Age-centered Research-Based Web Design Guidelines

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ABSTRACT
This paper presents the methodology and the results of the development of a set of age-centered research-based web design guidelines. An initial set of guidelines was first developed through careful literature review of the HCI & Aging literature. Then a series of classification methods (card sorting, affinity diagrams) were employed as a means for obtaining a revised and more robust classified set of guidelines. Finally the revised set of guidelines and the original set were tested through their application to a number of age-related websites.

Author Keywords
Aging, web design guidelines, universal design

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Aging Population
The global number of elderly persons by 2020 is expected to exceed one billion and there will be more seniors throughout countries in the developed world than ever before [6]. About 70 per cent of the western world will live past 65 years and 30-40 per cent past 80 years [12]. From these figures it can clearly be evidenced that it is impossible for designers to continue to ignore this growing population.

Physical & Psychological Changes
Some of the degenerative effects of aging include diminished vision, varying degrees of hearing loss, psychomotor impairments, as well as reduced attention, memory and learning abilities.

Vision is the most common physiological change associated with aging. After the age of 55 years, many seniors will experience vision changes, including presbyopia, a loss in near vision [1], reduced field of vision [3]. Older adults will also experience a decline in contrast sensitivity as well as reduced colour sensitivity, particularly in the blue and green range [4]).

Hearing, overall declines with age; and research has shown that 20% of people between 45-54 years have a form of hearing impairment, which rises to 75% for persons between 75 - 79 years of age [5].

Psychomotor abilities also decline with age. In older adults, response times increase with more complex motor tasks [10]. Older adults perform poorly when they try to track a target, make more sub-movements when using a mouse to track an item [13] and experience an increase in cursor positioning problems if the target size is small.

With age, it is generally accepted that there is a decline in the ability to process items from working memory into short term memory [8]. Studies have also found that there is a decline in episodic memory (memory for specific events) and procedural memory (memory for how we carry out tasks) [3].

Age-Centred Design
Universal design or design for all has been described as the philosophy in design that recognizes, values and accommodates the broadest possible range of human abilities, skills, requirements and preferences in the product and supporting environments to suit the broadest possible end user population [11].

A study by Hart [2], which evaluated websites designed for older adults found that websites designed for the elderly were still failing to adhere to simple guidelines such as providing large and highly contrasted text.

Web usability guidelines play an important role for web designers to ensure the usability and accessibility of websites when designing and evaluating websites.

Whilst guidelines have become popular for providing and spreading usability knowledge and experience.

The weakness up to now of such guidelines has been the absence of linkage between them and theoretical foundations and research. This is the area that this study is trying to cover by proposing a set of age-centred research-based web design guidelines.

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METHODS - RESULTS

Initial Guideline Development

An extensive literature review on the areas of aging and human computer interaction publications on aging was carried out by reviewing over 100 papers on these topics.

From the review of the vast literature, an initial set of 52 unique guidelines was established. These guidelines addressed the following areas: Vision (decline in static acuity, dynamic acuity, contrast sensitivity, colour sensitivity, sensitivity to glare, decrease in visual field, decrease in processing visual information), psychomotor abilities, attention (declines in selective and divided attention), memory and learning, intelligence and expertise.

Each guideline was backed up with at least one established piece of literature/study. The complete set of the initial 52 guidelines can be obtained by contacting directly the authors of this paper.

Card Sorting

After the initial 52 guidelines were established, a card sorting exercise was conducted with a group of 40 postgraduate Business Systems Analysis & Design students who are completing a compulsory module in Human Computer Interaction and Design. Participants were provided with a set of cards containing the initial 52 senior friendly usability guidelines, each with a short description.

Participants were asked to sort these guidelines into groupings/categories in which they thought similar or related guidelines could be grouped together and to provide category headings for the differently grouped guidelines.

The results from the card sorting session were then input into EZSort, which revealed a tree diagram depicting the 52 guidelines grouped distinctly into 9 different categories (Figure 1).

Focus Group

Building on the results from the card sorting exercise, a focus group was conducted with five participants (PhD Research Students, Researchers and Academics all experts in the domain of HCI).

The affinity diagram technique was used within the focus group (Figure 2), in which the 52 guidelines from the card sorting session had been printed onto yellow post-it notes and stuck onto the wall into the 9 different groupings that had been established by the cluster analysis software. The participants were then asked to review the guidelines within each category and were given the freedom to move or remove any guidelines from their initial position. This was an iterative process which consisted of guidelines being removed from groupings and being added to either other groups or being added to new guideline categories.

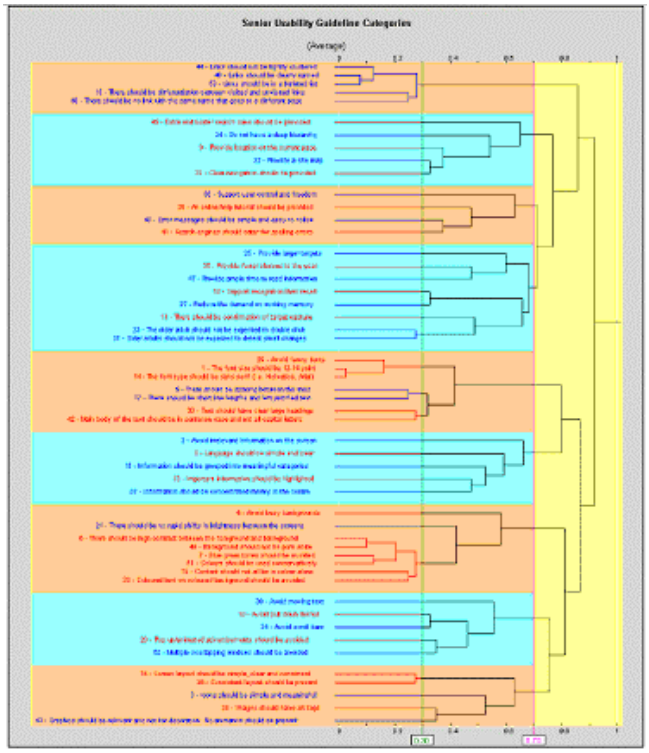

Figure 1. EZSort Output

Figure 2: Affinity Diagram Output

Once the participants had collectively reached agreement on the sorting categories for the 52 guidelines, they were then asked to consider whether there were any guidelines which they thought were very similar and could therefore be merged together to produce a smaller condensed set of senior friendly usability guidelines. The final task of the focus group was for the participants to provide agreed category headings on which the differently grouped guidelines could fall under.

Final Guidelines

The results of the Focus Group produced a new smaller set of 38 Senior Friendly Usability guidelines which were grouped under 11 distinct category headings.

Target Design
- Provide larger targets
- There should be clear confirmation of target capture, which should be visible to older adults who should not be expected to detect small changes
- The older adult should not be expected to double click

Use of Graphics
- Graphics should be relevant and not for decoration. No animation should be present
- Images should have alt tags
- Icons should be simple and meaningful

Navigation
- Extra and bolder navigation cues should be provided
- Clear navigation should be provided
- Provide location of the current page
- Avoid pull down menus
- Do not have a deep hierarchy and group information into meaningful categories

Browser Window Features
- Avoid scroll bars
- Provide only one open window eg. pop up/ animated advertisements or multiple overlapping windows should be avoided

Content Layout Design
- Language should be simple and clear
- Avoid irrelevant information on the screen
- Important information should be highlighted
- Information should be concentrated mainly in the centre
- Screen layout, navigation and terminology used should be simple, clear and consistent

Links
- There should be differentiation between visited and unvisited links
- Links should be clearly named and no link with the same name should go to a different page
- Links should be in a bulleted list and not tightly clustered

User Cognitive Design
- Provide ample time to read information
- Reduce the demand on working memory by supporting recognition rather than recall and provide fewer choices to the user

Use of Colour and Background
- Colours should be used conservatively
- Blue and green tones should be avoided
- Background screens should not be pure white or change rapidly in brightness between screens. Also, a high contrast between the foreground and background should exist, for example, coloured text on coloured backgrounds should be avoided.
- Content should not all be in colour alone (colour here is denoted by all colours other than black and white)

Text Design
- Avoid moving text
- Text should be left justified and text lines should be short in length
- There should be spacing between the lines
- Main body of the text should be in sentence case and not all capital letters
- Text should have clear large headings
- Use san serif type font ie. Helvetica, Arial of 12-14 point size. Avoid other fancy font types.

Search Engine
- Search engines should cater for spelling errors

User Feedback & Support
- Provide a site map
- An online help tutorial should be provided
- Support user control and freedom
- Error messages should be simple and easy to follow

Please note that every one of the above mentioned guidelines is backed up with a number of academic references that cite literature that support each guideline.

Due to the limited space for this paper, citations are not provided but a complete list of the guidelines and their references can be obtained from the authors.

Heuristic Evaluation

The validity of the new set of senior friendly guidelines was tested by conducting Heuristic Evaluations (HE) using both sets of guidelines (the initial 52 and the second set of 38) on two different websites.

Six participants were recruited to complete the heuristic evaluation. The participants were each asked to review two websites, http://www.nsclc.org and http://www.elderhostel.org./welcome/home.asp, one website using the initial set of guidelines and one website using the second set of guidelines. The websites were scored in terms meeting a guideline (if a web site met a guideline, it was allocated a '1' as a point. If the guideline did not meet the guideline it was allocated a '0' and if the guideline was not applicable, NA was marked).

The results from the Heuristic Evaluation demonstrated that in rating the http://www.nsclc.org website, participants using both the initial and the final guidelines achieved very similar and consistent results, with a small variance in the total

points being provided and a big agreement across evaluators (66% of the second set of guidelines and 67% of the initial set of guidelines were scored identically by all evaluators).

However, the results of the Heuristic Evaluation of http://www.elderhostel.org/welcome/home.asp show a different picture. The Heuristic Evaluation results using the second set of guidelines again show very similar and consistent results across participants, with 71% of the guidelines rated in exactly the same way by all evaluators.

The Heuristic Evaluation results using the initial set of guidelines, however show a totally different picture. Only 40% of the questions were answered in the same way by all participants.

This demonstrates that the final set of guidelines are more robust and generalized.

DISCUSSION - CONCLUSION

The initial set of guidelines produced was very detailed and comprehensive, covering all important areas of age decline that might effect the usability of interactive systems.

But we wanted to test whether a large number of guidelines (52 in this case), may be perceived by web designers to be too many to adhere to and in return potentially affect the effective use of the guidelines by web designers. Scapin et al [9] also support this view by stating that if the guidelines are potentially too long, general and not too specific, then a lot of time may be expended by the users of the guidelines in trying to interpret them according to the context of the user interface, with the designer not knowing when and how they can be used. Zajicek [14] also goes further by stating that this vast amount of research is often difficult to access by new designers of systems for older people because it requires the designer to first wade through the vast amounts of detail before they can understand how the knowledge applies to their domain.

Furthermore, Robertson [7] has asserted that it is important to ensure that guidelines, which have been created, are organized, useful and meaningful for the users of the product.

The study described in this paper has achieved to develop a manageable and robust set of guidelines for designing and evaluating age-friendly websites. We are currently in the process of further refining our guidelines and applying them to a larger set of websites with the goal of further validating their applicability.

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