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How can a user-interface best suit individual user experience level?

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ABSTRACT

The user interface of a computer program is generally static, in design and information retrieval as well as the actual task, which does not necessarily suit all the users when they have such a potentially different starting point and knowledge level.

By this work we hope to gain a better understanding of how a user interface may be designed to better suit the individual users experience and skill level, with the aim is of seeing if it is possible to include some dynamics in the interface, allowing it to adjust itself to better suit the users experience and skill levels and also to take into consideration factors such as aging and dynamism.

The objectives have been to search the literature and extract the factors most likely to influence interface suitability. This involves a thoroughly examination of existing literature in order to extract factors that are considered vital to the process of interface adoption.

Further, to create a questionnaire targeting a population consisting of people in different age and skill level.

By analysing the outcome of the survey, to determine if the result conforms to the literature, and summarise the result to come up with some guidelines for better user interface design. The guidelines were used to create a sample application to integrate a dynamic interface into a current application.

By actively using these guidelines they will contribute to the user interface and interaction by a higher degree of personalization.

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I certify that the work presented in the dissertation is my own unless referenced

Signature.

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CHAPTER 1: Project outline

The aim of this dissertation is to come up with a set of guidelines or techniques to be used to get a higher focus on individualization in the user experience of standard software to the end user. User experience is in this setting first of all the users interpretation of the interface as such, but also the whole interaction process between user and application is taken into consideration.

1.1 Introduction

As a data consultant and owner of my own company the primary daily focus is primarily software development. This brings me in contact with a lot of people using software developed by my company. The users have different skill levels and range in age from quite young people at about 25 years up to elderly people at about 70. The level of interest that people have for computers in general, and desire to use it as a working tool, also varies a lot. This is probably why the basic knowledge level varies a lot also when it comes to general tasks, such as backup, copying files, zip/unzip files and even basic knowledge as to when to click/double-click or what mouse button to use.

The user interface of a computer program is generally static, in design and information retrieval as well as the actual task, which does not necessarily suit all the users when they have such a potentially different starting point and knowledge level. Furthermore, most of the user interfaces are designed by computer programmers who sometimes make “obvious” assumptions not necessarily known or understood by the user (Gregor et al, 2002; Notess and Lorentzen-Huber, 2007). Developers often have a good knowledge of the tools used to create the interface, but knowledge of the communication process between user and the interface is lacking (Nielsen, 2002). Focus factors is generally how to cover expected functionality, time and cost.

With all this in mind, what if the user interface was designed so it could better fit the individual user experience level, also taking factors including aging and dynamism into consideration. Can an interface be made to dynamically adjust itself or “learn” from the user? Such an interface would have several benefits; it would better suit a broader range of users; it would create less frustration for users; and as a result, would help create a positive position in the market, ultimately leading to

increased sale of the product. The question of wherever an interface can dynamically adjust itself is the question we will be looking at in this work.

1.2 Research aim and objectives

We hope to gain a better understanding of how a user interface may be designed to better suit the individual users experience and skill level, with the aim of seeing if it is possible to include some dynamics in the interface, allowing it to adjust itself to better suit the users experience and skill level and also to take into consideration factors such as aging and dynamism.

The first objective is to search the literature and extract the factors most likely to influence interface suitability, in order to support our problem aims. This involves a thoroughly examination of existing literature in order to extract factors that are considered vital to the process of interface adaption. This is done in chapter 2.

The second objective is to create a questionnaire to a population consisting of people in different age and skill level, extract from relevant information concern desired interface needs and desires a review of the questions and a justification of using questionnaire as a data collecting tool will be included in chapter 3.

The third objective is, by analysing the outcome of the survey, to determine if the result conforms to the literature, and summarise the result to come up with some guidelines for better user interface design. This work is considered in chapter 4.

The fourth objective is, by using these guidelines, to create a sample application to integrate a dynamic interface into a current application.

1.3 Research approach

We will consider what has been written earlier concerning the topic of user interface design. We will focus on how data will be perceived from the user's point of view. In addition we will research what has been written on related topics including aging, dynamism and web content. And finally to come up with what are the critical factors in the communication process between user and user interface.

What is important here is the focus. There is a lot of literature and tools on designing user-interfaces and almost all of them start from the developer's point of view. The number of literature and tools are quite limited if one want to start from the users point of view.

1.4 Dissertation outline

The rest of the dissertation is organised as follows:

Chapter 2 provides a critical review of the related literature, in order to extract the factors most likely to influence the aim of this work.

Chapter 3 is a review of the questions and a justification of using this questionnaire as a data collecting tool.

Chapter 4 is the capture and analysis of collected data. The objective is to compare findings with the literature, and summarise as a set of guidelines to better help user interface design.

Chapter 5 to help describes development of prototype code to support the interface of an existing application. The mouse over effect is however presented in a separate small demo-application.

Chapter 6 is describing the guidelines in detail that this work has lead up to.

Chapter 7 is summary of work stating the problem, what contribution this work has done to it, and what might be done to further investigate the topic.

CHAPTER 2: Literature review

The literature review has been divided into several categories: the first relating to pure interface design; the second dealing with usability; the third looking into problems/subjects concerning elderly people; the fourth dealing with dynamism in user interface design; and the last covering issues that fit into more than one of these categories.

These categorisations have been done because they all have importance for the aim of this work and there is very little literature targeting the exact aim of this work.

2.1 Interface Design

If we look some years back we see that user interface (UI) design has traditionally not been seen as a very important factor in software design. Specialists in human factors were often seen as bureaucratic obstacles blocking heroic developers (Caroll, 1997) with naive focus on engineering optimality. Yet this is a view that is changing with increased commercial focus on usability and user-focused interaction.

The user interface of most computer programs has traditionally been static, in design and information retrieval. The actual task has been static, which does not necessarily suit all the users who have different starting perceptions and levels of knowledge.

Further, most of the user interfaces are designed by younger computer programmers who often make assumptions that are not necessarily understood by the user (Gregor et al, 2002; Notess and Lorentzen-Huber, 2007). Programmers often have a good knowledge of the tools used to create the interface but knowledge of the most effective interaction process between user and the interface is lacking.

To understand the details in the interaction process we must also understand the cognitive, perceptual and motor components which have been a long-running challenge in the design process (Olson and Olson, 2003).

To be able to use individuality as a target factor in user interface design, we must understand the requirements of the end user; a challenge that only few have focused much time on up to now. The aim of this work is to try to find factors influencing

individuality that may be adapted in the interface design process. To be able to do this we have to look at some of the factors influencing interface design, starting with usability.

2.2 Usability

Traditionally usability has been seen as a relatively unimportant factor (Isaacs et al, 1995; Olson and Olson, 2003; Patel et al, 2006). Accordingly a greater effort has to be made to make the user interface more compatible with the capabilities of the users (Verinikina and Gould, 1998).

Isaacs et al, (1995) have done work on successful cooperation between Software Engineers and Human Interface Engineers. Some of their findings are interesting, though seem obvious such as “design before coding”, “testing regularly” and “testing realistic”. In their conclusion they say that a product’s functionality, performance and reliability are still valued more than its usability. This has traditionally been true, but has changed in the last years. There has been a growing focus on design and a growing awareness of these factors not being separate from functionality issues.

Another factor concerning the user’s apprehension of usability is how the interface gives feedback to the user. Appropriate feedback gives the user a better understanding of how the system actually works (Lockton et al, 2008b). A better understanding is an important motivation factor and an important factor in all learning processes by minimising the difference between the users cognitive understanding of the model of the system, and the actual model of the computer interpretation of what the user wishes to accomplish (Verenikina and Gould, 1998; Wang, 2008). Catching the user’s attention and interest are important factors in all interface design (Shneiderman, 2000) and must be taken into consideration in the design process. Movement can be used as a tool in this connection, but must be used with great caution (Petersen and Nielsen, 2002).

Usability is closely connected to design, and the fact that design has been less focused may have a lot to do with the complexity, time and expenses required to make a good user interface (Quiroz et al, 2007a). Most development tools have toolkits, libraries and guidelines to help design the user interface, however often these guidelines are either too specific or too vague meaning interpreting guidelines unambiguously (Quiroz et al, 2007a).

With the traditionally low focus on design, this has most certainly influenced usability. It has only been in the last years that there has been a growing focus on usability due to the fact that user-groups such as elderly people, with different needs and demands, are coming on the scene in a greater numbers and with a greater commercial influence than earlier. When a group like this also is economically strong they start to become interesting to the software vendors as a customer group. Elderly people has become such a group, they stay longer active in work and has become economically stronger as a group in the last years. Since there has been a transfer of more and more availability of official information and services from pure office orientation to the internet over the last years, there has also been a growing official interest of involving elderly people in using a computer and internet as a tool.

2.3 Elderly People

A rapidly growing user group over the last years is the elderly people. From 2007 and up to 2010 the number of users above 65 years is expected to double (Notess and Lorentzen-Huber, 2007). Elderly people is not just the concern of those who start at 65 years (Nielsen, 2002) of age and up, since we will all sooner or later will be involved in age-related changes.

A challenge when it comes to usefulness is the large span in age since the number of seniors using internet, and therefore accessing a lot of user interfaces, has increased dramatically the last years (Notess and Lorentzen-Huber, 2007). This is further focused by a group study of older adults where as much as 53% of the frustrations in using various technologies had to do with design issues (Notess and Lorentzen-Huber, 2007). This may be explained by, as they also mention, the user interfaces developed by younger designers, who simply do not know the special concerns that must be taken into account to suit older users (Gregor et al, 2002; Notess and Lorentzen-Huber, 2007; Nielsen, 2002). The result of this may be a communication breakdown (Patel et al, 2006). If the process itself is unknown to the user it will be difficult to know what questions to ask or what information to look for, this will ultimately end in frustration. In their work on web-based interfaces Patel et al. (2006) stating that understanding the communication between the user and interface is important. However, it is believable that their findings also are important for user interfaces in general and not only web-based interfaces.

Increased knowledge is important, especially to elderly people, to reduce the negative feelings of using a computer. Most of them have not grown up with computers, as in contrast to the younger people of today where computers are an integrated part of their daily life. This leads to barriers due to lack of technical and software knowledge, and a major reason why elderly people have such negative feelings towards technology. The key to reduce these negative feelings will be through enlightening those individuals to the advantages that this technology has to offer. To achieve this it has to be done in a positive way by adopting constructive, self-directed techniques (Campell and Wabby, 2003).

The span in age and dynamism is a topic taken very little into consideration when developing user interfaces. This explains some of the reason why elderly people generally find it hard to work with computers. Even if more elderly people discover the possibilities of internet and computers, this process could be even easier with more focus on these factors in the design process.

2.4 UI Design

The user interface (UI) has evolved, from simply be a way of entering data in the early years, to today's advanced user interfaces combining several techniques and a lot more focus on the user and the communication process between user and the computer (HCI[1]).

The tools for UI-design have also evolved over time, from paper sketching techniques to today's highly sophisticated graphical tools. It is difficult, if not impossible, to state that one technique or tool is better than another. It depends largely on several parameters including: target, complexity, functionality, number of users, development environment (both persons and tools), current knowledge, capital or financing, just to name a few.

Brath (2002) describes a technique of using paper landscapes for visualising the design process, which help the different actors in the design process to achieve a common understanding of the task being solved. The difficulty, however, is the difference between the design artefact and the actual implementation. He point at the importance of resolving design/visualization issues prior to the start of coding due to the level of effort of later adjustment.

[1] HCI – Human Computer Interaction

The technique is interesting but probably most suitable for large system development, with many different stakeholders involved. For simple desktop solutions this may be seen as extensive, but describing the design as an iterative process of requirement collection, proposing designs, test and collect feedback is applicable also for small systems. The technique of paper landscapes is probably a bit outdated, as Brath (2002) also indicate by saying that better tools will replace paper landscapes in the future. A similar technique was presented by Landay and Myers (2001), who used paper sketching to generate the most functional design. The available UI design tools were missing this kind of flexible functionality. Another design method is presented by Leong (Leong, 2004) called conversational design where the idea is to use the same smoothness and efficiency in device interaction as when two people having a conversation. The idea is good but probably difficult to integrate in a design tool.

Lockton et al, (2008a) present persuasive design under the title “Design with intent”. This is a method to guide or give the user only valid selections in his interaction with the user interface (e.g. use of defaults and interlocks). The method may be used to achieve changes in behaviour of the user. This is not included as automated functions in design tools of today but would be an advantage. To achieve this today the designer/programmer must explicit by doing it in the tool; it is not automatically done by the tool.

There are a lot of articles on design, many of them presenting a list of design rules for interface design, (Computer Training, University of Washington, 2008; Hammell, 2008; Nielsen, 2007; Nielsen, 2008), and there has been a growing focus of the importance of design over the last few years. One of the pioneers using graphics to present quantitative information was Edvard Tufte (Computer Training, University of Washington, 2008), who came up with a set of design rules for when to use graphics and not.

Many of these design rules overlap with each other research work, but some work is distinct, like Nielsen focusing on senior citizens (Nielsen, 2002), and Tognazzini focus among others on colour blindness (Tognazzini, 2005). Wheeler Atkinson et al. (2007) did some work on summarising these rules to come up with a “Multiple Heuristics Evaluation Table (MHET)” (Wheeler Atkinson et al, 2007).

Other approaches have also been developed. User interface design built upon a technique called observe-orient-decide-act (OODA) has been described by Hammell (2008) leading up to a general checklist for UI-design consisting of 7 questions. Leung and Apperley (in Card et al. (1999) pp 350-367) point at the problem associated with viewing of large information systems where data is presented through a small window. They present distortion based presentation techniques for help with viewing graphical data. In the context of this work the bifocal transformation technique might be of interest. This technique may be of help also when it comes to making information more achievable in a context of aging and dynamism (Notess and Lorentzen-Huber, 2007).

Traditionally software has been developed for the mass market with factors concerning aging and dynamism very little in mind. Software tends largely developed by younger people, however, are not so concerned about this issues (Gregor et al, 2002; Nielsen, 2002; Notess and Lorentzen-Huber, 2007). Over the last years there has been a growing focus on this issue of web applications and sites, this is due to the fast growing amount of elderly people starting to use internet (Notess and Lorentzen-Huber, 2007).Older individuals are a group of people with good economic standing and who have a lot of spare time who are therefore an attractive customer group. However on desktop solutions the concern for this user group seems to be almost totally absent. There is a need to be focus more attention to the design of future software development cases. Seniors, as defined by Nielsen (2002), being 65+ is mostly at the last part of their active working period, but more and more seniors stay in their job even longer. In a strict working environment with difficulty of getting new skilled people, elderly people already in the business will be encouraged to stay longer in their positions. Computers, with internet connection, are becoming much more common for seniors to have in their home environment, and support a higher need to focus on this group in the design of desktop solutions.

One other aspect of user interfaces that has no had adequate focus is the computers (perceived) personality. This has been studied by Nass et al, (1995), whose findings state that people in a human relationship prefer to interact with other people with a similar personality to them self. Their findings state that this is also valid for human computer interaction.

In what direction is interface design moving? We can get an idea by looking at products such as Microsoft Surface (Microsoft, 2008b). Although this is quite specialised software (and hardware), and has limited usability concern for the mass

market it gives a hint of what may be expected of UI-design tools in the future. We are moving towards the use of touch screens, and toward the replacement of the mouse as a pointing device by simply using a finger. However, in desktop solutions it is believable that the mouse will still be used for many years to come since it is a so well established and a practical tool for this kind of application. An article in the Norwegian paper “It-Bransjen” referred to a statement given by Bill Gates early in 2008 saying that mouse and keyboard will be outdated in a few years and replaced by touch-screens (It-Bransjen, 11-2008), however, this is probably a bit to definite. As long as mouse and keyboard is a more suitable tool than touch-screens it will certainly still be used.

An important factor that has attracted considerable focus in the last years in the area of user interface design is the ability to “educate” the user whilst using the interface. If the user, by using the interface, can enter an interactive educational process towards the application or its underlying business process, she/he will be better off in recurring use of the interface (Klein, 1999). This may be quite a challenge for the design process because the application must be made as self-descriptive as possible (Strauss et al, 2003), but by achieving this, the knowledge and effectiveness in the organisation as a whole will be better (Skillsoft, 2007). An important factor achieving this is to introduce dynamism in the user interface design.

2.4.1 Dynamism in UI Design

Dynamism in this setting is the ability for the user interface to adapt itself to the user’s usage pattern and skill level. Most common up to now is static design, being exact the same interface for all users with no individuality to what skill level the users represent.

Some interesting work in the field has been done by Maloor and Chai (2000). The system they describe may very well be used with minor changes to achieve the goal of this dissertation. The system described in their report is a help desk system using modules and agents to adapt the dialog behaviour and subsequently updating the environment. They have used a system where they have defined a novice, moderate and expert level. The user is given points based on a reward/punishment base according to the actual goal and taking factors as complexity and time elapsed into consideration. What is less focused is the user interfaces itself and the actual

communication between the user and the interface. They touch this subject by indicating that a better understanding of the user cognitive process and human perception is desirable. Some work in the same direction has been done by Maeda et al (1999) describing a database interface that adapts itself to the users skill level. Parameters as type speed, miss-typing, number of help calls and accumulated time of use is parameters they use to estimate the degree of users skill. They come up with some useful conclusions, such as when a user is a beginner, it may be better to reduce the content of commands in menus to increase understand ability and readability. However, it is doubtable that type-speed and miss-typing is the best parameters for determining the user's current skill level. If we, for example, look at elderly people they may not have perfect vision and motor control (Nielsen, 2002), which will certainly have impact on issues such as type-speed and miss-typing, but they may still very well have a high skill level of the actual topic.

Use of historical data can improve user experience. Current software fails to integrate historical data from user interaction into their design (Pelaprat and Shapiro, 2002). This will make the application "learn" from the user's interaction and help present the right information to the user at the right time. Users might have to invest considerable effort in order to apply the knowledge to their own ends, developing an understanding of its shortcomings and particularities, as well as building on it. If we could capture traces of this knowledge work, others with similar needs might find as much value in talking with users of this knowledge (Thomas et al, 2001).

There has been a growing focus on design issues, which are in addition to functionality. However, there has been less focus on the human factor and the cognitive process to better fit the individual user experience level also taking factors as aging and dynamism into consideration. A better understanding of this process is desireable. Malor and Chai (2000) and Quiroz et al (2007b) state that "knowing how to incorporate user input is still a significant research challenge".

One of the difficulties facing developers of adaptive software, interfaces, and help systems is the uncertainty associated with assessing the needs of a specific user (Hui and Boutilier, 2006). In web services the environmental factors seem to be a driving force for adoption (Ciganek et al, 2006), one may suspect the same to be a parameter also for traditional non-web applications.

Probably the most important surface-level misfit is between user and the system (Blandford et al, 2005). They define three cases: user concepts not represented in the system, system concepts not accessible for the user, and cases where user and system concepts are similar but not equal.

In several standard applications, as MS Office and others, there is a possibility for customisation, but to use it you have to know where to find it, or at least know it exist to be able to look it up. This is a limiting factor of a solution as not all users know the application well enough for this assumption to be true. This way of customisation is also static, since it has to be re-set for a new user using the same application.

Brusilovsky (1997) is describing a technique called “stretchtext”, where a key or hot word like a link in an ordinary document may result in going to a new page, the hot word using “stretchtext” is simply replaced by a more explanatory text.

This technique may be difficult to append in the static layout of a form (Windows) without “disturbing” the form, but one may use a variant of this like a tooltip or balloon text triggered in the same way.

Movement or animation in user interfaces may be an efficient technique to “catch the eye”. It may, however, be depending on level of intrusion actually reduce the usability by preventing or disturbing the user from getting the task done (Petersen and Nielsen, 2002).

Adaptive hypermedia is a technique used by many companies, especially on the internet. It can be seen in use at primary sites including Google, Yahoo and Amazon. It is presented as an alternative to the “one-size-fits-all” approach to software development (Brusilovskiy, 1997, 2001). By building a model of the user’s goals, preferences and knowledge of each individual user, it is possible to present personalised information to the user. For example, Amazon will present the user with offers of books at the same type as he/she earlier bought. From earlier orders, and what pages the user has viewed, they also try to present an overview in accordance with the users interests. This is also combined with a presentation of what others have bought in addition to what the actual user has bought. This is closely connected to the user’s interaction history, the sequence of actions and the relationship of actions (Wexelblat, 1999) and might give an indication of the user’s skill level as well as some indication of the user’s personal preferences.

In this context, keeping a track of the user characteristics, as goals/tasks, knowledge, background, experience and preferences is of interest, but also to determine the users personality, as introvert/extravert, cognitive factors and learning styles (Brusilovskiy, 2001).

In the context of this dissertation adaptive presentation (Brusilovsky, 1997) is of interest by referencing the individual user's current knowledge, goals and other characteristics, being in able to for example, present a more in-depth and detailed information to the experienced user than the novice. A great challenge in the design process is to be able to mirror the user all the way from novice to experienced and autonomously adapt itself to the user's current state at any time (Maeda et al, 1999). It is important to present the user with the relevant information in the user interface and not expect the user to search for or gather information. Present the user with all the information needed for each step in the process (Tognazzini, 2005).

Another aspect and area of personalisation is the actual look of the user interface. Up to now the user interface in software has given little room for personalisation concerning the aesthetics, fun and the user's self-image (Brinkman and Fine, 2005). We see this as skinning techniques, mostly used in software targeting the younger user (media players, games). In its simplest form it just give the user at run time an opportunity to change factors such as background colour, pictures and font styles, but more advanced it may also influence on the actual interaction style (Brinkman and Fine, 2005) and considers factors, such as wherever the user has an extroverts or introvert personality. This may affect how the user actually sees the interface, if it is annoying or comfortable. A design targeting the extrovert personality seems to be an important factor of the first impression of the interface (Karsvall, 2002), a possible pitfall for the designer in this context will be to see his/her own personality as being "standard".

What we plan to look into is whether we can make a user interface dynamically to adjust itself or "learn" from the user; or at least to choose a skill level, taking the user experience level into consideration and also including factors as aging and dynamism into the design. If this can be achieved I believe we may get a user-interface adjusting to the user and not vice versa resulting in a better and more communicative interface. Ben Shneiderman (1996) wrote that the opportunity for dynamic displays takes user interface designers well beyond current wisdom. The development of tools and technology has evolved since 1996 and the impression is that we are closer to implementing efficient dynamic designs. The visualisation

techniques he present is, however, useful to keep in mind in a design process and absolutely relevant. This, first overviews the work, then zooms and filter, and then details on demand. This is relevant to the visualization itself, but he also mentions relations (to other items), history (of actions to support undo and replay), and extraction (of sub-collections).

Still, if a dynamic interface is desireable, we must keep in mind that since the user personality is different from person to person; there are most certainly also users that don't want this functionality. They may find it disturbing and find themselves disconcerted and disoriented by the altering behaviour of an adaptive or intelligent interface (Grey, 1988). Therefore it may be wise in the design to make it possible to turn off or at least minimise this kind of functionality.

Dynamism and a growing awareness of individuality in interface design may result in some interesting tools in the coming years.

2.4.2 The future of UI Design

It is impossible to predict the future, but it is interesting to see in what direction and criteria some major companies indicate the evolution to take place.

Bill Gates earlier this year said that keyboard and mouse will be outdated in a few years and replaced by touch screens (It-Bransjen, 11-2008). In some application areas it certainly is possible, like interactive public displays and information jukeboxes (Strauss et al, 2003), but for simple data entry the keyboard will still most probably be the most practical tool. Microsoft has come up with a product called Surface adopting a lot of these techniques and possibilities (Microsoft, 2008a) with no other interaction than the touch screen.

Hewlett-Packard (HP) has recently presented a new series of PC's called HP TouchSmart. Four models with 22" and 25.5" touch screens, the largest ones will be presented on CeBIT 2009 (Hewlett-Packard, 2008). However, these models still come with full keyboard and mouse.

We will probably move towards more use of touch screens than we see today, the next generation of the windows operating system, Windows 7 from Microsoft, will include full support for touch screen technology (Microsoft, 2008b).

As a Microsoft Certified Partner my company was invited to a meeting with Steve Ballmer (CEO of Microsoft) 30/9-2008 at Microsoft's premises here in Norway, and an opportunity came up to ask him if there is any effort done to be able to

automatically adjust the interface to the users “knowledge level” to optimise the user experience and increase usability in standard “off the shelf” software from Microsoft (ex. MS Office). His answer was quite general and saying that Microsoft was attempting to make the software so general and easy to use so that it will suit all users.

2.5 Personal Justification

One reason I have decided to consider this research topic is because of my experience with colour blindness. This is a factor very few have considered in the literature, yet it is a fact that a lot of people experience (Tognazzini, 2005). As much as 8% of males and 0.3% females (source: Wikipedia) suffer from colour blindness. In some internet sites one may see background and text colours that looks smeared together, which is quite frustrating. Very few with colour blindness are absolute colour blind, most has some weakness with certain colours, and most common is red/green colour blindness. Red and green are seldom mixed but they may both be mixed with other colours as certain shades of brown. Pink and some shades of blue may also be easily mixed.

When designing an interface and more than 8% might suffer from colour blindness, this is a factor that should be considered in the design process. My own experience in this case is that it is easier to see details where the difference between the greyscale of the colours are significant than where the greyscale is close to each others. An easy way of checking this (when you’re not colour blind) is taking a printout on a black and white printer of the designed interface, if the colours are close to each other in greyscale, consider changing the colours.

2.6 Summary

In this chapter the current literature has been reviewed with focus on design and dynamism in user interfaces. These factors have traditionally had very little focus in the design process, but with new user groups, better tools and technology, this area is becoming a greater focus for research.

The literature review raises some tasks further to be investigated through the questionnaire:

- Many have pointed at difficulties regarding elderly using the web (Campell and Wabb, 2003; Nielsen, 2002; Notess and Lorentzen-Huber, 2007). These difficulties may also being adaptable to human-computer-interaction (HCI), age related questions will therefore being investigated.
- Users can not be expected to look for functionality (Tognazzini, 2006), and lack of knowledge may result in ineffective use if the user is not even aware of the existence of the function (Patel et al, 2006). Visualization of functions will therefore be investigated.
- Conformity to the user has been discussed earlier and the topic will be investigated further.
- Use of animation is a great tool for “catching-the-eye”, but must be used with great care not irritating and disturbing to the user (Petersen and Nielsen, 2002). The use of animation effects will be investigated further.

Next chapter is about methods used for data collection, why they were chosen and why other methods weren’t. Also included is the selection of respondents for the questionnaire and their geographical distribution.

CHAPTER 3: Methods

The choice of methods for data collection can be a challenge. There are several possible tools in a setting like this. A quantitative method only, using a questionnaire, has been chosen for several reasons justified here. Further, why certain questions were asked and how the responders were selected is also justified in this chapter. Methods for software development are discussed and a justification of why ethical approvement was considered necessary is included in this chapter.

3.1.1 Why use questionnaire?

The choice of using questionnaire only as a quantitative tool for data collection is not obvious; it is not ideal but judged to be an acceptable compromise in this situation.

A combination of several methods, both quantitative and qualitative, including questionnaire as one of them, might have been better than just the questionnaire alone.

A mock-up or test installation presenting different layouts and techniques and observation, with qualitative methods as interview and possibly by video-filming the participants would probably have been a better test. Interviews of the participants following such a test installation would helped widening the base for the data analyze.

However, this would have required a lot of resources, and not to mention time which is very limited within the time limit of this dissertation in addition to my regular full time job. In this context a questionnaire is considered to be a reasonable compromise. It is accomplishable within the limited resources and time frame. These techniques may, however, to advantage been taken into consideration in future work on this topic.

The questionnaire was distributed on the web and an invitation to participate was sent by e-mail (see 3.2 for how participants were selected). One may argue that using e-mail invitations requires the participants the condition of knowledge of how to use e-mail, however, e-mail is one of the basic knowledge's and some of first to learn to use when starting with computers.

The decision to use online questionnaire was based on several factors, first of all earlier successful experience with this type of distribution. Secondly, it is fast and

simple both for distribution and data collection through e-mail. Third, it is cheap, if regular mail had been used just the cost of envelopes/stamps for 260 letters would have been considerable in addition to the extra time it would have taken to collect the address information and print it all. Fourth, the data collection is simple; using e-mail returns the answers could almost directly be copied and pasted into Excel for further management. The submitted questionnaire was given a unique number for identification and the data extracted for further analyses. The analyses was done using Excel, SPSS[2] and XMDV tool[3].

The distribution of the questionnaire to the web, however, caused some problems. The questionnaire was first designed to be put on the web-server of my company and use FrontPage Server Extension's for the reply to be sent to me. The company hosting my company web-pages had just before this done some work with active directory (AD) on the server, resulting in the server extensions not to work. They had no time and resources to fix it on a short term. The alternative was to use my internet service provider (ISP) where my private web-pages was sited, however this ISP did not either support FrontPage Server Extensions.

The final solution to this problem was then to rewrite the questionnaire to use Java scripts in stead of FrontPage Server Extensions. This was done and the questionnaire was put on the web at my ISP.

3.1.2 Composition of questions

Composing the questions to be able to extract as much information out of the questionnaire as possible may be a challenge. Only closed questions have been used to ease the processing of the responds. The goal in this work is to try to extract from the participants their attitude to certain aspects supposed to increase the individual user experience. Not all may have any clear understanding of this but some might. Some of the questions are therefore made to get an idea of the participant's current knowledge level and the state of consciousness when it comes to questions like this.

A brief explanation of the questions found in appendix A is given below.

[2] SPSS – A professional data analysing tool, available from http://www.spss.com
[3] XMDV tool – a tool for analysing multivariate data sets. Available from: http://davis.wpi.edu/xmdv/

1. Several questions use the notion “ordinary” or “standard program”. This question was asked to make the responders reflect on what was meant with this notion and given them an opportunity to choose such a program which they already knew. With this reference it would make it easier for them in later questions and most probably reduce the amount of errors or “don’t knows” in the answers when referring to “standard software”.

2. The aim of this question was to get en indication of the user’s general usage of the PC, but also function as a reference or being a state of conscious for the user with regards to the rest of the questions.

3. Agile work on a PC includes the awareness of the existence of a help system and how to find it. In this question the aim was to get an idea of the person’s general knowledge of how to get help in Windows. Looking up help may solve a lot of questions. From some years with customer support issues we experience easiness for the user rather to pick up the phone than looking it up their self simply because they don’t know or at least don’t remember at the moment how to get help from the program. By encourage the user through design to look up and probably solve the problem themselves the degree of learning is also higher and easier remembered next time.

4. Following this question was a link to a small page demonstrating mouse over technique and buttons for adjusting the font size up and down. Most internet-browsers got a function of adjusting font size, however quite few users seem to be aware of this, therefore it is appropriate to add this function to the question for clarifying what the question was about.
   The aim here was to see how the attitude towards changes of font size, as in many web-browsers, would be if adopted in a standard program.

5. This is similar to previous question, but focusing on buttons in the form. The aim was to get an idea of the attitude towards certain dynamism in the buttons, and also to see if this has any correlation with age. Most probably there will be a mixed response to this question, some will see it as an advantage but others may find it disturbing, one must be particular careful with to much animation in an user interface (Petersen and Nielsen, 2002).

6. Almost all standard programs have a firmly defined design both when it comes to the user interface as such but also the usage. The aim of this question was to see if general issues to the standard software they referenced was consider being difficult. Compared to age it may give some information if data is apprehended to be more difficult for older than younger people.

7. Many general attitudes to age may include sayings as:
   - older people are more careful than younger
   - older people are not grown up with computers and are therefore more sceptic to computers than younger
   - older people are more reserved to changes than younger
   - older people are more concerned of security than younger

   This question gives the user some expressions to consider related to sayings like those above. The aim of the question is to see if there is any firmness in sayings of this kind related to age.

8. One of the major aspects of this work is to see if it is possible to adapt some individual adjustment to standard software. It would then be interesting to know what the user's attitude to this is regarding usage pattern. One big challenge here is to get the user to really know what the subject of the question is, and afterwards to judge to what extent the answers is relevant. Did the user really understand the question?

9. This is similar to the previous, but focusing on competence. The same concern goes for this question regarding the users understanding of the question.

   Both question 8 and 9 are related to functionality almost absent from standard software and might therefore be difficult for the user to have a defined opinion about. This must be considered when analysing the response, however both questions are of such relevance to the subject of this dissertation so it is acceptable to ask them.

10. In some literature the fact that standard software is developed targeting a "standard user" is stated. The question was intended to se if there is a general awareness of this or not possible related to age.

11. Interest of data or computers in general may be a factor influencing on several of the topics in the questionnaire. The aim of this question is to get the users own judgement of his/her general interest of data. This may be interesting to compare to the next question, but also to see if there are any variations related to age and possibly also sex.

12. This question is similar to the previous, but asking for the users own judgement of his/her general knowledge of data. This may be interesting to compare to the previous question, but also as for the previous one to see if there are any variations related to age and possibly also sex.

13. This question asks how long the user has had access to a computer. Most of the users are expected to have had access for several years, but as a reference to some of the other questions this might have value to the degree of certainty.

14. Asking what kind of internet connection the user has. This is mostly informative only, though most users have access to broadband.

15. Asking of how many computers the user may access at home. Mostly informative only but may, as for question 13, compared to some other questions have value to the degree of certainty.

16. Age and sex are both important factors related to the topic of this work. It is believable that there are distributions in answers to several questions regarded to particularly age but possibly also to sex.

No personal details were collected to identify the actual respondent, therefore date and time of submission was also collected to be able to go back to the actual respond form if necessary. This information was used to mark those who had answered and a reminder was sent to the rest after two weeks from first invitation. The questionnaire was closed and replaced by an information sheet after four weeks total available on net.

3.2 Selection of participants

The participants were selected from what was available to me of person's with an e-mail address.

My current business deals with customers from all over Norway, but Norway only. Primarily this is taxi-owners, running their own business, and using my company's software package TAXI*total*. These customers were the largest group counting about 185 of the total 260 addresses. Further about 30 were private contacts, relatives and friends. The rest was other contacts, mostly business related.

One may argue that the group of responders, especially with such a large group of business owners, may not be statistically significant and reflect the general opinion to give a neutral and well balanced answer profile. This might very well be so, but working with some of these people over several years as customers, talking with many of them by phone, it is believable they are representative to be used for this questionnaire. The knowledge level of computers and software in general is varying from novice to expert. The same goes for the interest of data in general varying from no interest at all to all absorbing interest.

The geographical distribution of the respondents was spread over most of the country but with a concentration around Oslo and eastern parts of the country, simply because most of the invitations were sent to this area, see fig. 4.1 for details.

The survey was conducted in Norwegian, simply because all the participants were Norwegians, but also because many, especially elderly people, have a limited knowledge of English.

3.3 Software development

My first idea regarding software was to develop a sample application, with focus on the findings in the literature and from the survey, to see if they were correct. This is also what was stated in my first submission.

A sample application is however not very useful unless it is tested to get a feedback from the users. It might be a check to see whether or not the findings are applicable, but more interesting would be to get some actual feedback from the users.

The findings through this work is also not easily conducted in one application due to the fact that it is rather several improvements to current designs than a complete new way of doing the design.

Based on this the decision was done to implement some of this functionality into the actual production version of TAXI*total* (see last of appendix B for details) to easier find out if this really works. The risks by doing this is considered to be very small due to the fact that the functionality in question did not change the basic functionality of the program, it rather expanded it. One function, the mouse over effect (chapter 5.3), was not implemented. In my judgement, this might have been too controversial and therefore a too high risk to take to implement (We can't afford too many angry customers). Instead a small application was made to demonstrate the effect.

3.4 Ethical issues

When involving persons is part of the research, the Ethics Committee of Brunel University requires an ethical approvement. Due to this an application for ethical approvement was applied and the statement of ethics approval was received beginning of august 2008 from the Ethics Committee.

The Ethics Committee demands the following to be informed:

- The survey is voluntary, and the participation is free and one may withdraw from this survey at any time.
- The survey is anonymous, the participant will not be asked for name or other information which may be associated with or used for identification of the individual either now or in future.
- Collected data will be confidentially handled; all collected data will be deleted latest after 2 years.

This information was presented to the participant through the consent form, being the first page accessed from the link to the survey distributed through the invitations to the participants. A read verification had to be given by the participant to proceed to the actual survey.

Other ethical issues: As a student I will be respecting other people's point of view; dealing with fellow students and staff professionally and reasonably, respecting privileged project information that might be gathered from a company or from individuals; and finally taking responsibilities for my actions.

3.5 Summary

Chapter 3 has looked at the different questions in the questionnaire, including a justification of each question and of the choice of using only a quantitative tool as a questionnaire for data collection.

Further is an overview of how the participants were selected, a short overview of the software developed, and the issues related to the achievement of getting ethical approvement prior to the survey.

When the data has been collected the answers will be compared to what is written in the literature review. Hopefully this will lead to a better understanding of the factors of importance, and by this be in able to come up with some guidelines for better user interface design, the analysing of the data collected is in the next chapter.

CHAPTER 4: Analysing Data

The data received from the survey has been analysed to see if there were any correlation between the answers or if any direction of attitude among the responders could be found. Of special interest was any evidence of age related issues and if there were any correlation between own apprehension of knowledge and expressed knowledge to the extent it is possible to measure within this survey. An indication of the attitude towards more visualisation and active content is also of interest.

4.1 Introduction

A total of 260 invitations was distributed by e-mail, 19 mail addresses were rejected giving 241 active invitations. From the active invitations there were 76 subjects (n=76) answering the questionnaire giving an answer percentage of 31.5%.

The subjects were in the age span from 22 to 70 and with an average of 50 years. 59 of the subjects were male and 17 female. Almost all (97%) has had access to a PC for 5 years or more and 90% use broadband connection for internet access.

These numbers are quite close to the official statistics indicating 86% of the households having access to a PC and 84% having access to internet (Statistics Norway, 2009). The slightly higher numbers in this investigation may be explained by the quite high part of business people among the subjects.

		#	%
Total invitations		260	
Rejected		19	
Active invitations		241	
Number of answers		76	31.5%
Male		59	77.6%
Female		17	22.3%
Age	22-70	Avg. 50	Median: 54

Fig. 4.1 Overview of invitations and feedback

Figure 4.1 is summarising the number of invitations and answers in a table.

The demographic distribution on sex, occupation and to a certain extent also age in the responds is not ideal, but is a function of the invitations not having an ideal demographic distribution either. A greater population with a more even demographic and geographic distribution would have been better, however, the data set received is considered to be statistically significant in this setting.

Geographically the distribution of invitations was sent all over Norway, from Kristiansand in the south to Kirkenes in the north, from Bergen in the west to Oslo in the east. The answers also spread over the whole country; however the concentration was from around Oslo and eastern part of the country.

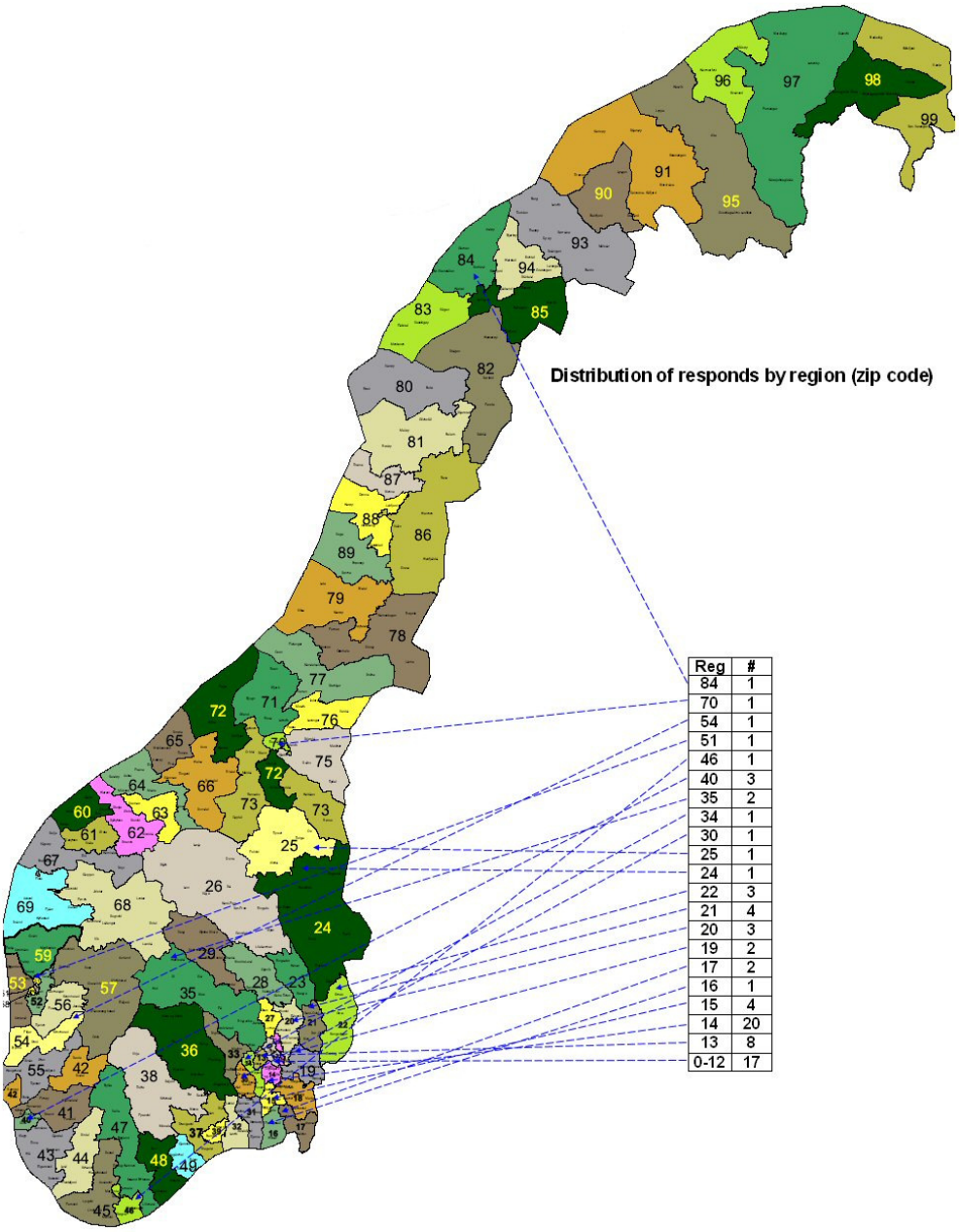

Fig. 4.2 Distribution of responds (map from www.posten.no)

The geographical distribution of the answers is shown in fig. 4.2. The table to the right of the map shows the number of responders by each region, were region is defined by the two first numbers in the responder's zip-code.

4.2 Analysing

The answers were received as e-mails and manually copied into Excel for refinement. Some responders had not answered all questions; the missing answers were registered as “don’t knows” to get an consistent set of data. This might be a source for erroneous analyse, but it is believed to be the best choice in this setting. This has been taken into consideration in the analyses and the “don’t knows” has not been used to any extent in this analyse. There are 3 questions with a percentage of “don’t knows” above 20%, that is question 4.1 firm change of font size, 5.1 if mouse over effect of buttons were considered disturbing, and 5.2 if mouse over effect of buttons were considered irritating. From the topic of these questions and the fact that few were blank on these three it is believable that the result is representative. The actual numeric value of the “don’t knows” is set to 0 to easily be able to exclude or leave them out of the analyses.

Excel has in addition to register the data from e-mail returns, been used to make some calculations on average and distribution of data. Excel has also been used to make the input files for SPSS and XMDV with some manual work in Notepad as well.

SPSS has, as the excellent statistical analytic tool it is, been used to determine if there is any significance in the results through a Pearson Correlation analyse. It has also been used for some comparisons by use of scatter plots. The input file for SPSS was produced directly from Excel simply by saving the data as a csv file.

XMDV is an excellent tool for visualisation of multidimensional structured data sets (see footnote on page 18). The visualization through parallel coordinates with the ability for brushing is especially useful for visualising coherence in the data. The okc format to be used with XMDV was made in the same way as for the csv-file, but with tab’s as separation of data values. The rest of the information needed in the okc file as, dimensions, titles and range of values, were manually registered by use of Notepad. The range values were achieved through SPSS by making a Descriptive Statistics report of all the variables. (SPSS: Analyse -> Descriptive Statistics -> Descriptives)

4.2.1 Expected findings

Many have pointed at difficulties regarding elderly people using the web (Campell and Wabb, 2003; Nielsen, 2002; Notess and Lorentzen-Huber, 2007). We may suspect these difficulties also being adaptable to human-computer-interaction (HCI) in general regarding elderly people and should therefore also being visible in this survey.

Using SPSS a Pearson Correlation was conducted on the data from the survey to see if there was any significant correlation in the material. The only findings related to age (R16_AGE, x-axis on fig. 4.2.1) was a weak correlation (.234*) against question 7.2 the importance of avoiding installing SW on own PC on web-applications (y-axis in fig. 4.2.1).

These findings indicate that age does not seem to be a major factor in this context. A scatter plot (fig. 4.2.1) of these two variables indicates that most of those who see this as important is of age 40/45 and above.

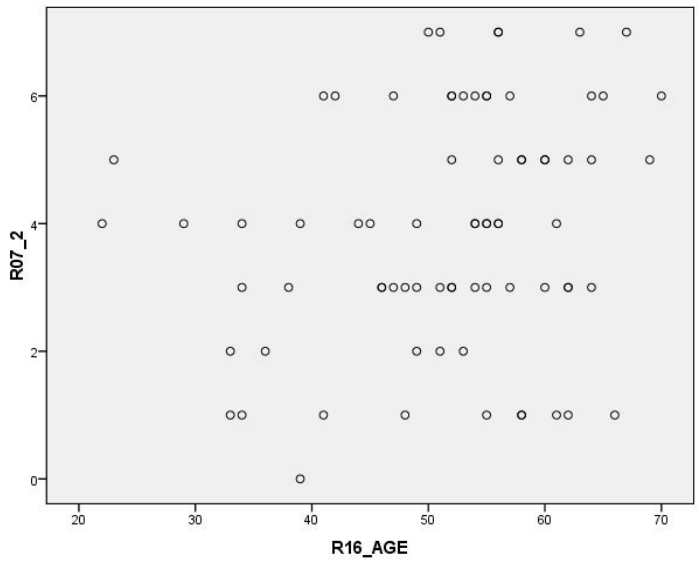

Fig. 4.2.1 Correlation between age (X) and “don’t have to install” (Y)

One possible explanation to the lack of age related correlation in this setting may be the age as such. Among all the subjects (n=76) only 5 were of age 65 or above which is the age used to define elderly in the literature (Campell and Wabb, 2003; Nielsen, 2002; Notess and Lorentzen-Huber, 2007). The total number of subject is also relatively low; a larger data set would absolutely been desireable. With a larger number both totally and the number of elderly, one may suspect a more defined result on age

related matters. This may be a factor of interest to address in future work where a larger number of subjects are involved.

Another age related finding using XMDV tool and compare age to “own interest of data” (R11) and “own knowledge of data” (R12) indicates that younger people judge their own interest and knowledge generally higher than older people. Figure 4.2.3 show these questions compare to age where age is brushed for ages below 50 (average) and question 11 and 12 is brushed to show values of 3 and above.

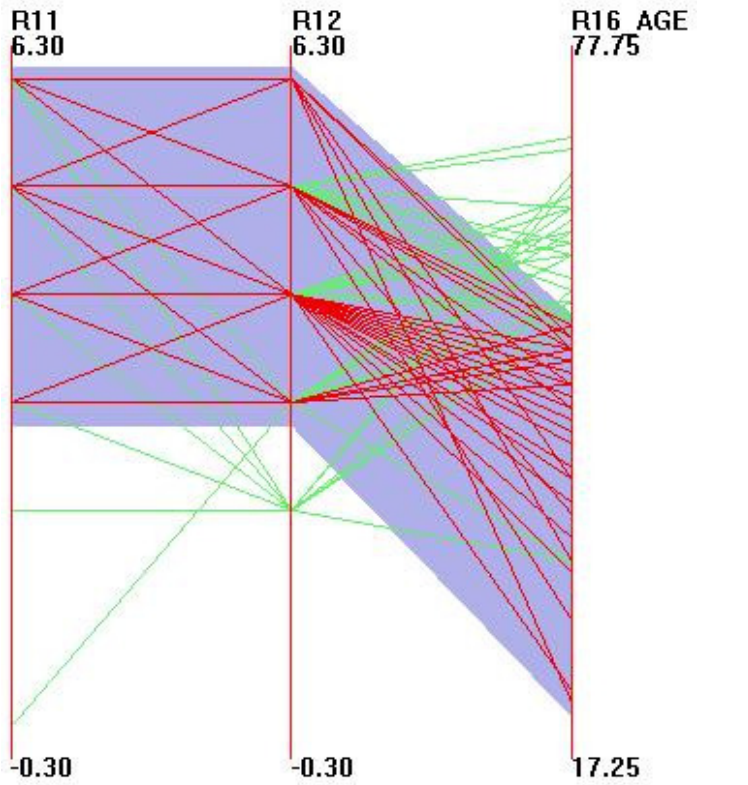

Fig. 4.2.2 Comparing own interest (R11) and own knowledge (R12) to age (R16_AGE)

All the XMDV figures show the different questions on the X-axis and their answer-value on the Y-axis. A question named R03_1 refer to being responds on question 3 first part-question, R03_5 being fifth part-question and so on. The scaling of the graph for each variable is shown with its min-value at the bottom and max-value below the title on the top. The min- and max-values has been set with some padding of the values for clarity in the graph and values not touching border lines. Related to fig. 4.2.2 the numbers 17.25 and 77.75 is the min- and max-age in years, the numbers -0.30 and 6.30 is the padded value of the answers ranging from 0 to 6 where 0 is “don’t know”. This explanation goes for all the XMDV graphs below.

4.2.2 Other findings

Using SPSS the Pearson Correlation show a strong significant correlation between responses on question 12, how do you judge your own knowledge of data (R12) and question 3.5, how to find help by pressing the button with a question mark (R03_5). What is interesting, however, is that this is not the case between question 12 (R12) and question 3.1, how to find help by pressing the F1 button (R03_1). This tells us that quite few know that these two buttons actually have the same function in most windows programs. This finding will justify a higher focus on visualisation of these functions in the user interface design.

There is also a weak correlation between 3.6, asking how to find help on the menu line (R03_6) and 12, how do you judge your own knowledge of data (R12).

These findings are also supported by a negative correlation for those who have answered “don’t know” to question 3.6 (R03_6) and question 12 (R12).

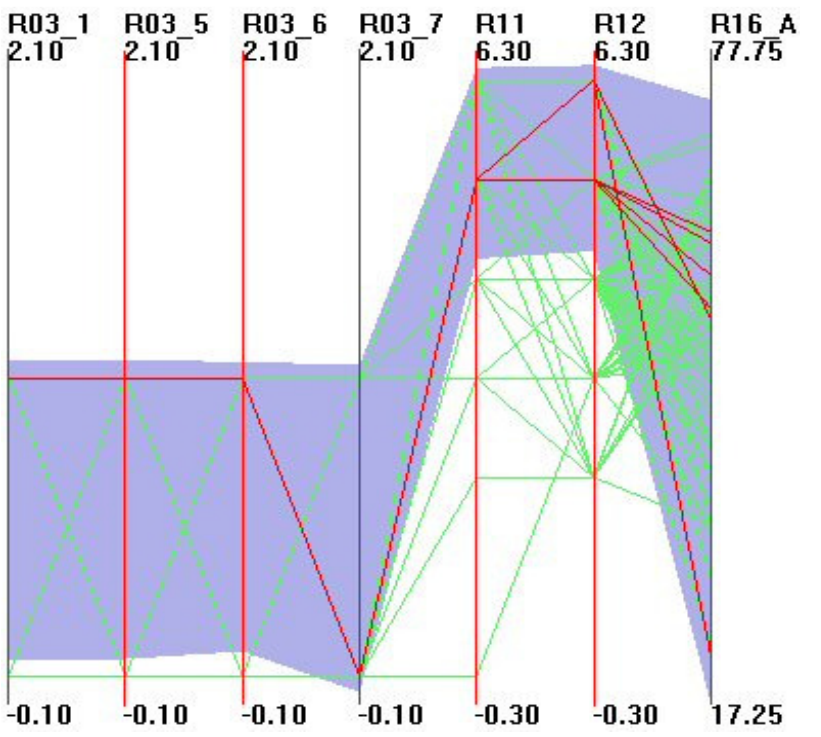

Fig. 4.2.3 How to find help (R03_1–7) related to knowledge (R12) and interest (R11)

The results of these findings are definitely interesting in this context and justify a better visualisation of the help functionality. A higher degree of visualization will make the usage of functionality in the program more intuitive and should be considered important in the design process of the user interface.

There is also a strong correlation between questions 11, how do you judge your own *interest* of data (R11) and question 12, how do you judge your own *knowledge* of data (R12). Because interest is often closely connected to knowledge (Verenikina and Gould, 1998; Wang, 2008) this must be considered an expected result.

A correlation, not very strong however, exist between question 13, for how long the household have had access to a PC (R13) and question 15, how many PC's do you have access to (R15), indicating that people with several years of access to a computer seem to have more than one computer.

Question 4 and 5 were dealing with animation effects. Expected findings her were certain scepticism for animation effects, this does not seem to be the case based these answers:

Question \ Answer	1	2	3	4	5	6	#	Avg
R04_1: Firm change	3	4	12	21	12	6	58	3,91
R04_2: Mouse over	3	5	13	13	19	12	65	4,17
R05_1: Disturbing	10	18	8	9	9	4	58	3,02
R05_2: Irritating	10	19	7	9	7	3	55	2,87
R05_3: Probably an advantage	7	9	14	16	14	7	67	3,63
R05_4: Very good	9	5	13	12	12	10	61	3,70

Fig. 4.2.4 Responses on question 4 and 5

The table show each question and the number of responds with values from 1 to 6 where 1 is "not interesting" and 6 is "very interesting", the total number of responds and the average answer excluding "don't knows" is also shown.

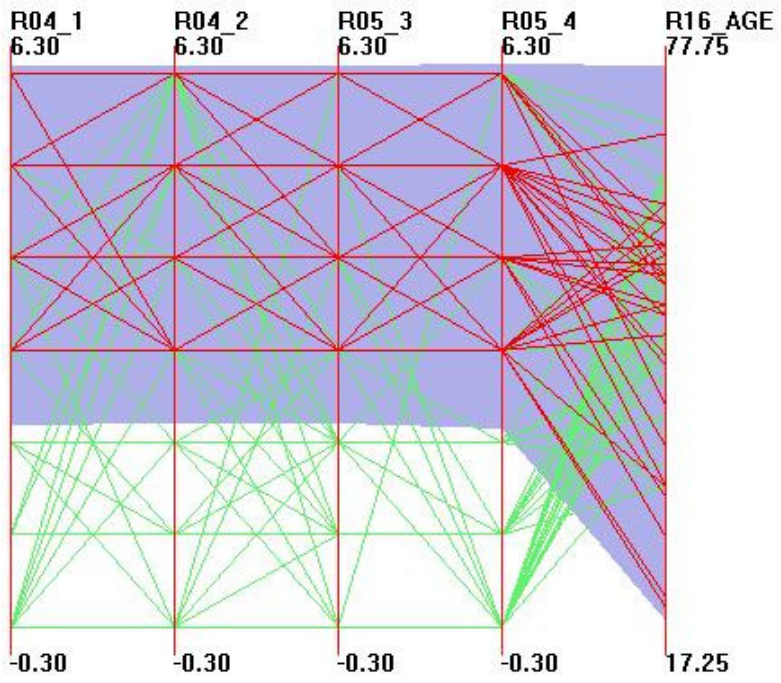

Fig. 4.2.5 Question 4 and 5 related to age

By illustrating the numbers in the table with XMDV (fig. 4.2.5) we clearly get the same picture as in the table. Figure 4.2.5 is brushed to show only answers of value 3 and higher on a scale from 0 to 6 for questions 4.1, 4.2, 5.3 and 5.4. We see a generally positive attitude to animation effects within all the age span; a greater scepticism was expected due to the possibility of generating irritation and frustration (Petersen and Nielsen, 2002). This indicates an opening for more animation effects to be considered the design, however, we still believe this has to be used with caution and, if possible, given the user a possibility to turn off this effect.

Question 8 and 9 were of special interest in this setting regarding conformity to the user. Question 8 was asking for the responder's attitude to the program learning and conforming to the user's usage pattern, and question 9 was asking the same but for the user's skill level.

Comparing the answers to age one may suspect that older people would appreciate this conformability; however, a comparison between age and this question using XMDV seem to indicate the opposite. Younger people are more open to the program conforming to their usage pattern and skill level.

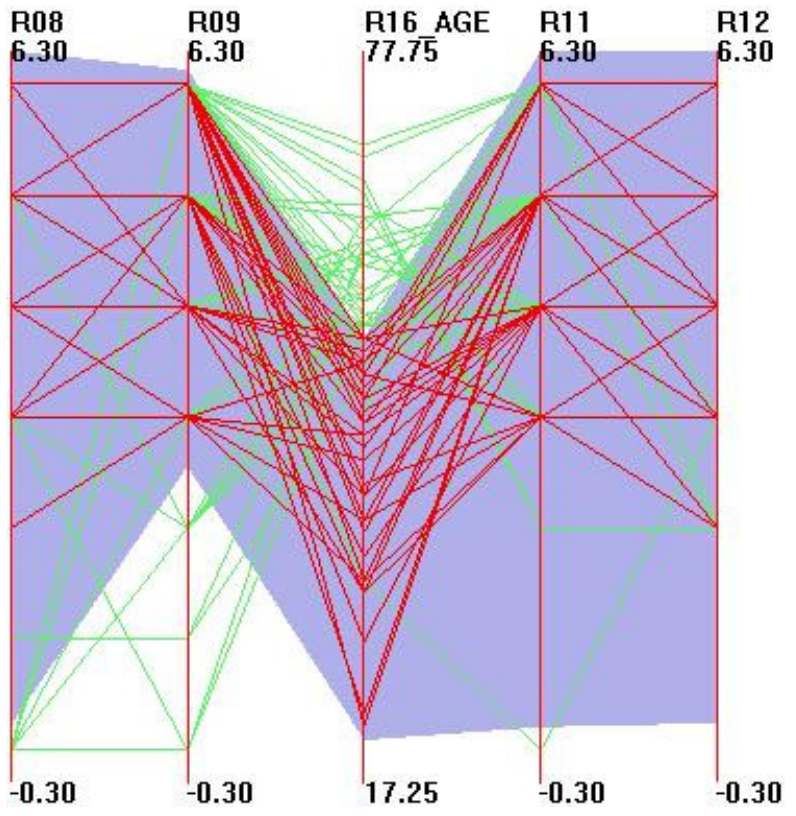

Fig. 4.2.6 Brushed to show age below median

These findings are illustrated in figure 4.2.6 where it has been brushed to show responders with age up to 54 years (median value) and an answer of 3 or higher on question 9. We see that none below 54 years have answered less than 3.

There might be several explanations of this finding. Elderly might have a higher scepticism to changes in general, younger people are grown-up-with computers and see them more as a natural tool than elderly, and the latter may have lead to a greater degree of confusing among elderly by simply don't fully understand the question.

If there is a higher scepticism among elderly, as these findings may indicate, this may also imply on adaptive interfaces, and of this reason this would be a question to be looked into in future research.

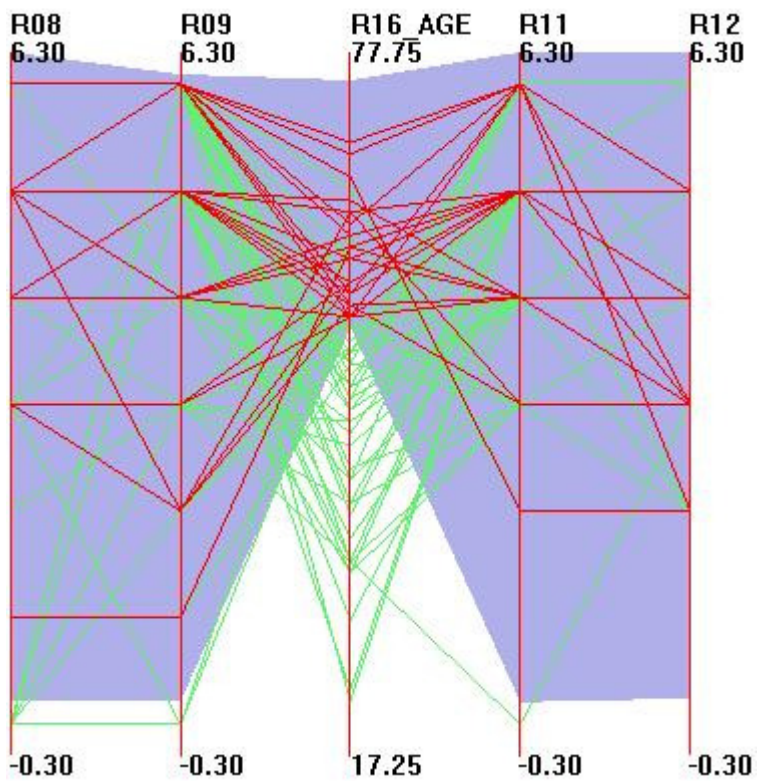

Fig. 4.2.7 Brushed to show age above median value

If the brush is changed to show values for those above 54 (median value) we find answers with values also below 3 on question 9 (fig. 4.2.7) which further strengthen the comments on figure 4.2.6.

The findings related to age is interesting; one may, however, keep in mind the relatively low amount of data this is based on. Of the total number of 76 responders 40 were up to including 54 years of age. Younger people are, to a greater extent, “grown up with” computers, this may be a factor influencing on the result (Campell and Wabb, 2003). They may simply better being in able too see the possibilities in the question asked than elderly. However, this is just a thought, it may not be so, but in future work addressing a larger population this would be interesting to look deeper into.

Adding sex to the scene gave an interesting aspect (fig: 4.2.8). It seems that females generally have higher answers on question 8 and 9, than males. However, we must have in mind here the relatively small amount of only 17 females of the total population of 76, but it may give an indication and raise this as a question to be investigated further on a larger population.

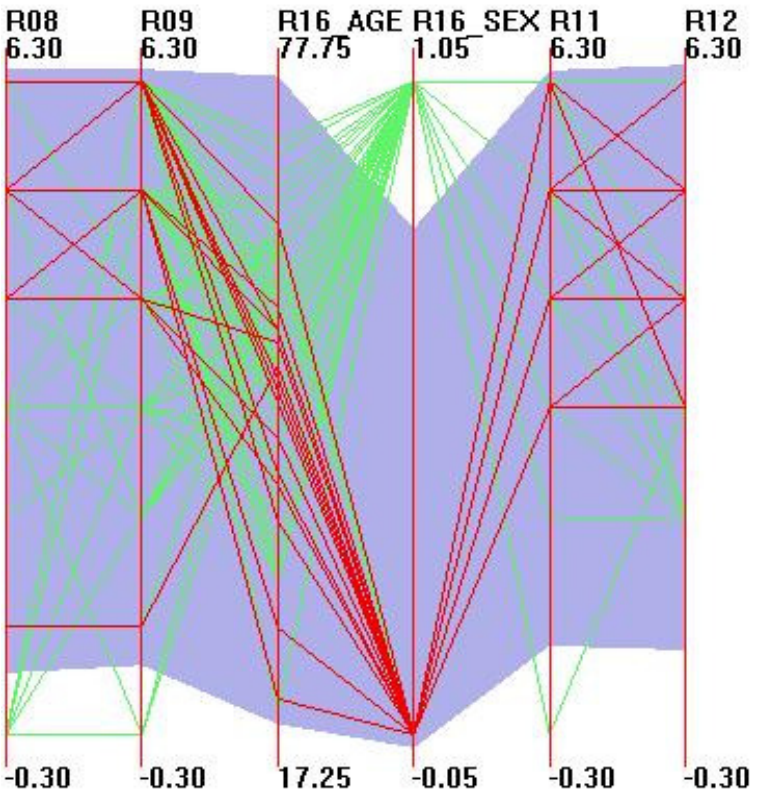

Fig 4.2.8 Adding sex to the scene, brushed for female

The figure 4.2.8 is basically the same as previous, just adding sex and brushed to show all ages and females only (in red). Females have the numeric value 0 and male 1 (range with padding from -0.05 to 1.05) in the figure. We see that most of the female answers on question 8 and 9 are having a value of 4 or higher.

4.3 Summary

Several of the analyses done are indicating just small correlations between certain values. The number of responders has only been 76; an assumption is that a larger number of responders probably would have influenced on the findings giving more defined correlations.

However, based on the findings age does not seem to matter as much as expected. Younger people seem to be more open to dynamism in the program by letting the program conform to their usage pattern and skill level.

The results from question 3 related to where to find help also indicate that visualising such functionality is important for people to actually find it when needed.

Use of animation effects is indicated to be more acceptable than expected.

The results of these findings, with a strong influence from the literature review, have been used to create a set of guidelines (Chapter 6) that is the basis for developing the prototype code. We expect these guidelines to be useful for other designers too.

Next chapter is describing the development of code used for implementing the functionality based on the findings in this work.

CHAPTER 5: Prototyping

The code has mostly been included in an existing application, TAXI*total,* instead of making a dedicated test application. The application is used by taxi-owners for registering of shift, salaries and for accounting.

The decision to include it in this application instead of making a dedicated test application is based on several issues. First of all, the findings are of different kind and would not easily been put into the same test application with a satisfactory result. Secondly, a sample application would be for test purposes only to demonstrate the technique. A better approach will be to actually test in on the users.

However, a small test application was made to demonstrate the mouse over effect on buttons. This was done because it was found too risky to implement this in the production version of TAXI*total,* it have to be refined and tested a bit more before this can be done.

5.1 Introduction

The TAXI*total* application is written in Microsoft Visual Basic 6.0 as the development tool and with a Microsoft Access 2003 (Jet 4.0) database to store the data.

All the communication with the database is done via ADO[4]/SQL[5] calls and updates to the database is done via T-SQL[6].

The application was chosen of practical reasons. Because it is a product of my company there were no problems regarding legal rights or any other bureaucratic obstacles to use it. It also got a number of active users which may contribute with feedback. This application is my company's main product and we expected functionality found in this work to be of such interest that this also gained the use of the application.

[4] ADO: ActiveX Data Objects, a Microsoft API
[5] SQL: Structured Query Language
[6] T-SQL: Transact SQL

5.2 Creating and updating history menu

A history menu, as implemented here, was added to ease the use of the program. This was achieved by putting the most used functions in the program, specific to the actual user, in one place for easy access later.

This functionality uses a table in the database that hold the information of the different forms, which has been loaded by the user and the elapsed time they (the forms) have been active. See appendix B for the code on this function.

Favorites

ID	FormNavn	Ant	Tid	Tittel
1	frmSkiftOversikt	49	7508	Skift Oversikt
2	frmSkiftInnles	9	887	Innlesing av Taksameterfil
3	frmSjafor	53	3160	Sjåfør Ajourhold
4	frmSjaforOversikt	37	5659	Sjåfør Oversikt
5	frmSkift	28	6396	Skift
6	frmLonnReg	54	5846	Periodeoppgjør
7	frmLonnKjor	10	673	Lønn kjøring
8	frmLonnOversikt	24	937	Lønn oversikt
9	frmBilagOversikt	8	1126	Bilag oversikt
10	frmLonnLister	29	7799	Lønns lister
11	frmReskontroB	1	8	Reskontro
12	frmBiler	3	133	Biler ajourhold
13	frmBilerOversikt	8	1348	Bil
14	frmKontoplanOversikt	3	83	Kontoplan Oversikt

Fig. 5.2.1 Favorites table populated

Fig. 5.2.1 shows the actual populated table. It has got fields for form names, access count (Ant), accumulated time used (Tid) and the caption (Tittel) to be used in the menu entries.

For each form-unload event a routine is called updating the favorites. If the form has not been used earlier a record is created, else the record is updated with an access count and the elapsed time is added to earlier elapsed time.

The menu is not refreshed dynamically but only each time the MDI-form loads, it then calls a routine updating the actual menu entries.

A dynamic update will probably be desireable as a future development of the function.

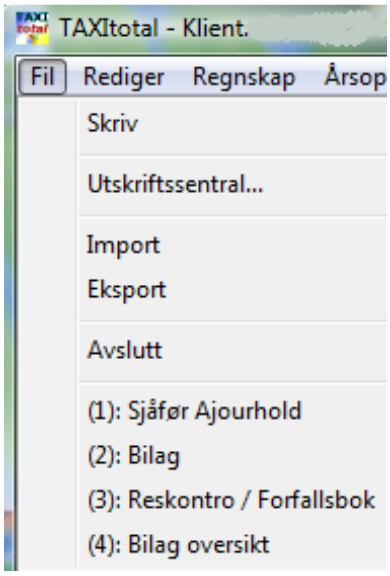

Fig. 5.2.2 showing menu entries at the bottom of the File -menu

The actual maximum menu entries, at the bottom of the file-menu, are preloaded and hidden. A higher degree of visualisation of the menu may also be evaluated, possibly by using more graphical representation.

The routine called at load-up of the MDI-form is connecting the actual menu entry to the respective form and giving it the name (caption).

This is all achieved by the data from the table in the database.

The records are fetched with an SQL, SELECT TOP x query where x may be up to 9 ordered descending by access count and time used.

The actual value of x is stored in a variable `MaxFavorites` read from registry.

One may argue wherever this is the best way to measure what is most used. The selection is simply a SQL-select statement with descending sort on access-count as first parameter and accumulated-time as second parameter. This selection will always show the form with most accesses at the top even if the total elapsed time in the form may be much less than for another form. Only when two forms got the same number of accesses the second parameter will be used and the one with the highest accumulated time will be sorted before the other. In my case with TAXI*total* this will be a quite acceptable result, but the actual selection rule should be considered if used in another setting.

The reference for this functionality in the guidelines is the need for visualising of functionality, due to the user is not expected to look for it (Tognazzini, 2006) and will not find functionality if not knowing it exists (Patel et al, 2006).

5.3 Creating Mouse-Over effect

This code has not been included in any program yet and needs some refinement before doing so (see appendix B for the actual code), of this reason and the fact that TAXI*total* is a commercial program it was not considered wise with reference to the customers to include this function in the existing application. A test application showing the effect has therefore been made.

When the mouse moves over the command button its size is increased by 30 pixels both in width and height and the text is shown in bold (as indicated to the right in fig. 5.3.1). The size and text is reset when moving off the button.

The illustration do not give the function the right credit, it is much more visible when seeing the actual change on the screen (the demo application developed for this effect can be found in the code folder in the attached zip-file).

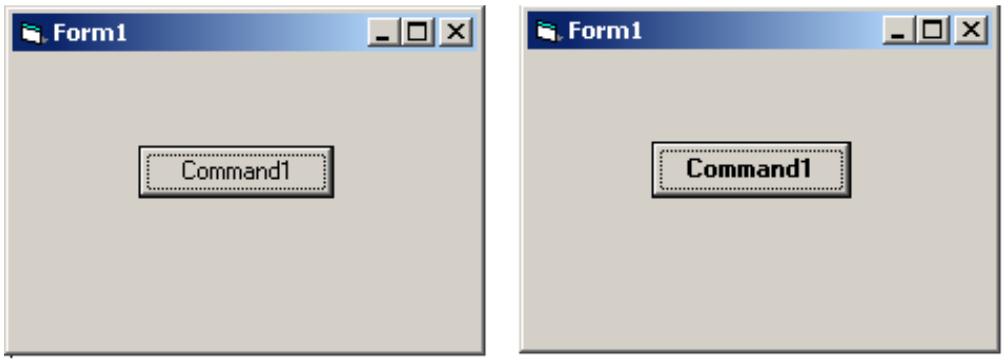

Fig. 5.3.1 Mouse over effect illustrated

One may use a variant of this functionality by using it to flash one or to times rapidly to indicate the default button or the default functionality just to catch the eye. However, if this is considered used it must be with great caution, animation effects may be apprehended as disturbing or even irritating (Petersen and Nielsen, 2002). If this functionality is considered used it should be able to turn it off for people don't wanting it.

5.4 Visualising context Help

In TAXI*total* as well as most standard windows programs there are usually a lot of information to the user in the context help for the actual form. This information is available by pressing F1 on the keyboard.

However, through support issues in the last couple of years and now also enlighten by the survey, it seems to be a lot of people not knowing how to achieve this information. At least not when they are in the middle of a problem and need it mostly. This justifies a better visualisation of the function, supported by the findings in the survey regarding where to find help.

The survey indicates that not all, considering themselves as knowing much of data, know about the F1 button being the general Help button in most Windows applications. But if we combine the two, F1 and the question mark, we will cover most of the responds.

As a result, visualizing the F1 functionality through a round help button is done in most forms of the program as indicated below in fig 5.4.1. (Tool-tip translation: Show help for this form (F1))

This function was added to the program (TAXI*total*) with a revision just before Christmas 2008 and after the questionnaire was closed. By the submission date of this work there has only been received uninvited feedback from two users, they were both very positive to it and they both seemed too suddenly "discovered" help functionality. Choosing the question mark as a symbol instead of a button with help text is done because this is commonly used and is therefore an easily recognizable symbol.

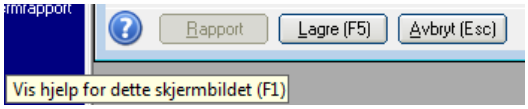

Fig. 5.4.1 Help context button

5.5 Summary

In this chapter the developed code has been described and discussed. Most of the code has been implemented in an existing application. The justification in doing this is because the code consist of small code snippets handling one function each, not easily put together in a test application keeping its intended functionality. Another reason is that some of these functions as visualising help and history menu were considered to be of such a great interest to our current customers so it was desireable to implement it in the existing commercial application.

The decision to not include the mouse over effect into the same application, but rather make a test application, was done because it needs some refinement before doing so. At this stage it was not considered wise with reference to the customers to include this function in the existing application, it may easily be apprehended as disturbing or even irritating (Petersen and Nielsen, 2002). If it is going to be implemented it certainly need to be able to be turn off by the user.

Next chapter is defining the guidelines for user interface design as a result of this work based on the literature review and questionnaire.

CHAPTER 6: Aims and Objectives

Most user interfaces is static in design, the aim of this work has been to see if it is possible to come up with some guidelines putting more dynamism into the design. Dynamism in this setting is the applications adaptability to the to the single users usage pattern and experience level.

Guidelines for design are not a new topic, many have written about this topic earlier. (Computer Training, 2008; Nielsen, 2002; Nielsen, 2007; Nielsen, 2008; Patel et al, 2006; Tognazzini, 2005) What is common for most of them is the fact that they highlight specific aspects of interface design, there is also naturally an overlap among them (Wheeler Atkinson et al, 2007). The objective of this work has been to come up with a more generally set of guidelines with validity to all interface design not only a specific aspect. They do not intend to go into detail on how to set up the interface but is more a set of guidelines to have in mind throughout the whole design process.

6.1 List of design guidelines

- Your own ideas are not necessarily the best.

  Do not treat your own personalised design as being the general opinion (Karsvall, 2002), it seldom is.

  This goes for how to present text also, make sure the language is clear and meaningful. Avoid using data-language or jargon not being common knowledge (Nielsen, 2007). If the application is targeting a branch with special knowledge and language be sure to use people knowing the branch for consultancy on both design and text.

- Educate the user.

  By visualizing and ease of access to functionality and help the user may be educated to a greater extent, and the consciousness of the availability of functionality and help makes it more fun to use and faster to look it up. Training will also lower the anxiety for and reduce negative feeling to the use of computers based on the lack of technological and software knowledge (Campell and Wabby, 2003) Education of the user may also use E-Learning, this may be achieved by access to online educational videos or online courses (Notess and Lorentzen-Huber, 2007). Both may by advantage be built into and/or being accessible from the user interface.

- Use standard design and controls in UI-design.

  There will easily be communication breakdowns if user gets another feedback than expected (Patel et al, 2006), or if controls looks as a control but isn't. A coloured underlined text may for example easily be assumed to be a link (Nielsen, 2008). Standard controls will also most probably work as expected when newer versions of the OS are installed.

- Use default values where applicable.

  If possible make the user aware of it. (Nielsen, 2008) This may be done with animation effects to catch the eye, but with great caution (Peterson and Nielsen, 2002). Default values goes also for colours, remember almost 10% of people suffer to a certain degree of colour-blindness (Tognazzini, 2006). The word "default" is not understood easily among all, use "standard" instead.

- Visualize functionality and help.

  Do not expect the user to look for it (Tognazzini, 2006). Lack of knowledge may result in ineffective use if the user is not even aware of the existence of the function (Patel et al, 2006). Make sure the user know there is a help system and how to find it. With growing complexity and larger application the need for personalization in help and interface design increase (Hui and Boutilier, 2006). Make the application learn from the usage pattern to personalise itself. This goes for menus by visualising better the most used functions and hiding less used (they still must be accessible) but also for the interface itself where applicable (Maeda et al, 1999; Maloor and Chai, 2000). If illustrations are used, make sure they are of high quality. If for example screen dumps are used in help file for illustration, make sure they are of a size and clarity so it is possible to see the details (Nielsen, 2007).

- Make a clean interface.

  Do not fill the interface with more functionality the necessary, a clean, not overfilled interface is easier to conform to for the user. Make sure the different functionality is assessable without taking one for another. For example in a browser interface, don't put the url-box and search-box close to each other (Nielsen, 2002). A clean interface will increase usability and by

this increase user satisfaction. Be sure the interface is structured, lack of structure may lead to the user not understanding the process (Patel et al, 2006) Make the approach as a natural as possible by sequencing the interface into steps where the user move from state to state (Hui and Boutilier, 2006).

Make sure the application don't "stop working", use progress bars, videos or other functionality that occupies the user (Tognazzini, 2006). If appropriate use multi treading for larger processes to avoid hang or stop in the interaction with the application.

- Use understandable language.

  If displaying error messages to the user make sure they are readable and understandable to the user (Nielsen, 2002). Use messages possibly followed by an error number, but do not display a memory dump or something like it to the user. Make sure to not concentrate only on the visible parts as font types and size, having the ill-luck to ignore the cognitive complexity of the interface (Notess and Lorentzen-Huber, 2007).

  Help system is an important part of all applications, make sure it really is to a help for the user, use plain language easily understandable to all users experience and skill levels. If appropriate use illustrations, but of good quality. Consider targeting the current active user, an expert user might not need the same information as a novice.

6.2 Summary

In this chapter a list of design guidelines is presented as a result of the research been done in this work. The value in this work, compared to others, is a greater focus on the user as an individual. A user is not something that can be defined as such, but a person with different skill level, age, sex and with a varying degree of attitude, interest and knowledge of the topic in question.

The guidelines presented here is putting the individual user more into focus and by this be a valuable contribution to developers dealing with design and user interaction. A better user interface will make a better application and may therefore as a result increase the sale of the product. This work should be of interest of all companies dealing with software development where users with different skill and knowledge are involved.

Next chapter is a summary of work with a note of the main points in the dissertation, contribution to research and a suggestion for future research and development.

CHAPTER 7: SUMMARY OF WORK

Most, if not all, user interfaces are static in design. The aim of this work has been to se if it is possible to add more dynamism to the interface. By doing this it will better suit the user's experience and skill level. Factors as aging and dynamism will also benefit from this.

Interface design is about making money for the company (Nielsen, 2007), this is important to keep in mind. A better design leads to a more satisfied user and will by this give the application more credit in the market.

To achieve the goals of this work a review of current literature on the topic was conducted. Based on the findings in the literature and the goals a questionnaire was made and distributed. From the responds from the questionnaire and the literature review a set of guidelines was made. By actively using these guidelines they will contribute to the user interface and interaction by a higher degree of personalization.

7.1 Summary of the dissertation

Chapter 1 introduce the aims and goal of this work by lead up to some guidelines or techniques to be used in the design process to get a higher focus on individualization in the user experience of standard software to the end user.

Chapter 2 is a critical review of the existing literature with focus on the factors most likely to influence the aim of this work. This was naturally split into topics of interface design, usability, elderly people and UI design with focus on dynamism. It concludes with a set of tasks further to be investigated through the questionnaire.

Chapter 3 is a review of the questionnaire with justification of it as a data collecting tool. Each question and the justification of asking it were described in detail.

Chapter 4 is a detailed analyse of the data received from the survey. The objective was to, taking the literature into consideration, to come up with some guidelines presented in chapter 6.

Based on the findings in the literature and the result from the questionnaire some prototype code was developed. This is described in Chapter 5 with a justification of splitting this into two, one existing - and one test application.

The aim and objectives and the actual guidelines perceived from this work is described in chapter 6.

Chapter 7 is this summary of work.

7.2 Research contributions

The academically and practically contribution of the work can be summarised as follows:

7.2.1 Academically

The academically contribution of this work is a broader more user focused approach than earlier work on the topic. A lot of papers are describing guidelines for user interface- and interaction design. Most of them have a specific, quite narrow starting-point, often with a specific branch or situation as an origin. This may then have a limited usefulness in another situation. What this work intend to do by the guidelines is giving a broader and more general approach to the question.

7.2.2 Practically

For developing of user interfaces the guidelines will be of practical usefulness as a platform prior to the design process. It does not give an absolute checklist but will by its general and practical approach, when used as a tool; increase the usability of the interface. There has been a growing focus on interface design over the last years due to greater competition in the market and better tools for development. The research on this area has not been following the development of tools, both software and hardware, hopefully this work may be of contribution to this situation.

7.3 Future research and development

As was mentioned earlier in chapter 6, the main aim and objectives were achieved. Yet there is still a lot more that can be researched within the area of individual conformability in software design.

This project targeted Norwegians only, a survey to see if there were differences in cultures regarding the topic of this work would be an interesting area of research.

What are the implications of these guidelines on other type of software? Is the validity of the guidelines the same to such as educational software and web-applications?

The impact of age related questions in this work is weak; here it would have been interesting to research these impacts on a larger population.

It would also been interesting to investigate the user conformity to more than history/most-used menu; this will certainly be a challenge for future research and will also been investigated further by my company.

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APPENDIX A: PRIMARY DATA COLLECTION METHOD

A.1 Questionnaire

A questionnaire was published 22. August 2008 and invitation sent to 260 e-mail accounts the same day. 19 were rejected with delivery failure.

When the publishing period ended after about two weeks 76 persons had answered the questionnaire, giving a answer percentage of 31,5%.

The original consent form and questionnaire has been included here, but due to the fact that it is in Norwegian a simple translation has also been included at the end of this appendix.

The original consent form:

Spørreundersøkelse

Tittel:
"How can a user-interface best suit individual user experience level"
Ansvarlig: Per Ola Lien

NB!
Får du en gul linje øverst i internett leseren din omtrent som denne:

Internet Explorer har begrenset denne websiden fra å kjøre skript eller ActiveX-kontroller ...

Klikk på linjen og klikk på "Tillat blokkert innhold"

Informasjon / Samtykke

Denne undersøkelsen inngår som en del av mitt forskningsarbeid til graden MSc (Master of Science) ved Brunel University i London.

Det er av stor hjelp for meg at du tar deg tid til å svare på disse spørsmålene, det vil neppe ta mer en 5 minutter av din tid.

Undersøkelsen er godkjent av etisk kommité ved Brunel University, the school of Information Systems, Computing and Mathematics; noe de krever når undersøkelser som involverer personer inngår i arbeidet til denne graden.

Etisk kommité ved Brunel University krever at følgende opplyses og at deltakeren samtykker i dette:

- Undersøkelsen er frivillig, jeg deltar på frivillig grunnlag og kan når som helst trekke meg fra undersøkelsen ved å lukke dette vinduet. Ingenting er regisrtert før jeg trykker på Send -knappen nederst på spørreskjemaet.
- Undersøkelsen er anonym, jeg vil ikke bli spurt om navn eller annen informasjon som kan knyttes til meg eller identifisere meg på annen måte hverken nå eller i ettertid.
- Innsamlede data vil bli behandlet konfidensiellt, alle innsamlede data vil bli slettet senest 2 år etter at undersøkelsen er avsluttet.

Bakgrunnen for denne spørreundersøkelsen er å få et inntrykk av hvordan man ser på bruken av data generelt og i hvilken grad data oppfattes som enkelt å forstå eller ikke.
Videre, med bakgrunn i dette resultatet og tilgjengelig litteratur, å forsøke å komme fram til faktorer som kan gjøre brukeropplevelsen ved bruk av data bedre med særlig vekt på individuell tilpassing av standard programvare.

Ved etiske eller generelle spørsmål til denne undersøkelsen kan Per Ola Lien kontaktes på epost: ci06pol@brunel.ac.uk

☐ Jeg har lest og forståtte teksten ovenfor

Klikk her for å starte undersøkelsen

English translation of the consent form:
Questionnaire

Note: This is just a direct translation from the Norwegian text, no effort has been done to write "good English". (data is often used in Norwegian as a synonym for PC with or without software)

Title:

"How can a user-interface best suit individual user experience level"

Responsible: Per Ola Lien

NB!
If you get a yellow line at the top in your internet browser saying about this:
To help protect your security, Internet Explorer has restricted…
Click on the line and click "Allow Blocked Content…"

Information / Consent

This survey is part of my work for the MSc (Master of Science) degree at Brunel University in London.

It is of great help to me if you take your time to answer these questions, it will probably not take more than 5 minutes of your time.

The survey has been approved by the Ethics Committee of Brunel University, the school of Information Systems, Computing and Mathematics; which they demand when surveys involving persons is part of the work for this degree.

The Ethics Committee of Brunel University demands that the following is informed and an consent is given by the participant:

- The survey is voluntary, I participate on my free will and may at any time withdraw from this survey by closing this window. Nothing is registered before you hit the Send –button at the bottom of the questionnaire.
- The survey is anonymous, I will not be asked for name or other information which may be associated with me or used to identify me as an individual either now or in future.
- Collected data will be confidentially handled, all collected data will be deleted latest after 2 years.

The background for this survey is to get an impression of the general use of data and to what extent it is easy to understand or not.
Further, with this result in mind and available literature, to try to find factors who can make a better user experience when using data with weight on individual adjustment of standard software.

If you have any ethical or general questions to this survey please contact Per Ola Lien at e-mail: ci06pol@brunel.ac.uk

☐ I have read and understand the text above

Click here to start the survey

The original questionnaire:

Spørreundersøkelse

Tittel:
"How can a user-interface best suit individual user experience level"
Ansvarlig: Per Ola Lien

NB!
Får du en gul linje øverst i internett leseren din omtrent som denne:

Internet Explorer har begrenset denne websiden fra å kjøre skript eller ActiveX-kontroller ...

Klikk på linjen og klikk på "Tillat blokkert innhold", svar Ja på spørsmålet.

1

Flere steder nedenfor er begrepet ordinære eller standard program nevnt.

Her tenkes det på standard programvare installert på PC'en.
Dette kan være program som TAXItotal, SuperOffice, Mammut, eller andre crm/regnskaps-/lønns-/årsoppgjørs-program.

Velg det som du kjenner best:

- TAXI*total*
- SuperOffice
- Mammut
- Annet, spesifiser:
- Kjenner ingen standard program

2
Kryss av på en skala fra 1 - 6, hvor 1 er "ikke viktig" og 6 er "veldig viktig".

Hva bruker du primært PC'en til.

Internett	1	2	3	4	5	6	Vet ikke
E-post	1	2	3	4	5	6	Vet ikke
Spill	1	2	3	4	5	6	Vet ikke
Arbeid	1	2	3	4	5	6	Vet ikke
Hobby	1	2	3	4	5	6	Vet ikke
Annet	1	2	3	4	5	6	Vet ikke

3
Kryss av for alle alternativer du mener er riktig.

De fleste ordinære dataprogram inneholder en standard hjelp funksjon, på hvilken måte vil du finne denne?

- Ved å trykke på knappen F1
- Ved å trykke på knappen F2
- Ved å trykke på knappen F7
- Ved å trykke på knappen F12
- Ved å trykke på knappen/tegnet merket
- Ved å klikke på Hjelp på menylinja
- Vet ikke

4
Kryss av på en skala fra 1 - 6, hvor 1 er "helt uinteressant" og 6 er "veldig interessant".

Hvis du kunne endre skriftstørrelsen (de fleste internettlesere har denne muligheten), og hvis vi forutsetter at du selv kan skru av/på en slik funksjon, vil dette være interessant også for ordinære program?

Klikk her for demo

Fast endring	1	2	3	4	5	6	Vet ikke
Musemarkør over	1	2	3	4	5	6	Vet ikke

5
Kryss av på en skala fra 1 - 6, hvor 1 er "helt uenig" og 6 er "helt enig".

Med tanke på standard programvare (ditt valg i spørsmål 1). Hvis knappene ble større (lettere å treffe) når musepekeren er over dem, ville dette være:

Forstyrrende	1	2	3	4	5	6	Vet ikke
Irriterende	1	2	3	4	5	6	Vet ikke
Sikkert en fordel	1	2	3	4	5	6	Vet ikke
Meget bra	1	2	3	4	5	6	Vet ikke

6
Kryss av på en skala fra 1 - 6, hvor 1 er "helt uenig" og 6 er "helt enig".

Med tanke på standard programvare (ditt valg i spørsmål 1). Hvordan stiller du deg til følgende utsagn:

Programmet er generelt vanskelig å forstå	1	2	3	4	5	6	Vet ikke
Det er vanskelig å komme igang (høy brukerterskel)	1	2	3	4	5	6	Vet ikke
Programmet mangler struktur	1	2	3	4	5	6	Vet ikke
Jeg roter meg lett bort	1	2	3	4	5	6	Vet ikke
Hjelp er vanskelig å bruke eller finne	1	2	3	4	5	6	Vet ikke
Tekster (på knapper, menyer, o.l.) er vanskelig å lese	1	2	3	4	5	6	Vet ikke

7
Kryss av på en skala fra 1 - 6, hvor 1 er "helt uviktig" og 6 er "veldig viktig".

Mange programvareleverandører kommer med web-baserte løsninger. Dette betyr gjerne at alle data lagres hos programvareleverandøren og at du kobler deg opp og registrerer data via internett.
Hva er viktig for deg ved en slik løsning når det gjelder:

Sikre backuprutiner	1	2	3	4	5	6	Vet ikke
Slipper å installere programvare på egen PC	1	2	3	4	5	6	Vet ikke
Er "mine" data sikre nok	1	2	3	4	5	6	Vet ikke
Er internett sikkert nok	1	2	3	4	5	6	Vet ikke
100% Oppetid	1	2	3	4	5	6	Vet ikke
Ikke avhengig av en bestemt PC	1	2	3	4	5	6	Vet ikke
Kan bruke "programmet" hvor som helst	1	2	3	4	5	6	Vet ikke
Jeg vil ha egne data i eget hus	1	2	3	4	5	6	Vet ikke

8
Kryss av på en skala fra 1 - 6, hvor 1 er "ikke interessant" og 6 er "veldig interessant".

Bruken av standard programvare er gjerne forsjellig fra bruker til bruker. Hvis programmet kunne lære av ditt bruksmønster og tilpasse seg dette (menyer, hjelp), vil dette være interessant?

1 2 3 4 5 6 Vet ikke

9
Kryss av på en skala fra 1 - 6, hvor 1 er "ikke interessant" og 6 er "veldig interessant".

Kunnskapsnivået er gjerne forsjellig fra bruker til bruker.
Hvis programmet kunne lære hvilket "kompetansenivå" du er på og tilpasse seg dette (menyer, hjelp, veivisere), vil dette være interessant?

1 2 3 4 5 6 Vet ikke

10
Kryss av på en skala fra 1 - 6, hvor 1 er "helt uenig" og 6 er "helt enig".

Utviklingen av programvare designes normalt for en "typisk bruker".
I hvilken grad er du enig i at en "typisk bruker" ser ut til å være en yngre person, gjerne gutt/mann, med gode datakunnskaper?

1 2 3 4 5 6 Vet ikke

11
Kryss av på en skala fra 1 - 6, hvor 1 er "ikke interessert" og 6 er "svært interessert".

Hvordan vurderer du din egen generelle interesse for data?

1 2 3 4 5 6 Vet ikke

12
Kryss av på en skala fra 1 - 6, hvor 1 er "helt blank" og 6 er "svært god".

Hvordan vurderer du din egen generelle kunnskap om data?

1 2 3 4 5 6 Vet ikke

13

Hvor lenge har du i din husstand hatt tilgang til PC?

Mindre enn 1 år 1-2 år 3-5 år Mer enn 5 år

14

Hva slags internett forbindelse har du?

Bredbånd (ADSL/SHDSL) ISDN Annet Vet ikke/Har ikke

15

Hvor mange PC'er har du tilgang til i din husstand?

1 PC 2 PC'er Flere enn 2 PC'er Vet ikke/Ingen PC

16

Til slutt, hva er din alder og kjønn?

Alder: - Velg alder -

Kjønn: - Velg kjønn -

Pass på at du har svart på alle spørsmålene.
Trykk på Send -knappen for å avslutte spørreundersøkelsen.

Send

English translation of the questionnaire:

Questionnaire

Note: This is just a direct translation from the Norwegian text, no effort has been done to write "good English". (data is often used in Norwegian as a synonym for PC with or without software)

Title:

"How can a user-interface best suit individual user experience level"

Responsible: Per Ola Lien

NB!
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Click on the line and click "Allow Blocked Content…"

1
Several places below are the notion ordinary or standard program used.
Here we have in mind standard programs to be installed on a PC.
This may be programs as TAXItotal, SuperOffice, Mammut, or other crm/accounting/salary/yearly-accounting –program.

Select the one you know best:
TAXItotal
SuperOffice
Mammut
Other, specify:
Do not know any standard program

2
Indicate on a scale from 1 – 6, where 1 is "not important" and 6 is "very important".

What do you primarily use the PC for.

Internet <1 to 6 and don't know>
E-post <1 to 6 and don't know>
Game <1 to 6 and don't know>
Work <1 to 6 and don't know>
Hobby <1 to 6 and don't know>
Other <1 to 6 and don't know>

3
Tick every alternative you consider correct.

Most ordinary dataprogram has a help functionality,
how will you find this?

- ☐ By pushing the F1 button
- ☐ By pushing the F2 button
- ☐ By pushing the F7 button
- ☐ By pushing the F12 button
- ☐ By pushing the button/sign marked (?)
- ☐ By clicking Help on the menu-line
- ☐ Don't know

4
Indicate on a scale from 1 – 6, where 1 is "not interesting" and 6 is "very interesting".

If you could change the font size
(most internet readers has this possibility),
and if we assume you may turn this function on/off,
will this be interesting also for ordinary programs?

Click here for a demo

Firm change <1 to 6 and don't know>
Mouse over <1 to 6 and don't know>

5
Indicate on a scale from 1 – 6, where 1 is "disagree" and 6 is "agree".

With ordinary programs in mind (your choice in question 1).
If buttons got larger (easier to hit) when mouse is over,
would this be:

Disturbing <1 to 6 and don't know>
Irritating <1 to 6 and don't know>
Probably an advantage <1 to 6 and don't know>
Very good <1 to 6 and don't know>

6
Indicate on a scale from 1 – 6, where 1 is “disagree” and 6 is “agree”.

With ordinary programs in mind (your choice in question 1).
How would you consider the following sayings:

The program is generally difficult to understand <1 to 6 and don’t know>
It’s difficult to get started (high user-threshold) <1 to 6 and don’t know>
The program is lacking structure <1 to 6 and don’t know>
I easily get lost <1 to 6 and don’t know>
Help is difficult to use or find <1 to 6 and don’t know>
Texts (on buttons and menus, o.l.) is difficult to read <1 to 6 and don’t know>

7
Indicate on a scale from 1 – 6, where 1 is “un-important” and 6 is “very important”.

Many vendors of ordinary programs comes with web-based solutions as well.
This often includes saving data at the vendors site and you register data via internet.
What is important for you with such a solution when it comes to:

Safe backup routines <1 to 6 and don’t know>
Avoid installing of programs on own PC <1 to 6 and don’t know>
Is “mine” data secure enough <1 to 6 and don’t know>
Is internet safe enough <1 to 6 and don’t know>
100% Up-time <1 to 6 and don’t know>
I do not need a dedicated PC <1 to 6 and don’t know>
I may use “the program” everywhere <1 to 6 and don’t know>
I will have my own data in my own house <1 to 6 and don’t know>

8
Indicate on a scale from 1 – 6, where 1 is “not interesting” and 6 is “very interesting”.

The actual use of standard programs is often different from one person to another.
If the program could learn your usage pattern and adjust to this (menus, help), would this be interesting?

<1 to 6 and don’t know>

9
Indicate on a scale from 1 – 6, where 1 is “not interesting” and 6 is “very interesting”.

The knowledge level is different from one user to another.
If the program could learn your “knowledge level” and adjust to this (menus, help, guides), would this be interesting?

<1 to 6 and don’t know>

10
Indicate on a scale from 1 – 6, where 1 is “disagree” and 6 is “agree”.

The development of standard software is normally targeting a “typical user”.
To what extent do you agree that a “typical user” seem to be a younger person, often male, with good knowledge of data?

<1 to 6 and don’t know>

11
Indicate on a scale from 1 – 6, where 1 is “not interesting” and 6 is “very interesting”.

How do you consider your own general <u>interest</u> for data?

<1 to 6 and don’t know>

12
Indicate on a scale from 1 – 6, where 1 is “know nothing” and 6 is “very good”.

How do you consider your own general <u>knowledge</u> of data?

<1 to 6 and don’t know>

13

For how long have your household had access to a PC?

<less than 1 year, 1-2 years, 3-5 years, more than 5 years>

14

What kind of internet access do you have?

<broadband (ADSL/SHDSL), ISDN, Other, Don’t know>

15

How many PC’s do you have access to in your household?

<1 PC, 2 PC’s, More than 2 PC’s, Don’t know>

16

At last, what is your age end gender?

<Age: Select age>
<Gender: Select gender>

Please check that all questions have been answered.

Press <Send> button to commit the questionnaire, you will get the answers up in an e-mail message, press the <Send> –button in this one as well

If you would like to have a copy of your answers, press the <Print> button.

<Send> <Print>

APPENDIX B: SOURCE CODE

Introduction.

The code has been included in an existing application, TAXI*total,* instead of making a dedicated test application. The application is used by taxi-owners for registering of shift, salaries and for accounting. It is written in MS Visual Basic 6.0 with an MS Access 2003 (Jet 4.0) database.
All the communication with the database is done via SQL calls and updates to the database is done via T-SQL.

Code for creating and updating history menu.

This functionality is using a table in the database holding the information of the different forms which has been loaded by the user and the time they (the forms) have been active.

Routine for checking if the database table exist, if not it is created.

```
Public Function EksistTableFavorites() As Boolean
  Dim b As Boolean
  If Not ExistTableInDb("Favorites") Then
    EksistTableFavorites = cAdo.Execute("CREATE TABLE Favorites " _
    & "(ID COUNTER CONSTRAINT ID PRIMARY KEY, KlientNr SHORT, " _
    & "FormNavn TEXT(40), Ant LONG, Tid LONG, Tittel TEXT(50))")
  Else
    EksistTableFavorites = True
  End If
End Function
```

For each form load event the start time is recorded in a global variable:

```
initStartTime = Now
```

For each form unload event a routine is called updating the favorites. If the form has not been used earlier a record is created, else the record is updated with an access count and time used is added to earlier time used.

```
Public Sub FavoritesUpdate(ByRef fName As Form)
  Dim FormNavn As String, FormTittel As String, AntSek As Long, i As
Integer
  On Error Resume Next
  FormNavn = fName.Name
  FormTittel = fName.Caption
  i = InStr(FormTittel, "- Klient")
  If i > 0 Then FormTittel = left$(FormTittel, i - 2)
  AntSek = DateDiff("s", initStartTime, Now)
  If cAdo.GetCount("Favorites", "KlientNr=" & Str$(CurrentClientNumber) &
_
    " AND FormNavn='" & Trim$(FormNavn) & "'") = 0 Then
```

```
        cAdo.Execute ("INSERT INTO Favorites
    (KlientNr,FormNavn,Ant,Tid,Tittel) _

                    VALUES (" & Str$(CurrentClientNumber) & ",'" &
    Trim$(FormNavn) & "',1," & Str$(AntSek) & ",'" & Trim$(FormTittel) &
    "')")
  Else
        cAdo.Execute ("UPDATE Favorites SET Ant=Ant+1,Tid=Tid+" &
    Str$(AntSek) & " WHERE KlientNr=" & Str$(CurrentClientNumber) & " AND
    FormNavn='" & Trim$(FormNavn) & "'")
  End If
End Sub
```

The menu is not refreshed dynamically but only each time the MDI-form starts, it then call the following routine updating the actual menu entries.

The menu entries, at the bottom of the file-menu, are preloaded and hidden.

This routine is connecting the actual menu entry to the respective form and giving it the name (caption).

This is all achieved by the data from the table in the database.

The records is fetched with an SQL, SELECT TOP x query where x may be up to 9 ordered descending by access count and time used.

The actual value of x is stored in a variable `MaxFavorites` read from registry.

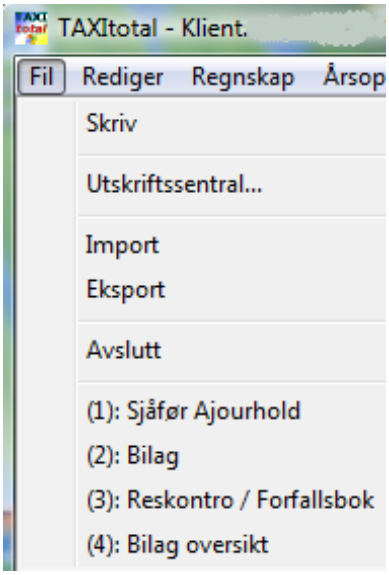


Figure showing menu entries at the bottom of the File -menu

```
Private Sub ShowFavorites()
  Dim tRS As ADODB.Recordset, tSQL As String, i As Integer
  On Error Resume Next
  If MaxFavorites < 1 Then Exit Sub 'do not show favorites
  mnuFileBar2.Visible = True
  If MaxFavorites > 9 Then MaxFavorites = 9
  tSQL = "SELECT TOP " & Trim$(Str$(MaxFavorites)) & " FormNavn,Tittel &_
         FROM Favorites &_
         WHERE KlientNr=" & Str$(CurrentClientNumber) & " &_
         ORDER BY Ant DESC,Tid DESC"
     Set tRS = cAdo.GetRS(tSQL, True)
   i = 0
   While Not tRS.EOF
     i = i + 1
     mnuFileFav(i).Caption = Format$(i, "\(\&0\)\:\ ") &_
   Trim$(tRS!Tittel)
     mnuFileFav(i).Tag = Trim$(tRS!FormNavn)

     If i <= MaxFavorites Then mnuFileFav(i).Visible = True
     tRS.MoveNext
   Wend
   Set tRS = Nothing
  End Sub
```

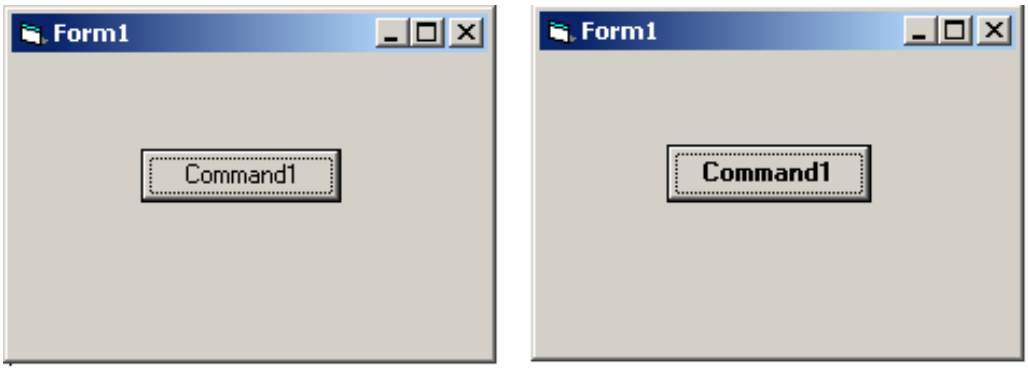
Code for creating Mouse Over effect

This code has not been included in any program yet and need some refinement before doing so, but below is all the code there is needed to create a test application to show the effect.

Create a new project in VB, copy this code into the forms code and run.

```
Option Explicit
Dim MouseOver As Boolean

Private Sub Form_Load()
  MouseOver = False
End Sub

Private Sub Command1_MouseMove(Button As Integer, Shift As Integer, X As
Single, Y As Single)
  ScaleUp Command1
End Sub

Function ScaleUp(ByRef c As Control)
  If MouseOver Then Exit Function
  MouseOver = True
  c.Move c.Left - 15, c.Top - 15, c.Width + 30, c.Height + 30
  c.FontBold = True
End Function

Private Sub Form_MouseMove(Button As Integer, Shift As Integer, X As
Single, Y As Single)
  If MouseOver Then Command1.Move Command1.Left + 15, Command1.Top + 15,
Command1.Width - 30, Command1.Height - 30
  Command1.FontBold = False
  MouseOver = False
End Sub
```

The effect is illustrated here:



When the mouse move over the command button its size is increased by 30 pixels both in width and height and the text is shown in bold. The size and text is reset when moving off the button.

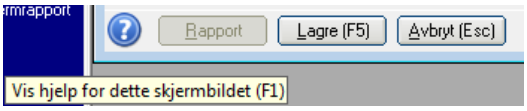
The illustration do not give the function the right credit, it is much more visible when seeing the actual change on the screen.

Visualising context Help

In TAXI*total* as well as most standard windows programs there are usually a lot of information to the user in the context help for the actual form. This information is available by pressing F1 on the keyboard.
However, through support issues in the last couple of years and now also enlighten by the survey, it seems to be a lot of people not knowing how to achieve this information. At least not when they are in the middle of a problem and need it mostly.

The survey indicate that not all, considering themselves as knowing much of data, know about the F1 button being the general Help button in most Windows programs. But if we combine the two, F1 and the question mark, we will cover most of the responds.

As a result, visualizing the F1 functionality through a round help button is done in most forms as indicated below. (Tool-tip translation: Show help for this form (F1)) This function was added to the program with a revision just before Christmas 2008 and I have by the submission date of this work only received feedback from two users, they were both very positive to it and they both seemed too suddenly "discovered" help functionality. Choosing the question mark as the symbol instead of a help text is done because this is commonly used and is therefore an easily recognizable symbol.



Code behind the click event for the button is simply simulating F1 to be pressed.

```
Private Sub Command1_Click()
  Call SendKeys("{F1)")
End Sub
```

The actual code activating the F1 button is shown below. To get this code to actually been executed the form property KeyPreview has to be set to True.

```
Private Sub Form_KeyDown(KeyCode As Integer, shift As Integer)
  On Error Resume Next
   Select Case KeyCode
    Case vbKeyEscape
      Call cmdCancel_Click
    Case vbKeyF1
      HelpUrlTopic = "html\bilag.htm"
      Call HtmlHelp(0, HelpFileUrl, HH_DISPLAY_TOPIC, ByVal HelpUrlTopic)
    Case vbKeyF5
      If cmdUpdate.Visible Then cmdUpdate_Click
    Case vbKeyF6
      If cmdAdd.Visible Then cmdAdd_Click
    Case Else
  End Select
End Sub
```

The HtmlHelp is an API call and to get it to work it has to be referenced before use:

```
Public Declare Function HtmlHelp Lib "hhctrl.ocx" Alias "HtmlHelpA" _
   (ByVal hwndCaller As Long, ByVal pszFile As String, _
   ByVal uCommand As Long, ByVal dwData As Any) As Long
```

TAXI*total*

Several references have been done to this program. The program is handling accounting, salary, shift and more for taxi-owners. It is distributed in Norway only. The latest version of the program includes several of the techniques described in this dissertation, it may be downloaded from www.taxitotal.no, click on “Nedlastinger” (Downloads), then on the button “Full installasjon” (Complete installation). The setup program may be started directly or downloaded first.

APPENDIX C: ETHICAL APPROVAL

School of Information Systems, Computing and Mathematics
K Darby-Dowman, Head of School, Professor of Operations Research
G Fitzgerald Head of IS&C, Professor of Information Systems
J Kaplunov, Head of Mathematical Science, Professor of Applied Mathematics

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Date: **01.08.2008**

STATEMENT OF ETHICS APPROVAL

Proposer: Per Ola Lien

Title: How can a user-interface best suit individual user experience level.

The school's research ethics committee has considered the proposal recently submitted by you. Acting under delegated authority, the committee is satisfied that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform the committee of any change of plans in relations to the information provided in the application form.

Yours sincerely,

A. M. Payne

Dr. Annette Payne Chair of the Research Ethics Committee
SISCM