Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 27 (2014) 359 – 368

Procedia Computer Science

5th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion, DSAI 2013

Developing a Multimodal Interface for the Elderly

Élvio Rodrigues[a], Micael Carreira[b], Daniel Gonçalves[b]

[a]*Instituto Superior Técnico, Avenida Rovisco Pais, 49, 1050-001 Lisboa, Portugal*
[b]*INESC-ID, Rua Alves Redol, 9, 1000-029 Lisboa, Portugal*

Abstract

The elderly remain excluded from technology, since they regard traditional computer interfaces as overly technical and difficult to use. However, the older users consider other forms of interaction easier to use – like touch and gesture recognition interfaces. Regarding the touch interfaces, we focused on text-entry tasks and developed and tested 5 virtual QWERTY keyboard variants in order to improve text entry speed and accuracy on tablet devices. Preliminary user tests with young adults revealed that soft keyboards without visual changes remain the fastest method for text entry, and allowed us to rule out the least promising variants. Regarding gesture recognition, we developed regular gestures as well as alternative functionalities based on the motion sensing device: user and ambient sensing. These features allow to create a more intelligent system that reacts to the user and environment without explicit interaction. In the near future, we will perform tests for both interaction modalities with older adults.

Keywords:
Multimodal interfaces; elderly; multi-touch tablets; body gestures; text-entry performance

1. Introduction

In our daily life, we find ourselves surrounded by technology, which enables the creation of new opportunities and forms of social interaction, instant information access, constant availability and higher control of the surrounding environment. New solutions of Human-Computer Interaction (HCI) are making our relationship with computers and technology in general, more natural and easier to learn.

However, the benefits of technology do not reach all social groups. The elderly show some resistance in adopting technology, making them deprived from the benefits it has to offer. This problem is gaining more importance, since due to our healthy lifestyles we live longer, and are likely to be physically, socially and cognitively active until older ages.

E-mail address: elvio.rodrigues@ist.utl.pt (Élvio Rodrigues), micaelcarreira@ist.utl.pt (Micael Carreira), daniel.goncalves@vimmi.inesc.pt (Daniel Gonçalves)

doi:10.1016/j.procs.2014.02.040

By captivating the interest of elder users in technology, we can fight isolation and exclusion and allow the elderly to be more productive, independent and to have a more social and fulfilling life. This can be done by improving the accessibility to existing devices and services. All this should be made possible at peoples homes, since elderly people have sometimes some level of impairments caused by age, which reduces their mobility.

In this study we will survey several HCI methods and control interfaces, evaluating the feasibility of different solutions, considering both physical and situational impairments of elder users. After concluding that multi-touch and body gestures interfaces are best suited for the elderly, we will describe the preliminary work we have been developing.

The multi-touch technology lack the haptic feedback of physical buttons, making it harder to accurately select targets. This characteristic particularly hampers certain tasks, such as text-entry, where the user has to constantly select one of many small targets. Therefore, our aim is to perform a series of studies to better understand touch behavior of both younger and older adults when typing. We developed 5 QWERTY keyboard variants which aim to improve typing speed and reduce the error rate, and afterwards performed an experimental evaluation. Then, we systematically analyze the performance of each variant.

As for the body gestures interface, we depict some preliminary work we have been developing. Usually, users interact with motion sensing devices by actively performing recognizable gestures, wich is the main purpose of these devices. However, we also explore other capabilities of the motion sensing devices, related with a more passive way of interaction. We developed features that allow to sense the user and ambient – user attention detection, user recognition and privacy management. These features still remain untested, but will be subject to experimental evaluation in the near future.

2. Related Work

The elderly show some resistance in adopting technology, making them deprived from the benefits it has to offer. Several studies were performed in order to perceive the most suitable interfaces for this age group. In this chapter, we will depict some of the most frequently used interaction interfaces nowadays, analyzing studies that focus on the usability of these interfaces for elderly users.

2.1. Traditional Interfaces

Nowadays, the keyboard and mouse are the most common setup to operate a desktop computer, despite the availability of alternative input devices.

In a study conducted by Kevan et al. [10], they aimed to determine whether computers can be helpful to elderly persons residing in a long-term care facility, by teaching them how to perform basic tasks on the computer. In the beginning, the elders were participating enthusiastically, but then they progressively stopped attending classes until the authors decided to stop lecturing. They concluded that the computers were not designed for operation by frail individuals and persons with physical or mild cognitive impairments. A similar result was achieved in a previous study [3], where the authors concluded that computer anxiety, computer efficacy, and attitude toward aging were significantly related to staying in the program.

Indeed, the primary instrument to manipulate the computer, the mouse, is not properly suited for the elderly. A study by Chaparro et al. [2] suggests that the aging population (particularly men) may face greater difficulty using an input device that relies on motions of the wrist, since they have a limited range of motion. The use of other pointing devices, such as a trackball, can mitigate some of the problems elders experience with the mouse. For people with low strength, poor coordination, wrist pain, or limited ranges of motion, rolling a trackball can be easier than shuttling a mouse across the surface of a desk [15].

As we have seen in different studies, the traditional interfaces are not easy to use for novice users, particularly when they are elderly. The hardware, software and technological characteristics of this technology make it unnatural, requiring a learning and adaptation process in order to use this interface. The fact that the elderly's cognitive skills often deteriorate, affecting their memory and learning, makes their capability to learn traditional interfaces rather reduced.