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Age, familiarity, and intuitive use: An empirical investigation

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ABSTRACT

Research has shown that older adults interact with products less intuitively than younger adults, and that familiarity is an essential element of intuitive interaction. This paper reports on the findings of two empirical studies that examined familiarity in younger and older adults. Each study comprised 32 participants over four age groups. The first study required participants to use their own contemporary products in their homes in order to investigate older adults' familiarity with them, and how this familiarity differed from that of younger adults. Older people were less familiar with their own contemporary products that younger people. The second study aimed to investigate differences in familiarity between younger and older adults while using products that they did not own and were likely to be less familiar with. When using products not already familiar to them, both middle aged and older adults showed significantly lower familiarity than younger people. The significance of this research is in its empirical findings about familiarity differences between age groups. It has been recognised that the identification and understanding of differences in familiarity will enable designers to design more intuitive interfaces and systems for both younger and older cohorts. The implications of the findings from the two studies reported here are discussed in light of this recognition.

1. Introduction

It is recognised that older adults have difficulties with contemporary electronic products (Djajadiningrat et al., 2004; Docampo Rama, 2001), and that they use products less intuitively, more slowly and less accurately than younger adults (Blackler et al., 2010). While there has been a move towards a more inclusive society (see Clarkson et al., 2003), and attempts to address the declines in capabilities that are experienced with ageing (Gregor et al., 2002), the difficulties that older adults experience with contemporary products and services demonstrate their limited accessibility for these groups. Devices such as mobile phones, which are firmly embedded in many younger adults' lives (Eisma et al., 2003), frequently baffle older adults (Pattison and Stedmon, 2006). Furthermore, older adults experience a decrease in a wide range of capabilities which, in turn, affects how they interact with products (Mynatt et al., 2000). This decrease can create frustration that can flow on to feelings of increased social isolation, reduced motivation, and even depression (Mynatt et al., 2000). Research demonstrates that a combination of cognitive decline and older adults' existing knowledge affects their use of technology (Blackler et al., 2010; Reddy et al., 2010).

Demographic changes are resulting in greater numbers and proportions of older adults in most countries (Fisk et al., 2004; Lloyd-Sherlock, 2000), and have wide-reaching social implications. To cater for the changing needs of the population, for example, it is necessary to change the products and services that are available (Fisk et al., 2004). In this regard, it is becoming more important on societal, ethical, and economic levels, to address issues surrounding older adults' use of modern digital devices. There are potential benefits, not only for older adults, but also for society in general, in designing products that they find highly usable. Some of these benefits include improved social integration, higher levels of productivity in the workplace, higher levels of independence, and improved health management (Baber and Baumann, 2002). All of these benefits are likely to lead to a more fulfilling life (Fisk et al., 2004) and a more valuable social contribution. To ensure that older adults can lead a fully integrated and rewarding life, issues surrounding their use of complex devices need to be addressed. Furthermore, as older adults are a significant market segment (Coy, 2003), there is also a business case for addressing these issues.

The focus of this research was to identify differences in product familiarity between younger and older adults, and to understand these differences, in order that older people's familiarity with existing technologies can be better applied through design. Study 1 was designed to investigate how familiar older adults were with their own

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contemporary products, and how their familiarity differed from that of younger adults. Building on Study 1, Study 2, on the other hand, aimed to investigate differences in familiarity between younger and older adults using products that they did not own and were therefore likely to be less familiar with. It also aimed to determine if these age groups differed in their use of analogue and digital products.

This paper addresses the theoretical background of the two studies, the research methods employed, the data analysis and results. It concludes with a discussion of the studies' findings, and their implications for design.

2. Intuitive interaction

One way of enhancing the usability of complex contemporary technology is to integrate intuitive interaction into the user interfaces of products and systems. Intuition is a cognitive process that is used in a variety of situations, such as interaction with product interfaces. Bastick's (2003) comprehensive examination of intuition and Klein's (1998) discussion of the role of experience in high pressure decision making, have both contributed to shaping an understanding of intuition. It is also necessary to understand that there is a difference between 'intuition' and 'intuitive interaction'. 'Intuition' is a cognitive process, while 'intuitive interaction' is the application of that process to interaction with a product or system interface:

> Intuitive use of products involves utilising knowledge gained through other experience(s) (e.g. use of another product or something else). Intuitive interaction is fast and generally non-conscious, so that people would often be unable to explain how they made their decisions during intuitive interaction (Blackler et al., 2010).

Characteristics of intuitive interaction, therefore, include an increase in speed, higher levels of efficiency and accuracy, and a lower level of conscious awareness of the cognitive processing taking place (Blackler et al., 2010). Hurtienne and Blessing (2007) report a similar definition of intuitive use developed by the Intuitive Use of User Interfaces (IUUI) research group at the Technische Universität Berlin: "A technical system is intuitively usable if the user's subconscious application of prior knowledge leads to effective interaction" (Blackler and Hurtienne, 2007, p. 2). Using a range of contemporary products, empirical studies have established that intuitive interaction is based on users relating their familiar and past experience with relevant products or product features to their use of a new product, and that prior knowledge thus plays a role in speedy, accurate and intuitive product interactions (Blackler et al., 2010; Fischer et al., 2014, 2015; Hurtienne, 2009; Hurtienne and Blessing, 2007; Kang and Yoon, 2008; Langdon et al., 2009; McEwan et al., 2014; O'Brien et al., 2011; O'Brien, 2010).

It is also known that older people use new products and interfaces less intuitively, more slowly, and less accurately than younger people. For example, Blackler et al. (2010), Gudur et al. (2013) and O'Brien et al. (2008) identified that older adults use products more slowly, less accurately and less intuitively than younger adults. Blackler, Mahar et al. (2010) conducted further investigations that explored the effects of ageing on intuitive interaction. These investigations included an examination of the role of age-related cognitive decline on intuitive interaction. Results show that technology familiarity and central executive (CE) function — the component of working memory that is responsible for tasks such as reasoning, problem solving, and attention — had more effect on time on task, correct use, and intuitive use, than chronological age. These studies demonstrated that while declines in CE function contribute to the differences in performance of younger and older adults, technology familiarity remains one of the most consistent and important factors. However, there has been little research investigating the extent and range of the familiarity of older adults. Therefore, in order to design products that people of all ages can use more intuitively, it became necessary to investigate the familiarity of people of varying ages, and how they are able to relate that familiarity to product use.

3. Experience, knowledge, and familiarity

There is a close relationship between experience, knowledge and familiarity. As discussed above, Blackler et al. (2010a,b) state that intuitive product interaction is facilitated by people's familiarity with similar products and product features from all areas of their lives. 'Familiarity' has been defined as "… an understanding, often based on previous interactions, experiences and learning …" (Gefen, 2000, p. 727). Gefen (2000) describes familiarity with a product as an awareness based on experience, where one has an understanding of the behaviour, function, or action of the system or interface being used. 'Experienced' is defined as "having become skilful or knowledgeable from extensive participation or observation" (Hanks, 1990, p. 435; Taatgen et al., 2008; VanLehn, 1996). These definitions show the importance of knowledge, developed through prior interactions and experiences, to both familiarity and intuitive interaction. For the purposes of this paper, the following definition has been constructed:

> Something is familiar when it is recognised, and in some way understood, as a result of prior knowledge. Familiarity, then, is a measure of the recognition and understanding of a person, place, or thing as a result of prior knowledge.

When conducting research into the nature of familiarity, it is clear that both prior experience and prior knowledge are important elements. For the purposes of this research, it was necessary to define these two terms, as they are often used interchangeably or in reference to the same idea, without being defined (Hanks, 1990; Langdon et al., 2009; Taylor and Todd, 1995; Zaichkowsky, 1985). 'Prior experience' was defined as a collection of experiences that an individual has had in the past. 'Prior knowledge' was defined as knowledge that has been acquired as a result of prior experience—knowledge that can then be applied in the future. While two individuals can undergo the same experience, the knowledge they gain from that experience might be very different due to age-related deficits (D. Howard and Howard, 2001) or differences in relevancy for the individuals concerned.

As this research focused on familiarity, it was necessary to understand it, particularly in relation to user interactions. Therefore, based on the skill acquisition literature, where most traditional skill acquisition models have three stages (Taatgen et al., 2008; VanLehn, 1996), a three-stage familiarity strategy was created. The transition from error-prone, slow interaction to fast, non-conscious interaction (Anderson, 1995; Ericsson and Towne, 2010) is made through practice and experience (Ericsson and Towne, 2010; Taatgen et al., 2008; VanLehn, 1996). All of the models reviewed by Taatgen et al. (2008) have some form of general strategy that is used initially in problem solving (Stage 1). Furthermore, they all explain increases in performance speed and the reduction of errors, in terms of improvements to the efficiency of the initial strategy as the result of experience (Stage 2). The final stage (Stage 3) of all of the models is the acquisition of specialised knowledge (Taatgen et al., 2008).

Based on these models, the first familiarity stage, developed by Anderson (1995), is the 'Cognitive' stage (Ericsson and Towne, 2010), and revolves around the general or base level knowledge required for a particular skill (Taatgen et al., 2008). Anderson (1982) claims that at this level, an individual only learns facts about an action, and has not yet learned about the cognitive processes involved in performing this action. The learner often uses a set of instructions, or is shown an example of how to perform the action. The knowledge that is utilised at this level is declarative, and is interpreted into appropriate action (Anderson, 1995). The characteristics of this stage include slow behaviour generation, and failures in memory and execution (Ericsson and Towne, 2010).

The second familiarity stage is referred to as the 'Associative' stage (Ericsson and Towne, 2010). This is the stage where the individual