Human-Computer Interaction and Usability Engineering for Elderly (HCI4AGING): Introduction to the Special Thematic Session

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Abstract. In most countries demographic developments tend towards more and more elderly people in single households. Improving the quality of life for elderly people is an emerging issue within our information society. Good user interfaces have tremendous implications for appropriate accessibility. Though, user interfaces should not only be easily accessible, they should also be useful, usable and most of all enjoyable and a benefit for people. Traditionally, Human–Computer Interaction (HCI) bridges Natural Sciences (Psychology) and Engineering (Informatics/Computer Science), whilst Usability Engineering (UE) is anchored in Software Technology and supports the actual implementation. Together, HCI and UE have a powerful potential to help towards making technology a little bit more accessible, useful, useable and enjoyable for everybody.

Keywords: Human–Computer Interaction, Usability Engineering, User Interfaces, Elderly People, Older Adults.

1 Introduction and Motivation for This Special Thematic Session

In most industrialized countries the demographical, structural and social trends tend towards more and more elderly people in single households, which definitely has effects on health care, emergency medical services and of course on the individuals themselves [1]. Older people and new technologies are one of the important research and development areas [2], where accessibility, usability and life long learning play a major role. For example, Intelligent User Interfaces (IUI) for Ambient Assisted Living (AAL) intend to support elderly by providing intuitive and natural interaction mechanisms [3]. However, such applications must be designed and developed to support the needs, the new, and special, demands and requirements of the individual end users. Clear benefits must be offered, whether in a physical, medical, emotional, motivational or educational respect.

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The design and development of IT must support the elderly end users, especially to overcome their fears and enable them to accept technological aids and mobile devices without reservations. The design must then reflect the acceptance of the end users and not be the cause of new biases [4]. In order to ensure this, the HCI community developed a variety of User–Centered Design (UCD) techniques during the last 15 years [5], which are meanwhile established usability engineering methods [6].

2 Future Trends and Research Issues in HCI4AGING

The broad interpenetration and ubiquity of information and communication technologies have fundamentally changed the nature of social, economic and communicative pathways in modern societies [7][8]. Technology is present every-where and at any time and seems to overcome physical as well as mental borders. With the increasing diversity of users, the diversity of technical systems (visible vs. invisible, local vs. distributed) and the diversity using contexts (entertainment, medicine, office, mobility), new knowledge is needed for the deeper understanding of users' interaction with technology and technology acceptance [9]. If looking at current developments, a number of crucial factors come into fore that impact the barrier-free integration of future technologies:

User diversity: As opposed to the past, when mostly sophisticated and technology prone professionals were the typical users of technical products, increasingly older adults are confronted with a broad range of technology. Though, older users do have higher demands on usable interface designs [10]. Thus, one of the key issues of HCI designs is to understand the impact of older users' abilities and restrictions as well as their needs and wants respecting age-sensitive technical designs.

Function complexity and device miniaturization: The mobile character of technology in combination with the small communication window represents a still higher usability demand compared to large display technologies. The limited screen space is problematic for providing optimized information access, especially for aged users and those with low technical literacy [11]. In addition the increasing variety of functions capable of running on these devices imposes high cognitive load for users. In order to fully exploit the potential of (mobile) wireless technologies for a broad user group, research has to consider the impact of information designs and cognitive complexity.

New application fields: The application contexts, in which (mobile) technologies are used, changed considerably over time, and, still, application fields will tremendously change in future technology generations. Devices are used in different using contexts, in which technology has different roles, appearance, forms, and responsibility. This especially concerns smart home technologies and ambient intelligent environments [7], in which devices are invisibly communicating with remote computers, sometimes integrated in clothing [12], furniture or walls [9]. Thus, research efforts should address usability issues in complex technical environments.

Taken together, given these developments, usability requirements are more important than ever. As long as technical designs are not easy to use and learn, technical innovations will not have sustained success. Design approaches should therefore take the user-perspective seriously. Technology must be developed in a way that users want to use it, and, still more important, that users are able to use it.

3 The 2010 Special Thematic Session Program

After a brief introduction to the special thematic session by the organizers, *André Calero Valdez* from RWTH Aachen University, Germany, presents the results of an exploratory study on mental models of mobile diabetes devices. Factors such as age, technology expertise, mobile phone expertise and medical domain knowledge were examined as mediating variables on the construction of mental models. The results show that the adequacy of the mental model and especially the lack thereof can heavily impact whether the initial usage of a device is successful or not. In this context, age as well as the lack of experience with mobile phones decreases the ability to form adequate mental models. In contrast, the users' domain knowledge did not significantly impact the quality of the mental model or the navigation performance.

This is followed by a talk of *Gemma Webster* from the University of Dundee, UK, who reports on the Portrait system. Portrait was designed for assisting medical care staff in learning important personal information about residents in nursing homes, thereby helping to stimulate conversations and discussions about the events outlined in the patients' profiles. The system consists of multimedia profiles of each resident presented on an easily and quickly accessible touch screen. Each profile contains information about the persons' key life events, family, preferences, as well as hobbies and interests. The talk closes by presenting the results of an initial usability study, carried out to evaluate the system with inexperienced computer users.

In the third talk, *Johannes Oberzaucher*, from the Living Lab Schwechat, Austria, reports on the development of a small and unobtrusive gait measurement system, which was especially designed for monitoring gait and body movements in unsupervised settings. The system can be used to record gait and body movement data in order to extract significant parameters for fall risk estimation. The developed insole system is used to determine spatiotemporal gait parameters during specified assessment procedures and thereby offers the opportunity to measure the bipedal gait and body movements wirelessly and directly at the foot in almost any surrounding while wearing normal walking shoes.

The forth talk by *Jan Rennies*, from Fraunhofer IDMT, Oldenburg, Germany, addresses the design of a novel tool for quality monitoring of acoustic communication. The presented system is designed to create awareness for the particular problems of hearing-impaired listeners and to control further means for enhancing the communication quality. The presenter illustrates the technical development process as well as the experimental evaluation of the prototype system.

In the following talk, *Tomoyasu Komori* from the Science and Technical Research Laboratories of Tokyo, Japan, reports on the development of a device for evaluating broadcast background sound balance for elderly listeners. The system design was guided by the results gained in two investigative user studies. The first study analyzed the ability of elderly people to separate narration from background sound. In the second study, the authors explored the influence of the recruitment phenomenon and sound separation ability deterioration by analyzing the subjective evaluation results and the program sound level. Based on these findings, an objective evaluation device was developed, which calculates the loudness of narration and background sound in real-time and indicates the appropriate sound balance for elderly people.

In the final talk of this session, *Guillaume Lepicard* from IRIT Toulouse, France, reports on an experimental user study analyzing touch-screen interfaces for older users. The study investigates the optimal position and number of tactile targets for touch-screen user interfaces intended for a diverse user population. The number of targets, the number of interaction blocks on the touch screen and the number of hands were used as independent variables in an experiment measuring realization time and accuracy. The presenter discusses the results and formulates design recommendations regarding touch-screen interaction for older people.

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