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Participatory Heuristic Evaluation of the Second Iteration of the eWALL Interface Application

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Abstract. The number of people having a chronic disease is increasing. Telehealth may provide an alternative to traditional medicine as telehealth solutions have shown to have a positive influence on quality of live and to decrease the number of hospital visits. A new telehealth solution is the eWALL system. Previously, the eWALL interface application has been evaluated using participatory heuristic evaluation (PHE). The previous round of PHE lead to drastic changes of the eWALL interface application. Consequently, a second round of PHE was performed. Five usability experts and two work-domain professionals inspected the eWALL interface application and identified usability problems (n=384). The work domain professionals had a tendency to use other heuristics than the usability experts highlighting the relevance of using PHE in an interface development process.

Keywords. Telemedicine, Participatory Heuristic Evaluation, Chronic disease, telehealth, usability

1. Introduction

The number of elderly with a chronic disease is increasing. The expansion seems to form the future picture of the general population distribution (1). Diseases such as chronic obstructive pulmonary disease (COPD) and mild cognitive impairment (MCI) are major chronic diseases that affect thousands of people in Denmark as well as internationally (1,2). COPD is a chronic lung disease characterised by persistent airflow limitation (3). Worldwide, COPD is the fourth leading cause of death (3). MCI is a condition where the mental skills deteriorates. Approximately 14-18% of people who have passed 65 years have MCI (4). The risk of developing dementia is enhanced if a person already suffers from MCI (5). The current treatment of patients with chronic diseases is time consuming and expensive. As the number of elderly with a chronic disease grows, alternative approaches to deliver health care services are required (6). Telehealth seems to have a positive influence on patients' quality of life and to decrease the number of hospital attendances and admissions (6,7). Thus, telehealth may be an alternative way to deliver healthcare to people with chronic diseases.

The European funded project 'eWALL for Active Long Living' aims to develop a prefabricated interactive wall that includes a number of functionalities in order to assist

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people with COPD, MCI and age related impairment (ARI) in their activities of daily living (ADL). The functionalities of eWALL include health monitoring, ADL-monitoring, physical activity monitoring, cognitive training and physical training (8).

It is highly relevant to perform usability tests in a system development process to limit usability errors and improve the user experience. Previously, eWALL has been evaluated using Participatory Heuristic Evaluation (PHE) in order to provide feedback on the user-friendliness of the eWALL interface application (9,10). PHE is an expansion of the traditional heuristic evaluation (HE). In traditional HE, a group of usability experts (UEs) perform an inspection, but in PHE the UE inspection is supplemented with an inspection by work-domain professionals (WDP). The purpose of expanding the evaluation with WDP is to supplement the theoretical knowledge of the UEs with the specific knowledge of the WDPs (10). The first round of PHE of the eWALL interface application lead to remarkable changes of the eWALL user interface (9). As a consequence of these remarkable changes, it was considered necessary to perform a second round of PHE on the eWALL interface application. The aim of the present study is to report the results of this second round of PHE.

2. Materials and Methods

2.1. The eWALL Interface Application

The eWALL interface application is the interface of large touchscreen installed on a prefabricated wall that incorporates a number of features aimed at assisting people with COPD, MCI, or ARI (8). The eWALL main screen illustrates a living room from which the user can access the features including: 1) My Daily Life, 2) My Sleep, 3) My Activity, 4) Cognitive Games and Mental Training, 5) Domotics, 6) My Health, 7) Physical Exercise Trainers, 8) Well-being Advertisements, 9) Notifications (Figure 1).

Figure 1. The main screen of the eWALL interface application. The main screen illustrates a living room from which the user can access various functionalities.

2.2. Participatory Heuristic Evaluation

The PHE was performed at Aalborg University in a laboratory setting. Five UEs and two WDPs identified usability problems of the eWALL interface application. Two researchers conducted the inspection with one inspector at a time. Prior to the inspection, the inspector was introduced to the purpose and target group of the eWALL interface application, to the list of heuristics, and to the severity rating scale. During the inspection, the inspector was asked to go through a number of tasks involving all functionalities of the eWALL interface application. The inspector was encouraged to think out loud. All the usability problem that an inspector identified was noted and the severity level was scored.

All of the PHE inspectors (n=7) were recruited from the Department of Health Science and Technology at Aalborg University in Denmark. The UEs (n=5) all had an MSc.in Biomedical Engineering and were working as either PhD fellow (n=2) or assistant professor (n=3). Four of the UEs also inspected the eWALL interface application in the first round of PHE (9). The remaining UE was a novice in performing PHE. Moreover, two nurses participated in the PHE filling the roles of WDPs. The nurses had a MSc. in Clinical Science and Technology and were currently working as PhD Fellows. Both WDPs also inspected the eWALL interface application in the first round of PHE (9).

The inspectors identified each usability issue using the 15 heuristics defined by Muller et al. (10): 1) *System Status*, 2) *Task Sequencing*, 3) *Emergency Exits* 4) *Flexibility and Efficiency of Use*, 5) *Match Between Systems and the Real World,* 6) *Consistency and Standards,* 7) *Recognition rather than Recall,* 8) *Aesthetic and Minimalist Design,* 9) *Help and Documentation,* 10) *Help Users Recognize, Diagnose, and Recover from Errors,* 11) *Error Prevention,* 12) *Skills,* 13) *Pleasurable and Respectful Interaction with the User,* 14) *Quality Work,* 15) *Privacy.*

The severity of the identified usability problems was rated using the following four level severity rating scale: 1) *Cosmetic problem only*, 2) *minor usability problem*, 3) *major usability problem*, and 4) *usability catastrophe*.

Both the identified usability problems and the severity grade were entered into Microsoft Excel for data processing.

3. Results

In total, the inspectors identified 384 usability problems distributed between all of the 15 heuristics. Fig. 2 shows how the use of the heuristics was distributed. The UEs used heuristic no. 7 the most (Recognition rather than recall), and the WDPs used heuristic no. 13 the most (Pleasurable and respectful interaction with the user). In total, heuristic no. 8 (Aesthetic and minimalist design) was used the most.

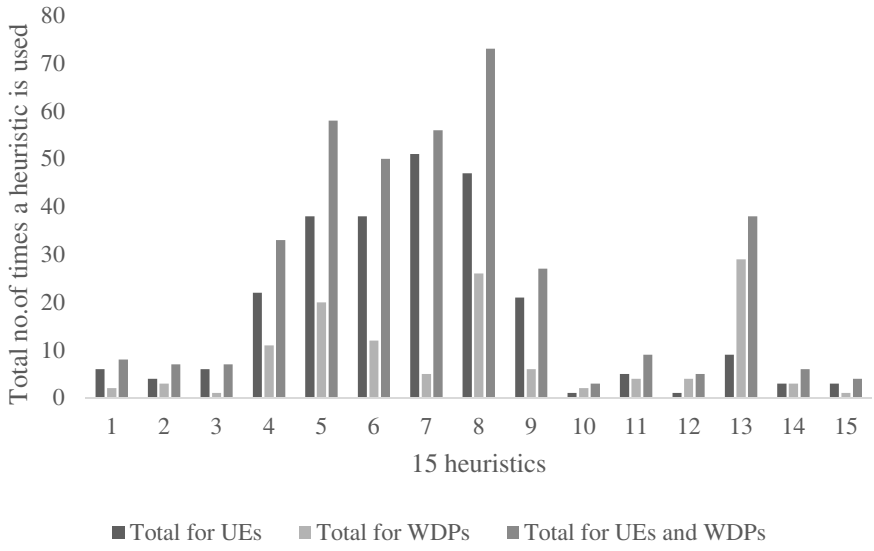

Figure 2. Number of heuristics used in total by the inspectors and separately for both the UEs and the WDPs.

The severity rating of the usability problems identified is illustrated in fig. 3. Severity grade 2 was used the most by the UEs, and severity grade 3 was used the most by the WDPs. Severity grade 1 was used the least by both groups. In total, severity grade number 3 was used the most.

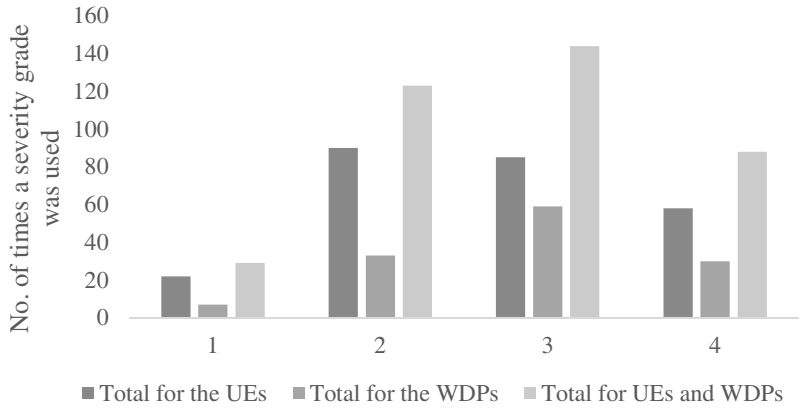

Figure 3. Number of times each severity grade was used by the UEs and by the WDPs

4. Discussion

The aim of this study was to present the results of the second round of PHE of the eWALL interface application. The first round of PHE of the eWALL interface application lead to significant changes of the interface design as often seen in a system

development processes (9). Consequently, several elements of the design were tested for the first time in this second round of PHE, and a large number of usability problems were identified (n=384). Moreover, the severity grade 3 was used the most (major usability problem) demonstrating that the eWALL interface application needs further development and testing in order to reach a permissible level of usability. These findings emphasize the need for several rounds of testing in an interface development process and also illustrate how one cannot expect to eliminate all problems after a first round of user tests. A next step in this process should include the final end users of the system. Five UEs and two WDPs participated in the study. The WDPs differed from the more traditional UEs in their use of heuristics, as they were more likely to use the heuristics in the end of the scale, whereas the UEs where more likely to use the heuristics in the middle of the scale. These findings indicate that the two groups of inspectors supplement each other well as their use of heuristics differ. Thus, the results indicate that PHE is a usable alternative to traditional heuristic evaluation as it provides a more nuanced picture of the usability errors identified. However, a limitation of the present study is that only two WDP's were included. Including more WDP's would likely have increased the significance of the results.

5. Conclusion

The PHE of the second iteration of the eWALL interface application identified 384 usability problems. Severity grade no. 3 was used the most (major usability problem) demonstrating that eWALL needs further development to increase the level of usability. PHE showed to be a relevant tool in an interface development process as the UEs and WDPs supplement each other in identifying different types of usability errors.

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