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Smart but not adapted enough: Heuristic evaluation of smartphone launchers with an adapted interface and assistive technologies for older adults



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ABSTRACT

Launchers have been suggested as a viable means of increasing the uptake of smartphones and assistive technologies (ATs) among older adults. Launchers can be designed to ease older adults' use of smartphones by addressing perceptual, cognitive, and motoric changes that might hinder their ability to operate smartphones. However, little research currently exists that analyses the characteristics and assesses the usability of launchers with an adapted user interface (UI) for older adults. Thus, we present a study in which we compared a set of commercialised smartphone launchers with an adapted UI and ATs for older adults by means of heuristic evaluation. The results showed that launchers generally integrate only basic features (i.e., calls, texting, contacts) and only one AT (i.e., an SOS service). Although considerable variation exists between them in terms of overall usability, we also report the limited adequacy of launcher UIs in meeting older adults' needs and abilities. In particular, usability problems linked to content and perception were discovered that limit the older adults' capability for error recovery as well as visual, auditory, and haptic access to the information provided by the UI. Interestingly, launchers with a larger number of features and ATs were found to have, on average, less usability problems. This indicates that reducing the number of features is not necessarily a feasible way to increase usability. Instead, more research-based development is needed, which should better consider recommendations for the age-friendly design of UIs on smartphones.

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1. Introduction

Even though smartphones¹ are rapidly becoming an ubiquitous portable technology in the western world and the diffusion of smartphone apps could influence the adoption of smartphones among older adults (Berenguer, Gonçalves, Hosio, Ferreira, Anagnostopoulos, & Kostakos, 2017), the most recent population-based figures from the US and the UK have shown that the use of smartphones is still highly age-dependant. For instance, when 58% of adults owned a smartphone in the US, the percentage of younger

older adults (aged 55–64) was 49%, while the 65 and older age group was only 19% in 2013 (Smith, 2013). A similar age-related gap was reported in the UK. In 2013, when 62% of adult Britons owned a smartphone, only 20% of those aged 65–74 and only 5% of those aged 75 and over were smartphone users (Ofcom, 2014).

Researchers have suggested that age-dependant gaps in smartphone adoption could be addressed and potentially reduced in two ways. On one hand, smartphones and smartphone apps should have an optimal design that is appropriate for older adults to accommodate their age-related perceptual, cognitive, and movement control resources (Holzinger, Searle, & Nischelwitzer, 2007). Accordingly, it is argued that gestural interfaces and other design characteristics of smartphones (e.g., a large display) could overcome existing barriers related to the use of feature phones (Piper, Garcia Cornejo, & Brewer, 2016; Zhou, Rau, & Salvendy, 2012). On the other hand, the uptake of smartphones could be fuelled by the proliferation of user-friendly services and apps that meet their

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¹ In this paper, we use the term “smartphone” to refer to a smartphone with a touch screen.

social and personal needs as well as generating positive expectations in terms of their quality of life (Doughty, 2011; Piper et al., 2016; Plaza, Martín, Martín, & Medrano, 2011).

In this sense, many researchers have identified in smartphones the potential for developing apps that would integrate assistive technologies (ATs). For instance, Doughty (2011) suggested that apps could be used as ATs for overcoming age-related sensory deficits, for detecting accidents and incidents while ageing in place, for supporting older adults with chronic diseases, and for enhancing personal communication and social companionship. In particular, many authors have identified health-related ATs on smartphones as having the greatest potential for older adults; including services for improving diagnosis, investigation, monitoring, treatment, self-management and adherence (Doughty & Williams, 2016; Joe & Demiris, 2013; Lamonaca, Polimeni, Barbé, & Grimaldi, 2015).

However, the practical exploitation of such apps is at present rather limited amongst older adults (e.g., Ernsting et al., 2017), as they are mostly focused on a specific health issue (e.g., diabetes, falls and fall risk), they seldom have an age-friendly interface design, or assume that older adults are proficient in installing, learning and using them on a (normal) smartphone (Joe & Demiris, 2013). Alternatively, very recently specific services have been introduced to the market that reduce the complexity of a smartphone by installing on the device an app with an age-adapted interface. Arab, Malik, and Abdulrazak (2013) showed that these so-called *launchers* enable older adults to be more successful and efficient in operating the smartphone. Likewise, Balata, Mikovec, and Slavicek (2015) demonstrated that the overall completion rate of tasks for the age-adapted launcher was much higher than for the standard Android user interface (UI). In addition, older adults in their study perceived the age-friendly launcher's UI as more comfortable and efficient than the standard Android UI.

Besides enclosing an adapted UI that replaces the generic interface of the smartphone's operating system (OS), launchers can also integrate a different number of basic features that are most often used by older adults (e.g., calls, contact book, alarm, display of date and time) with various ATs (e.g., SOS button, medication alarm). By having the ability to be installed on an existing smartphone's OS, they have also the advantage of being available to users relatively quickly at low or very moderate cost, without any requirement for the development of new specialized hardware. Another favourable aspect is their social unobtrusiveness in the sense that launchers are less likely to identify older adults who use them as a group of users with special needs and requirements. The literature, in fact, indicates that the social stigma associated with the use of ATs as well as "senior phones" is one of the most important barriers for the acceptance of ATs among older adults (Pedlow, Kasnitz, & Shuttleworth, 2010).

However, virtually no research exists which would provide a comparison of the usability of launchers with an adapted UI for older adults that integrate some kind of ATs. Therefore, the aim of this study was twofold. First, to identify and examine what ATs, designed for supporting the independence and quality of life of older adults, are integrated into the launchers with an adapted UI for older adults. Second, to empirically determine the usability of such launchers through a heuristic evaluation in order to assess their overall level of usability as well as to identify the presence of the most common design problems associated with them, through a validated set of heuristics.

The remainder of the paper is structured as follows. Section 2 discusses the relevant literature pertaining to the availability and acceptance factors of ATs for older adults on smartphones, potential

age-related usability issues with smartphone UIs and the results of existing heuristic evaluations of smartphones and apps designed for older adults. Section 3 describes the procedures and methods used in the empirical part of this study. In Section 4, the empirical results of the heuristic evaluation are presented. Section 5 discusses the empirical findings, while Section 6 and Section 7 offer future research directions and our conclusions respectively.

2. Literature review

2.1. Availability and acceptance of assistive technologies on smartphones

Plaza et al. (2011) suggested that smartphone apps with ATs target different areas and needs of older adults. They can help older adults with issues such as safety, security, privacy, and mobility (e.g., person location service, tracking devices, telecare monitoring, and an alarm system). They can include solutions that facilitate older adults' individual development (e.g., distance learning and training) and/or can support services that contribute to older adults' social lives. Such solutions can enable their broad communication with others (e.g., social network and community platforms), hobbies (e.g., digital games adapted for older adults' requirements), or even religion and spirituality (e.g., services offering religious calendars, holy and prayer books, religious ringtones).

However, most researchers agree that in the future the most important contribution to older adults' quality of life will be derived from the apps designed to help manage their health (Doughty, 2011; Joe & Demiris, 2013; Steinhubl, Muse, & Topol, 2013). In particular, Plaza et al. (2011) underscored the importance of health-related ATs such as voice response on the mobile phone or text messages that are used for monitoring wandering in dementia, monitoring blood glucose in diabetes, monitoring prescribed diet, and reminders to take medication. These services are especially relevant for older adults with chronic diseases and for those who need assistance with (instrumental) activities of daily living, since with their help the older persons are able to prolong and support self-management of their chronic health condition (Joe & Demiris, 2013).

Consequently, we can also observe a tendency of the integration of ATs on smartphones with telecare as part of the mobile care (i.e., mCare) services (Doughty & Williams, 2016). An important advantage of mCare is that it enables monitoring of vulnerable persons not only inside but also outside the home. For instance, in combination with a wristband (Plaza et al., 2011), pill dispenser (Mayhorn, Lanzolla, Wogalter, & Watson, 2005), devices integrated in clothing (e.g., wearable sensors), and various home care platforms and ambient assisted living solutions that integrate built-in smartphone sensors for detecting potential abnormal condition on the move (e.g., a long state of hibernation or a sudden fall) (Deen, 2015), mCare can improve older adults' living situation. Doughty (2011) even argued that ATs on smartphones could make some of the standalone telecare solutions for independent living either redundant or uncompetitive, suggesting that by combining several telecare services into one smartphone app, the acceptance and increased use of ATs are likely to rapidly increase.

However, even though older adults represent the most relevant target group in the field of mCare (Lorenz & Oppermann, 2009), ATs in smartphones are still used by only a very small number of older adults. This is mainly related to the general low-adoption of smartphones and smartphone apps among older adults, which has been explored in the past with the Unified Theory of Acceptance

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