Chapter 19
Touch Screens for the Elderly: Some Models and Methods, Prototypical Development and Experimental Evaluation of Human–Computer Interaction Concepts for the Elderly

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ABSTRACT

The fast aging of many western and eastern societies and their increasing reliance on information technology create a compelling need to reconsider older users' interactions with computers. Changes in perceptual and motor skill capabilities that often accompany the aging process bring important implications for the design of information input devices. This paper summarizes the results of a laboratory study with different information input device. Three different input devices; mouse, touch screen and eye-gaze; were analyzed concerning efficiency, effectiveness and mental workload with respect to the age group of the computer user. The results derived from data of 90 subjects between 20 and 75 years show that regardless of participant's age group the best performance in terms of short execution time results from touch screen information input. This effect is even more pronounced for the elderly.

INTRODUCTION

Demographic change requires new ergonomic concepts and methods to support elder working persons, who, due to the prognosed shortage of qualified labor, will be involved in achieve employment for a longer working life until retirement.

Especially "Work With Computing Systems" (WWCS), formally "Work with Display Units" (WWDU), will be a major working form that due to automation of working means and a presumably distant attitude of elder employees versus computerized work requires ergonomic attention (Nair et al. 2005, Rogers et al. 1995).

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So the use of computers in different contexts may be a barrier of employment for the elder, because a lack of experience and age-dependent changes in performance and strain can be diagnosed which, in itself, is a challenge for ergonomic design efforts in hardware and software (Craik & Salthouse 2008, Czaja & Lee 2002, 2008, Hawthorn 1998, Czaja et al. 1996).

In detail some presumed decreases in sensory as well as motor performance (Craik & Salthouse 2008, Birren & Shaie 2006, Park & Schwarz 2000, Gogging & Stelmach 1990) lead to usability problems in WWCS.

However, models of aging were undergoing some changes in the past (Luczak & Stemann 2008, Luczak & Frenz 2008), especially initiating new views of strategic ergonomic intervention as well as new paths of competency development.

SURVEY

Explanation Models of Aging

Models that cope with changes in the broad picture of performance types and stress forms of aging people have diversified a lot in recent years. In earlier times so called "deficit model" dominated the aging scenarios, which postulates a "graceful" degradation in human information processing and physical functions from the late 20'ies onward (Naegele 2004).

Nowadays the changes that occur with aging are subsumed under the "compensation model" or "sustainable competency model". These models acknowledge that age-dependent changes can be compensated by behavioral strategies, experiences and attitudes, or that the elderly dispose over an alternative performance spectrum as compared to the young (Astor 2006).

However, the decreasing scope is highly individual and depends on the function being considered. A second aspect in the deficit model is the mixture of individual characteristics with age-groups related data sets. The result is an over emphasis of expected slopes, that have almost nothing to do with working periods over lifetime.

However, nobody can escape the fact, that near to death physiological and psychological functions decrease drastically. The superimposition of these decreases, that in individual terms become more frequent the older the persons become, causes the age group related overestimation underlying the deficit model (see Figure 1).

The main message of the "compensation model" is a "win" situation in slopes, when using training incentives for a specific function or when changing in between functions by shifting from the steeper slope to a more even development path function set.

The main message of the "sustainable competency model" is that it is possible to maintain a specific function level or even to improve it over time by respective work demands. The main effect is "winning time" before the expected steep descent occurs.

Both models can respect hindering or improving effects by technology use or technology developments, as the Gehlen thesis of organ projection indicate with "enforcement", "replacement", "substitution", technology that can be easily transferred from technology development theory and philosophy to the HCI-practice.

Figure 1. Physiological and psychological functions measurements