Informatics, Management and Technology in Healthcare
J. Mantas and A. Hasman (Eds.)
IOS Press, 2013

doi:10.3233/978-1-61499-276-9-103

Breadth, Depth and Visibility: A Design Guide for Information Architectures Aimed at Elderly Users

Anders BRUUN[a,1], Claudia HAHN[b], Benjamin VOIGHT[b] and Martin SCHULTZ[b]
[a] *Dept. of Computer Science, Aalborg University, Denmark*
[b] *Telemedicine Center, Charité University Medicine, Berlin, Germany*

Abstract. This study extends previous research by exploring the quality of the interaction experienced by a group of elderly participants interacting with a healthcare portal when applying a touch screen remote control. This is compared to a standard remote control with physical buttons.

Keywords. Usability test, touch screen, remote control, elderly

Introduction

For telemedicine systems to succeed in securing decreased costs and patient autonomy they must be intuitive to the end users, i.e. they need a high level of usability [1]. This perspective validates the attention paid to elderly usage of home telemedicine systems seen within health informatics research. However, empirical Human-Computer Interaction (HCI) research in the area of health informatics mainly provides holistic views of the usability problems experienced within user interfaces. In terms of user interfaces these holistically oriented studies cover several design elements such as feedback mechanisms, help functions, system visibility, consistency etc. [2]. Although such holistic views are useful we find that there is a need to further narrow the focus on specific interaction design elements within user interfaces of telemedicine systems and to conduct in depth studies of these. One crucial element is the information architecture, which determines the way in which information is categorised, labelled and presented, and, thus, whether users are able to locate relevant information efficiently [3]. In the research area of HCI it has been known for several years that designers should emphasize breadth over depth when designing menu structures [4]. It is still unclear how elderly users perform in their interactions with an IA compared to younger users.

In this paper we propose a design guide for information architectures based on usability problems experienced by a group of elderly users. The SmartSenior healthcare portal is used as a case [5] and the performance of a group of elderly users is compared to that of a group of younger users.

[1] Corresponding Author: Anders BRUUN, Aalborg University, Denmark, e-mail: bruun@cs.aau.dk.

1. Method

1.1. System & Setting

The SmartSenior healthcare portal offers various features such as communication with the hospital and other seniors, advice for healthy diets and room climate, measurements of vital parameters etc. The system is aimed for use by seniors in their homes and all user interaction is done through a web portal aimed for display on a TV using a remote control. External devices are required to conduct measurements of blood pressure, weight etc. A usability evaluation was conducted in a room at the telemedicine center. In the test room participants were sitting in a chair operating the portal using two different remote controls; a remote control with physical buttons and a touch screen remote implemented on a smartphone. The smart phone was simulating haptic feedback through vibrations when buttons were pressed. A test monitor was sitting next to the participant and a data logger was standing in the test room behind the test participant and test monitor to observe all test sessions and to take notes.

1.2. Participants & Procedure

The system is primarily intended for use by elderly people and we selected 6 elderly test subjects (μ=67.2 years, SD=3.9) but also chose to include a control group of 6 younger users (μ=35.3 years, SD=5.6). All 12 participants were female. Although 6 participants in each group is relatively small number, it should be noted that formative usability evaluations in the domain of Human Computer Interaction are typically conducted using 5 test participants, which, from a cost/benefit point of view, is the most feasible [3]. None of the participants had previous experience with this or any similar portal system. Their experience in using electronic equipment in general varied. All participants owned a cell phone. Six tasks were given to the participants one at a time and participants were asked to think aloud while solving these. Participants were using the standard remote control and the touch screen remote control in random order to solve the tasks. All test sessions were recorded using screen capture software, a webcam and a microphone. We conducted a conventional video based analysis in accordance with [4] to identify the usability problems experienced by the test participants. Three evaluators analyzed the video data individually and made a list of identified usability problems. The severity of each problem was also categorized as either “critical”, “serious” or “cosmetic”. The three lists of usability problems were discussed by the three evaluators and then merged into one list of usability problems.

2. Results and Conclusion

2.1. Usability Problems

The qualitative analysis of the usability test data showed that the group of elderly participants experienced difficulties with the remote control sensitivity, which was the case for both the standard remote control as well as the touch screen remote. As an example some of the elderly participants typed in double letters at the log in screen of the portal. Another problem related to the touch remote was that the elderly did not feel

the vibration of the smart phone when activating a feature by touching the screen. This resulted in multiple presses on the same button.

2.2. Number of gazes

The fewer the times a user has to gaze at a remote control, the less time they have to spend on the interaction, which increases the quality of the interaction. For this reason we decided to count the number of times the participants had to gaze at the remote control while interacting with the healthcare portal. Findings show that the group of elderly users on average gazed 102 times (SD=53) using the remote control with physical buttons and 139 times (SD=32) when applying the touch screen remote control. In case of the younger control group the average number of gazes on the standard remote was 22 (SD=13) and 70 (SD=26) in case of the touch screen. These findings indicate a downside to the touch screen remote, as both groups of participants spend mores gazes when applying the touch screen remote compared to the standard remote with physical buttons. A two sample T-test for unequal variances (Welch test) reveals significant differences in the number of gazes between the group of elderly and younger control group when applying the standard remote control ($t = 3.6$, $df = 5.75$, $p = 0.01$). In this case the elderly participants have to spend more gazes than the younger participants. This is also the case when considering the touch screen remote ($t = 3.9$, $df = 7.8$, $p < 0.01$). The physicality of the standard remote control enables haptic feedback where users can feel the buttons, which ideally enables them to interact without having to look at the remote control. Currently, touch screen remotes do not provide such haptic feedback, which explains the above findings. This is also supported by our observations of the elderly not feeling the vibration of the touch remote, which simulated haptic feedback.

2.3. ***Conclusion***

We found that the group of seniors made significantly more menu selections at levels 2, 3 and 4 in the IA compared to the team members. Additionally we found that, in comparison, the group of seniors and younger participants had similar error rates when making selections at level 1 and that seniors had a considerably higher error rate at level 2. This difference may be explained by the lack of overview of menu items at level 2, which differed from the design applied at level 1 where all menu items were visible. These problems were related to information, visibility

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