

# Riktlinjer för att designa hemsidor med fokus på seniorer

- Utvärdering av hemsidan Smarta Ting

Magisteruppsats, 10 poäng, i informatik

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# Guidelines for designing web pages with the focus on Seniors

## - Evaluation of the web page Smart Things

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Guidelines for designing web pages with the focus on Seniors  
- Evaluation of the web page Smart Things

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**Abstract**

The Internet is a large used technology and seniors, like everyone else, want to take part in the experience of navigate the Web. Many guidelines about how to develop usable web pages exist, but not many of them are focused on seniors. This paper aims to issue guidelines for developing web pages intended to be used by seniors, based upon the results of the observations of seniors and younger adults while browsing the Web carried out by the authors. The findings point out that the seniors think the same way as younger adults but it takes them longer to performance, and since many times they lack the knowledge of the models of this technology they benefit more from usable pages than the rest of users. The paper also presents the guidelines the authors had come up with.

**Key words**

Guidelines, seniors, usability and web pages.

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# 1 Introduction

This is a master thesis where we present which guidelines are needed when designing web pages for seniors, corresponding to 10 weeks of fulltime work for each author. The task was given by The Swedish Handicap Institute where we have helped them to evaluate their web page Smart Things.

In this master paper we define elderly people or seniors as people over 65 years.

## 1.1 Background

Usability is not a new concept that was born with the Internet, but it started to be relevant with the revolution of personal computers and their promise of making life easier for the users. Before that, and as stated by Nielsen, (1993, p. 8)

*“...computers were... so expensive that it was reasonable to let users suffer a little if the computer could be utilized more efficiently.”*

Demands on easy and understandable web pages have resulted in many usability guidelines about how to design web pages. W3C, which stands for World Wide Web Consortium, was created *“to lead the World Wide Web to its full potential by developing protocols and guidelines that ensure long-term growth for the Web”* (W3Ca). One of the de-facto recommendations in the Internet are Web Content Accessibility Guidelines, WCAG, 1.0 (W3Cb) and now 2.0 (W3Cc) also – which are still a draft –, by W3C, which among other topics, they address usability recommendations. By now people designing web pages already realize the importance of usability. The challenge now is to understand that not all users fit into the ‘normal’ user definition. The problem is that, at the moment, there are not many guidelines focusing on how to design web pages for seniors. This topic is becoming more and more important since in the last 10 years the amount of seniors has increased 1% and in the next 10 years the group of elderly will increase by 27% (Sveriges kommuner och landsting p. 7).

The Swedish elderly generation is living in a modern society with an establishment in a technological landscape and it is with these conditions they meet the future (Senior2005, SOU 2003:91). People over the age of 60 starts to have difficulties with hearing, muscular strength and reduced sight which lead to that they need three times as much light as a 20-year old person. This does not mean that all people over 60 year have disabilities but age is a factor when it comes to physical limitations (Senior2005, SOU 2003:91). Disabilities occur most frequently in seniors over 75 and these people have the most need for assistive products (Senior2005, SOU 2003:91). Access to Internet is mostly increasing in the group of 60 to 75 years in the year 2000 (Senior2005, SOU 2003:91 p. 139) and because more people have access to Internet, the need for Internet based service and advice on how to find and buy assistive products has emerged, according to Ulrika Lebbin at The Swedish Handicap Institute. To accommodate this increased need, The Swedish Handicap Institute with support from Stiftelsen för Teknisk Hjälp åt Handikappade (Foundation for technological aid to

disable people) has developed a web page called “Smarta Ting”, which we translated to Smart Things. The purpose of the web page is to provide a place where people having difficulties with movement and cognition can find simple assistive products and information (<http://www.hi.se/hi/default.shtm>). Senior group is particularly unlikely to use the Internet (Dickinson et. al., 2005). A good way to avoid this feeling in seniors could be making web pages easier to use and understand by taking seniors more into consideration when developing web pages.

## 1.2 Problem area

As we mentioned in the background, guidelines exist about how to develop web pages with the focus on usability, but guidelines with focus on seniors are less common. When designing for elderly people some cognitive aspects should be taken into account, since they make web pages more comprehensible and easier to use. Cognitive aspects, such as memory, attention or psychomotor issues should be addressed. The idea that every aspect about cognition gets worse when aging, should be ruled out, since there are some of them, like focused attention, that remain the same (Denise Park & Norbert Schwarz, 2000).

A couple of years ago the Swedish commune provided information about assistive products and how to buy them, but because of savings and withdraws this service has decreased. People are now forced to find that information in other ways. One way is through the web page Smart Things. By helping The Swedish Handicap Institute to evaluate the web page with the focus on seniors, we believe that knowledge about how seniors are browsing the Web and how they are thinking when doing it, can be achieved, so we can present guidelines in order to make their experiences with the Internet more pleasant. What makes the evaluation of the web page Smart things interesting is that the target group is seniors and people with disabilities that are in search of assistive products. It is therefore even more important that seniors understand how to search for assistive products and find other important information at the Web page Smart Things.

### *1.2.1 Research questions*

Our research question is:

- Which guidelines are needed when designing web pages for seniors?

Sub questions:

- What problems do seniors have when browsing the web page Smart Things?
- Are there any differences between how seniors and the younger generation browse the web page Smart Things?



### **1.3 Purpose**

After evaluating how elderly people navigate the web page Smart Things, our purpose is to present some guidelines about how to design web pages intended to be used by seniors.

### **1.4 Delimitations**

We will concentrate on only making the evaluation of the web page Smart Things with the focus on seniors. Since we will only evaluate this web page, there will be many aspects that will be missed, such as how to present information for sale or how to make forms that are supposed to be filled in by seniors. Hence, note that there are many guidelines concerning those missing aspects that are not included in our study.

Our focus with this study is on seniors and how they use the Web, and particularly the web page Smart Things. Although we have a control group in our study which is under 65, they are not our focus. The purpose of having this control group is to compare how seniors and non-seniors manage on the Web.

Although Smart Things is to be used both by seniors and people with disabilities, we will not take into account people with disabilities. This does not mean that seniors participating in our study do not have disabilities, but it is not our main focus. In order to study how people with disabilities manage on the Web, we would need a broader sample of people with different disabilities in order to compare.

### **1.5 Intended audience**

Our target group is people that are interested in what to take into account when developing web pages for seniors. This essay is also done to give The Swedish Handicap Institute and other authorities' knowledge and understanding about how elderly people use the Web page Smart Things and their opinions about it. We believe that people who read this paper are familiar with the vocabulary that is used in Informatics and computer science such as browse, net, web pages, navigate and so forth.

## 2 Method

### 2.1 Choice of method

We have followed Kyléns (2004) recommendations about using a method that will help us to find the knowledge we are seeking instead of using a method that we are used to. We believed that a deductive approach (Thurén, 1998) was most suitable for our research since we are presenting guidelines on how to develop web pages with focus on seniors. We have chosen to have a qualitative approach in our study.

According to Creswell (2002) the qualitative method can be used no matter what kind of scientific question you may have. The qualitative methods are done in natural settings which give the scientist possibilities to gather knowledge about the specific place, experience and more details of the study (Creswell 2002). According to Miles and Huberman (1994) text speaks more convincing and explains better than numbers to the readers and we agree.

We have chosen to use techniques that are developed for interaction designers to receive information that is useful that traditional method can't provide. By using the "thinking-aloud technique" we believe that we received more information and developed a better relationship with the participants. The combination of the thinking-aloud technique with a traditional method like interviews, has given us the most out of our contact with seniors. When using only interviews, participant frustration and other human responses are difficult to capture, but by using the thinking-aloud technique this is captured (Preece et. al, 2002). The thinking-aloud technique alone was not enough for us, because we wanted to understand why they felt frustration and that kind of knowledge we got by way of interviews.

### 2.2 Data collection

According to Creswell (2002) the research question should be combined to a strategy. Since we lack experience and knowledge about seniors' use of computers we had to gather that information before evaluating the webpage Smart Things. When we had the basic knowledge we performed the observation.

#### *2.2.1 Observing the thinking-aloud technique*

To gain knowledge about how seniors browse the Internet compared to younger generations we used the "thinking-aloud technique" as mentioned earlier (See appendix 1). Three seniors and three younger people participated in this observation. We let the participants decide where to meet and when, so that they would feel comfortable, as recommended by Kvale (1997). We gave them three identical tasks to solve. The task was to find different products through different search functions at the web page Smart

Things. Through the whole task we let them think out loud. Thinking-aloud technique is, according to us, a good technique to use when observing how people browse the Web. Instead of asking them questions, participants must solve a task and talk out loud as they think. This gives more information, and interesting data and frustration and misunderstanding is easier to find (Preece et. al, 2002).

According to Preece et. al, (2002) a silence can occur during the observation which is a big problem. It is, therefore, important to remind the participant to think out loud. This happened in several occasions with the seniors. In our observation the younger people had no problem thinking aloud but one of the women did not want to make mistakes and asked us “*right?*”, “*Am I doing correct?*” which made it more difficult to follow the technique strictly. According to the thinking-aloud technique the participants are not supposed to receive help (Preece et. al, 2002) but we felt that it was more important for us to observe how they think in all the different steps than not having the task completed. Therefore we helped them when they were stuck. This has been documented.

After the participants had finished the task we had semi structured interview (Kylén, 2004) with them. We believe that semi structured interviews were most suitable because, depending on the outcome from the task, we could have a more relaxed and open discussion but still remaining in the area we were investigating without going too far from the main subject. We asked them questions about the layout, information, and about the search function.

All six participants had the same tasks to solve with the same conditions. We therefore maintain that the observation had been to a high standard. The interview later on did not follow a structured template, all participants got the same questions, but in another order. Due to that, the semi structured interview can't have as high standardization as the observation.

### **2.2.2.1 Analysis**

The data gathered from the observation was transcript like a summary. Miles and Huberman (1994) state that all information from an interview is not necessary to be transcript. We did not only perform interviews, we did observations, which made it more difficult to transcript what they were doing and saying at the same time. We made a reduction of data (Miles & Huberman, 1994) that was not relevant to our research question, but that information is presented in appendix 2 because it is relevant to the evaluation and suggestions about how to improve the web page Smart Things to The Swedish Handicap Institute. In order to know that we did not misunderstand or interpret the data in a wrong way we performed what Bryman (1997) describes as a responders control. We contacted the responders by telephone and let them make corrections if we had misunderstood them.

## 2.3 Choice of participants

We have followed Trost (1994) recommendations when selecting sample from the population by deciding first our purpose and who is representative. In our case, all people over 65 years were representative.

The Swedish Handicap Institute did not have a member list or knew seniors that could participate answering our questionnaire. We, therefore, contacted different senior organisations but no one could help us. We had some contact with the Pensioner national organisation (Pensionärernas Riksorganisation, PRO) and hoped for their collaboration but unfortunately they could not help us. They have a bureaucracy that would take 3 months before a member list could be given to us. By then this paper had to be handed in. We therefore, asked seniors at different service houses, at libraries and downtown in Lund and Malmö to fill in the questionnaire. We also met seniors during a information meeting in Eslöv where we found two seniors that participated in our observation. We chose to ask seniors with different backgrounds, those who were used to browse the Internet and those who never used Internet. The participants under the age of 65 that participated had also different backgrounds and experience.

## 2.4 Method problem

To make sure that our approach and choice of method is reliable we had to critically investigate our findings and conclusions. We followed Kvale (1997) recommendations to investigate if our material was valid and reliable. According to Kvale (1997) you can verify knowledge in relation to reliability, validity and generalisation. In our case we focused on following the three goals when generalising, videlicet to study what is typically, usual and ordinary, what can be found and what should be found. We knew from the beginning that since we are performing a qualitative study in the observation we can't make a generalization of the whole population of seniors, only those in our research (Bryman, 1997).

### 2.4.1 *Validity and reliability*

According to Miles and Huberman (1994) a researcher has to ask the question whether the research will provide something significant. We believe that our research will do that. When drawing conclusions and reporting them, it is our ethical responsibility to present valid and reliable data. This is achieved along each stage in the process, assuring that every stage is carried out in the proper way and following the ethical issues in each of them (Miles & Huberman, 1994).

To reach high validity we have tried to conduct our observation in a way that the research can be repeated and receive the same result as we did (Thurén, 1998). The participants had the same task to solve with the same conditions. We have tried to have in mind that we are measuring the right thing in a reliable way (Thurén, 1998). We have therefore collected material before conducting the observations.

#### *2.4.2 Scientific and ethical quality*

We believe that our research can contribute in some significant way. We had experience in performing evaluation from previous studies but not in the area of seniors and Internet. We therefore had help from The Swedish Handicap Institute to get the knowledge we lack and also from literature we found.

We have been using Kvale (1997) 7 recommendations about how to handle the ethical quality throughout the whole process by following the seven science stages which are; theme, planning, interview situation, transcript, analysis, verifying and reporting.

We, as researchers, have a big responsibility, and we have been critical about the quality of the scientific knowledge and about the soundness of ethical decisions in our research (Kvale, 1997). In order to get some references about which kind of ethical issues can be encountered in this context and how to deal with them, we have addressed the typical ethical issues, such as assuring confidentiality, anonymity and privacy (Miles & Huberman, 1994). We have followed Yin (2003) recommendations about the importance of explaining to the participants in the research how the information will be used and who will access it during the research process and when it is finished. The participants that performed the tasks in observations were good informed about the purpose with our research and that the information will be introduced to The Swedish Handicap Institute and in our master thesis. The participants were not forced to participate and only those who wanted to take part did it, which we believe, make this research correct and trustworthy (Miles & Huberman, 1994). They were also informed that they could terminate observation in any given time (Kvale 1997).

When conducting the interviews we were very cautious to not ask leading questions. From the beginning we started to think about how to obtain the subject's informed consent to participate in the study. During the development of the observation we asked ourselves about the triviality of the study, how important is it? Is it useful? (Kvale, 1997) We think that the guidelines we extracted from our research can be useful when designing for seniors. It is important to note that presenting guidelines can have disadvantages. It is important to understand that guidelines are only recommendations that can't always be followed strictly. The guidelines that we present are not only applicable to senior's but also to people with disabilities. We have only focused our research from the senior's perspective and we believe that our guidelines can help the Swedish Handicap Institute to design a more usable web page with the focus on seniors.

#### *2.4.3 Quality of the source*

When searching for relevant theories and information we selected literature that came from a scientific background by selecting books and articles that been published in an accepted scientific community, for instance like ELIN (Electronic Library Information Navigator, at Lunds University). If possible we always tried to refer to the main source. The web pages that we have referred too are well-known web pages that in our opinion are serious.

## 3 Literature study

### 3.1 Seniors and computers

One of five seniors has access to Internet in Sweden which is a small amount comparing to the younger generation where four out of five people under the age of 50 have access to Internet (Senior2005, SOU 2003:91 p. 189). According to SCB Statistiska Centralbyrån 28% in the ages 65–74 had or were using the computer in 2002 compared to the whole selection with the ages 16–74 where 73% were using the computers. From the elderly group 20% had or is using the Internet. There has been an increasing used of the Internet by the elderly group where they mostly search for information, only 8% buy or sell on the Internet, which is a small number compared to the whole selection where 48% sell or buy on Internet (Senior2005, SOU 2003:91 p. 139).

One of the most important barriers that elderly people face when trying to use the Internet and computers is lack of familiarity with them and with the models associated to them (Dickinson et. al., 2005), like for instance, how to use a mouse, what to expect when scrolling a page or how to use a toolbar. This makes them more insecure and less confident (Morrel & Echt, 1997). The evidence shows that as senior's computer skills and knowledge increase, their feelings of fear and uncertainty toward the computers decrease as well (Smith, 2005). Besides, users without previous experience with computers and Internet might have problems forming mental models of Web navigation, which are exacerbated by complex page layouts and pages dense with content and navigational options (Hanson & Crayne, 2005).

However, according to Morrel and Echt (1997), older people are motivated to use technology and computers, and studies about seniors attitude towards technology have shown that they want be part of the development that is happening in today's society and that the need for learning the technological vocabulary and structure of system is high (*Senior 2005*, SOU 2003:91, p. 132). On the other hand, they could also gain many benefits from it, like decreasing levels of depression, increasing cognitive skills or making use of a valuable mean of social interaction.

Finally, among the reasons for seniors not using computers could be:

- Computer hardware and software developers have focused their attention in younger people (Coyne & Nielsen, 2002; Dickinson et. al., 2005; Morrel & Echt, 1997).
- Computer hardware and software are usually developed by younger people who *“often assume that all users have perfect vision and motor control, and know everything about the Web”* (Coyne & Nielsen, 2002).
- Many seniors lack knowledge, experience and mental models about how computers and the Internet work (Coyne & Nielsen, 2002; Morrel & Echt, 1997).

## 3.2 Cognitive aspects for seniors

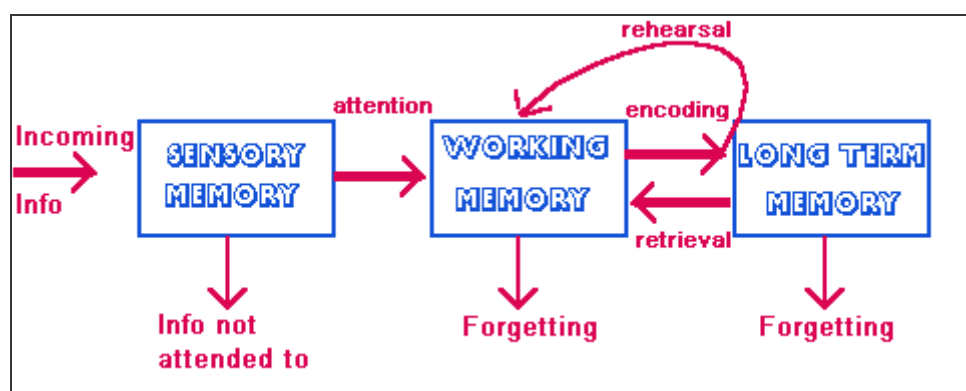
There are many stereotypes associated with getting older and with elderly people. Getting older is not only about losing cognitive capacities, as usually thought, but some gains also exist (Park, 1999; Sternberg & Lubart, 2001; Howard & Howard, 1997). Although technologically developed and western cultures tend to devalue elderly people, many cultures attribute to people in this stage of life some qualities, such as wisdom or experience. Both aspects, gains and losses, must be understood in order to design usable web pages for older people. In this section we are going to explain which are the myths and the truths about how age affects cognition.

### 3.2.1 Memory

Memory is not just one single function that a person can have or lose, but it is composed of several systems (Westen, 2002). Different mechanisms and systems are working when recalling how to drive a car and when trying to remember one friend's phone number. No single system is completely immune to the negative effects of aging on performance (Bäckman et. al., 2001), but there are certainly some differences in the amount of loss depending on the memory task under consideration ( Craik, 1999). In this section a brief review of the effects that age can cause on memory is presented.

Unfortunately there is no agreement about how to decompose the overall concept of 'memory'. The standard scheme is the one which suggests three successive stages (picture 3-1): sensory memory, short-term memory (STM) and long-term memory (LTM). A more extended model proposed by Tulving and his colleagues (Craik, 1999) goes for five components as follows: procedural memory, the perceptual representational system (PRS) (which corresponds roughly to sensory memory), primary memory (which corresponds to STM), episodic memory, and semantic memory (both of them corresponding to LTM).

In the following sections the three stages scheme for memory is addressed. Given the fact that procedural memory in the five component model is the only one without a match in the three stages model, it will be explained separated.



Picture 3-1 Three stages scheme for memory

(Georgia Tech-College of Computing)

### **Sensory memory (Perceptual representational memory)**

Sensory memory keeps brief information of the environment around us, it starts working when some stimuli are presented and it retains the information after the stimulus has disappeared (Westen, 2002). The information in sensory memory goes into the next level of memory by paying attention, therefore that information of the environment that is not of interest disappears after few moments.

Although we have five senses, most research has focused on visual and auditory sensory registration. The iconic storage is where visual images are kept for a short time (ChangingMinds.org, 2006) and it lasts approximately for half a second (Sperling, 1960). On the other hand there is echoic storage, which is a “momentary memory for sound and speech” (Westen, 2002, p. 197).

Little research has been done assessing the effects of aging on sensory memory ( Craik, 1999). However it is clear that the different sensory mechanisms show some changes with age, as seniors usually have vision and hearing problems.

### **Short-term memory (Perceptual representational system)**

Short-term memory is a system for temporally storing and managing information (MedicineNet.com, 2006) for roughly 20 to 30 seconds, unless some effort is made to keep it by repeating it over and over (Westen, 2002). The average number of pieces of information that a person can keep in short-term memory is 7, plus or minus 2 (Preece et. al., 2002). According to Lars Bäckman et al. (2001, p. 353):

*“...short-term-memory operations can be roughly divided into those that deal with merely holding information in consciousness (primary memory) and those that involve processing information while maintaining other information as well as task-relevant goals and strategies at a conscious level (working memory).”*

According to Bäckman et. al. (2001) and Craik (1999) there are some studies showing that the primary memory is little affected by passage of time, whereas for the working memory, this is, when the task requires storage as well as processing of information, age-related effects can be easily perceived, increasing these effects when cognitive demands increase.

### **Long-term memory (Episodic and semantic memory)**

Long-term memory is memory that can last as little as 30 seconds or as long as decades or even as long as a lifetime (Bäckman et. al., 2001). According to the standard model, the longer the information is in the STM, more likely it is to go in LTM (Westen, 2002).

Mapping the five stages model into the standard model, long-term memory corresponds to episodic and semantic memory. *“Episodic memory deals with the acquisition and retrieval of information that is acquired in a particular place at a particular time”* (Bäckman et. al., 2001, p. 354), it consists, therefore, of memories of particular events that happened quite recently. This kind of memory allows people to remember what



they had for dinner last night, for example. There are strong evidences that episodic memory suffers of a big descent from thirties and forties to seventies and eighties ( Craik, 1999). However there are some differences when presenting elderly people with some kind of cue or hint, helping them, this way, remember.

Coming to semantic memory, it refers to general world knowledge (Westen, 2002) such as knowing that the capital of Sweden is Stockholm. The information stored in the semantic memory has not any reference to when it was acquired (Bäckman et. al., 2001; Craik, 1999). Some aspects of this memory, like knowledge and use of vocabulary shows very little decline until last senescence (Craik, 1999), being, in some cases, older adults superior to younger adults in vocabulary tests (Howard & Howard, 1997). Studies have also shown that there are almost no differences between younger adults and older adults in tasks assessing the ability to describe objects (Bäckman et. al., 2001). On the other hand, difficulties have been reported in word-finding activities, like the problems they encounter when trying to retrieve names, generating items in tests of verbal fluency, naming common objects and producing words from definitions (Bäckman et. al., 2001).

### **Procedural memory**

Procedural memory, also refereed to as *skill* or *habit memory*, is a term used to cover the learning of activities that have to do with motor and cognitive skills. This kind of knowledge is not directly accessible to consciousness and can only be demonstrated by action, (Bäckman et. al., 2001). An example of that is riding a bike, if asked it is difficult to explain how to do it, but still the person can ride a bike. The kind of knowledge that is kept in the procedural memory is acquired slowly, and it goes into this memory by practicing, since at the beginning another kind of memories plays a role. Therefore these abilities have an automatic component associated to them (Craik, 1999), like when we drive a car we do not have to think about how to change gears or brake.

Procedural knowledge is not hardly affected by the passage of time, as can be shown when trying to ride a bike after many years without doing it. According to Craik (1999) there are some examples that show that procedural memory processes are not affected by aging. On the other hand there are some evidences that aging can affect procedural memory negatively, in both non motor and motor procedural tasks (Bäckman et. al., 2001). One of the aspects that seem to be generally affected by age is skill learning (Howard & Howard, 1997). However these differences in the results of the studies can be due to the fact that since procedural memory involves a big range of abilities (Howard & Howard, 1997), each study can have been focused on only one aspect of it. Therefore there is no sufficient evidence about the way that aging affects the procedural memory.

### 3.2.2 Attention

*“Attention refers to the process of focusing conscious awareness” (Westen, 2002, p. 305).*

In general the more practice an individual has in doing something the less attention it requires, this is, it becomes more mechanical (Moray, 1969). Different kinds of attention can be distinguished:

#### **Selective attention**

We are constantly receiving stimulus from the environment, but it is impossible to pay attention to all of them, which is why we must select which of them are important at a given time to accomplish a specific task and which ones are not. Selective attention, therefore, filters stimulus (Rogers, 1999). Two processes are involved in selective attention: selection of relevant information and inhibition of irrelevant information (Rogers & Fisk, 2001).

When coming to the effects of age in selective attention, the evidence shows that at first senior are as good as younger adults at selective attention tasks (Rogers, 1999). This is like that when the task at hand is relatively easy, such as simple features searches, the task does not require much memory load, when seniors have sufficient practice in the task at hand or when cues are provided (Rogers, 1999; Westen, 2002). However, for more complex tasks, the deficits in selective attention for older people can be reduced providing them with experience or with cuing information (Rogers, 1999).

#### **Focused attention**

Focused attention is about concentrating the attention on one stimulus, blocking out other present stimuli. The difference between focused attention and selective attention is that in focused attention the individual knows where the target is, whereas in selective attention the individual has to look for it (Rogers & Fisk, 2001).

*“Focused attention involves concentration; that is, intense processing of information from a particular source” (Rogers, 1999, p. 60).*

Investigations show that seniors are able to concentrate as well as younger people, being age-related differences minimal (Rogers & Fisk, 2001). In the case of focused attention, again, older adults – as well as younger adults – benefit from cuing (Rogers & Fisk, 2001).

## **Sustained attention**

Sustained attention, also referred to as vigilance, refers to the ability of maintaining (to maintain) attention over time.

*“Successful vigilance is dependent on a number of variables ranging from the intensity of the stimulus itself to the cost of missing the appearance of the signal information” (Rogers & Fisk, 2001, p. 272).*

Whether aging affects sustained attention or not is not very clear (Rogers & Fisk, 2001; Rogers, 1999), it depends on the characteristics of the task. For vigilance tasks that require a very subtle distinction between target and non targets, or show the target for a too short period of time, performance of older adults is worse than the one of younger adults, but it is not this way for tasks where the target is very salient and demands on memory are minimized (Rogers & Fisk, 2001). This could be explained by the fact that seniors need more time for processing or that their sight is not as good as when they were younger. Therefore seniors having a worse performance on sustained attention tasks does not mean that their sustained attention is worse, since that can be explained by other aspects of the task. However it is clear that they performance better if the stimulus is shown for a quite long period of time and the requirement to maintain information in working memory is minimized.

## **Divided attention**

Divided attention is about an individual’s ability to perform more than one task at the same time (Rogers, 1999). To the question whether aging affects divided attention, the appropriate answer again is it depends. Some studies show that if the tasks are memory demanding seniors may be able to divide their attention into two different tasks (Rogers & Fisk, 2001). Besides age related effects can be minimized by providing practice in one or both tasks (Rogers & Fisk, 2001), the more automatized one activity is, the more easy is to perform it without paying attention. There are, therefore, some variables to take into account, such as the difficulty of the tasks, the practice provided on each task, the degree to which each task requires attention and the point to which the task is automatic.

## **3.3 Vision and auditory perception**

It is known that sensory mechanisms, which are, vision, hearing, taste, touch and smell, get affected by the pass of years ( Craik, 1999). Not all of them are equally important for the use of computers. Visual input is, by far, the most common way to get information from a computer. In some cases it could be very important hearing input as well. To effectively design web pages for use by the elderly, it is very important to gain a basic understanding of how aging affects vision and hearing.

### 3.3.1 Vision

Declines in the visual system can start appearing in the middle age, but the greater losses are seen in later life (Morrell & Echt, 1997). According to the studies older adults can benefit more than younger adults from a better contrast and a high level of illumination (Forzard & Gordon-Salant, 2001). Controlling the light is important also in order to avoid glare since it takes longer for older adults to recover from it (Kline & Scialfa, 1997). Coming to the colours, colour discrimination also declines with age (Kline & Scialfa, 1997; Forzard & Gordon-Salant, 2001) and it is even poorer when the luminance is low (Forzard & Gordon-Salant, 2001).

According to Hanson and Crayne (2005) the failing eyesight that older people get with aging make it difficult to read a text on a computer screen, it also accurate mouse usage due to that seniors with poor vision have difficulties selecting targets and using a scroll bar.

### 3.3.2 Hearing

The evidence shows that older adults have more problems than younger adults in both intensity and frequency discrimination (Kline & Scialfa, 1997; Forzard & Gordon-Salant, 2001). According to Kline and Scialfa (1997) the biggest decline in frequency discrimination occurs at high frequencies and it can be even more degraded after being long time exposures to noise. These declines can be a problem both for speech perception and sound localization (Forzard & Gordon-Salant, 2001).

## 3.4 Usability

In this section we present definition about usability and why it is important to put the user first and the technology second to achieve products that are user-friendly.

### 3.4.1 Definition

There are several definitions on what usability is. According to Cronholm (1998) the conception of usability is wild and wide where everybody knows what they are talking about but no common definition exists.

ISO 9241-11 define usability as:

*“Usability is the extent in which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”.* (Ottersten & Berndtsson (2002 p. 16).

Ottersten and Berndtsson (2002, p. 14) define usability as a

*“...quality characteristic among interactive products. A product has high usability if it fulfils the purpose for the target group”.*

According to Pühertmair and Miesenberger (2005 p. 861):

*“Usability refers to the quality of a system and the process of designing a usable system”.*

They state that usability can't be checked automatically and that usability in web design has to cope with:

- Perceptibility
- Understandability
- Operability
- Memorability
- Efficiency and
- Technical robustness

According to Ottersten and Berndtsson (2002) there are three different aspects of usability; the human system, the consistency where the product will be used and the benefit that the product is expected to give. Ottersten and Berndtsson (2002) state that by only following GUI (Graphical User Interface) guidelines will not result in usable interfaces, what you see on the screen is not the same as usability and it requires analysis to program a usable interface.

Preece et. al. (2002, p. 14) present goals of usability which are:

- Effective to use
- Efficient to use
- Have good utility
- Easy to learn
- Easy to remember

By following these goals the user will be on focus and the product will be developed from the user perspective.

Jordan (1998) states that a user can experience a product to be very hard but once they understood it, and had practice it they later believe that it is easy. To reflect this, Jordan developed a three-component model. The components are (Jordan, 1998, p. 12ff):

- *Guessability – The effectiveness, efficiency and satisfaction with which specified users can complete specified task with a particular product for the first time.*
- *Learnability – The effectiveness, efficiency and satisfaction which a specified user can achieve a competent level of performance on specified tasks with a product, having already completed those asks once previously.*
- *Experienced user performance – The effectiveness, efficiency and satisfaction with which specified experienced users can achieve specified tasks with a particular product.*

A later extension of this model includes the components:

- *System potential – The optimum level of effectiveness, efficiency and satisfaction with which it would be possible to complete specified tasks with a product.*

- Re-usability – *The effectiveness, efficiency and satisfaction with which specified users can achieve specified tasks with a particular product after a comparatively long period away from these tasks.*

#### 3.4.2 *The importance of usability*

Jordan (1998, p. 16) states that:

*“Lack of usability can cause problems which, at one end of the scale, may frustrate or annoy the user and, at the other end of the scale, might be life-threatening.”*

According to Kaasgaard (2000) the designers of software need to have an understanding of the whole context of usability and not just part of it. Usability has many faces and today's technologies have increased demands and needs on systems that require that usability takes into consideration. To do that it is necessary to apply design from the basis of different disciplines like computer science, cognition, sociology, communication science, graphical science and interaction design (Kaasgaard, 2000). The reason for projects which takes usability into consideration to fail, is a result of a too big rift between designing an application and using it. Kaasgaard (2000, p. 14) states that people generally have no difficult to use a computer, it is rather the cognitive distance between the mental model of designers and the users that is a fact. Ledell (1993) takes this a step further and claim that it doesn't matter if the information is correct, the usability depends on how the user feels toward the product. If a user has bad attitude and knowledge towards the product, he or she will not accept it. It requires competence, positive attitude for all involved in developing a product for the users to accept it.

#### 3.4.3 *The new usability challenge*

Thomas and Macredie (2002) are promoting that the new usability challenge is how to respond quickly to emerging technologies and applications. They argue that today's existing methods are not good enough because they are focusing on one user that is facing the computer and gives full attentions to the system with minimal distractions. This is not how users are using the products today. Hallnäs and Redström (2002) claim that it should be a focus on presence instead of functional descriptions of use. This is due to that people are using devices, like mobile phone while they are interacting with other things and therefore require new ways of interacting with the device.

#### 3.4.4. *General recommendations for designing web pages*

In this section we present different recommendations on how to design web pages that are focusing on usability. There are many different guidelines that are similar to each other that explain how to design web pages and with the increased popularity of usability many methods have emerged.

Nielsen (1999) argues that simplicity is very important for developing usable web pages. A home page principle is to answer the user what they are doing there and the purpose with the home page. This is also stated by Pühertmair and Miesenberger (2005) that say it is important from the usability perspective that a user easily can go back to the main page or have an understanding where they are going and where they have been. Nielsen (1999) claims that the three most important functions in a home page is a catalogue over the web pages main area (navigation), a summary of the most important news and a search function. The logotype is also important and should be placed in the left upper corner. Research has shown that it takes 25 % slower to read on a screen than on paper and therefore should the text on a web pages be short and consist. Capital letters should be avoided, if not to get user's attention, because it is about 10% slower to read than mixed-case text (Nielsen, 1993).

Pühertmair and Miesenberger (2005) imply the importance of the web page to be readable and that the buttons and links can be identified by the user. The user must understand how to navigate and be able to recognize where they are. Pühertmair and Miesenberger (2005) state that content is more than pure text and a usable web page has interesting functionalities with new and correct information where the quality and not the quantity matter. That is important to have a successful web page. Pühertmair and Miesenberger (2005 p. 864) presents in their article different checkpoints that contain in WCAG (Web Content Accessibility Guidelines) that are related to usability. Some of these checkpoints are present below.

1. The language should be clear and simple.
2. There should be a division between large blocks of information into more manageable groups.
3. A consistent manner should be in the use navigation mechanisms.
4. A logical tab order should exist.
5. The distinguish information should be placed in the beginning of headings, paragraphs and list.
6. A consistency across the pages should exist.

Hanson and Crayne (2005 p. 47) state in their article that the W3C User Agent Accessibility Guidelines address the user's need when it comes to web pages. They claim that:

*“In order to meet the diversity of user needs, it is necessary to provide for user control over content delivery such that individuals are able to make adjustments to pages to tailor them to their needs.”*

According to Ling and van Schaik (2001) the navigation is one aspect that affects usability due to the fact that navigation actions compose 90 % of all recorded web browser actions. It is therefore important that these actions can be performed easily and efficiently otherwise can the poor design result in decreased task performance. The authors recommend colours to enhance the effectiveness of graphical displays which can lead to faster search times.

They state that:

*“Well-chosen colours will enhance performance, poorly chosen ones will decrease performance and increase the probability of visual fatigue. All colours can be specified in terms of a combination of red, green and blue (indeed, this is how colours are specified in HTML), and research has shown that the primary colours of red, green, blue and yellow lead to higher levels of conspicuity than non-primary colours”.* (Ling & van Schaik, 2001 p. 224)

Future Ling and van Schaik (2001) recommend that the use of colours should also be influenced by the cognitive and perceptual constraints of a user.

### **3.5 Previous studies about usability for seniors**

#### *3.5.1 Web usability for seniors citizens (Coyne & Nielsen)*

Nielsen Norman Group report has made a study in order to gain knowledge about how people with age 65 and over use the Web and whether there are any web usage differences between seniors and people between ages of 21 and 55. As a result Coyne and Nielsen (2002) came up with some guidelines for designing web pages for elderly people, which, if applied, can be useful for any kind of users, not only seniors. In this section we present their research with the most relevant guidelines for our study.

##### **3.5.1.1 Methodology**

Coyne and Nielsen (2002) conducted a quantitative and a qualitative study to learn how seniors use the Internet. The study was divided as follows:

- A quantitative study, using three web pages and a Web-wide task, with 20 seniors and a control group of 20 users between the ages of 21 and 55.
- A qualitative study with 20 U.S. seniors using 10 U.S. sites.
- A qualitative study with 4 Japanese seniors using 4 Japanese sites (to assess the international applicability of the findings).

In the quantitative study all the participants receive the same tasks. The participants had to look at three web pages for performing the tasks. All the participants tested the same web pages. The next tasks were included in the quantitative study:

- Fact-finding
- Buying an item
- Retrieving information
- Comparing and contrasting

In the qualitative study the participants didn't test the same web pages, so although they performed the same type of tasks, those were different depending on the web page being



tested. Ten different web pages were tested, where each of them tested twice. Each participant used only one site. The qualitative study included different tasks that we present below. Participants were told what to find but not how, non specific web page was provided. The tasks were to:

- Searching on the Web
  - What movie won the Academy Award for Best picture in 1991, and who were the two main stars and the director?
  - How tall is the Empire State Building?
- Research and learning
  - Your friend has the flu, plus an earache and a wheezing cough. Figure out whether she needs to call the doctor.
  - Explain why the shape of a wine glass makes it optimal for tasting.
- Buying item/finding contact information/applying for or requesting items
  - Book a flight to San Francisco on March 15, and come home on March 20.
  - Buy something that will keep your socks together.
  - See what volunteer opportunities are available, and find out who to contact to get involved, and how to contact them.
  - Apply for an automobile loan for \$20,000, to be paid off in three years.
- Retrieving information/fact-finding
  - How many people in the U.S. have osteoporosis, and what percentage of them are women?
  - What's on TV on the Discovery Channel on Saturday at 10:00 P.M.?
  - Find a toy for your 10-year-old grandson who likes science and music.
  - You have a little currency left over from a trip you took abroad. Currently, how many U.S. dollars can you get for one Euro and one Japanese Yen?

### **3.5.1.2 Coyne and Nielsen Findings**

According to Coyne and Nielsen (2002) many seniors have not necessarily learned the conceptual models of how computers and the Internet work, which results to more difficulties for them with navigation. Coyne and Nielsen (2002) state that seniors suffer more with usability problems than younger people, since they usually have more problems with eyesight, precision of movement, and memory.

Due to problems with eyesight, the type in web pages should be at least 12-point as the default, always offering the possibility of increasing the size of the text when the target groups for the web pages are seniors.

Coyne and Nielsen (2002) noticed that seniors had difficulties when browsing the Web pages due to memory problems. In order to reduce their work load Coyne and Nielsen (2002) recommend that links always should change colour after having visiting them, due to that elderly people easily loose track, and forget where they have been previously. They also recalled that senior had psychomotor problems due to pull-down menus, hierarchically walking menus, and other moving interface elements which for seniors are difficult to manoeuvre. Therefore they recommend too use interface elements that do not require pixel-perfect pointing.

When encountering errors, Coyne and Nielsen (2002) recommends that those should be clearly explained. Simplicity is even more important for seniors, since many seniors lack the technical vocabulary used particularly in some error messages. With search engines and forms, Coyne and Nielsen (2002) recommend that they should be more flexible. Many times seniors got used to different formats than exist today, for example telephone numbers' format, which, in some places, used to need a hyphen or parentheses but not anymore. In this study many seniors got thwarted when, after typing hyphens in their search queries, did not get any result.

Coyne and Nielsen (2002) study show that seniors work, generally, more slow than younger participants and it took them longer to complete the tasks. They also notice that the number of seniors who quit before completing a task was much greater than the number of people in the control group. Seniors usually stopped working when they felt that they had reached a standstill. Despite all this, they were slightly more forgiving in terms of overall satisfaction. According to Coyne and Nielsen (2002) seniors were usually quite satisfied with the overall Web experience, and since they noticed that they had learned something during the sessions, they were interested in learning more new things. The level of confidence of seniors, compared to younger control group, was lower, perhaps due to the fact that they had little affirmation that they were performing the task correct.

Another remark that Coyne and Nielsen (2002) made was that seniors read and scroll pages more than the younger control group. When things like error messages, alerts or purchasing terms appeared, seniors occasionally read them, unlike most other users in the study.

Finally, an important observation that was made by Coyne and Nielsen (2002) is that few seniors had their computer workspace set up properly so it was comfortable and ergonomically correct, which could have contributed to participants' fatigue levels and tendency to stop.

### **3.5.1.3 The quantitative study**

In the quantitative study Coyne and Nielsen (2002) used three web pages and a Web-wide task, with 20 seniors and a control group of 20 users between the ages of 21 and 55. They tracked success rate, time on task, error count, and participant's subjective ratings.

Success rate indicates whether participants completed the task.

- The time on task measure indicates the time required for users to perform a task.

- The error count indicates how many erroneous actions users performed during a task.
- The subjective rating indicates users' average response to three questions that assessed their satisfaction, confidence, and frustration levels.

The table 3-1 presents the measurements of the above explained measures. As it is shown in the table there is a big difference between the group of seniors and the control group, being all the measures worse for seniors. Based on these measures Coyne and Nielsen (2002) estimated that the Web is about twice easier to use for non-seniors than for seniors.

**Table 3-1** Measurements for some indicators in Coyne & Nielsen's study

	SENIORS	CONTROL GROUP
Success rate	52.9%	78.2%
Time on task (min:sec)	12:33	7:14
Errors	4.6	0.6
Subjective rating (1=low, 7= high)	3.7	4.6

**Success rate** – On average, people age 65 and over were about 68% as successful completing tasks as participants in the control group. In the study it was found a strong correlation between the success score when performing the tasks and participants' subjective rating of the web page:  $r = 0.78$ . When increasing seniors' satisfaction they are more likely to return and form a long-term relationship with that site.

**Time on task** – It took seniors 66% more time completing tasks than participants between the ages of 21 and 55.

**Subjective rating** – Seniors rated their satisfaction at 3.70 out of a possible 7, while non-seniors rated it at 4.19. This means that seniors were 22% less satisfied than participants between the ages of 21 and 55. Although satisfaction is still lower for senior than for non-seniors, it is an unexpected result, based in previous studies.

When talking about confidence, on average, seniors rated their confidence at 3.95 out of 7, and non-seniors rated it at 5.04 out of a possible 7, which means that seniors were 22% less confident than non-seniors when completing tasks. When it came to frustration, on average, people age 65 or more rated their frustration at 3.44 out of 7, with 7 indicating the least frustration, and non-seniors rated it at 4.55. This means that elderly people were 24% more frustrated than participants between the ages 21 and 55.

#### 3.5.1.4 Coyne and Nielsen Guidelines

Coyne and Nielsen's study was particularly wide, including many participants, web pages, tasks and both quantitative and qualitative approaches. Our study is not as broad as that one. As aforementioned, we only have tested the web page Smart Things, so we are missing many aspects of web pages, such as it could be a web page to sell products,

or a web page for an air company, where some forms should be fill in. Therefore, some of the topics that are covered in Coyne and Nielsen study are not relevant for us, such as ‘presenting items for sale’, ‘web address and homepage’ or ‘forms’. Those and other not relevant have not been included here and we are not taken into account for the discussion.

The same way, even if the topic is presented, sometimes we have decided to exclude some of the guidelines in it because of the same reason. The purpose of this is to compare their guidelines with the ones we got from our study.

In this section we briefly present some of the guidelines and they are taken literally from Coyne and Nielsen (2002, p. 22-25) study.

### **Presenting information and text**

1. Ensure that text size is at least 12 points by default.
2. Offer a button to increase text size for the web page.
3. Use available space economically.
4. Write for the users. Present technical information in a non-technical way that is easy to read and understand.
5. Present information messages (and error messages) clearly, and in a non-threatening way.
6. Carefully consider whether using Web terms in your text is necessary.
7. Present information in a format that is easy to scan.

### **Presenting navigational elements and links**

8. Differentiate between text used for linking and text used for headings. Throughout the site, present headings and links consistently. For links, use blue, bold, underlined text.
9. Use static navigational elements. Avoid using moving menus.
10. When graphical elements appear close to a text link, make those elements part of the working link.
11. Ensure that link size is at least 12 points by default. Leave space between links. Make the area immediately surrounding a link or button (within about 5 pixels) part of the link.
12. Use large text that contrasts with the background for navigational elements. Consider a link’s colour contrast both before and after it is visited.
13. Always change a link’s colour after a user visits it, especially in navigational elements and menus.
14. If you use pop-up windows, make the default size big enough to fit all or most of the information so users do not need to scroll.

15. Pull-down menus and scrolling lists are difficult for many seniors to use. Consider using drop-down menus or static UI elements instead.

## Search

16. In search queries, if a user types a dash or hyphen, ignore it by default. At the very least, detect it and specifically inform the user to remove it and search again.
17. If the search area of your site offers both a search and browsing interface, clearly separate the search box from the browsing area. (For all sites, make the search area and the area's limits obvious).
18. Cross-reference terms to ensure that searches reap results.
19. In search results, always clearly repeat the user's query.
20. Precisely label the search field. Reserve the word Search for open fields where users can type in actual search queries.
21. Ensure that search results are visible on the page without scrolling.

### 3.5.2 Applying web accessibility to Internet portals (Gappa & Nordbrock)

In a study by Gappa and Nordbrock (2004) the target group was both disabled and older people. *“The objective of the study was to gather information and issue suggestions and recommendations for the improvement of portal designs and services, as well as standard strategies for portal customisation.”* (Gappa & Nordbrock, 2004, p. 80) This study was trying to get qualitative rather than quantitative data, since the authors of the study believe that the impressions on usability and accessibility are very important for understanding the barriers encounter by the target group. Although this study was not exclusively for older people, many seniors suffer with hearing or physical impairment, which makes this study relevant and interesting to present.

#### 3.5.2.1 Methodology

In the study 23 disabled and 6 older people participated. They were distributed as it follows:

- Six physically impaired
- Six hearing-impaired
- Ten learning disabled
- Six non-handicapped seniors

They also had one expert blind person who was not a participant but helped in their study.

Gappa and Nordbrock (2004) had a people with different ages inside every group of participants. The experience that each participant had was measured by the criteria

‘frequency of Internet use’. In the table 3-2 it is displayed the experience of the participants in each group.

Table 3-2 Internet experience per group and in total

	Hearing impaired	Learning disabled	Physically disabled	Seniors	Blind expert	Total
Novice	1	1	2	0	0	4
Advanced user	3	6	2	2	0	13
Expert	2	2	2	4	1	11

In order to gain the intended knowledge, Grappa and Nordbrock (2004) used the tools as questionnaires, standard tasks, log files and observation protocols which we shortly present the result below:

- **Questionnaires** – The questionnaires consisted of structured questions, with option to write personal comments when possible. The amount of open questions was kept low because according to the authors, these kind of questions use to receive few input. The first questionnaire that participants fill in was about personal information: personal background, educational and professional background, level of computer expertise, level of Internet expertise, type of assistive devices that were used by the participants and why were they used.

Another two questionnaires were given to the participants in the study. Both of them were filled in after fulfilling the standard task. The first of them was to gather information about the participants’ opinion the German Internet portal web.de<sup>1</sup>. The items in this questionnaire were statements which participants were supposed to rate in a scale from 1 to 7, meaning 1 that the statement was always true and 7 that it never applied. The statements dealt with the layout of the web page, the design of the web structure and accessibility.

In the second questionnaire the participants were asked to express their requirements based on the experiences the gained from completing the standard task. They could choose from a checklist, write their own requirements and answer open questions.

- **A standard task** – In the standard task the participants had to look in the portal for a telephone rate’s calculator, and to determinate the cheapest rate for a call between Berlin and Bonn at a given time and date.
- **Log files** – In order to interpret the user’s behaviour, log files were kept for every step that led participants to a new web page. These log files were also used to see if the problem-solving techniques differed from one user to another and why was that.
- **Observational protocols** – The test conductor kept a protocol of every session recording incidents, conversations, and personal observations. That turned out to be a very useful information according to the authors.

<sup>1</sup> <http://web.de/>

### **3.5.2.2 Gappa and Nordbrock findings**

*In this section we will pay more attention to the results from seniors, since it is the most relevant information for our study.*

None of the participants was able to fulfil the standard task without errors, and all of the seniors reported accessibility and usability problems.

After analysing the first questionnaire Gappa and Nordbrock found out that all participants stated a clear and simple design to be crucial.

When it came to the layout and the structure, in order to support an appropriate presentation of information, 67% of the participants selected the provision of identifiable headlines, and 83% of the participants chose distinctive paragraphs of information. Besides 51% preferred at most 4-6 lines per text block, and if more lines are necessary 61% of the participants would like to have a summary.

65% of the test participants said that they would not like to have more than 6 navigation buttons, with an easy-to-remember declaration.

The majority of the participants thought that the colour coding is useful in order to distinguish practical information and differentiate between types of information. This characteristic was especially important for older people and for hearing-impaired participants (100% of the older people and 100% of hearing-impaired persons chose it).

In order to support readability of text, 100% of the seniors in the study said that they needed a big font (none of them knew how to change the size of the font), and 33% thought that it would be useful to have the text readed out loud. The need for scrolling caused many problems to all participants.

In this study all the participants who failed looking for some information in the web page, ended up using the search function. 40% of them could not use the search function with success, either because there was some irrelevant information before the searched one, or due to some spelling mistakes. According to the authors, older people are more used to look for information based on an index, as it works in printed media, and all of them tried to find the requested information by selecting items from the index instead trying it with the search engine.

Gappa and Nordbrock (2004) found out that older users are more goal-oriented in their navigation habits than the rest of the participants. Therefore they tend to leave the web page and not come back again if they are not satisfied with their experience. But on the other hand, if they find the information they want in the web page they are very unlikely to look for other providers of the same services.

### **3.5.2.3 Gappa and Nordbrock recommendations**

Grappa and Nordbrock did not use the word 'guideline' in their study, they named them recommendations.

Grappa and Nordbrock (2004) presented in their study recommendations when designing a portal for disable and older people. Their recommendations are presented in

text, not clustered by topics or ordered in some way. In order to be easier to read them, we present their recommendations in a list and clustered by topics.

We present these recommendations shortly below.

### **Layout**

1. In order to avoid the users to scroll, it should be implemented a system of pagination like the one in PDAs or mobile phones. Another solution could be presenting floating navigation bars which are always visible.

### **In-site search engine**

2. Always offer a visible in-site search function, placed at the top of the page, near the navigation bar.
3. Search engine should accommodate weak writing skills, neglect typing and spelling mistakes, and recognize conjugated verbs and declined nouns.
4. The result of the search query should be presented before any other information is displayed.
5. There should be a database with synonyms for the possible search queries that users type in.
6. The search engine must be able to suggest alternative keywords according to the users' histories of search queries.

### **Presenting information**

7. The wording and arrangement of links should accommodate the users' perspective, rather than design and marketing issues.
8. It might be helpful to emphasise the key words, since people usually scan the screen for information because reading from a screen is pretty tiring.
9. Keep the initial information set as small as possible.
10. Provide headers and summaries in the main page.
11. In the text blocks it is better to have short sentences with only one idea.

### **Buttons**

12. Enlarging the size and the distance of the navigation buttons should be customizable by the user.
13. Offer a clearly visible button for customization in the top of the screen.



**Others**

14. If after clicking a link another window is to be opened, the user should be informed by a message that another web page with different layout will be displayed in another window, and to go back to the former web page the last window should be closed.

## 4 The Swedish Handicap Institute

### 4.1 About the Swedish Handicap Institute

The Swedish Handicap Institute is a national resource on assistive technology and accessibility for persons with disabilities. They work for full participation and equality for persons with disabilities by ensuring access to high-quality assistive technology, an effective provision of assistive devices and an accessible community. The Swedish Handicap Institute is run by the Ministry of Health and Social Affairs, the Federation of Swedish Country Councils and the Swedish Association of Local Authorities.

The Swedish Handicap Institute activities cover testing and procurement of assistive devices with approximately 30 product categories and they produce assistive devices and accessories to a value of 150 million Euro per year. They also make research and support development of methods and knowledge for assessment, usability and evaluation of assistive devices. The Swedish Handicap Institute also analyses needs, knowledge and methods development for the service delivery system, compile statistics, carry out studies and gives courses on web accessibility, on rehabilitation for old persons living at home.

One of the purposes that The Swedish Handicap Institute has is to spread information and to increase knowledge and they produces 50-70 reports, books, brochures and video films every year in Sweden.

The web page that [www.hi.se](http://www.hi.se) has about 20,000 visitors per month where user can find information and links to other organisations and activities.

### 4.2 About the web page Smart Things

For couple of years ago the commune provided information about assistive product and helped people find them, but because of savings and withdraws this service has decreased. People are now force to find that information in other ways. One way is through the web page Smart Things.

The web page Smart Things – easy assistive products for home use was developed by The Swedish Handicap Institute with the support from Stiftelsen för Teknisk Hjälp åt handikappade (Foundation for technological help for disable people). During 2006 the web page was further developed with collaboration with Pensionärernas Riksorganisation, PRO (Pensioner national organisation) and Sveriges Pensionärsförbund, SPF (Swedish Pensioner alliance). The web page Smart Things was originally thought to be a new information portal on Internet, but today it is a web page where people can find tips about smart and easy assistive products that can be good to have in a daily basis, for instance products to have for personal care, in the household or to have support in your home or support for the memory.

The assistive products do not require any specific training or knowledge to use and it is obvious to understand the purpose with the products. The target group for this web page is people with different disabilities and elderly people and also for relatives and staff that work in care related work, like in a service house. The products are mostly for people that have different disabilities.

The web page Smart Things can be found from The Swedish Handicap Institute's web page [www.hi.se/smartating](http://www.hi.se/smartating).

#### *4.2.1 What the web page contains*

There are many activities that can be performed on the web page Smart Things. We shortly present them below:

- A database with simple and everyday used products.
- Addresses to supplier and manufactures of the products.
- Tips and advice where to turn for help, find information, choose product that suite the purpose and target group.
- Tips and advice how to furnish a home that makes the daily life easier.
- Laws and rules that are interesting to read about when it comes to assistive products.
- Links to relevant web pages.

## 5 Result

### 5.1 Evaluation of the web page Smart Things

#### 5.1.1 The participants

In order to see if there is any difference between how seniors navigate the web page Smart Things and how younger people do it, we did the same task with six participants, three of them under 65 years that we call the young group, and three elderly people, that we call the senior group.

Below we present a table with short information about the participants.

**Table 5-1 Information about participants in the study**

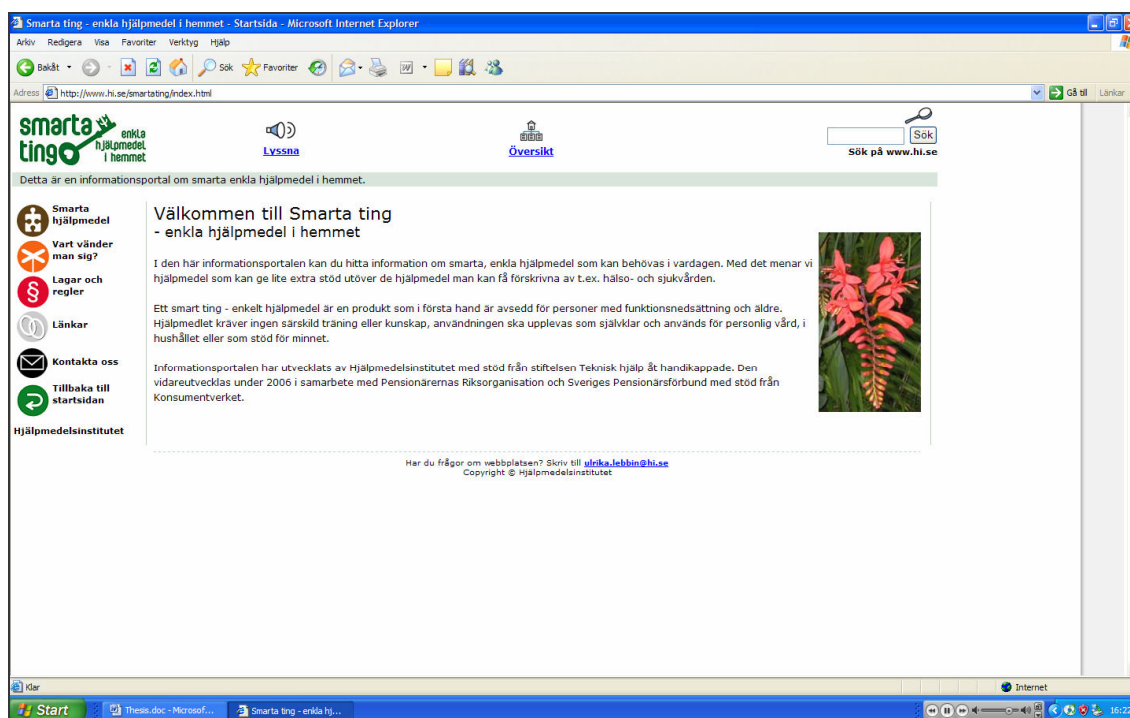
Senior Group	Young Group
Woman, 78 years old. Has no disability and has taught how to use word processor before she retired. The Internet came to her work environment after she retired. Uses the Internet little but want to learn more. Has a modem connection.	Man, 28 years old. Computer engineer that works at SonyEricsson. Has no disability and has highly experience in navigating the Web.
Man, 84 years old. Had stroke and is blind in one eye. Used computer in his profession but not Internet before he retired. He does not have a computer at home but access in a public facility where activities occur for seniors. The computer has broad band connection.	Woman, 46 years old. Runs a cafe and has no disability. She rarely used Internet.
Man, 71. Had a stroke and is in a weal chair with difficulties in moving a function disability with moving his arms and legs. Has a computer with special aids but not Internet connection and did the test at the public facility.	Woman 25, years old, student and has no disability. She uses the Internet daily but has not taken any courses about computers and Internet.

### 5.1.2 The search tasks

The tasks that the participants received were three different searches: A glass easy to grasp through the picture based search; A bottle opener through the text based search; And a sticky tablecloth for the table to put objects on that reduce the objects from slipping through the picture based search also. After the test we conducted semi-structured interviews about different aspects of the web page.

The first thing all of the participant saw when they entered the web page Smart Thing was the flower (see picture 5-1), which in their opinion was not representative of the Handicap Institute.

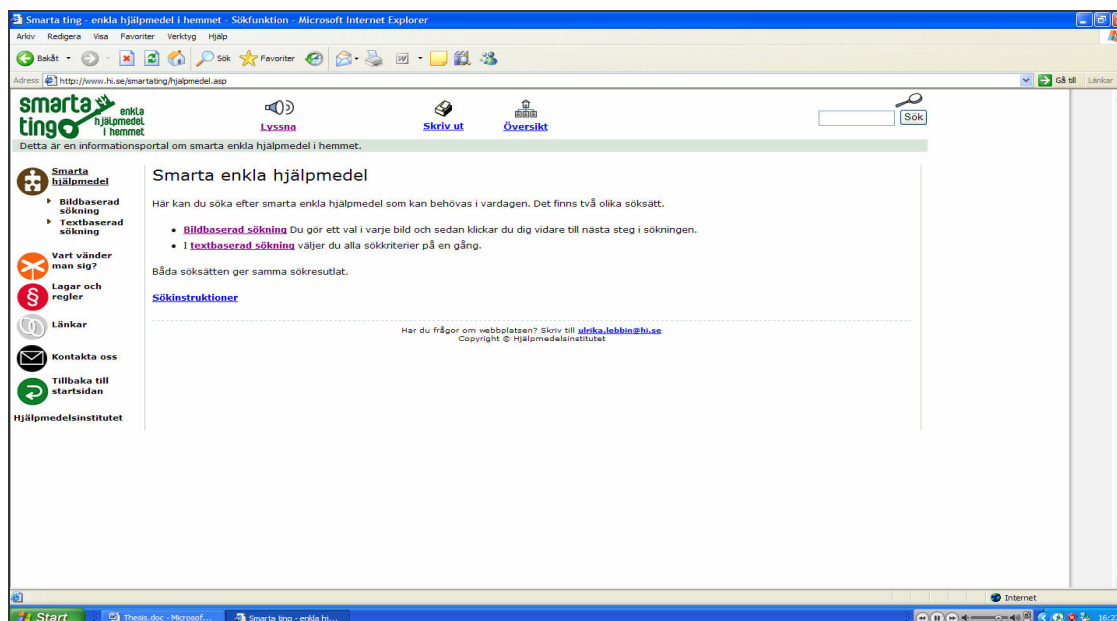
They did not feel that all the icons represented the purpose, especially the *Smart Aid* except for the 28 year old man. The icons for *law* and *rules*, *contact us* and *back to the main page* were relevant, but not the others. One of the seniors participant said that the icon for *where to turn* looked like a sign for dangerous wire.



Picture 5-1 Main web page for the “Smart Things”

None of the participants had any problem with understanding the options about how to search for products. The two choices *picture based search* and *text based search* were easy to access and understand (see picture 5-2).

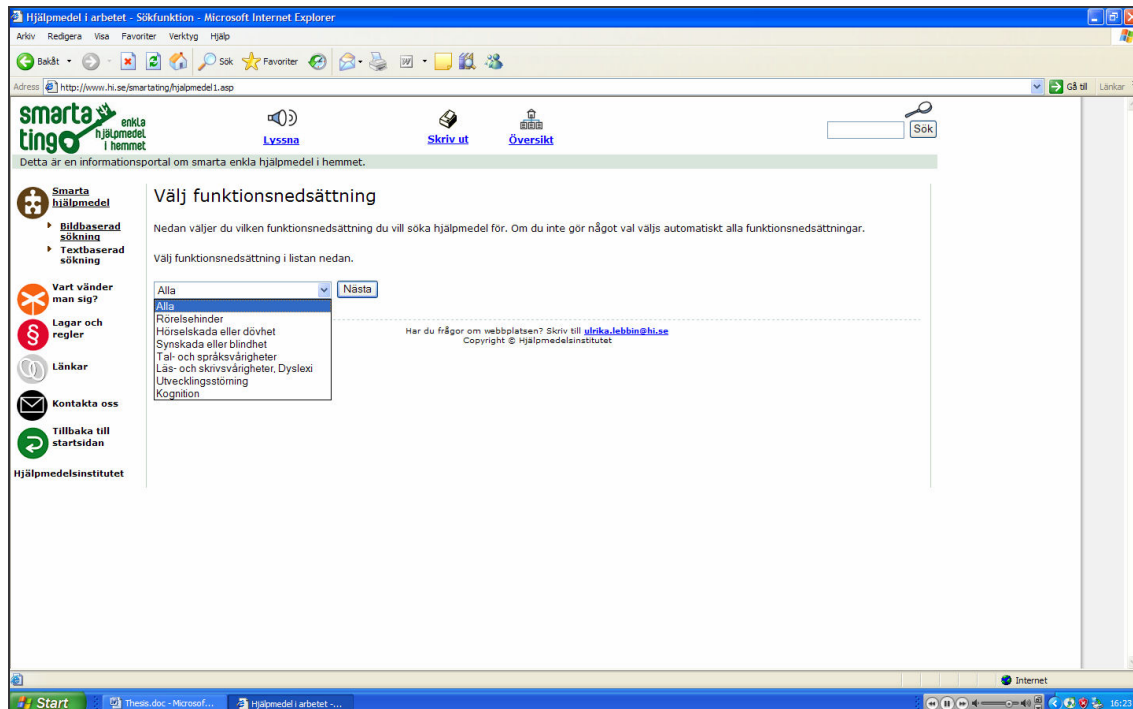
One of the seniors participants did not find the “Smart Things” logo relevant and asked us what the key represented. The 28 year old man said that it was difficult to see what where the links and the text on the page.



Picture 5-2 Option to choose picture- or text based search

After clicking in any of the searches the users arrived to a page where they were forced to choose from a list of functional disabilities before they could continue the search. The picture 5-3 shows the web page. One of the senior participants got offended and did not like the heading *Choose functional disability*. None of the participants in any group understood why they had to pick a disability at all for searching a product. None of the participants realized at first why they were there, that was not what they expected. The seniors thought they made a wrong selection and clicked the picture based search again and the young group looked at us surprised. The man that was 84 years old had difficulties with selecting a disability. The options were too close to each other and he chose the wrong disability by mistake several times.

When it came to the third task, where participants had to find a sticky tablecloth through picture based search, the seniors had difficulties choosing which disability to pick.

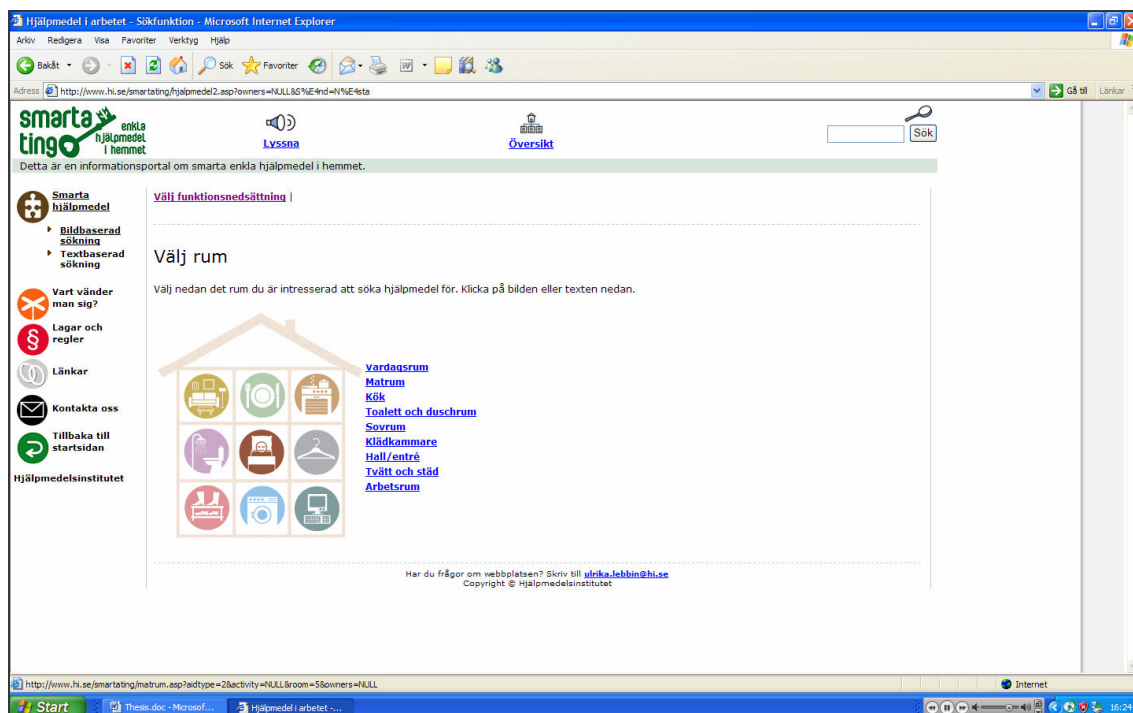


Picture 5-3 Different functional disabilities that has to be chosen before searching for a product

None of the senior participants understood what to do next after selecting a disability and they got frustrated. The woman said *“I have selected the disability so why is nothing happening?”*. The two men started to select a disability again and searching for something in the web browser menu. One of them thought that the button for scrolling the option list was the *next* button and got confused when the options appeared.

To continue the test we informed them that a *Next* button existed beside the option list. One of the participants said that *“sometimes when you look at an icon you don’t understand it, but when it is explained you learn”*. The woman in the young group that was not used to browse on the Web did not know what to do next either.

After clicking the button *Next* the participants came to the page where they had to select a room (in the picture based search) in which the product could be (see picture 5-4 below). The 28 year old man did not like that the information was presented twice, he said: *“It looks messy”*. A better solution according to him would be to have the links under the icon, because it confused him how they were displayed now.

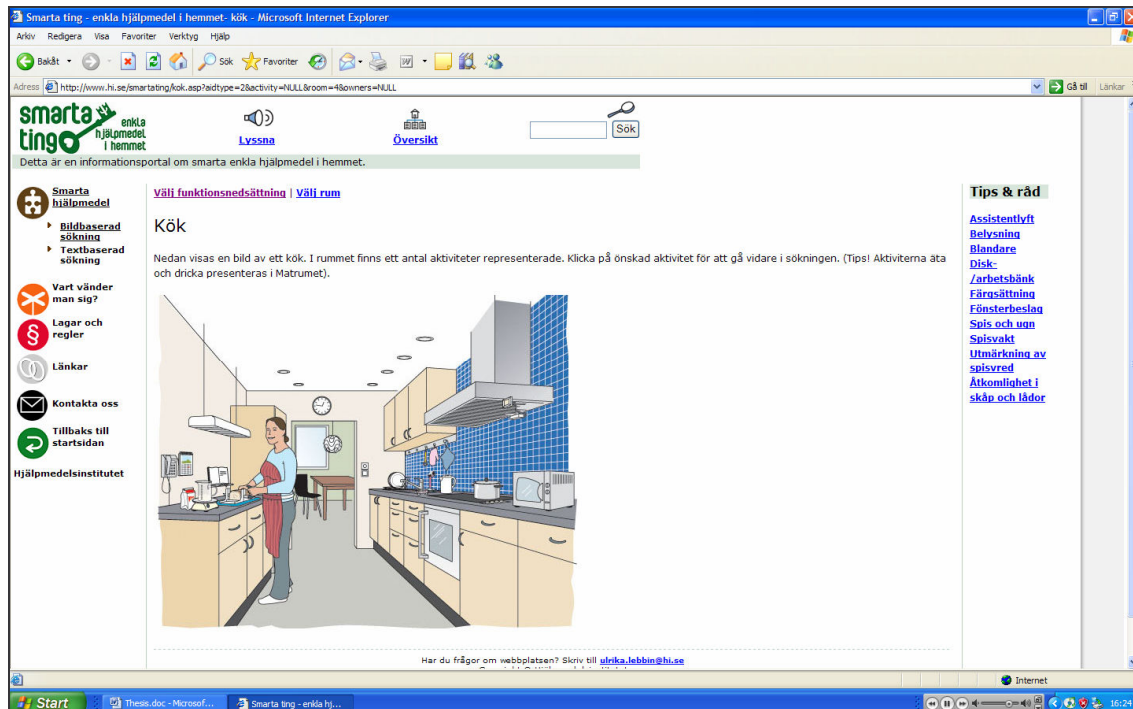


Picture 5-4 The user chooses a room clicking the icon or the links for where the product could be

The senior men and one younger woman clicked on the icons when selecting the rooms. The 78 years old woman who only had modem connection made a selection on the links before the house appeared. Before the house appeared she had already found the room she was looking for in the link. Anyway during the performance of the tasks the house appeared at some point. She kept on clicking on the links. When we asked her why she chose the links, she said that she did not notice that the house represented icons.

When she entered the kitchen when performing the picture based search, it took time before the picture of the kitchen appeared and she therefore found the list of links under the headline *Tips & advice* in the right side of the webpage (see picture 5-5). Some of the links are: window, dishes, cupboards and drawers. Because of the names of the links, and since she could not see the picture of the kitchen she just clicked on one of the links that she thought that could lead her to find the glass, without reading the headline above it which read *Tips & advice*. She got confused with what the popup window that appeared in the screen. On the other hand, the 28 year old man said that the *Tips & advice* was confusing.



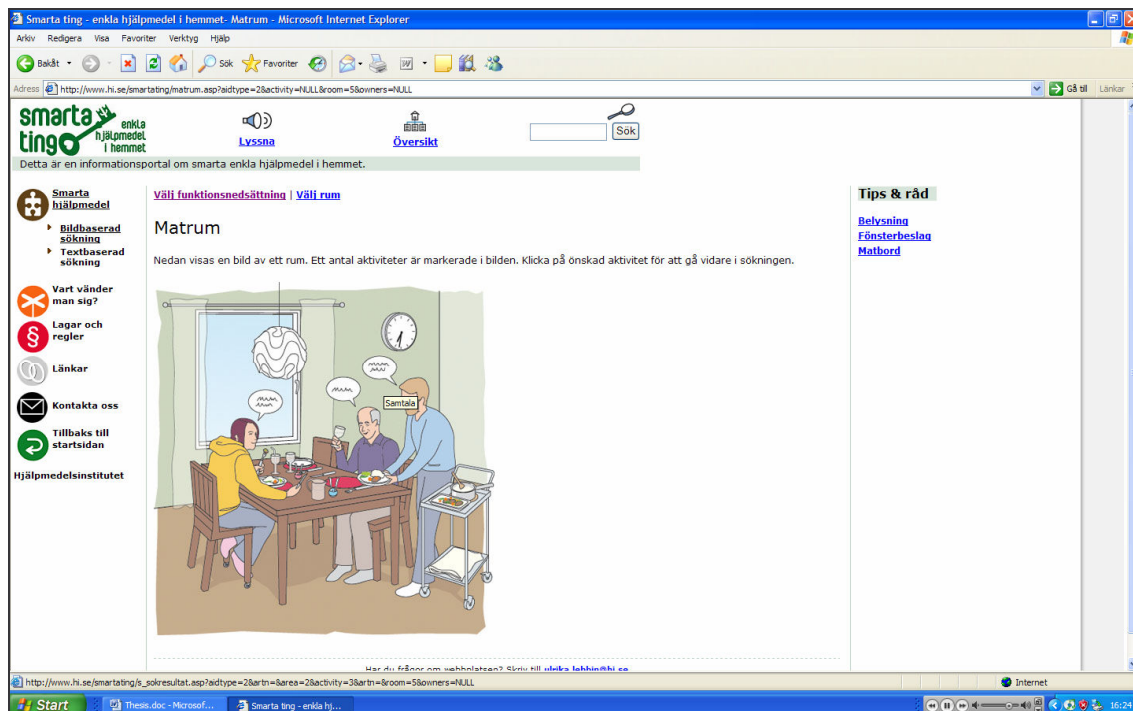


Picture 5-5 The kitchen with object to click on for more information. The links in the right are tips and advice

All participants thought they could find the glass in the kitchen (see picture 5-5), and therefore that was the first room they chose. When they realized that the product was in another room the seniors did not know how to go back one step. The 78 years old woman clicked the link *back to main page* in the menu, thinking that this was the back function, while the senior men asked for help. We suggested they used the back function in the web browser menu.

The 28 years old man got irritated when he read the information, placed above the picture, about how to choose 'activities' on the picture. That information says (originally in Swedish, translated by the authors): "*Below there is a picture of a kitchen. In the room there are several activities represented. Click on the activity you wish to move on in the search. (Tip! Activities eat and drink, are represented in the dining room)*". He said: "*what activity, activity for glass?*"

He was the only one that saw and used the link *choose room*, right above the picture of the kitchen in the above picture.

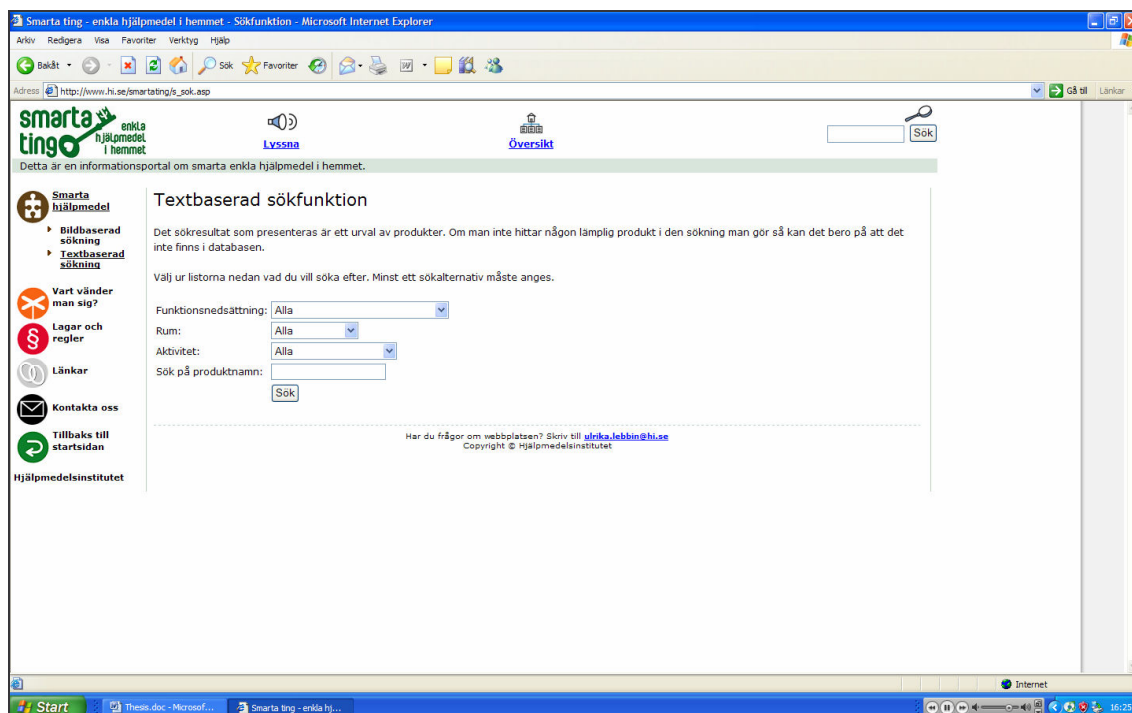


Picture 5-6 The dinning room

After the participant selected dining room they had no difficulties to understand that they should click on the different objects. What made them all irritable was that they clicked on one object and got products that were not relevant, or they thought that they had nothing to do with the object they clicked on. One example was that a participant got curious and wanted to see a plate and got information about forks and knives, although it was not possible to click on the forks. One of the senior men had problems with clicking on the glass because the glass was too small. One of the seniors did not realize that the arrow of the mouse changes to a pointing hand when the object is selectable in the picture and got frustrated when she couldn't select other object in different rooms. She said *"I'm clicking but nothing happens!"*

When it came to the third task, where participants had to find a sticky tablecloth through picture based search, five of six participants search in the dining room. When they realize that was not there, they search in the kitchen. This time, it was easier for them to find the products, but it took longer for seniors to find it. They had forgotten more that the younger group on how to search.

The second task was to search for a bottle opener through the text based search, as aforementioned.

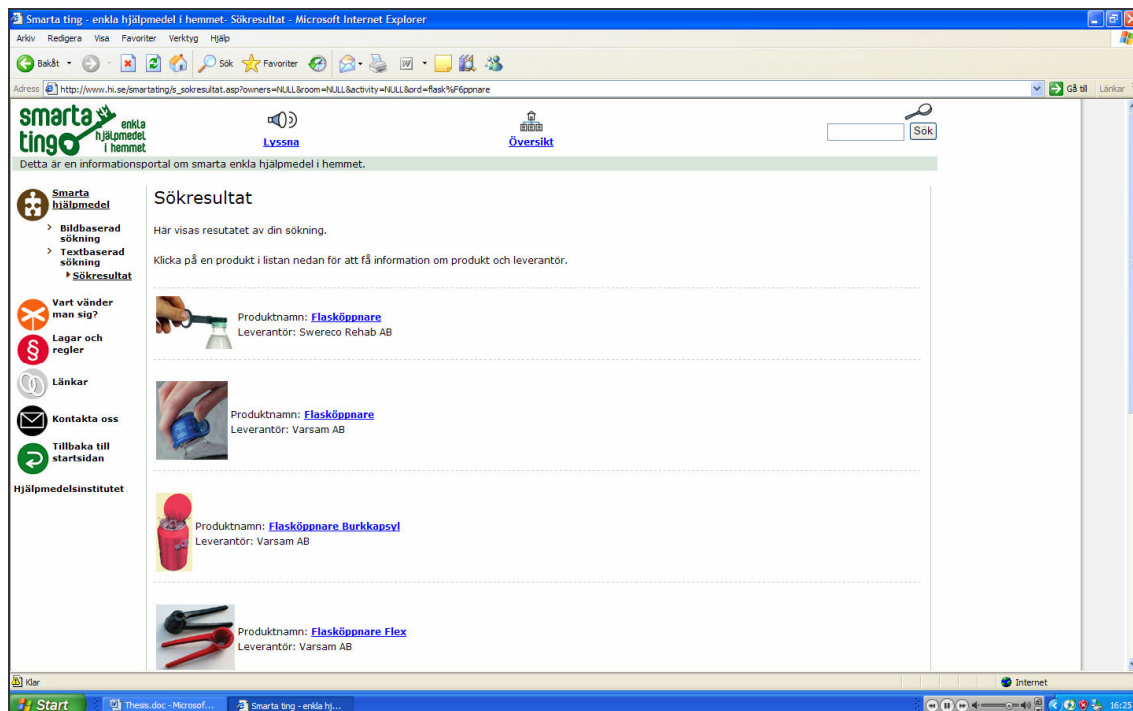


Picture 5-7 The text based search with the input field

None of the participants had problems arriving to the text based search. The participants, except for the two senior men wrote in the *search on product* input field “bottle opener” and found the product (see above picture 5-7). The senior men had more difficulties but they found after long search the product. They thought it was necessary to select all the options in every input field. One of them had problems with using the scroll list and he selected wrong options, mainly because the options were too close to each other.

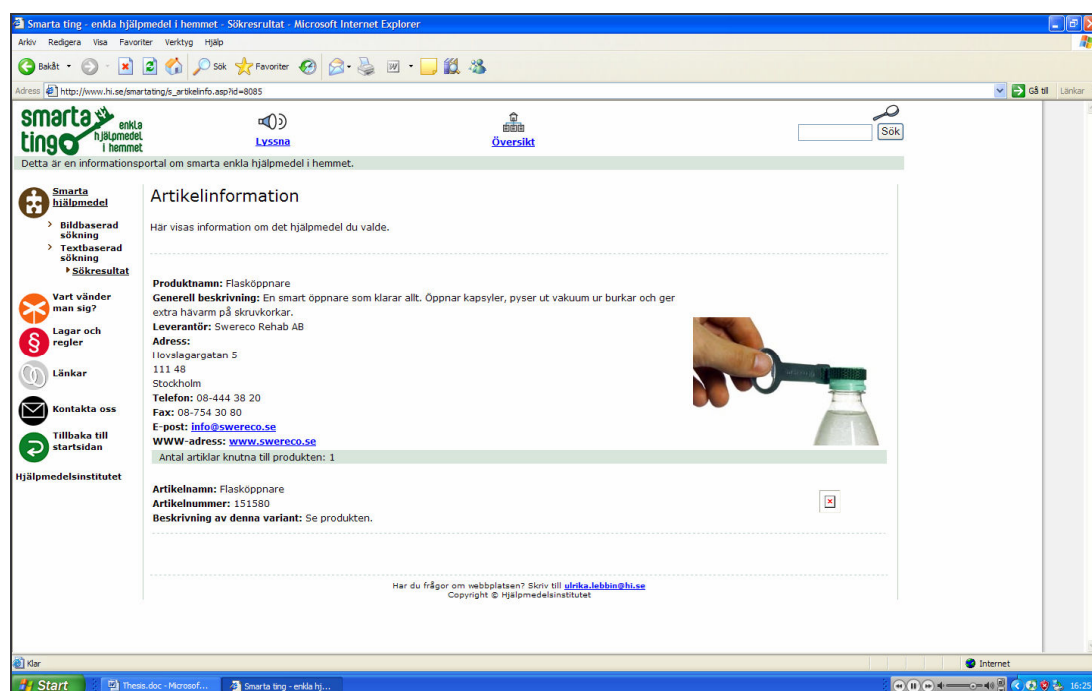
The 28 years old man wrote in the input field bottle opener as two separate words (in Swedish this word is together) to see if the search function looked for two words: a bottle and a opener, to receive more hits. The search function did not do that and he got a notification that the product did not exist. The same happened to the senior woman that accidentally misspelled without realizing it.

One of the women in the younger group, whose mother tongue was not Swedish, had many problems when trying to find the bottle opener, since although she knew how to say it she did not know how to spell it. After some tries we told her how to spell it.



Picture 5-8 The result with all the products

All of the participants clicked on the picture of the product to receive more information except for the 28 years old man. He said that when he sees a link he always clicks it and not the icons or pictures. The women realized quickly that it was not possible to click on the picture and clicked the link instead. The senior men did not understand why nothing happened and clicked the picture several times.

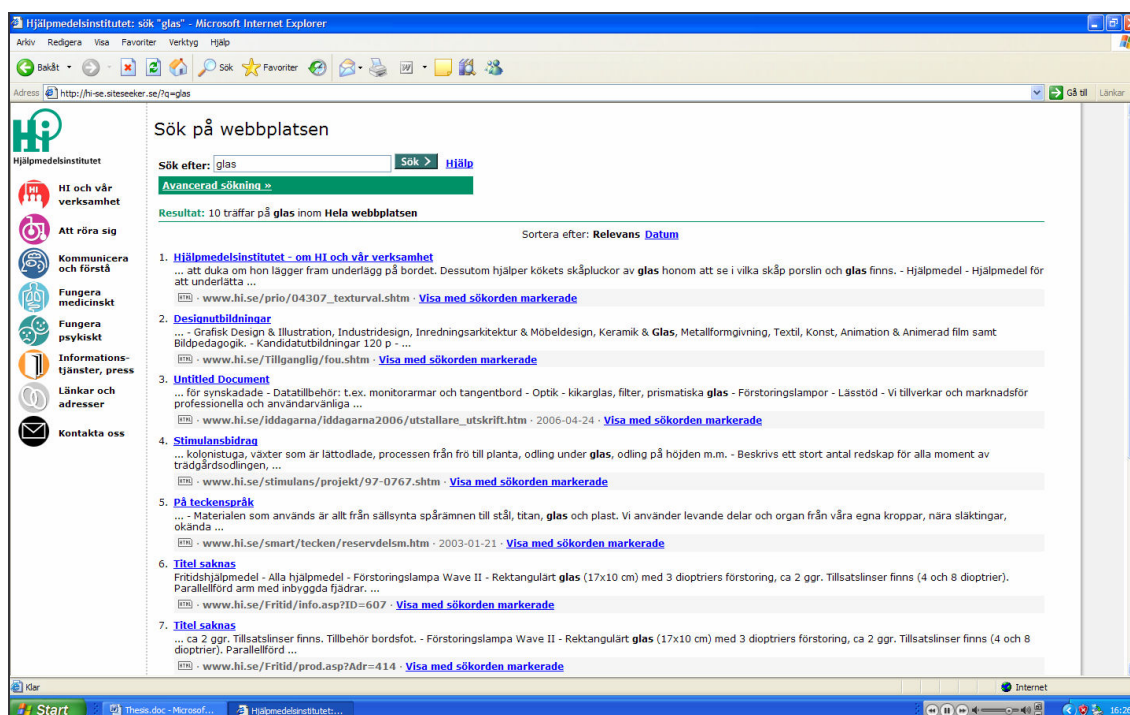


Picture 5-9 The page with the information about the product and the supplier

When selecting the link for a product the information about the product appeared. The information was not clear according to the participants. The senior participants did not know what to look for and thought they could buy or contact the supplier from the web page. The senior woman said gladly that it was easy to contact the supplier by just clicking on the link *contact us*. She did not realize the link was part of the menu and that you only contact The Swedish Handicap Institute. The younger group said that the information was not good presented, the text was too messy.

## 5.2 Other findings

The senior participants did not know what the search input field was on the top of the right corner. One of them mistook it with the search input filed in the text based search and tried to search for a product. All seniors used the search function on the top page but they did not realize that they were no longer at the web page Smart Things and that they searched the whole Swedish Handicap Institute, [www.hi.se](http://www.hi.se), which made them confused.



Picture 5-10 The [www.hi.se](http://www.hi.se) search function

In several occasions the 84 years old man accidentally clicked on the right mouse button and got the web browser menu popup which confused him. He did not realize that the popup menu was Internet Explorer's menu. This made him loose the focus on what he

was doing. He had problems with clicking the mouse and clicked too hard or at the wrong button when he was selecting options in a scroll list. It was then when the problems occurred. He had also difficulties to see the difference between the objects in the web browser and the web page.

### *5.2.1 Differences between the senior group and the young group*

An interesting finding that we got was that seniors and younger people think the same way, but the younger are faster and more used to searching the Web than seniors. If the web page is not usable, the two groups have the same problems of finding the right information, although the younger find it faster than seniors.

Comparing the result from the test between seniors and young people, we have come to the conclusion that seniors read the information more carefully. Sometimes it takes them longer to perform a task because they are reading all the information. From the senior group, the woman was the one that did the test quickest and she was the only one that did not read all the information as properly as the men did. One reason for this can be that she had more knowledge and experience with computers than the men and learned how to navigate on the Web.

In the younger group the woman who rarely uses Internet had most problems with using the web page and she did almost the same mistakes as the seniors, with the exception that she was much faster in realizing what she did wrong and trying new solutions.

The main difference between these two groups is that the young group has the knowledge about what a web browser is and how to navigate. The seniors did not have the same knowledge. For the young group fields and icons was something they knew how to use. If there were a button next to a scroll list they knew what to do, but not the seniors. They mistook the menu from the rest of the information, thought that the 'search the Web' field was to search products and one participant had difficulties to separate the web browser menu from the web page Smart Things.

## 6 Discussion

In our research we have found that seniors had to overcome several barriers when browsing the web page Smart Things. Seniors have usually more problems with different disabilities as sight, precision of movement and memory. This is also stated by other researches, for instance, according to Dickinson et. al. (2005) the older person is more likely to have some reduction in visual acuity and are likely to have less fine motor control and, to learn new concepts and remember them.

The younger generation in our research had an better understanding how a web page is built, which functions to look for and could solve problems easier due to that knowledge. Even if a web page is not usable they have an understanding where to look for the information and they were generally aware of shortcuts that facilitate their search. We believe that seniors that got retired before computers and Internet were introduced in their work environment have not the basic knowledge of the conceptual model with the concept of web pages and Internet. The seniors that we met were self-taught, which explains the confusion they felt and the mistakes they made that the younger generation did not. It is therefore, even more important that web page that target seniors are usable so they understand the basic concept and developers can't assume that seniors know the basic concept of web pages today.

When conducting the observation we noticed how uncomfortable the seniors sat on their chair and did not had the workplace ergonomically set, this remark has also be made by Coyne and Nielsen (2002) in their research. We believe that this can be a factor that results in seniors to feel more negative towards the computer and Internet. Not only are they having difficulties with browsing the Web, they are not sitting comfortable resulting in pain in their body.

### 6.1 Usability

We have found in our research that usability and accessibility is even more important when designing web pages for seniors. If seniors have a bad experience with web pages they will likely not return, for them is usability necessary to browse the web. According to Gappa & Nordbrock (2004) seniors are very goal-oriented in their navigation habit, if effort-result is not balance they will leave the web page and not visit it again. Our findings are much similar to Coyne & Nielsen (2002) research even if we used different methods. It shows, in our opinion that seniors in United States of America, Japan and in Sweden have the same difficulties when browsing the web. This should be taken into consideration when the amount of seniors is increasing and the need for finding information on Internet is required from the society.

We agree with Kaasgaard that it is necessary to apply design from the basis of different disciplines, especially when seniors are the target group and that a designer has to understand the whole context of usability and not just part of it. It is then even more important that knowledge from disciplines like cognition, interaction design, sociology, etc. are taking into consideration. Usability is always important when designing web pages, but it is even more important for seniors, that, beside from the problems that

come naturally with aging exist, have also small or no background about computers or the Internet. This has been confirmed by our study, but it was also stated in the literature and studies that we have read. We agree with Ottersten and Berndtsson that high usability fulfils the purpose for the target group and that, as Preece stated the usability goals has to be taken into consideration when designing web pages. Seniors in our study told us that if a web page is not user friendly, they will high likely not visit the web page again. In studies made by Nielsen and others this same conclusion has been made. We agree with Kaasgaard that it is not people that have difficulties with using a computers, it is rather the cognitive distance between the mental model of designers and the users that is a fact. The designer has to think from the user perspective and not what they believe is best, according to Jordan, and we could not agree more. From the usability perspective contra seniors we have found that it is even more important that a web page follow the usability goals which are; effective to use, efficient to use, have good utility and is easy to learn and remember. Seniors, due to cognitions problems that comes naturally with aging has more difficulties remembering and learning, compare to the younger generation. But that does not mean they don't want to learn. It just takes them longer to understand and the more repetition is needed. Due to that, if a web page is design with the focus on seniors, it is more likely that the amount of repetition can be reduced if usability is taken into consideration and the web page. We notice that even if seniors had difficulties using the web page Smart Things for the first time, they learned how to use it by practice but we realize how important usability was for them. They could not solve some of the tasks because they did not understand how, and the difficulties with navigation and presentation of the information made them loose their track. The younger group had also difficulties solving the tasks but they saw quickly how things were related and from that knowledge they got it without the need of more repetition. The third task had the same structure as the first, and the younger group did not have problems with solving is compare to the seniors that had more difficulties remembering how they performed the task the first time. Pühertmair and Miesenberger (2005) imply in their study the importance of the web page to be readable and that the buttons and links can be identified by the user because he or she must understand how to navigate. It is not only Pühertmair and Miesenberger (2005) that state this, Nielsen, Ling and van Schaik also agree. We noticed how our participants showed frustration when they could not find the information they were looking for or did not understand how to navigate. We therefore claim that the importance of selecting relevant words in links, menus and in the information must be taken into consideration if a web page is to be user friendly.

### *6.1.1 Comparing reviewed studies' results with our results*

Although the method used by Coyne and Nielsen is different from the one we used, our findings are very similar.

In Gappa and Nordbrock study not only seniors took part but we will discuss here the important data obtained from the senior group.

In this sections an overview with similarities and differences is presented.



- *Presenting information and text:* There is strong evidence that seniors benefit from a clear presentation of information in the screen, but this seems not to be enough by itself. It would be also a good idea not to present too much information, so it is easy to filter the important information at the first glance. Although cognitive theories say that for easy tasks, as it is reading from a screen, seniors' selective attention – the one in charge of filtering relevant information – is as good as younger adults' one, we think that both seniors and non-seniors would benefit from a little amount of information in the main web page. Also it must be taken into account that it is difficult to read from a screen, and seniors' sight usually is not as good as it used to be. Due to that fact the text should not be smaller than 12 dots, and there should be a button in a visible place to enlarge the size of the text.

About not using Web terms in the web page, as stated by Coyne and Nielsen, we do not agree completely with that. Some of the participants in our study liked doing the task and learning something from that, and there was a woman who told us some ways to improve the web page Smart Things the next day she did the test, which means that she kept on thinking about it. This confirms that seniors like learning as much as anyone. Hence, our suggestion is not removing every single term which has to do with the Internet, but use them wisely and have a visible option with a dictionary about those kinds of terms.

- *Links:* Changing the colours of the links after using them is strongly recommended. According to our research about cognition in seniors, it is very important to reduce at maximum the memory load of the tasks. If the colours of the link did not change after being used, it would be required from the senior to keep in mind where he or she has been before, which increases the memory load. Now the question of which colours to use remains. Both we and Coyne and Nielsen claim that consistency is important, not only through all the web page, but with the whole Web. Hence, our recommendation is to use the most used combination of colours for links throughout the Web: blue before being visited and kind-of-red after.

Another important consideration, due to possible problems with sight and psychomotor control, we also recommend that the links are not clustered very close to each other, and if there is any picture associated to it, it should be possible to click either on the link or on the picture, since in our study many seniors preferred to click on the picture by the link.

Analysing the information that we got from our study, we realized that seniors need a strong relationship between the picture related to the link and the text in the link. Therefore pictures must be very representative.

- *Search:* Many web pages have a couple of search function: one for searching the web page and another one for searching the whole Web. In our study some seniors mistook the search function for the whole web page with the one for searching only for products in Smart Things. This means that it is very important to clearly label what a search box is for, and if many, clear difference should be done. The same finding is stated by Coyne and Nielsen in their study. However, our recommendation is to keep the number of search function as low as possible, since it seems that it just gets seniors confused, and since seniors are very goal-

oriented they are not likely to search for another things while they are in a web page. If they need another kind of information they will just look for it in the proper web page.

Two of our younger adult test participants were not Swedes, but they could speak Swedish. One of them knew how to say bottle opener in Swedish but she couldn't spell it properly, so she just kept finding 0 results for her search. This indicates that the search function should be tolerant with spelling errors. The same results were found by Coyne and Nielsen, and by Gappa and Nordbrock. Gappa and Nordbrock go further and they state that the search engine should recognize conjugated and declined nouns.

As far as Gappa and Nordbrock are concerned, the in-site search function should be placed at the top of the page, near the navigation bar. This way of placing it seems to be the most common one nowadays, therefore it could be helpful since it maintains consistency all along the Web. But on the other hand, and as we could see in our observations, seniors have usually problems to recognize the navigation bar as not being part of the web page and they usually mistook the in-site search with the search-all-the-Web function placed in the navigation bar. Therefore we think that if both search function are placed close to each other, it could be even more confusing for them. We believe that the place in the web page is not as important as labelling appropriately and in an unmistakable way each search field.

When coming to the results of the search, both Coyne and Nielsen and we think that scrolling should be avoided, so our suggestions is present the results clustered by a number that can be kept in the screen without scrolling, and presenting a button labelled 'next results' or 'more results'.

## 6.2 Cognition

We strongly believe that the cognitive aspects have to be taken into consideration when designing web pages for seniors. According to Craik (1999) the different sensory mechanisms show some changes with age, as seniors usually have vision and hearing problems. The cognitions aspects that we have taken into account are associated with aging, since, we believe that with this understanding developers gain important knowledge about what to have in mind and focus on during design work.

The previous studies we have found have been taking cognition into consideration but in different amount.

Web pages should be design so good and focused on seniors that the knowledge about how to it should be in the procedural memory. Which means that seniors should be browsing the web pages without thinking about what they are doing step by step, like when we are driving a car. According to (Craik, 1999), most studies show that the procedural memory processes are not affected by aging.

### *6.2.1 Vision, movement and colour*

It is important to understand what changes in people's vision when they age. Colour discrimination declines with age and seniors need more time for processing. We therefore believe that it is important to choose colours and size of text that give seniors better contrast and a high level of illumination. Vision combined with the problems seniors have with movement and precisely pointing at an object, makes it important to have spaces between the options and not forcing the user to click on a small object. We notice that it was difficult for some seniors in our research to move the mouse toward an icon and hold the mouse steady while pressing the left mouse button. They had problems with holding the mouse still.

### *6.2.2 Memory and attention*

When knowing that information in the sensory memory goes into the next level of memory by paying attention, and that the information of the environment that is not of interest disappears after few moments (Westen, 2002), it is not only important that a web page is easy to understand, it has to be interesting and has relevant information so that the user wants to explore the web page more. On the other hand usability also depends on how the user feels toward the product, as stated by Ledell (1993). In our research, one user complained that the web page Smart Things looked boring like a government page that has to be visited, not because it is funny and interesting.

Thomas and Macredie (2002) discuss that web pages developers tend to think that users are sitting by the computer without any distraction and giving full attention to the task at hand, which they claim is an issue in today's way of developing. As Roger (1999) states it is more difficult for seniors than for younger people to focus on a complex task with full attention and we therefore agree with Hallnäs and Redström (2002) that it should be a focus on presence instead of functional descriptions of use when it comes to design. As we could notice in our observation, when one of the seniors participant performing the task in a public facility with people wandering around, was interrupted, had difficulties to focus back and remember what he was doing. We believe that with this knowledge we can keep on pushing towards a more easy and usable web pages that are not complicated to navigate or find information when the target group is seniors but that the information still must be fun and interesting for the user to not lose the attention.

According to Bäckman et. al., (2001) studies have shown that there are almost no differences between how seniors and younger people describe objects in tasks. The differences are in the word-finding activities where seniors have more problems with retrieving names, generating items in tests of verbal fluency, naming common objects and producing words from definitions.

## 7 Guidelines for developing web pages with the focus on Seniors

### 7.1 Information

1. **Relevant and small amount** – Since reading from the screen is tiring and seniors are likely to have some sight problems, only small amount of information should be displayed. It also takes a user 25% longer to read on a screen than on paper (Nielsen 1999). Since that is the case, the information displayed should be carefully chosen, and only the most relevant information should be displayed.
2. **Easy to read** - In order to be easier to read, it is important that the size of the text is at least 12 points by default. This would not only be good for seniors but for non seniors as well. Due to possible further sight problems, an option for increasing the size of the text should be placed in a visible place in the web page. Not all seniors have bad sight but for those who do, a web page with big letters is to prefer. For those who have a good sight, should not “suffer” that the text is to large due to the generalisation that all elderly people have bad sight. For making both parties satisfied the best solution is to have an option to change the layout. We recommend two options. One with a link to click for enlarging the text or an option button on top of the page where a pop-up menu that doesn't need to be scroll down is presented with the option to enlarge in different sizes.

### 7.2 In-search function

3. **Well labelled** – Since some seniors had problems in our research to distinguishing between the different searches engines, it is strongly recommended to make a clear difference by clearly labelling them. The appearance of the in-site search function could also be different from the one for browsing the Web in order to be easier to recognize.

In the case that user's choose to search the whole Web, a message warning them should appear, saying that they are going out of the web page and give suggestions on how to get back.

4. **Tolerant** – The search engine and any search function should be tolerant when misspelling and should recognize words spelled separately when should be together and vice versa.
5. **Messages for incorrect searches** – In our study when the participants misspelled in the text based search, they received the message; ‘0 results’. A better explanation message should be displayed, perhaps recommending checking the spelling or giving suggestions about how to spell it.

### 7.3 Layout

- 6. Clear separation between static menus for the whole web page and the current webpage** – Some seniors had problems distinguishing between the fixed menu on the left side of the web page, and the actual web page, so sometimes they thought that they were connected. Our recommendation is to make the difference bigger by using a clear colourful line or something similar, to separate them.

### 7.4 Links

- 7. Different colours** – In order to diminish the memory load, the colour of the link should change after visiting it. Our recommendations is to use blue for the ones non visited and garnet for the visited ones.
- 8. Separation** – The links should not be placed very close to each other, due to possible psychomotor problems.
- 9. Links and pictures associated** – When having an image or picture associated to a link, it should be possible to click on both the link or/and the picture.

### 7.5 Icons and buttons

- 10. Understandable icons** – The icons must be easy to understand and represent the purpose.
- 11. Back button** - It is important that the user quickly and easy can go back to the previous page. The developer should not assume that the user will use the web browsers back function. The back button should be placed always in the same place all through the web page and always have the same name.
- 12. Button for the main home page** – A button for going back to the starting point, the main web page, should also exist and be placed always in the same place.
- 13. Design of buttons and icons** – Design the buttons and icons in a way that are easily distinguished from those ones belonging to the browser.

### 7.6 Other aspects

- 14. Consistency** – Consistency is very important through the web page, it helps to reduce the memory load, and make everything easier and more faster to learn.
- 15. Reduce the need for scrolling** - Seniors in our research and in Coyne and Nielsen's had difficulties with using scrolling lists due to the psychomotor problems. It is therefore important that the web pages are developed with as

little scrolling, hierarchically walking menus and moving interfaces as possible. If a scroll list is necessary proper space between the options has to exist so that it does not require pixel-perfect pointing.

- 16. Clear and simple design** – Both seniors and non seniors would benefit from a clear and simple design. It also makes the web page more attractive and easier to navigate. Seniors are very likely to come back to the web page again if they reach their goal the first time and they would not try to look for another provider for the same service.
- 17. Explain popup windows** – If a popup window is to be displayed it should be explained how to close it and go back.
- 18. Help option** – A button or a link with help should be always available and in a visible place.
- 19. Visible number of steps** – If a task must be carried out in many steps, like it is the case when searching for objects in Smart Things, the number of the steps and which is the current step should be displayed. This way the user also has feedback about if he or she is still doing it properly and following the steps or not. In our study, when the webpage with the option for choosing one functional disability appeared, some thought that they mistook when clicking and arrived to the wrong webpage.

## 8 Conclusion

With the knowledge of the literature review and our findings from the evaluation of the web page Smart Things we have come up with guidelines on how to develop web pages with the focus on seniors. The guidelines, briefly explained, are:

- Information – Present relevant and small amount of information
- In-search function – Well labelled search function with the tolerance for misspelling.
- Layout – Clear separation between the static menu and the rest of the webpage.
- Links – Should have different colours and be separated.
- Icons & buttons – Have to be understandable and a back function has to exist.
- Other – Consistency, clear and simple design with a help option, a reduction of the need of scrolling. An explanation of pop-up.

We have shown in this study the importance of knowing the target group before designing web pages. In our findings seniors had more difficulties than younger people in many aspects due to their age. We have come to the conclusion that when seniors and younger people lack knowledge and experience how to solve a task, seniors need more time and repetition to understand and complete the task compare to younger people. When people are getting older, it is natural that problems occur with vision, memory and movement. It is therefore important that the cognitive perspective is taken into consideration when designing web pages for seniors. Usability is a very important aspect, because seniors have a tendency to not visit a web page again if they find it not usable. Seniors are more sensitive when facing difficulties with browsing the Web than younger people. They get more affected with lack of usability than younger people and will not visit the web page again.

One interesting conclusion that we have made is that our findings are much similar to the pervious studies that has been made with seniors and computer, even if we have not been using the same methods. The guidelines that we have presented and other researchers have presented shows that this has to be taken seriously. The amount of seniors in Sweden are increasing and the demand on using Internet has emerge which means that more and more seniors will use the computer in the upcoming years. As the commune in Sweden are withdrawing the service of helping people find assistive products, web pages like Smart Things must be usable and easy to understand, due to the fact that people who visit this web page has some kind of disability or are seniors and need to find information about assistive product or buy them.

Finally we can say that the two main reasons why guidelines with the focus on seniors should be taken into consideration are:

- Seniors knowledge about how web pages are structured and build is lower that with younger people. We believe this is due to that seniors have not had a natural experience in their work environment like the younger population with Internet. Because seniors lack knowledge on the technical vocabulary and understanding, they make more mistakes and the web pages need therefore to be more adapted to this reason.

- It is more common that seniors “suffer” with more cognition difficulties that younger people which comes naturally with aging. The most common problems are vision, memory and movement. Seniors need more time to learn, understand and complete a task that younger people even if they both have not used a computer previous.

## **8.1 Future work**

For future work it would be interesting to perform this study in a bigger scale and include research about how seniors buy and sell items on Internet. More user evaluation with different web pages that we conducted in this research could be done. It would also be interesting to investigate how seniors learn to navigate and understand how to browse the Web by following them through a longer period time.



## Appendix 1

### The think aloud observation

It is important that you think out loud through the whole test. The purpose with this test is for you to find products through different search points.

A) Go to [www.hi.se/smartating](http://www.hi.se/smartating)

1. Try to find a glass that is easy to grasp through the picture based search.
2. Try to find a bottle opener through the text based search
3. Try to find a sticky tablecloth (glidmatta) through the picture based search

B) Go to [www.hi.se](http://www.hi.se) and see if you can find directions to smarta ting.

## Appendix 2

# How to improve the web page Smart Things

*In this section we present suggestions that can be made about how to improve the web page Smart Things. The suggestions are based on the evaluation of the web page made by us and on the theoretical knowledge that he have gained.*

## The layout

The first impression is the most important one when visiting a web page for the first time. According to Nielsen (1999) if it takes too long time for a web page to download or the displayed information is not usable there is a big chance that the users leave the web page and not return. It is important that the user understand where they have come from, what can be found and how he or she can find what they are looking for.

### *Replace the flower in main web page*

In the main web page the first thing people saw was picture of the flower (see the arrow in the figure 7.1 below). The first thing that users saw should be the logo of Smart Things. We suggest that if the flower is not important for the purpose of the web page and the information, it could be change to a more discrete picture that doesn't take the focus from the logo or menu.

It is not necessary to remove it but it would be a good idea to change it for something more representative of the purpose of the web page.



Figure 1 The main web page

### *Option to enlarge the web page*

In the main web page we suggest to present an option on top of the page with the possibility to enlarge the text. In our findings the participants were satisfied with the text size, but they would like an option to change the layout.

One good example is the Swedish bank FöreningsSparbanken where they have an option to adjust the web page as the user prefers (see figure 7.2 below) with a popup box. The arrow in the picture point on the link *adjust*.



Figure 2 Web page for föreningsSparbanken with the option to change the size and contrast for the web page

The web page Smart Things target groups are people with disability and seniors. It is therefore important, according to us, to provide them with an option to choose what size they want to have.

### *Differences between the frames*

It should be clearer where the menu ends and where the information frames start. The colour of the menu is white as the background for the information which makes it more difficult to distinguish (see figure 7.3). The seniors in our study had problems to distinguish the text in the menu from the information frame. They did not understand that the menu was static and the information changed and that these parts were not together. The senior woman thought, when she was reading information about the product, that the menu was a part of the product information.



Figure 3 Difficult to distinguish the menu from the rest of information

### *Back function*

A back function should exist on every page. Only using the web browser back function is not enough in our opinion. The participants mistook the link *Back to the main page* in the menu as a back function and that should not be a case (see the figure 7.4 below).



Figure 4 Icon for the back to main web page in the menu

There are different solutions on how the back function can be. Arrows ( $\leftarrow$   $\rightarrow$ ) can be on top of the page or a button down on the page where the information ends (see figure 5 below).



Figure 5 Icon of a back button

### *Relevant icons*

In our research the participants did not find all icons relevant. It is important that the icons represent the purpose. A user should not have to learn what an icon represents, it should be obvious. We suggest that icons *Smart Assistive products* and *Where to turn* is more looked into and perhaps changed so it is more relevant to the topic. The main issue is that the purposes with the icons are good but the users did not associate a puzzle or a road sign with their corresponding links.



Figure 6 Icon for Smart Aid and where to turn in the menu

## **How to present the information**

The first thing we noticed when browsing the web page Smart Things was that the information was not displayed the same in Firefox as in Internet Explorer. We believe that it is important that the same information is displayed correctly independent what web browser the user have. It should be possible to use all web browsers and not just Internet Explorer. The alt text with description on what the user are looking at is not displayed in Firefox.

### Consistency

It is important that consistency is the same when browsing the web page through different pages. Otherwise the users may get confused. When selecting *functional disability* in the picture based search, the button beside the input field is named *Next* while in the text based search the button is named *Search*. This should not be the case.

**Textbaserad sökfunktion**

Det sökresultat som presenteras är ett urval av produkter. Om inte finns i databasen.

Välj ur listorna nedan vad du vill söka efter. Minst ett sökalternativ.

Funktionsnedsättning:

Rum:

Aktivitet:

Sök på produktnamn:

Figure 7 The button has the text 'Search'

**Välj funktionsnedsättning**

Nedan väljer du vilken funktionsnedsättning du vill :

Välj funktionsnedsättning i listan nedan.

Figure 8 The button has the text 'Next'

When selecting a product, for instance a glass, there are products that occur twice in the results with different suppliers (see figure 7.9 below). A better presentation could be to have one picture of a product and when selecting more information the user can choose from different suppliers to contact.



Figure 9 The same product is displayed in the result but with different suppliers

### Presenting the product

The information about the product could be presented in a more appealing order. It is difficult to get a fast and easy overview of the information (see figure 7.9 below). The

information about the product and how to contact the supplier could be divided in two parts. First a short presentation about the product, and after that a new topic; how to come in contact with the supplier could be displayed. It should also be white space between the topics. This makes it easier for the reader to get a better overview of the information.

### Artikelinformation

Här visas information om det hjälpmedel du valde.

---

**Produktnamn:** Glas Basic glas  
**Generell beskrivning:** Glas på fot. Vikt 75 gr Rymd 300 ml  
**Leverantör:** Varsam AB  
**Adress:**  
Box 218  
701 44  
Örebro  
**Telefon:** 019-12 55 05  
**Fax:** 019-611 21 43  
**E-post:** [varsam.ab@varsam.se](mailto:varsam.ab@varsam.se)  
**WWW-adress:** [www.varsam.se](http://www.varsam.se)

Antal artiklar knutna till produkten: 1

**Artikelnamn:** Glas Basic glas  
**Artikelnummer:** R8062  
**Beskrivning av denna variant:** Se produkten.

Figure 9 The product information

### *The web search is not necessary*

We believe that the web search is not necessary to have in the web page Smart Things. It confuses the seniors that believe that this search function is the same as a text based search function.




Figure 10 The web search for **www.hi.se**

If users want to search for general information from The Swedish Handicap Institute database they can do it from The Swedish Handicap Institute's main web page. According to Nielsen (1999) a search function should always exist in a web page but we believe that in this case, it is not necessary, it only confuses the seniors that are not used to Internet. If the web search will remain it is important to display in the result page that

the page is a general search for Handicap Institution and an easy back function to Smart Things should exist.

### *Option 'functional disabilities' not necessary*

When people want to find aids they don't see a need to choose a disability first. All of our participants got confused when they came to this page. The options did not fit with the product they were looking for. Besides they did not understand why a disability must be selected.

When searching a product through the picture based search, after choosing one disability, never mind which one is chosen (even if the option 'alla' is chosen), the pictures of the house and the different rooms is always the same. So it is not really matter which is the option chosen by the user. The only difference is that some products are not available anymore depending on the option. For instance, if you choose *intellectually handicapped* you will not be able to find a glass. When clicking on the glass in the dining room you would receive a message with 0 results. This way, the users would believe that the product does not exist. We therefore believe that this option is not necessary. If the option remains, a solution could be to have an advanced search with these options but this advanced search should be placed in the page with the picture of the house. This way, this page is always displayed in the first instance.



Figure 11 The scroll list with the different disabilities options

If the option will remain it is important that the scroll list is changed and that a space between the scroll list and the button *Next* is larger. The seniors had difficulties using the scroll list and we recommend that another solution is made or that the scroll list have more space between the options.

It is also important that a clear message is displayed when the result of the search turns to be 0.

### *How to Improve the Picture based search*

The concept of the picture based search is good but much has to be done for it to be user friendly. Not all information has to be displayed. For instance, when clicking a clock on the wall in the dining room the information about a communication folder is



not relevant. It should not be possible to click the talk bubble when no product is shown.

One suggestion is to narrow down the amount of information and make selectable only objects that have relevant products. When clicking a clock, only other clock or reminders should be displayed. Further more, we suggest that the objects that are selectable in the different rooms should be in some way displayed. That can be done by having a border around them. The senior participants did not notice that the mouse arrow changed to a hand when an object was selectable. See the figure 12 below about how it could be displayed.

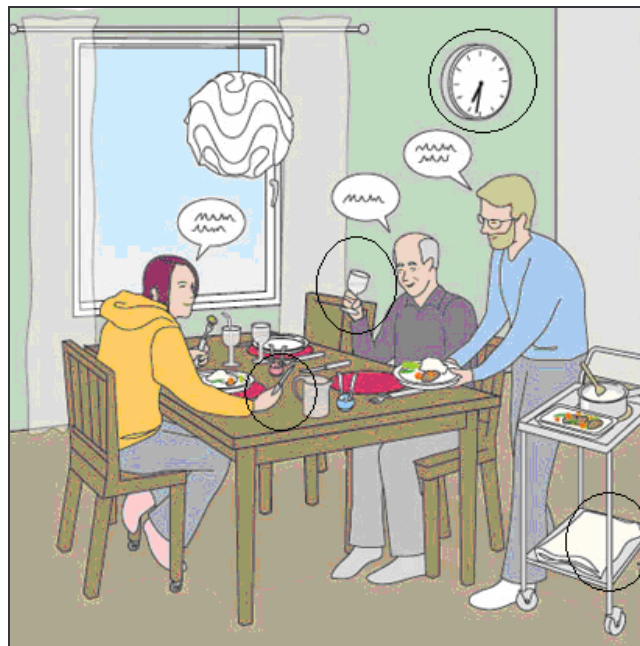


Figure 12 Having a border round the objects that are selectable

Another solution can be to enlarge the object when the user comes near it. Which solution is the most suitable has to be tested with seniors and people with different disabilities.

#### *How to improve the Text based search*

The search function in text based search should be more visible and perhaps in the beginning of the search. Our participants felt confused with all options and search for an input field. The input field should, according to us be, the first selection, not the last one. One solution can be to have two search functions. Like when searching a book at the library there are two alternatives. A basic search function and an advanced. When a user enters the text based search only one field should exist, the basic search function where the user can write a product name. Next to the input field a link with *Advanced search* link could exist with options as the options that are displayed today with disability, room, activity and product name.

If you misspell a word you receive a notification that the product does not exist (see figure 7.13 below). Perhaps a better solution would be to receive suggestions with a word that is similar. Or a message could be displayed “*This product does not exist in our database, please check your spelling*”. In our findings the participants did not reflect upon that they misspelled and thought that the product did not exist.

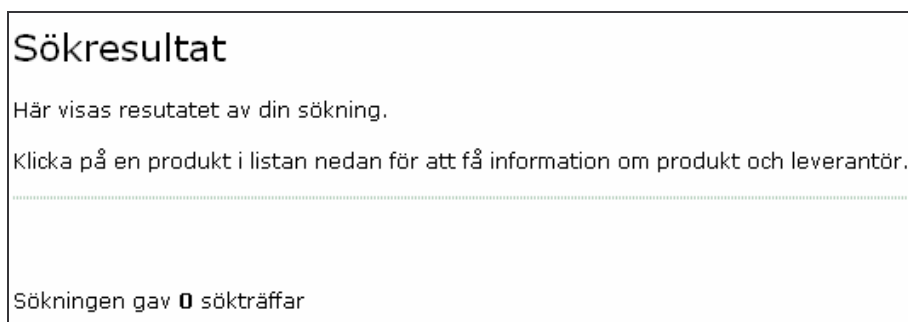


Figure 13 The message displayed when, after misspelling, the user does not get any result

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