to detect trends in data. The result from this analysis was summarized according the different areas of personalization, as described in 7.2.2.

What features of value does the subject describe?

The objective of the interview was to make the subject understand the concept of the proposed system and to give the researchers an idea of the subjects ideas and attitudes towards personalization. The interview also aimed to conclude which features of personalization and the different proposals the subjects would focus on and ascribe as important. Throughout the interview the different aspects of personalization are therefore discussed and the results have been analyzed and described according to these features.

What stories or incidents does the subject describe that refers to how their car is used?

Through stories or descriptions of incidents, which the subject has either experienced or watched, it is possible to gather information on how the subject uses his/her car.

What are their problems?

What are the problems with the different aspects of personalization that the subjects bring forward? Because of differences in background and experience of the subjects, the interviews gave a rare opportunity to find and understand problems and difficulties regarding the different parts of the personalization concept.

How well have they understood the system? How do they see the system?

Since the subjects had a wide range of different backgrounds and work experiences it was clear that the subject’s frame of reference might affect how the concept of personalization was understood. Therefore, specific attention was paid to how the subjects understood the concepts and proposed solutions throughout the interview.
6.3.1 Part one - General information and behavior

The eleven subjects interviewed were all employees of Volvo Car Corporation in Gothenburg, Sweden. Their areas of expertise were widely spread and the subjects worked under departments such as finance, global marketing, special cart design (special vagnar), testing and center stack design.

The subjects all owned and/or drove Volvo cars and nine subjects frequently drove a 2003 model or newer.

Only one of the subjects interviewed did not share his car with anyone while the other ten shared their primary car with at least one other person.

Four of the eleven subjects interviewed used cars with electronic seat adjustments and therefore only four of the subjects had access to seat memory in their primary cars. All, except one of the subjects, had a remote control key to their primary vehicle. More detailed information about these results can be found in Appendix H.
6.3.2 Part two - Personalization and settings

The result is categorized according to the features highly valued by the subjects during the interview. All quotations have been translated from Swedish.

Attitudes regarding personalization in general

During the interview the general concept of personalization was discussed along with the different aspects of personalization. Even if the overall attitude towards personalization varied among the subjects, no negative comments were explicitly expressed. All of the subjects stated that they would use personalization to some degree if it was available. An overview of features mentioned as important by the subjects during the interviews, and the number of subjects who mentioning them can be found in Table 5.1. Attitudes towards personalization, discussed during the interview, are described below.

Table 6.1 Features described as important when discussing personalization in general

<table>
<thead>
<tr>
<th>Feature</th>
<th>Number of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy &amp; comfortable</td>
<td>11</td>
</tr>
<tr>
<td>Safety</td>
<td>5</td>
</tr>
<tr>
<td>Time</td>
<td>3</td>
</tr>
<tr>
<td>Cool</td>
<td>2</td>
</tr>
</tbody>
</table>

Easy and comfortable

This is the number one reason why the subjects liked personal settings. All of the subjects mentioned comfortableness in some way.

“being able to enter the car and drive away immediately” (S3)

“it’s more comfortable and adjusted after my preferences, we all look different, long legs, short legs ... it is useful... definitely” (S7)

Safety

Half of the subjects mentioned safety as important when designing personal settings. Some of them believed that personal settings improved the vehicle safety, as you don’t have to adjust your initial settings while driving.

“it often means a lot of fiddling, if you can get as much as possible automated... It decreased the risks but sometimes you sit in one position when driving away and after five minutes you start fiddling with the rear view mirrors while you are driving which is definitely not good” (S10)
“oups, it turns out I can’t see anything” (comments regarding the rear view mirrors while driving) (S9)

**Time**

Less than half of the subjects mentioned time as an important benefit.

"it takes time and is disruptive and annoying" (to change settings) (S2)

"Save time, if it concerns the driver position, since that’s where you save time. You always fiddle with the adjustments, pumping up the seat and pulling it forward. If everything was already adjusted you could just start driving" (S11)

**Cool**

Less then half of the subjects thought personalization was cool or luxurious.

"I think it’s pretty cool"

"it would have been luxurious"

**Possible personalized settings**

During the course of the interview the subjects discussed different kinds of personal settings that would be of interest. These comments are summarized below.

With regard to the driver position, all subjects were in agreement that the driver seat and mirrors are useful to personalize. Less then half of the subjects also mentioned the steering wheel position as part of a personalized setting.

Half of the subjects mentioned radio or sound settings as an attractive personal setting. Favorite radio settings and current radio station personalization was a common theme.

"if I can have my favorites on the radio, I would like to have it” (S6)

"if you have changed your radio station I sometimes find it hard to find my way back” (S8)

Half of the subjects mentioned climate as an interesting personal setting. There were mainly two parties regarding the climate, those who thought climate was all weather-dependent, and those who actually had/wanted their specific default-setting of the climate.

"It would be good if you always use 22 degrees (C)” (S11)

Other interesting personal settings mentioned were chassis-settings, warning signals, and engine profiles. Engine profiles concerned the possibility to individually change the engine effect.
“75% of the time I want a more alert engine, and then during longer drives I might want a more fuel efficient driving, my partner might have a smoother feel while I want a more sporty feel to it” (S5)

Table 6.2 Personal settings mentioned by the subjects during the interview

<table>
<thead>
<tr>
<th>Personal settings*</th>
<th>Number of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver position</td>
<td>11</td>
</tr>
<tr>
<td>Radio &amp; sound</td>
<td>6</td>
</tr>
<tr>
<td>Climate</td>
<td>5</td>
</tr>
<tr>
<td>Chassis settings</td>
<td>1</td>
</tr>
<tr>
<td>Warning signals</td>
<td>1</td>
</tr>
<tr>
<td>Engine profiles</td>
<td>1</td>
</tr>
</tbody>
</table>

**Personal settings management**

The subjects where introduced to two different approaches on how to save their personal settings. The first option was to treat the saving of personal settings as just another possible adjustment, controlled by the same display as the rest of the settings applicable to a certain function. For example, personal settings dealing with the radio system would be found amongst other settings controlling the radio system of the car.

The second option introduced to the subjects defined personal settings as a function by itself. This meant that the different functions of the system that could be personalized where all found in a specific menu. This menu was displayed as a list of settings which could be saved to the driver’s personal settings.

Table 6.3 Features described as important concerning save by list or save by setting.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Save by settings</th>
<th>List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Overview</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Esthetically pleasing</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Preferred setting management</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>
Simplicity
The most frequently expressed comment with which the subjects described their preferred way of handling the personal settings referred to “simplicity”, being able to enter the car and drive away immediately. This was mentioned by five subjects when discussing the first option (all personal settings collected in a list). Simplicity was referred to both in the sense of how to understand the capabilities of the system and remembering how to control the system. Only one person mentioned simplicity in the context of option two (controlling the personal setting by function).

Overview
While trying to understand how the proposed system for personal settings would be handled, the subjects referred to overview of the system as an important influence on their impression. The first option (all personal settings in a list) gave the subjects a good overview of which settings could be personalized and the settings had been adjusted and saved.

“if someone else would make adjustments to my profile by mistake, it would be easier to change them back if they were all collected in one spot” (the list)
(S3)

Control
Feeling in control of the system was explicitly mentioned by two subjects. Features such as simplicity and overview can both be seen as contributors to gaining a feel of control over the system. Simplicity allows the user to build a correct mental model of the system by helping him/her decide how to use the system. Overview allows the user to easily access the current status of the system.

Safety
Since managing the system takes attention away from the primary task of driving, a system that promotes changes to be made while you are standing still is preferred. If the choice to save by setting is used then it will be utilized when a day to day change to the setting (such as changing your presets for the radio) is performed. Because these day to day changes are likely to be performed during driving and they should not require a lot of the driver’s attention.

Esthetically pleasing
One person mentioned that it was important for the system to be esthetically pleasing and pointed out the list (option one) as the more esthetically pleasing of the two options.
Other aspects mentioned about the two proposals where:

If a personal setting has been changed without your knowledge, a list provides an easy access to all your personal settings and the change can be acknowledged and corrected to your satisfaction.

In the proposed option where all personal settings can be found in a list, there is a risk that it will be difficult for the user to create a usable mental model of the system. If management of the personalization settings is done through a list but the adjustments of the settings mentioned on the list are done somewhere else this can be create confusion.

Personal settings saving method

During the interviews the interviewer introduced two different ways of managing the saving of your personal settings. The first way was by asking the user to actively choose to save an adjustment. This proposal suggested some kind of control that needed to be activated by the user to initiate saving of the personal settings. The second way of managing the saving of your personal settings was by allowing the system to automatically save your personal settings when you were driving. This meant that the driver did not have to initiate saving of the personal settings since this would be done automatically by the system at a certain time. These were not represented in the low-fi prototypes but instead introduced into the discussion along with the general problem of how to handle the personal settings.

Table 6.4 Features described as important concerning when to save your personal settings.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Change on demand</th>
<th>Automatic change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Simplicity</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Preferred save method</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

Convenience

Saving the settings automatically was described as convenient by two of the interviewed subjects however the aspect of letting the car automatically update the settings was described by others as inconvenient since this would mean less control over which settings were saved.

“saving automatically is good, otherwise I’ll have to go in and save every time”
More than half of the subjects spoke about some sort of “default” mode which they could use as their basic personal settings. The subjects liked the idea to be able to return to their favorite settings. This is clearly stated in the comments below:

“It’s more logical if I myself decide when something should be saved, otherwise all changes will be saved, even though they might have been done by a passenger” (S7)

“A good thing is that you don’t have to save every afternoon after you have been out driving, or if you have been out buying boards and pull the seats forward very far. If you don’t do anything you’ll get your default setting back the following day. If it had been saved when you removed the boards, it would still have been pulled forward and I would have had to readjust the seat again” (S8)

Simplicity
As well as how the personal settings should be managed, (question nr.3) simplicity was also mentioned in discussion regarding when your personal settings should be saved. When the driver chooses to update his/her personal settings, they need to be easily accessible otherwise they will not be beneficial to the driver.

Control
Feeling in control when the settings are saved is also a factor mentioned during the interviews. The user might not have any desire to save temporary changes. By letting the driver control when adjustments should be saved, undesired changes will not be saved.

“Only save when I want to save, it’s not a big thing if I forget”

“Simple and you are in control over when things are saved”

Other aspects mentioned about the two proposals where:
Five of the eleven subjects referred to a “default” status of their personal settings which they would want to create themselves. If anything changed in the car because of contextual circumstances they would want to be able to recall their default settings. An example of this is if a temporary change is made to the setting of the driver position because of an oversized object in the back seat; then this change is temporary and should not be saved. When the driver chooses, his/her “default” setting will be recalled.

One of the subjects mentioned safety as important when saving your personal settings: “you should save when the car is standing still, not while driving” (S6). Whenever something is saved automatically, there is a risk that the user does not have enough information of when and how the settings are saved. This
could lead to an incorrect understanding of how the system works and ultimately to confusion.

The most common argument against automatic saving is that it is not desirable to save all changes made to the driver environment. Some changes are temporary and some changes are meant to be permanent. The same conclusions were made from the survey.

**Memory buttons**

Four of the subjects had experience with memory buttons (one more had memory buttons but had never used them). All four subjects expressed that memory buttons are necessary. Consequentially, the ones who spoke negatively about memory buttons did not use the memory buttons in their car.

**Table 6.5 Features described as important when discussing whether or not memory buttons should be kept.**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Memory buttons and menu</th>
<th>Menu only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Efficiency</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Aesthetics</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Subjects preferred choice</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

**Simplicity**

Half of the subjects mentioned simplicity as important when choosing between keeping the memory buttons or not. The reason mentioned by most of the subjects is that it would be unnecessarily with two ways of doing the same thing. Another reason mentioned is the possibility of supporting those who don’t like technical gadgets; you can then use the memory-buttons and never care about the menu. However, one of the subjects thought that a list would be easier to understand then the current seat button.

"it’s unnecessary to keep the memory buttons if it’s located in the key, saving in two ways might be to complicated… it should be simple” (S1)

"it seems to be a bit over ambitions to have these buttons in different places” (S8)

"most of the time both of you might not have your own key however, then you can still change it manually” (S11)
"I guess it’s good to save all the things that should be saved in one menu" (S7)

"what if I’m one of these people who are afraid of these things (technical gadgets)? Then I at least have the option of accessing my seat position here (memory button) (S2)"

Efficiency
Half of the subjects expressed that keeping the memory buttons would promote easy access of the driver position and support the change of drivers. This was mentioned as an important benefit from keeping the memory buttons. All those who mentioned efficiency as a feature they appreciated were positive towards including seat memory. There were at least three reasons regarding efficiency and the seat-memory buttons. 1) Easier to change driver-position when using wrong key. 2) Possibility of saving the seat while driving. 3) Proximity i.e. you have to be able to save your seat where you change the seat.

"I can’t find my key, I grab my wife’s key and then I press number 1 which gives me my driver position... I wouldn’t go in and change her position” (S3)

"if you’re out driving for a long period of time and you stop at a rest stop to switch drivers it would work well if you could do that (changes seat adjustment through memory buttons), since you might not have access to the other key right then and there”(S7)

"it’s simpler, if I want to change the driver seat settings it’s much easier to do it by the seat, that’s where the controls are located with which I change the seat, (S6)

Cost
Two of the subjects thought that cost was of importance when choosing between keeping the memory buttons or not. The reason for this was that it was seen as cheaper to remove the memory buttons and include the function in a larger menu.

Aesthetics
Two of the subjects valued aesthetics more than functionality. Both of the subjects who expressed aesthetics as an important feature would like the memory buttons removed.

"I think buttons are so ugly that it is not worth putting ugly buttons in the panel of the door” (S10)

"I prefer not having a lot of things in the car, think it looks good with a nice looking interior and that’s enough” (S11)
Safety
One of the subjects thought that the memory buttons should be kept because of reasons dealing with safety. Using memory buttons would be beneficial during stressful situations since you don’t have to enter a menu.

Other aspects mentioned about the proposals where:
Letting personal setting be accessed through memory buttons ensures that the personal settings can be activated even though you do not have access to your key.

Personal settings identification
An important part of the interview dealt with the aspect of how to open/unlock the car. The use of personal settings can be efficient if the settings are easily reached. This includes being able to apply your personal settings to the driver environment in an efficient way. It is not just a question of saving a personal setting but also of how to retrieve it. This includes some kind of identification of whose personal settings should be applied to the driving environment at a certain point. Three different proposals were discussed which all identified the driver through the key/remote control of the vehicle. The first proposal suggested that a separate button be introduced on the remote control. This button opened the car and applied the personal settings of the key, to the car.

The second proposal suggested that the already existing unlock button on the remote control could be used in two different ways. It could be used to unlock the car in a regular manner by pressing the unlock button but it could also be used to unlock the car and apply the personal settings by interacting with the button in a different way (a button sequence e.g. long-push or double push).

The third proposal applies a switch to the remote control which indicates if the remote control will open the car without applying personal settings (neutral mode) or applying personal settings (personal settings mode). This proposal would mean that the user could use the remote control in the same way as he/she has done before with the exception of choosing if personal settings should be applied when the car is opened, or not.

As seen in table 5.6, most of the subjects preferred a separate button or a switch button. Only one subject preferred the button sequence. How the subjects reasoned are described below.
Table 6.6 Features described as important concerning identification method

<table>
<thead>
<tr>
<th>Feature</th>
<th>Button</th>
<th>Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sequence</td>
<td>Separate**</td>
</tr>
<tr>
<td>Simplicity</td>
<td>-7***</td>
<td>4 4</td>
</tr>
<tr>
<td>Evident</td>
<td>-1***</td>
<td>5 -5***</td>
</tr>
<tr>
<td>Cool</td>
<td>1 2</td>
<td>1</td>
</tr>
<tr>
<td>Discrete</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Esthetically pleasing</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Subjects preferred choice*</td>
<td>1(11)</td>
<td>4(9) 4(11)</td>
</tr>
</tbody>
</table>

* One subject suggested to use an extra “neutral” key for guests; one subject suggested fingerprint as an identification method.
** This alternative was proposed as a third option when discussing button sequence.
*** Negation indicates a negative value towards the proposal.

Simplicity

More than half of the subjects mentioned simplicity and declared that the normal case should be the easiest. The normal case was referred to as how a frequent driver uses his or her principle car. Comments such as “and that’s what you do? you just press... and it’s the norm” (S1) and “it’s my car, why should I have to press twice when I want my settings? I use it every day” (S5) was expressed.

The fear of making mistakes often accompanied the statements dealing with simplicity. For example, one argument regarding the sequence button was made which dealt with the possibility of pressing the button in the wrong way. “..if you accidentally press the button twice and suddenly my settings are not in the car?” (S10).

Another aspect of letting personal settings be activated by the most common interaction is that a person borrowing the car is forced to use the key in an “uncommon” way. This might cause a problem since the temporary drivers will not know how to open the car without activating the personal settings associated with the key. Comments related to the use of a separate button show this clearly: “if there is a symbol for personalization, the people using the car will learn to press it while people borrowing the car will use the regular button to unlock the car, without even considering pressing the other button.” (S8).

Evident

More than half of the interviewed subjects mentioned that a switch button would be confusing. This could be because a switch would not clearly show the...
meaning of its position. Comments such as "the switch button might cause trouble... which position did I have and what did it mean?" (S2) was expressed.

Concern about remembering the switch button when lending the key to another driver, was also expressed: "the switch would have to be huge!" (S4) and "I don’t know... do you think you will think of it? but I guess it gives you the possibility (to choose)" (S9).

Half of the subject expressed that a separate button on the key would make the function noticeable and it would make it clear that there are more than one way of opening the car.

**Cool**

Being able to open the car in a certain way and activate your personal settings was received by half of the interviewed subjects as a positive aspect of personalization. Comments mentioned the function as a smart and clever way of handling the activation of personal settings.

“I think it’s pretty smart actually, if someone else is driving the car I can switch to the "neutral” position and they don’t have to fiddle with my personal settings” (S11).

“Really good! Simple, I have my settings and if you will borrow my car I just switch of my settings and then I just switch them on again when I get the key back”(S6)

**Discrete**

Three of the subjects mentioned that a switch would be a discrete alternative. The reason for this was that the switch was located on the side of the key.

**Esthetically pleasing**

One of the subjects expressed that adding another button to the key makes no difference since the key itself is not esthetically pleasing as it is. Yet another subject mentioned esthetics when discussing the use of another button. Adding another button to the key would have a negative effect on the esthetics of the subject mentioned esthetics when discussing the use of another button. Adding another button to the key would have a negative effect on the esthetics of the key; in this case a switch would be more discrete and would therefore be preferred.

**Other aspects mentioned about the proposals where:**

Two subjects mentioned that the proposed switch button should work easily with a so called keyless vehicle.

One subject pointed out that it is not always the driver who opens the car; it could as easily be another person, even a child. This favors the switch button
since no decision regarding how to open the car so that your personal settings are activated has to be made when the car is opened.

The ability to control whether or not your personal settings are activated when you open the car can not be placed inside the vehicle. If the car is often shared with someone else, the most likely scenario is that the key exchanges hands away from the car. Therefore the personal settings should be activated outside the vehicle. "If you borrow the key you must have this"neutral" button (separate button) otherwise it will fall flat on its face, it comes with the territory" (S11).

One subject expressed the opinion that having the ability to choose if your personal setting should be activated or not is not a necessary problem to solve. The reason for this is that the subject thought the cost of solving the problem (through the application of an additional button, switch or button sequence) is too high.

---

1 A keyless vehicle refers to a vehicle that can be opened without explicit interaction with the key or remote control. If a key is in proximity of the car and a door handle is pulled, the car will automatically be unlocked.
7 Discussion

Generally the suggestion of applying personalization to the driver environment of a car was well received. The most frequently mentioned benefit of personalization was the fact that personalization was a convenient feature that would make managing the settings easier. Another benefit of applying personalization to a driver environment was that the user would use less time making adjustments and therefore concentrate on the driving as well as save time.

By applying personalization to the driver environment of a car, the experience of the car can be affected and the car may be seen as more technically advanced. However, this technical advancement may not always be appreciated. As shown in this study, some resistance exists towards some parts of the personalization. Some features are obviously not appreciated and this study can help give directions on which features to personalize and which not to personalize. The findings from this research have been gathered in seven final statements. Each statement is discussed below.

7.1 Final statements

Driver position the most significant setting

The most favored setting, as both the survey and interview indicated, is the possibility to have a personalized driver position (including the mirrors and other physical adjustments). The next most favored settings are the ones already existing today, such as radio and climate system. The men showed somewhat more interest in general than women, especially concerning the possibility to adjust different chassis settings. This might suggest that a more advanced chassis setting would be more welcome by men than women.

The results from this study show that adjusting the ergonomic features of the car, such as driver position and airflow, are rated highly by the subjects. This may be because it could give the subject easier and quicker access to adjustments needed for the primary task of driving. Music lists, which included access to your personal music lists and radio-channel-presets, were also rated among the top settings to personalize, suggesting that productivity was rated highly as a reason for personalization. In the chapter of earlier research, it is mentioned how Stanley et al. (1996) found that most user initiated personalization was done with the intention of increasing productivity. Just as the study conducted by Stanley et al., the results from this study suggest that settings dealing with visual appearance of the interface (color of display) was not among the most wanted features of personalization.

Optional personalize settings

The assumption of this study has been that a function who’s specific setting is seen as important to maintain, together with the ease with which you can access
your preferred setting will decide if a function will benefit from being included in a personalization concept or not. However, it is not clear how important the setting must be to maintain or what level of accessibility that is needed. The results show that a personalization concept should allow for flexibility and allow for optional settings. If adjusting a setting is very simple then is it really necessary to personalize it? Maybe adjusting your settings is part of your driving experience and decreasing your need for these adjustments will make driving less enjoyable.

The reason for introducing personal settings is not based on an expressed need from the users nor on a need to reduce irritation, but it is based on the possible benefits which can be gained. The primary benefits are convenience and comfort. However some results also indicated that personal settings could be seen as increasing the safety (see Results, chapter 6.3, p64). Indications from the survey and interviews also show that personalization might increase the “cool” factor of the car.

**Gather the personal settings**

Being evident and coming across as simple are features that are highly prioritized when discussing the personalization concept. This suggests that all personal settings should be gathered and easily overviewed, i.e. they should be included in a separate menu or list where management of the personalized settings can take place. The result of the interview showed that the list clearly became the most popular way of managing personal settings, even though such a list means that you separate the actual adjustments from the saving of these adjustments.

Since the concept of personalization was new to the subjects, a large part of the interview was devoted to creating an understanding of the concept. The explanation and discussion of how the personal settings could be handled also fulfilled the purpose of helping the subjects understand the concept of personalization. Because the proposed list might have been more easily understood by the subjects it might have generated a more favorable attitude to the proposed solution of the concept. It might also have been easier for the subject to understand and remember during the interview, this could have affected the discussion and response to the two options. It can be concluded that if personalization should be a part of the driver system in a car, the feature needs to be easily understood by the user otherwise the function will not serve its purpose.

**Let the user be in control**

During the interviews it was clear that one negative aspect of automated saving was the lack of control it gave to the user. Letting settings be saved automatically could lead to a misunderstanding of how the system worked and
it was seen as something that would create problematic situations. As shown by the results from the survey (see Results chapter 5.2, p34) it is clear that temporary changes are frequently made by drivers (or their passengers).

During the interview the different saving options where discussed and it became clear that the subjects preferred saving on demand even though it could mean that they sometimes forgot to save an adjustment. It was considered more irritating to have changes automatically saved, than having to re-adjust a setting because of forgetfulness. By allowing the personal settings be saved automatically it is less obvious for the user that the function of personalization actually exists. Saving on demand could therefore not just promote the users feeling of control but also the user's awareness of the function. However, letting personalized settings be saved on demand requires that the settings can be easily accessed, as an example through a direct accessed list.

**Keep the memory buttons**

Three reasons to keep the memory buttons emerged from the results of this study:

- Easier to change driver-position when using the “wrong” key.
- Possibility of saving the seat while driving.
- Closeness; you have to be able to save your seat where you change the seat.

During the study it was clear that subjects accustomed to using memory buttons advocated keeping the easy access to the driver position they provided. The subjects advocating saving the memory buttons expressed an appreciation with the efficiency they provided. They also expressed that the memory buttons would be a safer alternative than integrating the functionality into a menu, i.e. if the driver would like to change the settings during travel, a menu system was seen as less safe. The subjects advocating an integration of the seat memory into a menu expressed the simplicity and aesthetic as highly valued features. They also declared that controls for saving a driver position should be located close to where the adjustment of the driver seat is done to increase the awareness of the function. This could lead to confusion if saving the driver position is mentioned as a part of a list of functions included in a personalization profile (described as the most appreciated way of handling personalization).

Since it is clear that the drivers who have had some experience with memory buttons appreciate their existence, they should not be removed. The results also indicate that their existence and benefits might not be known to some users. It
was expressed that if users knew how they worked they would have used them. An improvement in communicating this feature to the customers is needed.

The subjects who express simplicity as a highly valued feature of a system put forward both negative and positive aspects of keeping the memory buttons. Subjects expressing efficiency as a highly valued characteristic of a system also express a desire to keep the memory buttons. It is worth mentioning that the subjects, who have an experience with memory buttons, are more likely to express an appreciation for the function. Implementing a personalization concept into the menu of the system might exclude their need for memory buttons; however it could also lead to a decrease of usage of the function. The question of how to evaluate the arguments put forward is raised.

The current usage of the functions in the car also needs to be considered when implementing personalization into the driver environment. While it’s desirable to support the current behavior of the user, it also important to expanding and improve the experience. Personalization might have to be considered as a luxury improving your experience, but a user should also have the option to ignore the function if she or he chooses to. Keeping the memory buttons allow for such ignorance as the user still can personalize the most important feature (driver position) and don’t have to care about the rest of the personal settings.

**Evident identification**

As shown in the results, opening the car with a button sequence is not a desirable solution. As you often press the button several times (until the car opens) or by mistake, a button sequence could mean confusion and error when managing the personal settings. Concerning the other two options the result does not clearly show a winner, although a separate button was perceived as less confusing. If you would like to drive the car with your personal settings, you press a “personal key” button, and if you don’t want your personal settings you press the “ordinary” open button. In the case of the switch solution, the driver has to be aware of the state of this button. Even though both suggestions include adding another button to the remote control they are both favored above the button sequence. Using a switch and determining a mode of the key (profile or neutral) can be used in combination with a keyless vehicle. However, the use of a separate button will also work with a keyless vehicle since the settings included in the personalization profile could include a preferred way of opening (either with or without personal settings identified by a specific key).

It is important to subtlety indicate whether your personal settings are being activated or not. This is important since the driver might not be the one using or opening the car or might unintentionally activate the personal settings. Subtleness is important since the result showed a high resistance towards features such as the welcome message.
It could be possible to include the option of somehow reaching your personal settings without having access to your key. However if the seat memory buttons are kept, you will always be able to reach your preferred driver position just by pressing the dedicated memory button.

**Individual differences are larger than cultural**

Our survey indicated that there are gender differences as well as between Sweden and USA, concerning attitudes towards personal settings. This confirms the complexity of cultural differences as described in earlier research. Evers and Day (1997) suggested that Australians put more emphasis (than Chinese) on the way an interface might look than the actual functionality. This functionality versus aesthetically demand was also found in our small sample of interviewed subjects. Some of the subjects were evidently more interested in aesthetics than the functionality and usability itself. This result indicates that cultural differences such as the ones Evers and Day found must be considered with precaution. Differences between different target groups could be greater than differences between cultures. Further research can contribute towards an understanding of how much the cultural differences affect the design of interaction.

As described earlier, Venkatesh and Morris (2000) studied technology acceptance concerning perceived usefulness and ease of use, stating some gender differences. Even though not explicitly investigated in this study, it is clear that there are individual differences concerning perceived usefulness and ease of use. Some people value features not directly related to performance (such as aesthetics and coolness) whereas other value features more related to performance (such as comfortness and simplicity). These totally different views make it hard to conclude any general solutions, suitable for all drivers. Even though there might be cultural and individual differences it seems as the authors of this research have found some general results which can be applied to the majority of the drivers.

**To Personalize a car is (not) to overdo it**

New technology puts new demands on in-vehicle design; is personalization the right way to do it? Manber et al. (2000) states that people often do not personalize because they think it is time consuming. This study has shown that there is a great interest in personalization, though mainly for the most usual settings. As described in the problem area, a lot of research exists concerning different kind of adaptive systems and safety systems such as blind spot detection, adaptive cruise control etc. Each of these systems have some kind of sensitivity settings for individual adjustments which paves the way for a more extensive personalization. Not until this technology has been extensively
implemented, can the full potential of personalization be discovered and evaluated.
7.2 METHOD DISCUSSION

The research conducted by the authors has been of an exploratory nature. The result of the research is based on distribution of a web based survey together with data collected through interviews. In the survey subjects had to rate their interest in a number of settings and describe their behavior in, and usage of, the car. In the conducted interviews subjects were asked to discuss possible solutions for handling and saving settings, discussing how identification of the driver could be solved, as well as give their opinion on personalization as a concept. There are three major problem areas with these methods.

Firstly, the subjects have been asked to subjectively give their opinion on aspects of personalization without having a concrete system to base their opinion on. There is no way of knowing if the subjects have understood the concept of personalization in the same way. In the survey the explanations given to both the settings and what the researchers meant by personalization might have been understood differently by each subject, consequently leading to a misguiding result. In the case of the interview, low-fidelity prototypes were used in an attempt to create a similar understanding of the concept and the proposed design solutions. Because low-fidelity prototypes were used, the system was still dependent on some level of interpretation. The prototypes could have been interpreted differently among the interviewed subjects and their mental models of how the system would work could have been different and generated a misguided result.

Secondly, the data collected in the study has been supplied by the subjects themselves. As a result there might be a discrepancy between how the subjects claim they behave and how they actually behave. All subjects stated that they would use personalization in some way or another if it was available today however this could have been a result of their sympathy for the researcher.

Thirdly, the subjects have rated a concept of personalization based on a system with which they have no experience. Their answers are based on how the subjects believe they would interact with, and react to, the concept. The subjects are also building their understanding of the system on their previous experiences. This includes subjects participating in the survey as well as subjects participating in the interviews. This could effect how subjects rated their interest in personalizing different settings in the survey as well as influencing which settings the interviewed subjects gave as suggestions for possible settings to include in a personalization concept.
7.3 CONCLUSIONS

Final conclusions which can be drawn from this research are as follows:

- The most favored setting, as both the survey and interview indicated, is the possibility to have a personalized driver position (including the mirrors and other physical adjustments). The next most favored settings are the one existing today, such as radio and climate system.

- The reason for introducing personal settings is not based on an explicit need from the user or on a source of irritation, but based on the possible benefits such as convenience and comfort. Some results also indicated that personal settings could be seen as increasing safety. Introducing personal settings and the fact that your car adjusts itself to your needs could be seen as increasing the “cool” factor.

- When implementing the concept of personalization on a car it is important not to overdo the personal aspect of the design. It has been concluded that using the analogy of a welcoming friend to the personalization concept is not a favored approach. The personalization has to be discrete, efficient and non-intrusive.

- Evident and simplicity are features highly prioritized by subjects of this study, suggesting that all personal settings should be gathered and easily overviewed, i.e. a separate menu or list managing the personal settings should be used.

- When studying the results, there is no question that the subjects preferred control over when to save settings. The problem with automatic saving is that the saving is not controlled by the user and therefore temporary changes to the settings (made either by the driver himself or the passengers), could accidentally be saved. It is also clear that many of the drivers liked the idea of a default mode that they could return to, which ‘save on demand’ supports to a higher degree.

It is very hard to predict the outcome of implementing a lot of personalized features. It is however, clear that there is an interest in personal settings. Further research could investigate how a personalized car actually would be used in real life.
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As the research described in this thesis have been conducted in Sweden the language of the material included as appendixes are both Swedish and English.
Appendix A - Brainstorming information participants

Brainstormingssessionen är helt frivillig och din medverkan kan avbrytas när som helst. Materialet kommer att användas för Tomas och Monikas examensarbete om profilhantering i förarmiljön. Inspektion sker under brainstormingen.

Bakgrund
I och med att allt fler funktioner och inställningar blir möjliga i förarmiljön behövs ett sätt att hantera detta. Ett sätt att göra det är genom att skapa så kallade profiler, dvs inställningar som är specifika för en användare. Den här sessionen kommer att diskutera kring vilka inställningar som kan vara aktuella.

Syfte
Att generera möjliga inställningar för profilhantering i förarmiljö och att ta upp positiv/negativ kritik kring dessa.

Restriktioner
Ideerna ska vara applicerbara i en förarmiljö inom en realiserbar framtid.

Utförande

Del 1
Individuell brainstorming kring personliga inställningar. 5min.

Del 2
Parvis brainstorming koncentrerade till fyra specifika syften. 4 x 8 min.

Del 3
Kort redovisning av tidigare förslag. Diskussion/kritik om dessa. 10 min

Tack för din medverkan!

Tips
Byt aktör: barn – vuxen, kvinna – man, förare – passagerare
Byt kontext: sommar – vinter, dag – natt
Byt objekt: klimat – navigation – parking assistance – belysning etc
## Appendix B - Result brainstorming

<table>
<thead>
<tr>
<th>Känslor/Nöje</th>
<th>Infolagring</th>
<th>Ergonomi</th>
<th>Effektivitet</th>
<th>Övrigt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display dimen</td>
<td>Sparade rutter man kört</td>
<td>Ratt</td>
<td>Sätt att gömma tillfälligt ”onödig” info – kontext anpassad meny</td>
<td>Fläktnivåer hög/mellan/låg</td>
</tr>
<tr>
<td>Ändra blinkersljud/varningsljud</td>
<td>Importera/exportera data från/till bil</td>
<td>Pedaler</td>
<td>Telefon modes, hindra vissa samtal (jobb/fritid)</td>
<td>Temperatur profil: varmt fotter/kallt/ventilation (ett sätt att beskriva hur kunden föredrar luftflödet)</td>
</tr>
<tr>
<td>Röstguidning navigation</td>
<td>Individuella samtalslistor</td>
<td>Stol</td>
<td>IDIS på menyer tex omkörning i 180 km/h kanske vissa menyer ska döljas</td>
<td>Stolsvärme temperatur</td>
</tr>
<tr>
<td>Skins navigation</td>
<td>Medelförbrukning, hastighet etc</td>
<td>Backsidospegel</td>
<td>Olika förväntad blåtands telefon beroende på person/nyckel</td>
<td>Automatisk stolsvärme av/på</td>
</tr>
<tr>
<td>Skins radio</td>
<td>Körsträcka</td>
<td>Konfigurerbar HMI inkl. valbara knappar</td>
<td>Favoritfunktion – systemet känner av vad som används mest och lägger i ett favoritställe.</td>
<td>Styra autofunktionen i klimat, vilken stolsvärme det ska vara.</td>
</tr>
<tr>
<td>Telefon vibration</td>
<td>Adress</td>
<td>Värme/ventilati on</td>
<td>Genvägar till funktion via keypad</td>
<td>Reostat?</td>
</tr>
<tr>
<td>Bakgrundsbild</td>
<td>Musik/film/bilder</td>
<td>Vinkel display</td>
<td>Kontextbaserad meny – slut på bensinger tips på bensinmack</td>
<td>Stol, backspegel, ratt, pedaler</td>
</tr>
<tr>
<td>Ljusstyrka</td>
<td>Kallender</td>
<td>Dölja displayfält för förare</td>
<td>”googlesökning” i navi tex efter McDonalds</td>
<td>Alla menyinställningar: ADD, FCW (forward collision warning), LDW (Lane departure warning), lås, larm, approach light, security lighting.</td>
</tr>
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<td>Känslor/Nöje</td>
<td>Infolagring</td>
<td>Ergonomi</td>
<td>Effektivitet</td>
<td>Övrigt</td>
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<tr>
<td>Bekräftelse ljud</td>
<td>Allmänna filer - dokument, bilder etc</td>
<td></td>
<td></td>
<td>Sätesinställningar, ratt</td>
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<tr>
<td>Välkomstmeddelande</td>
<td>&quot;Office viewer&quot;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ringsignal</td>
<td>Manual till bilen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virtuell knapp mot funktion</td>
<td>Spara körjournal – tanka, sträckor, gps etc</td>
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<tr>
<td>Nedladdningsbara funktioner</td>
<td></td>
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<tr>
<td>Färger</td>
<td>Musik</td>
<td>Stol</td>
<td>Radiokanaler</td>
<td></td>
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<td>Radiokanaler</td>
<td>Hur långt jag har kört</td>
<td>Ratten</td>
<td>Playlist</td>
<td>stolsinställningar</td>
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<td>Lukt</td>
<td>Bensinförbrukning</td>
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<td>Vanliga resmål om man har karta</td>
<td>ringsignal</td>
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<td>Ställa in signaler</td>
<td>Platser man tycker om</td>
<td>Sidospeglar</td>
<td>En knapp/handling för att profilen ska &quot;köras&quot;</td>
<td>Ringvolym</td>
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<tr>
<td>Ljudvolym</td>
<td>Resmål</td>
<td>Handbroms – hur hårt, vinkel, placering</td>
<td>Var man vill ställa in saker</td>
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<tr>
<td>Ställa in ringsignaler från mobil</td>
<td>Rapportera trafikolyckor/viltolycko</td>
<td>Flytta centerstacken</td>
<td>Fälla nackstödet om man kör ensam</td>
<td>Val av källa</td>
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(Appendix C – Result brainstorming)
<table>
<thead>
<tr>
<th>Känslor/Nöje</th>
<th>Inföljning</th>
<th>Ergonomi</th>
<th>Effektivitet</th>
<th>Övrigt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belysning av instrukt, färgstyrka osv</td>
<td>Info om vart man befinner sig</td>
<td>Pedalkänslighet – hur hårt, när kopplingen tar, bredd mellan pedaler</td>
<td>Genväg för värmeinställning</td>
<td>Ljusintensitt i display</td>
</tr>
<tr>
<td>Välja operativsystem på displayen</td>
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<td>Växellåda – lägen, hur hårt, klonk/ljudeffekt</td>
<td>Val av funktioner</td>
<td>Vilken BT telefon som sparas</td>
</tr>
<tr>
<td>Inställningar för lampan i taket</td>
<td>Info om bilen (bredd, höjd, chassi etc.)</td>
<td>Ljudvolym</td>
<td>Radiokanaler</td>
<td></td>
</tr>
<tr>
<td>Playlists</td>
<td>Tidigare ägare</td>
<td>Värme/klimat</td>
<td>Ordning på menyval</td>
<td>Förarsäte</td>
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<tr>
<td>Kanalinställningar</td>
<td>Resultat från besiktning</td>
<td>Tona fönster</td>
<td>Favoritlistor</td>
<td>Klimat (värme, luft, sätte)</td>
</tr>
<tr>
<td>Film i baksätet</td>
<td>Hur långt bilen gått</td>
<td>Armstöd</td>
<td>Rattknapparna ska vara programmerbara till mina personliga val</td>
<td>Ljusstyrka från displayen</td>
</tr>
<tr>
<td>Volym i telefon</td>
<td>Lagring av körstil, automatisk anpassning av bilen ex nav pedalkänslighet.</td>
<td>Vad som presenteras i dimen och hur</td>
<td>Favoritfunktionen för navigering</td>
<td>Ratthöjd</td>
</tr>
<tr>
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<td>Softkeys/direktknappar</td>
<td>Favoritknappar i färddatorn</td>
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<tr>
<td>Grafik på dim</td>
<td>Lagring av sekvens av körning, fart kamera framåt, bakåt, sidor</td>
<td>Stol – höjd, rygg, rattärhet, nackstöd</td>
<td>Hur man vill växla, spak, paddlar, automat</td>
<td>Volym på radion</td>
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(Appendix C - Result brainstorming)
<table>
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<th>Effektivitet</th>
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<td>Alkoholhalt</td>
<td>Spelglar</td>
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<td>Känslighet på olika sensorer, back, kollision, varningar</td>
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<td>Blinkers ljud</td>
<td>Fysiologiska värden, puls, ögonrörelser, antropomatrisk data</td>
<td>Värme, klimat, fläktriktning</td>
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<td>Radiokanaler – inställningar på snabbknappar</td>
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<td>Display i bakrutan ex</td>
<td>Ljud, volym</td>
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<td>Ljusstyrka, färger</td>
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<td>Senaste inställningar för allt som är kopplat till min användare</td>
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<td>Möjliga softkeys inställningar</td>
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<td>Visning av info tex varräknare, klocka, trip</td>
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<td>Volym på radion</td>
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Din förarmiljö


Alla dina svar är helt anonyma

Tack på förhand!

Monika Nilqvist & Tomas Ericsson
1. Kön:
   □ Kvinna
   □ Man

2. Ålder: _____ år

3. Vad arbetar/studerar du med?
   ______________________________________

4. Om du använder dator, vad använder du den till?
   □ Använder aldrig dator
   □ Spel, film
   □ Ordbehandling/kalkylbehandling
   □ Bild/Grafik
   □ Internet, jobbrelaterat
   □ Internet, nöjesrelaterat
   □ Internet, privata ärende (bank, försäkringar etc.)
   □ E-post
   □ Annat: ______________________________

5. Hur många bilar kör du regelbundet (mer än en gång i månaden)?
   _______st

6. Hur ofta kör du bil?
   □ En gång i månaden eller färre
   □ Mer än en gång i månaden
   □ Mer än en gång i veckan
   □ Dagligen

   Märke: ______________________
   Modellnamn: ___________________
   Årsmodell: _______

8. Hur många personer har någon gång under det senaste halvåret använt den bil du kör mest?
   □ Ingen annan än jag
   □ 1-5 personer
   □ 6-10 personer
   □ Mer än 10 personer

9. Hur många är det som Regelbundet (mer än en gång i månaden) använder den bil du kör mest?
   ______ personer (inklusive dig)
10. Hur många nycklar finns till den bil du kör mest?
   _____st
   □ Vet ej

11. Hur använder du nycklarna till den bil du kör mest?
   □ Jag har min egen nyckel
   □ Jag delar nyckeln/nycklarna med någon annan
   □ Jag har ingen egen nyckel utan lånar en
   □ Annat: _____________________________

12. Har du något stolsminne till den bil du kör mest?
   □ Ja
   □ Nej
   □ Vet ej

13. Hur ofta ändrar du sätesinställningarna när du sätter dig i bilen?
   □ Aldrig
   □ Mindre än hälften av gångerna jag sätter mig i bilen
   □ Ungefär hälften av gångerna jag sätter mig i bilen
   □ Mer än hälften av gångerna jag sätter mig i bilen
   □ Varje gång jag sätter mig i bilen
   a) Om du ändrar sätesinställningarna när du sätter dig, vad är anledningen?
      _____________________________________________
      _____________________________________________

14. Hur ofta ändrar du sätesinställningarna under tiden du kör?
   □ Aldrig
   □ Mindre än hälften av gångerna jag kör
   □ Ungefär hälften av gångerna jag kör
   □ Mer än hälften av gångerna jag kör
   □ Varje gång jag kör
   a) Om du ändrar sätesinställningarna under tiden du kör, vad är anledningen?
      _____________________________________________
      _____________________________________________

(Appendix D – Survey, Swedish)
15. Hur ofta blir du irriterad över att någon annan har ändrat stolsinställningarna?
- Aldrig
- Mindre än hälften av gångerna någon annan har ändrat inställningarna
- Ungefär hälften av gångerna någon annan har ändrat inställningarna
- Mer än hälften av gångerna någon annan har ändrat inställningarna
- Varje gång någon annan har ändrat inställningarna

16. Hur ofta blir du irriterad över att någon annan har ändrat klimatinställningarna?
- Aldrig
- Mindre än hälften av gångerna någon annan har ändrat inställningarna
- Ungefär hälften av gångerna någon annan har ändrat inställningarna
- Mer än hälften av gångerna någon annan har ändrat inställningarna
- Varje gång någon annan har ändrat inställningarna

17. Hur ofta blir du irriterad över att någon annan har ändrat ljudinställningar (volym, balans, bas, källa etc.)?
- Aldrig
- Mindre än hälften av gångerna någon annan har ändrat inställningarna
- Ungefär hälften av gångerna någon annan har ändrat inställningarna
- Mer än hälften av gångerna någon annan har ändrat inställningarna
- Varje gång någon annan har ändrat inställningarna

18. Om du använder navigationssystem i bilen, hur ofta blir du irriterad över att någon annan har ändrat inställningar tillhörande navigationen?
- Använder aldrig navigationssystem
- Aldrig
- Enstaka gånger
- Mer än en gång i månaden
- Mer än en gång i veckan
- Dagligen

19. Hur bra stämmer nedanstående påstående med dig?
Jag anpassar alltid mina tekniska prylar efter mina behov.
- Instämmer helt
- Instämmer till stor del
Varken eller
Instämmer till viss del
Instämmer inte alls
I och med att allt fler funktioner och inställningar blir möjliga i förarmiljön behövs ett sätt att hantera detta. Ett sätt att göra det är genom att skapa så kallade profiler, det vill säga inställningar som är specifika för en förare. Den här delen berör hur intresserad du är att knyta ett antal inställningar till dig själv (din profil) i bilen.
1. Färg och utseende på display

I och med att bilarna får allt mer funktioner börjar det komma in större displayr i bilarna, som visar information om alla funktioner i bilen (radio, klimat, navigation, bilsystem etc.). Det finns möjlighet att ändra färg och utseende på den här displayen.

Jag är intresserad av att knyta displayutseendet till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________
_______________________________________________

2. Musiklistor

Det finns idag många olika musiksystem i bilen såsom radio, cd, mp3 och musiklistor kan innehålla radiokanaler eller favoritlåtar.

Jag är intresserad av att knyta musiklistor till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________
_______________________________________________
3. Körjournal

En körjournal är en funktion som kan spara information om hur en förare har kört. Den innehåller bensinförbrukning, trippmätare och genomsnittlig hastighet.

Jag är intresserad av att knyta en körjournal till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________

_________________________________________________________________

4. Välkomstmeddelande

När bilen startar visas ett välkomstmeddelande i en display i mittkonsolen. Förarens namn visas sedan diskret i displayen.

Jag är intresserad av att knyta ett välkomstmeddelande (med till exempel namn) till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________

_________________________________________________________________
5. Favoritknappar på ratten

På ratten finns det ett antal knappar varav några går att associera till olika funktionalitet. Till exempel går det att välja att en knapp ska ändra luftflödet och att en annan knapp ska ändra radiokanaler.

Jag är intresserad av att knyta favoritknappar till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________

____________________________________________________________________

6. Dölja/Visa information

I displayen finns det möjlighet att gömma eller visa viss information. Föraren kan välja att lägga till eller ta bort mindre nödvändig information (som temperatur, klocka, trippmätare, bensinmätare, information i menyerna).

Jag är intresserad av att knyta vilken displayinformation som ska visas till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________

____________________________________________________________________
7. Förarposition

Det finns ett antal inställningarna kopplade till förarens position; föraren kan ändra stol, ratt, speglar och pedalplacering.

Jag är intresserad av att knyta inställningar rörande förarens position till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: __________________________________________________________

_______________________________________________

8. Luftflödet

Det finns möjlighet att anpassa luftflödet med styrka, riktning och temperatur på enskilda fläktar för att bättre tillgodose förarens behov.

Jag är intresserad av att knyta luftflödet till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: __________________________________________________________

_______________________________________________
9. Kontaktlista

I likhet med telefonen finns det möjlighet att skapa en kontaktlista i bilen där det finns telefonnummer, adress och eventuell övrig information.

Jag är intresserad av att knyta en kontaktlista till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________

_____________________________________________

10. Resmål

I navigationssystemet kan föraren välja att lagra ett antal resmål. Det kan till exempel vara en släkting, en sommarstuga etc.

Jag är intresserad av att knyta ett antal resmål i navigationen till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________

_____________________________________________
11. Köregenskaper hos bilen

I bilen finns det möjlighet till att ställa in olika lägen på fjädring, chassi och styrning för att anpassa köringen både efter körstil och efter vägunderlag. Exempel kan föraren vilja ha inställningar som ger en mjukare köregenskap.

Jag är intresserad av att knyta bilens köregenskaper till mig själv

☐ Instämmer helt
☐ Instämmer till stor del
☐ Varken eller
☐ Instämmer till viss del
☐ Instämmer inte alls

Kommentar: _______________________________________________

12. Valfritt

Om något, hur skulle du ytterligare vilja anpassa din förarmiljö?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Appendix D - Survey, US

Your driver environment

This survey is part of an ongoing thesis project by students enrolled in the Cognitive Science program at the University of Linkoping. The aim of this survey is to investigate how the driver environment in a car can be improved and how the different adjustable settings in the car are used by the driver. Your answers are important to us and the questions have been carefully selected to generate a deep understanding of a driver’s behavior and attitudes towards the driver environment. Please answer each question to the best of your ability.

The results of this survey will be used in our ongoing thesis project and by Volvo Cars Corporation.

Your answers will be anonymous.

Thank you for your time!
Monika Nilqvist & Tomas Ericsson
20. Sex:
   - [ ] Female
   - [ ] Male

21. Age: ______

22. What is your current job description/occupation?
   ________________________________

23. If you use a computer what is the purpose of your use?
   - [ ] Never use a computer
   - [ ] Games, Movies
   - [ ] Word processing/spreadsheet
   - [ ] Pictures/Graphics
   - [ ] Internet, work related
   - [ ] Internet, leisure related
   - [ ] Internet, private business (internet banking, etc)
   - [ ] Email
   - [ ] Other: ____________________________

24. How many cars do you regularly drive (more than once a month)?
   ______

25. How often do you drive?
   - [ ] Less than a couple of times a month
   - [ ] A couple of times a month
   - [ ] A couple of times a week
   - [ ] Daily

26. Please fill in the information applicable to the your principal car, the car you drive on a regular basis.
   - Brand: _________________
   - Model: _________________
   - Year: _________________

27. In the last 6 months, how many people have used your principal car?
   - [ ] None other than me
   - [ ] 1-5 people
   - [ ] 6-10 people
   - [ ] >10 people

28. In the last month, how many people have used the principal car?
   ______ people (including you)

29. How many car keys does your principal car have?
30. How do you handle the keys to the principal car?
   - I have my own key
   - I share a key/keys with someone else
   - I borrow a key from someone else
   - Other: _____________________________

31. Does the principal car have a car seat memory?
   - Yes
   - No
   - I don’t know

32. How often do you adjust your car seat when you enter the principal car?
   - Never
   - Less than half the time
   - About half the time
   - More than half the time
   - Every time
   a) If you adjust your car seat when you enter your car, what is the reason?

33. How often do you adjust your car seat while driving?
   - Never
   - Less than half the time
   - About half the time
   - More than half the time
   - Every time
   a) If you adjust your car seat while driving, what is the reason?

34. How often does the fact that someone else has adjusted the car seat annoy you?
   - Never
   - Less than half the time
   - About half the time
   - More than half the time
   - Every time
   a) If you adjust your car seat when you enter your car, what is the reason?
35. How often does the fact that someone else has adjusted the radio settings annoy you?
- Never
- Less than half the time
- About half the time
- More than half the time
- Every time

36. How often does the fact that someone else has adjusted the climate control annoy you?
- Never
- Less than half the time
- About half the time
- More than half the time
- Every time

37. How often does the fact that someone else has adjusted the sound settings annoy you? (volume, balance, base, source etc.)
- Never
- Less than half the time
- About half the time
- More than half the time
- Every time

38. If you have a navigation system in the car, how often does the fact that someone else has adjusted the settings for the navigation system annoy you?
- Never
- Less than half the time
- About half the time
- More than half the time
- Every time

39. How well do you agree with the following statement?
- I adjust my technical gadgets to suit my needs.
  - I strongly agree
  - I moderately agree
  - Neither agree/disagree
  - I moderately disagree
A growing number of adjustable options in the driver environment have put new demands on the development and design of settings and functions. To deal with the growing amount of settings, manufacturers are looking at creating unique user profiles for each driver. Unique driver profiles tie together and save a number of settings that are specific for a person. The second part of this survey deals with which settings you may find interesting to include a unique driver profile.
1. Color and appearance of display

An increased amount of technology has lead to greater driver influence into the overall appearance and functionality of the display in a car. The display can show information about the climate, radio, navigation and diagnostics of the overall car.

I have an interest in including a specific color and appearance of the display to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment:  _______________________________________________
______________________________________________

2. Music lists

The entertainment systems in modern cars include different parts such as radio, cd, mp3 and music lists (radio stations and play lists).

I have an interest in including specific music lists to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment:  _______________________________________________
______________________________________________
3. Drivers log

A driver’s log will record information regarding how a car has been driven. It includes mileage, gas mileage, average speed, etc.

I have an interest in including a driver’s log to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: _______________________________________________

_______________________________________________

4. Welcome message

When the car starts, a welcome message is displayed in the center stack. The driver’s name will then discreetly appear in the display.

I have an interest in including a specific welcoming message (e.g. my name) to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: _______________________________________________

_______________________________________________
5. My buttons

A number of buttons are located on the steering wheel. Some of these buttons allow the driver to choose what function they should be associated with. For one user a button can be made to control the airflow in the compartment while for another user is made to control the navigation between radio channels.

I have an interest in including my buttons to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: _____________________________________________

6. Hide/show information

The display allows for the driver to choose if information should be shown or hidden. This allows the driver to exclude information of less interest and include information of more interest. Examples of such information are temperature, clock, mileage and gas usage.

I have an interest in including what information to show and hide to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: _____________________________________________

Comment: _____________________________________________
7. Positioning of the driver

Settings regulating the position of the driver can include the positioning of the seat, steering wheel, mirrors and pedals.

I have an interest in including my driver position to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: ____________________________________________________________

8. Airflow

It is possible to adjust the airflow and climate of the driver compartment. This includes adjusting the intensity, angle, temperature and separate fans to accompany the specific needs and preferences of the driver.

I have an interest in including the airflow and climate to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: ____________________________________________________________
9. Address book
Similar to how contact information can be saved in an address book it is possible to create a list of contacts in the car where phone numbers, addresses and other information can be saved.

I have an interest in including an address book to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: _____________________________________________

_____________________________________________________

10. Destination
In the navigation system the driver can choose a destination. Such destinations can be the address of a relative or a sports arena that you do not visit frequently.

I have an interest in including a list of destinations to my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: _____________________________________________

_____________________________________________________

(Appendix E - Survey, US)
11. Driving characteristics

The car gives you the option of adjusting the settings of how the car handles on the road. Different options are available such as adjusting the chassis, suspension and steering to accompany different roads and driving styles.

I have an interest in including driving characteristics in my saved settings.

☐ I strongly agree
☐ I moderately agree
☐ Neither agree/disagree
☐ I moderately disagree
☐ I strongly disagree

Comment: _______________________________________________
_______________________________________________

12. Optional

Except for the functions mentioned earlier, what settings would you like to be able to adjust according to your preferences and save to your settings in a driver environment?

___________________________________________________________
___________________________________________________________
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### Appendix E - Survey data, personal settings

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(Appendix F - Survey data, personal settings)
### Appendix F - Survey data, irritation

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## Sex * Irr.Ljud * Language Crosstabulation

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<th>Half the time</th>
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## Sex * Irr.Klimat * Language Crosstabulation

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Appendix G – Interview, supporting documents

Information till deltagare

- Vad gör vi?
- Vad handlar examensarbetet om?
- Vad handlar intervjun om?
- Frågar dig i egenskap av förare och inget annat.
- Frivilligt & Anonymt
- Vad används materialet till?

Inspelning sker under intervjun för att jag ska slippa anteckna så mycket under tiden. Är detta ok?

Några frågor?

Börja inspelning!

Fråga om inspelning igen.
Vi kommer att börja med några bakgrundsfrågor och sen diskutera lite frågor kring som finns kring personalisering och jag kommer att visa några exempel på hur det skulle kunna lösas.

**Några frågor?**

40. Kön:
   - [ ] Kvinna
   - [ ] Man

41. Vad arbetar du med?
   __________________________________________

42. Vad har du för märke eller modell på den bil du kör mest? Årsmodell?

   Märke: ____________________
   Modellnamn: ____________________
   Årsmodell: __________

43. Hur ofta kör du bil?

44. Hur många personer använder den bil du kör mest?
   
   a) Hur ofta använder de bilen?

45. Kan du justera ditt förarsäte elektroniskt?
   
   a) Har du stolsminne?

46. Har du en fjärrkontrollnyckel till bilen? (där du kan låsa upp bilen via en knapp på nyckeln)?
Om personliga inställningar

I och med att det kommer mer och mer inställningar i bilen, och att mer och mer inställningar blir elektroniska, behövs det ett sätt att hantera det här. Att ha så kallade personliga inställningar är ett sätt att hantera detta.

Tanken med personliga inställningar är att man ska knyta inställningar i bilen till en förare, så att den föraren slipper att ändra inställningar för att någon annan har gjort det. Detta kan ha fördelar såsom att man kan pilla mindre på inställningarna och att bilen känns mer anpassad.

1. Tycker du att det låter intressant med personliga inställningar?
   Varför?
   Vad är det som är intressant?

A. Vilka inställningar ska kopplas till föraren? (stol, speglar, radio).

A1. Om du fick välja, vad skulle du vilja ha till dina personliga inställningar?
   Varför?
   Ser du några nackdelar eller fördelar med att knyta den inställningen till föraren?
   Klimat, Körjournal, Displayinställningar?

A2. Vad skulle du inte vilja ha som personlig inställning?
   Varför?

Skisser


Några frågor?

Allmänt om systemet:

Bilen har en mittkonsol med en stor display (bild). Inställningarna är uppdelade i områden som styrs via display.
Radio, CD, Sound, Navigation, MyCar och …
Temperatur samt ljudvolym styrs via direktnappar.
I de exempel som jag kommer visa är de personliga inställningarna kopplade till 
nyckeln. Det vill säga exemplen bygger på att jag har min nyckel där mina personliga
inställningar finns, och min sambo har sin nyckel med sina personliga inställningar. Hur
det är löst kommer att framgå senare.

Några frågor?
B. Hur ska föraren förstå vilka inställningar som är sparade? (BILD: lista versus sparning vid varje inställning)

B1. Vad tycker du om de olika sätt att spara informationen? Ha inställningarna samlade i en lista eller spara vid varje funktion?
   - Vad är bra respektive dåligt?
   - Spara allt på en gång med en knapptryckning?
   - Varför?
   - Har du några andra idéer på hur du skulle vilja spara?

B2. Vad tycker du om att välja själv vilka inställningar som ska sparas till dig.
   - Varför?

B3. Hur detaljerat vill du kunna välja vilka personliga inställningarna som ska sparas till?
   - Varför?

C. När ska inställningarna sparas till föraren? (BILD: samma som ovan, aktiv och automatisk sparning)

C1. Skulle du vilja spara dina personliga inställningar aktivt eller skulle du vilja att inställningarna sparades automatiskt?
   - Varför?
   - Ser du några nackdelar eller fördelar med en sådan lösning?
   - Återkalla tidigare inställningar?
   - Någon annan ändrar under tiden?

   Minnesknappar. (BILD: beskriv minnet och listan)?

D. Hur ska man identifiera föraren så att inställningarna ändras vid rätt tillfälle? (ange problemen som uppstår vid identifiering i nyckeln: utlåning av bilen)

Beskriv de två lösningarna vi har (BILD: två knapptryckningar vs lägesknapp)

D1. Föredrar du någon av de här lösningarna?
   - Vad är det som gör att du föredrar det?
   - Finns det några andra lösningar du hellre skulle se?
   - Byta läge i display?

D2. Vad tycker du om att ha dina personliga inställningar kopplat till just nyckeln? (så som båda förslagen har)
   - Varför?
Slutfrågor

Om de här förslagen var möjliga idag, skulle du använda något av det?
  Vad då?
  Varför?
  Vad skulle du inte använda?

Har du något annat att tillägga?
Save it together


Det finns **två sätt att öppna dörren** med det här förslaget. Du trycker två gånger för att öppna bilen och då ställs dina inställningar in när du öppnar dörren. Du kan också välja att inte använda dig av de inställningar som sparats till nyckel genom att endast trycka en gång för att öppna bilen.

Har du identifierat dig med nyckeln så visas ditt **namn** (eller det namn du valt till din nyckelprofil) diskret på **displayen**.

Några exempel på hur det är tänkt att fungera:

**Exempel 1:**

**Exempel 2:**
Om någon lånar din nyckel i det här förslaget så öppnar dom genom att endast trycka en gång. Bilen används då utan att dina inställningar görs när bildörren öppnas. Ändras något i bilen när du öppnat på det här sättet så sparas inte ändringarna.
Save it separate


Om du vill spara något till dina personliga inställningar så görs detta genom att spara till nyckeln. Inställningar sparas under respektive funktion. I radiomenyn kan du välja att spara radioinställningarna till nyckeln och i navigationsmenyn kan du välja att spara navigationen till nyckeln (bild).

I det här exemplet finns även en nyckelprofil-menyn under MyCar>Nyckelprofil. Gå igenom listan och sedan ”koppla till stolsminne”. När du sedan öppnar bilen ställs de inställningarna in som du har gjort på tilldelad stolsknapp.


Några exempel på hur det är tänkt att fungera:

Exempel 1:

Exempel 2
Om någon ska låna bilen av dig så ställer du nyckeln I läge “från”. Det gör att du kan låna ut bilen utan att personen som lånar din nyckel kommer åt dina inställningar. De ändringar som görs av denna person påverkar inte dina inställningar eftersom nyckeln inte är aktiverad.
## Appendix H - Results, interview subjects background

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<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
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<td>Provning – instrument</td>
<td>Center-stack</td>
<td>Global Marketing, brand and product experience</td>
<td>Special vagnar</td>
<td>Ekonomi</td>
<td>Strategisk form och kommunikation</td>
<td>Inköp (process utveckling vid inköps-processer)</td>
<td>Eftermarknads-frågor Serviceverkstäder</td>
<td>Inköpare</td>
<td>Marketing sales / safety issue</td>
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<td><strong>Remote control</strong></td>
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Appendix I – Blom’s disposition and effect of personalization

Blom’s Dispositions (benägenhet) to Personalize Appearance:

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<th>Disposition</th>
<th>Description</th>
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<tr>
<td>Frequency of use</td>
<td>– if used frequently the likelihood of personalizing would increase</td>
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<tr>
<td>Ownership of system</td>
<td>– if the user owns the system they are more likely to personalize</td>
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<tr>
<td>Knowledge of Personalization</td>
<td>– awareness of, and knowledge of, how to personalize has an effect on whether or not someone personalizes an application.</td>
</tr>
<tr>
<td>Ease of personalization</td>
<td>– perceived level of difficulty to personalize.</td>
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Table J.1 Disposition to Personalize (Bloom 2003)

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<tr>
<th>Feature</th>
<th>Description</th>
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<td>Effectiveness of personalization features</td>
<td>– the effect of the personalization must be effective. They must efficient in eliciting emotions, express the identity of the user or make the product appear to be easier.</td>
</tr>
<tr>
<td>Socioemotional context of use</td>
<td>– motivation and socio emotional functionality both play a part.</td>
</tr>
<tr>
<td>Cost of Personalization</td>
<td>– effects if the person will personalize.</td>
</tr>
<tr>
<td>Absence of Technical Constraints</td>
<td>– it must be technologically possible to personalize if the need arises.</td>
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<tr>
<td>Seasonal and Media influences</td>
<td>– a specific holiday (Christmas) or media event (Olympics) will affect your willingness to personalize</td>
</tr>
<tr>
<td>Peer Influence</td>
<td>– If many of your friends personalize their product you will likely be influenced to do the same.</td>
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<tr>
<td>New to the system</td>
<td>- if a system is new to a user the likelihood of personalization is greater (maybe because of the novelty of personalization).</td>
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<tr>
<td>Blom’s Effects of Personalization on the User:</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td>by personalizing an application the product will be perceived as being more easy to use.</td>
</tr>
<tr>
<td><strong>Improved aesthetics</strong></td>
<td>the product becomes more aesthetically pleasing to the user (an emotional effect).</td>
</tr>
<tr>
<td><strong>Recognition of system</strong></td>
<td>making the device distinctive and easily recognized, An emotional and functional effect.</td>
</tr>
<tr>
<td><strong>Reflection of Personal identity and reflection of group identity</strong></td>
<td>a way of distinguishing oneself from others at the same time as identifying oneself as a part of a group or value set.</td>
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<tr>
<td><strong>Familiarity with system</strong></td>
<td>by focusing on different features of the system, the familiarity with the system increases.</td>
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<td><strong>System feels personal</strong></td>
<td>the system feels personal.</td>
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<td><strong>Feeling of control</strong></td>
<td>personalizing a device can increase the feeling of control.</td>
</tr>
<tr>
<td><strong>Feeling of ownership</strong></td>
<td>personalizing a device can increase the feeling of ownership.</td>
</tr>
<tr>
<td><strong>Release of boredom</strong></td>
<td>being able to do adjustments to the appearance of an application can improve the elicitation of emotions in the user.</td>
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<tr>
<td><strong>Fun</strong></td>
<td>feeling of amusement or fun</td>
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<td><strong>Positive Associations</strong></td>
<td>personalization evokes positive associations in the user.</td>
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<td><strong>Attachment to system</strong></td>
<td>personalization is a process contributing to a feeling attachment to a system.</td>
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<td><strong>Accommodating current emotional state</strong></td>
<td>personalization could be seen as a way of regulating one’s current feelings</td>
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Table H.2 Effects of Personalization (Blom 2003)