An Investigation into the Usability & Accessibility of UK Health Information Web Sites.

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Abstract

This paper presents the results of an exploratory study aimed at assessing the usability and accessibility of three health information web sites for elderly novice users. The results from the study show that certain aspects of these web sites make it difficult for elderly people to use them, especially if the users have impairments. The paper highlights problematic areas regarding usability and accessibility, and makes recommendations based upon the findings.

1 Introduction

The purpose of this study is to examine the usability and accessibility of healthcare web sites in relation to elderly, novice users. Firstly, it is necessary to distinguish between usability and accessibility, in relation to its reference in this paper. In terms of usability, Spool et al suggest: "*The more a site helps people find the information they are looking for, the more usable it is*" (1999, p4). Accessibility refers to the ease with which people with special needs can access web-based information. The special needs limitations considered here include all types of visual and motor restrictions as well as dyslexia.

Health information is of relevance to everyone. Since the advent of health care web sites more people are seeking advice on health matters via the Internet. There are now more than 10,000 such sites available on the Web (Fox & Rainie, 2000). Search engines were cited as a major conduit to sources of health information in a Harris Interactive poll conducted in April 2002 ('eHealth's influence continues to grow' (Health Care News, 3(6)). In addition, a survey was conducted in the US by Harris Interactive, who found that 47% of all adults use the Internet and of these 75% seek online healthcare information, approximately three times a month (2001, Rogerson, S, & Fairweather, B.) This equates to around 111 million people in the United States of America alone, using the Internet to seek information about health matters (Taylor & Leitman, 2004). The benefits of exchanging information via the Web means that patients are able to deal quickly and sensitively with information that they may not wish to divulge to family, friends or doctors (Kaiser Family Foundation, 2001). This means of accessing information would also be useful to elderly people that are housebound or live in remote areas. Given the large numbers of elderly people present in the UK, many of them could benefit from this type of service.

Population aging means that the numbers of elderly people will continue to increase. In the last thirty years, the UK population has grown by 6.5% (National Statistics, 2004) and by the year 2030, it is estimated that approximately 25% of the population will be over 65 (Kinsella & Velkoff, 2001). This will mean that more people will experience age related impairments, such as: reduced vision, motor restrictions, and cognitive/language impairments, thus increasing the likelihood of encountering accessibility problems. These conditions can present themselves as combinations of impairments, thus increasing the likelihood and severity of accessibility problems.

There are 180 million visually impaired people worldwide, 45 million of whom are blind and 58% who are over 60 (WHO, 2001). Vision impairment causes the most serious accessibility problems (Nielsen, 1996), and affects a wide spectrum of people from those with low vision to those that are blind. Visually impaired people are classified as 'legally blind' when visual acuity is 20/200 or worse following correction (Trace, 2002). In terms of how the disability affects accessibility, blind people are classed as being unable to "see" a web page without the aid of a screen reader or an audible web client. This means that any use of graphics result in the page being categorically unreadable. Given that a vast majority of web sites are designed to be visual almost 50 million people are then automatically excluded (WHO, 2001). Motor restrictions will be likely to affect elderly people, though not to the same extent as visual impairments. Motor restriction covers people that are dexterity impaired, either as a result of a neurological disorder or arthritis. Problems generally relate to difficulties in performing precise mouse movements, and holding down keyboard keys simultaneously. According to Nielsen (1996) image maps are the main cause of access difficulties simply because they require such preciseness in mouse usage. Impairments within the final category include: cognitive and language difficulties. A cognitive disability is one that impacts upon an individual's ability to access, process, or remember information, such as dementia or reduction in working memory and attention span. Language relates to reading/writing ability and language comprehension as well as processing ability (White, 2002).

Customers of the caring professions have varying requirements from information systems, and exhibit a large range of the universal accessibility and universal usability variations that Shneiderman (2001) mentions. With an increasingly elderly population in this country, greater demands will be made of health care services. Coupled with this is the push by the government to encourage web usage for the older generations to ensure they are not excluded from the digital world (NAO, 2003). Consequently impaired vision and slower reactions are factors that will need to be addressed in interface design for this demographic (Nielsen, 2002; Chaparro & Stumfhauser, 2001). Even issues such as allowing end users to control font sizes (Nielsen, 2002a; Bernard, Liao & Mills, 2001, updated 2002), both on their desktop and through browsers, can have an impact on ease of use. Poor memory, hearing deficiencies, and precision of mouse movements are also likely impairments (Nielsen, 2002). In considering the problems that impaired users encounter, added to the emotional turmoil that some patients (and their families) are undergoing, health information web sites really do need to be 100% usable and accessible.

One explanation why health information web sites may not be easy to use for the general public could be because they tend to be used to administer patient admission information and billing charges. A search engine enquiry on 'Google', conducted in October 2002, about 'user interfaces in the health service' revealed that around 95% of the results were centred on the health service professional's point of view only. The bulk of this work related to electronic patient records. Only 5% of the results were concerned with patient user interfaces.

The goal of 'universal access' (Shneiderman (2001) would enable patients to discover and/ or share information about their condition. Though there has been much debate on the subject of creating a *universal* Internet, it is a concept that many web designers have yet to aspire to. There are still problems for users with impairments, and this category includes elderly people. This is due to the lack of consideration of user needs in the design process, with poor design leading to poor usability. (Nielsen; Shneiderman, 1999; Preece et al, 2000)

Universal access brings its own design problems. Disabled users are an important user group for the Internet, especially in the light of recent legislation such as the disability discrimination act (DRC, 2004). For example, the act maintains that all sites should be readily accessible to screen readers and that input can be easily made using non-standard equipment, as well as ensuring audio or textual alternatives to web pages are available. Nielsen (2001) highlights the plight of disabled users on the web, explaining that "usability is three times better for non-disabled users" … and that putting usability guidelines into practice improves disabled user support for their tasks. However

Nielsen (1999) also notes that despite adhering to usability guidelines, it is still possible to design an unusable user interface if the design process ignores the users needs.

Shneiderman, who coined the term universal access, feels that the most important usability issues to be addressed in the near future will involve a shift of focus towards user needs, further extending the boundaries of 'universal usability' (Shneiderman, 2002). Thomas and Macredie (2002) suggest that existing approaches to usability need updating to keep up with the needs of users of the emerging technologies described above. Their concept of 'The New Usability' highlights the "digital consumer experience" requirement of fast paced technological advances, rather than the traditional usability view of "ease of use". Much of this new technology is no longer tied to the desktop, but occurs in locations where the user's attention to the task on hand is fragmented, resulting in a new issue to be taken into consideration during the design process (Abowd & Mynatt, 2000; Thomas and Macredie, 2002).

The Web can be a useful means of accessing health information that might not be readily available elsewhere. However, although online resources may be available, it doesn't necessarily imply that they are easy to use or that the information is accessible or easy to understand. This is particularly relevant for novice Internet users and those with age related or other type of impairments. Aside from the strong likelihood of elderly users having an impairment, there is also the possibility that these users may be unwell. This then has implications on usability and poses greater issues on health information web sites than other sites. Poor usability and accessibility do not just affect the user at the time they are interacting with the web site; a poor experience is likely to result in negative feedback: users will often tell their friends and acquaintances of the experience.

2 Method

The aim of this study is to evaluate the usability and accessibility of these three health information web sites:

- InteliHealth (http://www.intelihealth.com): an American site featuring consumer health information, which is backed up by information from the Harvard Medical School. This site carries some advertising material.
- NetDoctor (http://www.netdoctor.co.uk): a British 'commercial' site, claiming to be 'the UK's leading independent health web site'. It has a lot of advertising material on it.
- NHSDirect Online (http://www.nhsdirect.nhs.uk). This is Britain's 'official' health information web site, and is run by the National Health Service (NHS) and carries no commercial advertising. It partners a 24-hour emergency telephone service.

There were 2 parts to the study: one part evaluated usability and the other looked at accessibility. A user-centred approach was adopted using a thinking aloud protocol combined with an observation study, followed by a questionnaire. The participants were divided between the 2 conditions. This was because it would decrease the amount of time each participant would be involved in the study and reduce the anticipated confusion when differentiating between the concepts of usability and accessibility. This would have proved difficult when participants were required to voice opinions and give responses to specific questions.

2.1 Participants

Twenty-six participants, male and female, aged between 60 and 85 were selected to take part in this study. Participants were recruited from a wide range of institutions, including: adult learning centres; specialist colleges for the disabled; residential care homes, as well as other individuals who responded to advertisements for participation. All participants confirmed that they had little or no experience of using the Internet (figure 1, below), and that they had some form of impairment, this being predominantly vision related. There were only 2 participants that experienced motor restrictions in addition to being visually impaired. Six participants used some type of assistive software. These included:

- Screen readers
- Screen magnification software
- Scanning software
- Text browsers

- Specialist software for dyslexic users

Some visually impaired participants that did not use assistive software did increase the font size to the highest that was available. Those with minor motor impairments used ergonomic keyboards, wrist-rests and specific mouse pointer devices.

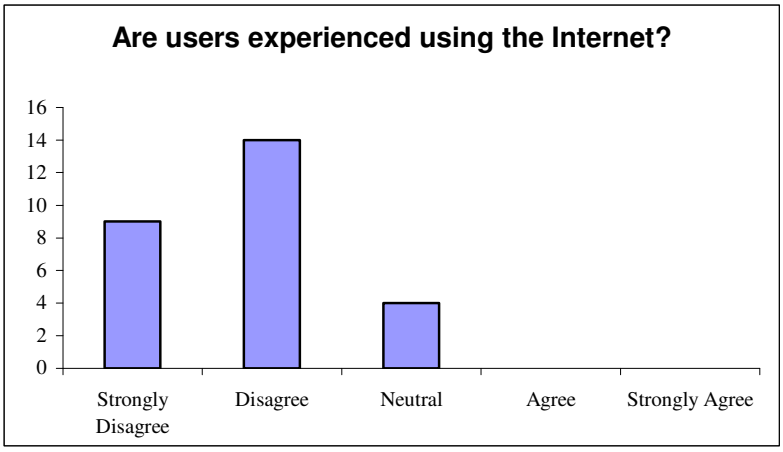

Figure 1: Participant Internet Experience

2.2 Procedure

2.2.1 Usability Study

Participants were asked to carry out three search-related tasks using all 3 of the specific health information web sites. Participants were asked to talk through their search process, describing their thoughts and rationale for finding the requested information in the web pages. A post-test questionnaire was administered after all three tasks were carried out, to collect participant observations comparing site performances and their ratings relating to specific site features including ease of use, preference, and the most successful site in achieving task goals.

The tasks were taken from the three principle sections of the NHSDirect Online home page as it was in October 2003. These sections were: the health encyclopaedia; a self-help guide, and a local NHS services database. Tasks were then designed to search for information in these areas. The tasks participants were asked to carry out were to:

- Look for three symptoms of flu; find a new viral medicine treatment for it, and to find two 'at-risk' groups qualifying for a flu vaccination.
- Find out the mailing details, telephone number, visiting times and if there is an accident and emergency department at a specified hospital.
- Work through a self-diagnostic test for backache and record the suggested treatment.

Participants searched a different site for each task, and the order the tasks was randomised. These measures were used to reduce the effects of 'learnability'. As participants were novice Internet users, any experience gained during the study increased their Internet searching experience. The tasks reflected information that people might normally be expected to be searching for: Fox's study for PIP (2002) noted that: 93% of their health information searchers have looked for details about a particular illness or condition; 32% have looked for information concerning a particular doctor or hospital; and 8% have looked for information in order to enable a self-diagnosis.

2.2.2 Accessibility Study

Participants were asked to browse some information from the Web specifically relating to finding out what the current situation on Severe Acute Respiratory Syndrome (SARS) is, using any or all of the 3 web sites specified. Participants were requested to talk through the process expressing their thoughts on the web pages they visited. In particular, they were to voice any problems relating to ease of use and accessibility of web pages. Observations and comments were noted. After completing the task, participants were asked to specify which elements of the web sites they used affected the ease with which they were able to access the information. They were then asked to select the three most prominent elements and rate them between one and three with one being the element that made accessibility the most difficult.

3 Results

The study yielded two types of data, qualitative and quantitative, which will be analysed differently but will be used for comparison. The elements that were rated by users were analysed using a quantitative approach. The thinking aloud protocol/observation method yielded qualitative data that was analysed using content analysis. It is the user defined ratings of elements that this study is predominantly concerned with and as such, the qualitative data will be used for reference only. It should be noted that there was little difference between the two sets of results

3.1 Usability Study

This study produced two types of data – a ranking for the usability of the three web sites, and supplementary qualitative data that highlighted the specific usability problems encountered in the sites. The qualitative data was evaluated using content analysis, and categorised according to Nielsen's heuristics (1994). These results have been summarised in Table 1 (below).

Table 1: A Comparison of the Usability of Health care Web Sites.

	Intelihealth	**NetDoctor**	**NHS Direct**
Easiest to use	1	2	3
Most preferred (liked)	2	1	3
Most successful web site	2	1	3
Usability issue 1	User control and freedom	User control and freedom	Aesthetic and minimalist design
Usability issue 2	-	Visibility of system status / Aesthetic and minimalist design	User control and freedom

3.1.1. Ratings

As can be seen in Table 1 (above), the novice users concurred in their ratings of the sites for most liked and the success of use, with NetDoctor being most highly rated and NHSDirect Online the least highly rated. However, when it came to which site was easiest to use, Intelihealth outdid NetDoctor in this category, with the NHSDirect Online site being the one that novice Internet users found the least easy to use. Spool (1999, p13-4, p95-6) mentions that when carrying out comparative software testing users often liked best the product they were most successful with, but with comparative web site testing users would find a site interesting, but this was not always the site they were most successful at finding information in. Commercialised or 'selling' health information sites are often rejected by health information seekers (Fox, 2002; Sillence, Briggs, Fishwick, & Harris 2004, p115), yet both the more highly rated sites, NetDoctor and Intelihealth, carry some amount of advertising, whereas the least highly rated site, NHSDirect, does not.

3.1.2 Usability Issues

The usability issues causing most problems are similar to those noted by Stokes (2005), but with a different distribution between the sites. Categorising user comments within the heuristic issues is subjective, plus comments can fall into more than one heuristic. NetDoctor and NHSDirect Online attracted the most comments; the few comments for Intelihealth centred on its commercialization and use of advertising pop-ups, there was no concrete secondary heuristic problem. This use of advertising and pop-ups relates to the 'user control and freedom' heuristic. Advertisements are not displayed at the user's request; pop-ups often obscure crucial areas of the screen, and novice users may not realize that they are able close down pop-ups, or know that software is available to prevent pop-ups appearing in the first place. Observations revealed that Intelihealth carries less advertising and uses fewer pop-ups than NetDoctor. On reflection, this would suggest that it is the way in which the advertising and pop-ups are used which makes the impact on this group of users, rather than the fact that these features are used at all.

The 'user control and freedom' heuristic drew the most comments across the three sites. As indicated above, this heuristic relates to the user being in control of the web site, rather than the web site controlling the user. From being able to switch off unwanted animations or audio, to being permitted to make mistakes (particularly spelling in forms and search facilities), to being clearly directed by navigational mechanisms (especially important are the words used to provide links, categories and headings); users can easily be led astray from their quest for information by sites. Apart from pop-ups, the main complaint here related to unclear labeling, both of site facilities (NHSDirect Online) and headings (NetDoctor). Small font sizes were also, commented on, with NHSDirect Online being a particular culprit.

The 'aesthetic and minimalist design' heuristic provoked the next largest group of comments, and this was the primary cause for concern at the NHSDirect Online site. This heuristic covers design issues such as the use of unnecessary graphics, superfluous content, irrelevancies, and conversely, too much white space. The main criticisms were that too much information was contained on the page, making it difficult for users to find what they wanted, too long lists to choose from, not enough graphics, poor layout. As well as the small font size used by NHSDirect, commented on above, other problems were caused in the site by using small fonts as part of the navigational structure. An A-Z selection list is used here, and the small fonts meant that the participants only had a tiny area to click on to make the link, and this caused participants to need several attempts to succeed in making the link work.

The 'visibility of system status' heuristic received comments for the NetDoctor web site. This heuristic refers to users being able to see what is going on and why they may be waiting for something to happen. Keeping the user informed is of paramount importance, otherwise boredom sets in and they click away elsewhere. One aspect of keeping the user informed covers the ease with which users are able to orient themselves on a given page. Users can enter a site at any page, so it is important that they are able to easily see where they are and where they can go. Consequently clear global and higher level navigational aids are required. At the NetDoctor site participants found it unclear where to look for the information they required.

3.2 Accessibility Study

The participants were asked to list three elements and rate them in the order in which they affected web page accessibility. The elements were given scores according to their ranking. The first element was assigned a score of three, the second element received a score of two and the third element received a score of one. Table 2 (below) demonstrates how the scores were calculated for elderly users.

Most of the participants rated font size, and low contrast between background and font colour, as the most significant accessibility issue. These elements would certainly affect readability, which is a common problem for users with vision impairments. Given that all participants stated that they were short sighted, the occurrence of these elements is expected (W3C/WAI, 2004; Good, Jerrams-Smith & Stevens, 2005). Three participants assigned frames

as being the second element, with a rating of two, that caused accessibility problems with the other three assigning this rating to pop-ups. The second two most common elements that were specified by participants were pop-up adverts and plain pages. The use of pop-ups obscures screen real estate and is particularly problematic for novice users given that they are usually unaware of how to close them. Users with motor restrictions highlighted three elements, which were scroll bars, small links and text boxes. These elements have been identified as common problems for users with motor restrictions (W3C/WAI, 2004; Good, Jerrams-Smith & Stevens, 2005).

Table 2: Web Page Elements Affecting Elderly Novice Users

Element	Level One (Score - 3)	Level Two (Score - 2)	Level Three (Score -1)	Calculations	Total Score
Font size	4	1	1	(4 * 3) + (1 * 2) + (1 * 1) =	15
Contrast between B/F colour	1	4	3	(1 * 3) + (4 * 2) + (3 * 1) =	15
Pop-up adverts	1	2	1	(1 * 3) + (1 * 2) + (1 * 1) =	8
Plain pages	1	0	2	(1 * 3) + (1 * 2) =	5
Embedded links	1	1	0	(1 * 3) + (1 * 2) =	5
Lack of pictures	1	0	1	(1 * 3) + (1 * 1) =	4
Scroll bars	1	0	1	(1 * 3) + (1 * 1) =	4
Lack of headings	1	0	0	(1 * 3) =	3
No menu on index page	1	0	0	1 * 3	3
Too much colour	0	1	0	1 * 2 =	2
Small links	0	1	0	1 * 2 =	2
Blue links	0	1	0	1 * 2 =	2
Text boxes	0	0	1	1 * 1 =	1

The actual elements specified by the users were further backed up by results from the observational study. No additional elements were mentioned.

4 Discussion and Recommendations

This paper presented the results of an exploratory study to investigate the usability and accessibility of three health care information web sites, using elderly novice participants. The study was divided into two parts with different participants used for each part.

The usability study revealed particular problems with health information sites for older users. These are summarised in figure 2 (below). The highlighted problems centre on participants feeling overwhelmed by the amount of information contained in pages, and thus being unable to easily find navigational cues directing them where to look for the information they require. Coupled with the poor use of words for links, categories and headings, many of the participants felt confused by the sites. Qualitative information collected during the course of the study supports this view. One participant's comment regarding the sites encapsulates this: "*I found them all difficult to comprehend.*" Other participants commented: "*If you are unable to see it straightaway why bother"* and *"The headings are not clear as to the information they lead to."*

The NHSDirect Online site received more criticism than NetDoctor, with Intelihealth receiving the fewest comments. A particular theme of dissatisfaction with the NHSDirect Online site drew this participant comment: "*The web site looks too full, its difficult to read all at once."* This comment suggests that these novice users are

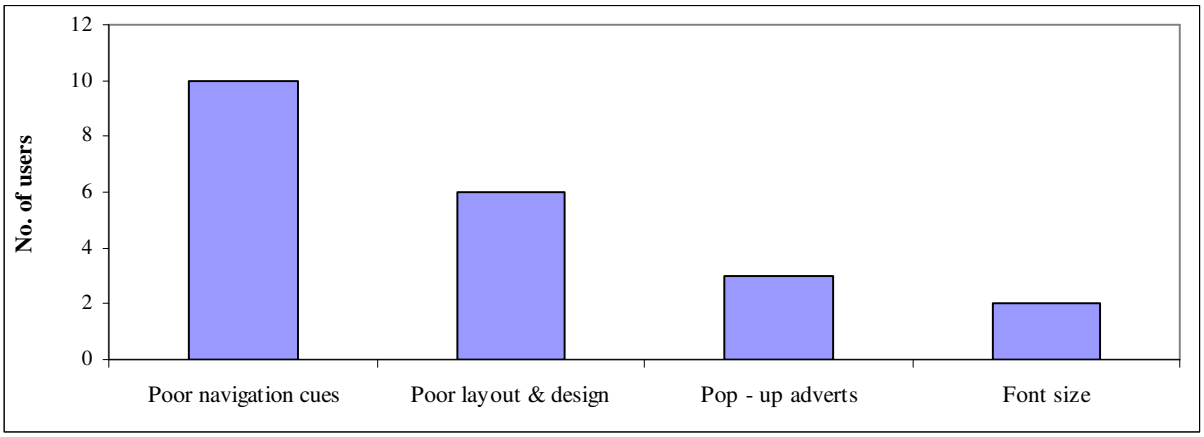

Figure 2: Principle Usability Study Problems Encountered

trying to read everything on the page, rather than scanning it to pick out relevant information. A recent Alertbox by Jakob Nielsen (2005) centring on work conducted with lower-literacy users discovered that these Internet users do not scan the text on pages either. These observations suggest that page design still needs to be simplified and streamlined in order to prevent novice users being overloaded by extraneous information.

The accessibility study highlighted elements of web pages that are particularly problematic for elderly people, in particular, those with age related impairments. All participants had some degree of vision impairment and 2 also experience motor restrictions. Participants were asked to specify and rate, with a scoring of one to three, the elements they felt affected accessibility of web pages. Many of the elements that were rated were ones that are specified by the WAI as being relevant for visually impaired participants. In addition, previous research has found that small font size and low contrast between font and background colour to be elements that affect accessibility for visually impaired, the most (Good et al, 2005).

Although the studies focused upon different issues, the problems uncovered do overlap to a degree, sometimes directly, on other occasions by highlighting different aspects of the same core problem. It was mentioned at the beginning of this paper that the reasoning for separating the studies was primarily not to confuse participants over differentiating between usability and accessibility. Many of the issues expressed by participants in the 2nd study related to accessibility problems that visually impaired people might experience and some related to motor restricted users. However, there others that related to neither group of users. These were more to do with aesthetics. It is difficult to determine whether a user's *experience* of using a website might interfere with their usage or indeed ease with which they are able to access the information. However, the issue of aesthetics was relevant enough for almost half the participants to rate it as a significant factor.

The comments specified by participants from the usability study were categorized into specific usability issues (See figure 2). Given that participants from the 2nd study highlighted issues that were not recognized as being accessibility problems, using the same principles of categorization that the 1st study adopted, these issues were also grouped together. For example, 'plain pages', 'lack of pictures' and 'too much colour' could be said to relate to layout and design. Whereas, 'embedded links', 'lack of headings', 'blue links' and 'no headings', relate to navigation. Lastly, 'scroll bars' and 'text boxes' relate to user control. This helps to identify the main issues affecting elderly, novice users, when using health care web sites and make the appropriate recommendations. Figure 3 shows the ratings of all the elements specified by the participants. It is interesting to note that the issue of poor navigational cues is one of the most a significant factors in both studies. In addition, poor layout and design as well as pop-up adverts, were also issues to come out of both studies.

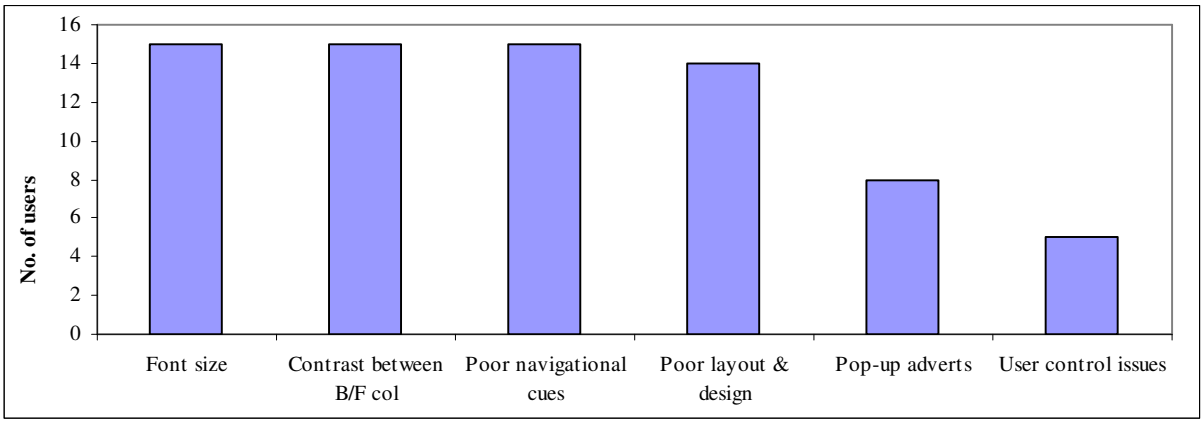

Figure 3: Principle Accessibility Study Problems Encountered

4.1 Recommendations

The following recommendations are to be considered as guidelines when designing health care information web sites.

- Ensure navigational cues are clear. Users need to clearly understand where to go without the needing to scan the page for options.
- Ensure that the layout and design of a web page doesn't obscure necessary information or make readability more difficult as too much information can be confusing to a novice user. This is particularly relevant to vision impaired users.
- Avoid pop-up adverts. Many elderly, novice users often do not know how or are unable to close them. This is particularly relevant for motor restricted users who would have problems in making the precise mouse movements necessary.
- Make information comprehensible. The language used needs to be understood by everyone and not just those with a high reading ability.

Encourage scanning and readability by avoiding cluttered screens
Avoid or be careful Popup adverts – obscure screen real estate - the way they are used seems to influence users more than the fact that they are used at all
Font size
Careful use of words, particularly in categories, headings and navigational links/ cues

Make sure the user is in control of their use of the site, not the other way around

5. Conclusion

Elderly people can be considered a special user group due to the high likelihood that these users have impairments – age related or otherwise. Being a novice user then exacerbates the problem. The issue of poor usability and accessibility is widely recognised with numerous interest groups researching new techniques and introducing legislation that will provide better access to future web-based information. However, despite the availability of standards and guidelines there is still a significant shortfall of compliance. It is this shortfall that prevents people with disabilities attaining equal access of information. Where non-compliance to design standards prevails, there will always be users who are faced with barriers. Learning potential, inclusion and empowerment are all issues that are affected by unusable and inaccessible web pages. The results from the study have enabled recommendations to be made that can be used as guidelines to make health care websites inclusive to all. Though this paper has primarily focussed upon the needs of elderly, novice users health information seekers may well be ill or stressed

when they are looking for information within these web sites. Therefore usability and accessibility of online health information is then paramount.

Age can affect working memory span (Salthouse, 1994), which in turn can affect the ease with which Internet users elicit information from web sites. Further research aims to discover the effects of working memory capacity on novice user performance with web sites. Current research is focussed upon selecting web pages according to specific needs. This would be particularly beneficial to users with age related impairments. Lastly, future research aims to focus how elderly users *experience* a web site and the impact that this might have upon using it. If we have time, we will also carry out research to assess Suzanne's oral technique. Naturally, I don't wish to be involved in such an overt display of lasciviousness so another researcher by the name of Wendy will be drafted in. Poor girl!

References

Abowd, G. G. & Mynatt, E. D. (2000). Charting past, present, and future research in ubiquitous computing. *ACM Transaction on Computer-Human Interaction,* 7(1), 29-58.

Ageing population. More over 65s than under 16s by 2014. (2003). Retrieved February 05, 2003, from National Statistics Online: http://www.statistics.gov.uk/cci/nugget.asp?id=287

Bernard, M., Liao, C. & Mills, M. (2001). *Determining the best online font for older adults.* Retrieved February 04, 2003, from http://www.psychology.wichita.edu/surl/usabilitynews/3W/fontSR.htm

Burton R.R. & Brown J.S. (1982). An Investigation of Computer Caching for Informal Learning Activities In Intelligent Tutoring Systems, (Ed.), Sleeman D. & Brown J. London: Academic Press, 1982, pp. 79-98.

Chaparro, B. & Stumpfhauser, L. (2001, updated 2002). *Designing a touch screen kiosk for older adults: a case study.* Retrieved February 04, 2003, from http://psychology.wichita.edu/surl/usabilitynews/3W/kiosk.htm

Disability Rights Commission (2004). The Web: Access and Inclusion for Disabled People. London.

Fox, S. & Rainie, L. (2000). *The Online Health Care Revolution: How the Web helps Americans Take Better Care of Themselves.* Retrieved 30 March, 2005, from the Pew Internet and American Life Project web site: http://www.pewinternet.org/pdfs/PIP_Health_Reprt-1.pdf

Fox, S. (2002). *Vital Decisions. How Internet Users Decide What Information to Trust When They or Their Loved Ones are Sick.* Retrieved 29 March, 2005, from the Pew Internet and American Life Project web site: http://www.pewinternet.org/pdfs/PIP_Vital_Decisions_May2002.pdf

Good A., Jerrams-Smith J., Steven B. (2005). Enabling Accessibility and Enhancing Web Experience: Ordering Search Results According to User Needs. *Proceedings of HCI International, 2005*. Lawrence Erlbaum Associates. July 2005. [In Press]

Kaiser Family Foundation, (2001). *Generation Rx.com. How young people use the Internet for health information.* [Electronic version]. Kaiser Family Foundation Survey, December 2001. Retrieved April 17, 2003, from: http://www.kff.org/content/2001/20011211a/GenerationRx.pdf

Kinsella, K. & Velkoff, V.A., (2001). An Aging World: 2001. International Population Reports, US Department of Health and Human Services, and US Department of Commerce. Retrieved 29 March, 2005, from: http://www.census.gov/prod/2001pubs/p95-01-1.pdf

National Statistics (2004). Ageing 16% of UK population are aged 65 or over. Retrieved 31 March, 2005, from http://www.statistics.gov.uk/ci/nugget_print.asp?ID=949

National Audit Office (2003). *Progress in making e-services accessible to all – encouraging use by older people.* Press release retrieved February 25, 2003, from http://www.nao.gov.uk/pn/02-03/0203428.htm

Nielsen, J. (revised 1994). *Ten Usability Heuristics.* Retrieved March 21, 2005, from http://www.useit.com/papers/heuristic/heuristic_list.html

Nielsen, J., (1999). *Do Interface Standards Stifle Design Creativity?* (Alertbox, August 22, 1999). Retrieved January 22, 2003, from http://www.useit.com/alertbox/990822.html

Nielsen, J., (2001). *Beyond Accessibility: Treating Users with Disabilities as People*. Retrieved December 12, 2004. http://www.useit.com/alertbox/20011111.html

Nielsen, J. (2002). *Usability for Senior Citizens* (Alertbox, April 28, 2002). Retrieved January 22, 2003, from http://www.useit.com/alertbox/20020428.html

Nielsen, J. (2002a). *Let users control font size* (Alertbox, August 19, 2002). Retrieved January 22, 2003, from http://www.useit.com/alertbox/20020819.html

Nielsen, J. (2005). *Lower-Literacy Users.* Retrieved March 30, 2005, from http://www.useit.com/alertbox/20050314.html

Preece J., Rogers Y. & Sharp H. (2001). *Interaction Design*. New York, NY: John Wiley & Sons.

Salthouse, T. A. (1994). The aging of working memory. *Neuropsychology,* 8, 535-543.

Shneiderman, B. (2000). Universal Usability. *Communications of the ACM*. May/Vol. 43, No. 5.

Shneiderman, B., (2001). Universal Usability: A research agenda for Human-Computer Interaction to empower every citizen. In R. Earnshaw, R. Guedj, A. van Dam, & J. Vince (Eds.), *Frontiers of Human-Centred Computing, Online Communities and Virtual Environments* (pp 179–189). London: Springer Verlag.

Shneiderman, B. (2002) interviewed by Jenny Preece in Preece, J. Rogers, Y. and Sharpe, H. *Interaction Design. Beyond Human-Computer Interaction.* New York: John Wiley & Sons Inc

Sillence, E., Briggs, P., Fishwick, L., & Harris, P. (2004). Timeline Analysis: A Tool for Understanding the Selection and Rejection of Health Websites. In A. Dearden, & L. Watts (Eds.), *Proceedings of HCI2004: Design for Life: Vol. 2. (pp113-116).* Leeds, UK.

Spool, J., Scanlon, T., Schroeder, W., Snyder, C. & DeAngelo, T. (1999). *Web Site Usability. A designer's guide.* San Francisco: Morgan Kaufmann.

Stokes, S. (2005). An Evaluation Comparing the Performance of Novice Users Using Health Information Web Sites. [In Press] *Proceedings of HCI International 2005: Vol. 2*. Las Vegas, USA.

Taylor, H. & Leitman, R. (2004). No Significant Change in the Number of "Cyberchondriacs" – Those Who Go Online for Health Care Information [Electronic version]. *Health Care News,* 4(7), 1-4. Retrieved March 29, 2005, from the Harris Interactive web site: http://www.harrisinteractive.com/news/newsletters/healthnews/HI_HealthCareNews2004Vol4_Iss07.pdf

Thomas, P., & Macredie, R.D. (2002). Introduction to The New Usability. *ACM Transactions on Computer-Human Interaction,* 9(2) 69-73.

WHO, (1995) *Population Ageing*, A Public Health Challenge Fact Sheet N°135. Retrieved February 17, 2005. http://www.who.int/inf-fs/en/fact135.html

W3C/WAI (2004). *Web Content Accessibility Guidelines 2.0*. Retrieved December 14, 2004. http://www.w3.org/TR/2004/WD-WCAG2020040311/

W3C/WAI (2004). *How People With Disabilities Use the Web*. Retrieved November 18, 2004. http://www.w3.org/WAI/EO/Drafts/PWD-Use-Web/Overview.html