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# Self determination-based design to achieve acceptance of assisted living technologies for older adults



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#### A R T I C L E I N F O

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#### ABSTRACT

Providing technological support to assist older adults in their daily activities is a promising approach to aging in place. However, acceptance is critical when technologies are embedded in the user's life. Recently, Lee et al. established a connection between acceptance and motivation. They approached motivation via the *Self-Determination* Theory (SDT): the capacity to make choices and to take decisions. This paper leverages SDT to promote a new design style for gerontechnologies that consists of prin-

ciples and requirements. We applied our approach to develop an assisted living platform, which was used to conduct a six-month field study with 34 older adults. We show that self-determination is a determining factor of technology acceptance. Furthermore, our platform improved the selfdetermination of equipped participants, compared to the control group, suggesting that our approach is effective. As such, SDT opens up new opportunities for improving the design process of gerontechnologies.

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#### 1. Introduction

The demographic context outlined by the World Health Organization (WHO) shows an increase in the population of older people and an increase in life expectancy. Supporting aging in place is a critical challenge for aging population countries, creating a tremendous interest in gerontechnologies. These technologies are dedicated to evaluate, monitor, and/or compensate the difficulties related to aging that may compromise an autonomous and independent living (Pollack, 2005). They form an environmental support, which promotes the adaptation and well-being of older adults in their home (Mokhtari et al., 2012; Morrow & Rogers, 2008).

Technology designers and HCI researchers have made considerable efforts to design and develop systems that respond better to the needs and specific characteristics of the older user (Arreola et al., 2014; Charness, Demiris, & Krupinski, 2011; Fisk, Rogers, Charness, Czaja, & Sharit, 2012; Lindley, Harper, & Sellen, 2008; Mcgee-lennon, Wolters, & Brewster, 2011, pp. 2105–2114). For example, the perceptive, motor and cognitive capabilities of the older user have been the subject of significant attention in the design approaches used for gerontechnologies (*e.g.*, Rogers & Fisk, 2010). Even though Human Factors and Psychology of Aging have improved the usability of the proposed solutions and contributed to their acceptance by older adults, long term adoption is still a challenge for gerontechnologies (Durick, Brereton, Vetere, & Nansen, 2013; Hernández-Encuentra, Pousada, & Gómez-Zúñiga, 2009; Rogers & Fisk, 2010).

To address this challenge, we propose to leverage user motivation, via the self-determination theory (SDT), to achieve technology acceptance. Self-determination is more than an ethical principle; it is grounded in health psychology research and establishes a direct link between self-determination and quality of life/well-being of the older adult (Ferrand, Martinent, & Durmaz, 2014; O'Connor & Vallerand, 1994). Specifically, the more a person perceives themselves as being self-determined (rather than externally controlled), the more their health and quality of life increase. More specifically, the more an individual's environment supports self-determination, the more this dimension increases, resulting in improved wellbeing (O'Connor & Vallerand, 1994).

From the perspective of user-centered design (Clarkson,

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Coleman, Keates, & Lebbon, 2013; Newell, Gregor, Morgan, Pullin, & Macaulay, 2011; Rogers & Fisk, 2010), self-determination is increasingly used to explain the motivational aspects of users (e.g., attitudinal, emotional) for designing and evaluating technologies. Specifically, the relationship between self-determination and technology acceptance and technology uses in young adults has been established. Lee et al. (Lee, Lee, & Hwang, 2015), found that when technology supports self-determination, it positively impacts technology acceptance. Furthermore, Przybylski et al. explored how digital games fulfill or thwart self-determination needs, and thus promote or discourage sustained engagement and either positive or negative outcomes for players (Przybylski, Rigby, & Ryan, 2010). Recent studies Ford et al. show similar results for acceptance and continuance use intention of e-learning systems for children and young adults (Chen & Jang, 2010; Ford, Wyeth, & Johnson, 2012; Roca & Gagné, 2008). Surprisingly, to the best of our knowledge, there is no study investigating the self-determination model in the context of gerontechnologies.

This paper makes the following contributions.

- We leverage SDT for assisted living technologies dedicated to older adults. We promote self-determination dimensions as an intrinsic part for the design of gerontechnologies
- 2. We put SDT dimensions into practice for the development of an assisted living platform for older adults.
- 3. We conduct a field study to demonstrate that SDT dimensions effectively support self-determination of an individual's environment, improving their self-determination performance.
- 4. We evaluate the impact of self-determination of our participants on *technology acceptance* as a determining factor for technology acceptance in older adults.

#### 2. Related work

#### 2.1. Designing gerontechnologies

Although the user is a central concern in HCI research, the field of gerontechnologies is still dominated by technology-centered approaches (Durick et al., 2013; Preece, Sharp, & Rogers, 2015; Vines, Pritchard, Wright, Olivier, & Brittain, 2015). According to the literature review done by Durick et al. (Durick et al., 2013), this is due in part to the aging stereotypes of designers and researchers that mistakenly ignore the variabilities in aging. They view an older adult as passively aging, unable to actively manage this process to maintain their daily functioning and well-being. This vision contradicts WHO that promotes, since 2002, active aging, the biocultural theory, and the Selection-Optimization-Compensation model of aging proposed by Baltes et al. (Baltes, Baltes, Freund, & Lang, 1999). When these aging stereotypes are carried into the design, they create a mismatch between the technology and the end user (Durick et al., 2013, pp. 467-476; Sengers & Gaver, 2006) with two main concerns:

 Unmet needs. The technologies developed by designers mainly target the compensation for the loss of an ability due to aging. But in fact, older adults expect technologies to support or optimize the behavioral adaptations they have willingly developed to maintain their daily functioning. This situation makes it difficult for gerontechnologies to attract potential users. Conceptually, technology should be designed by leveraging the spare abilities of older adults, rather than focusing on restoring their declining abilities. Such an approach is promoted by Wobbrock et al. for users with impairments and referred to as ability-based design paradigm (Wobbrock, Kane, Gajos, Harada, & Froehlich, 2011). As a result, a technology leveraging and respecting spared adaptative capabilities would be empowering and thus motivating for the older user.

2. Unsatisfactory experience. Often, the purpose and functionalities of gerontechnologies are driven by the needs and requirements of their social and caregiving environments. Even when participatory design has been used, the contributions may not reflect the variabilities of the needs of this population. When older adults acquire gerontechnologies, their functionalities may not match their intrinsic motivations and expected benefits. Their approach and experience with gerontechnologies do not lead them to pursue the use of technologies for their own sake or inherent satisfaction. Consequently, there is a lack of sustained engagement from older users in using gerontechnologies; they end up finding them useless, stigmatizing, and cumbersome. This situation hinders their long term adoption. As a result, a technology with self-decided services would be engaging for the older user.

Recently, Chen and Chan (Chen & Chan, 2014) have provided overall evidence of these problems by focusing on the relationship between acceptance and the usage of gerontechnologies in older adults, according to the Technology Acceptance Model (TAM) (Davis, 1989). Specifically, TAM exhibits two critical attitudinal factors in explaining acceptance and usage of technology: perceived usefulness - "the degree to which a person believes that using the particular technology would enhance his/her performance" - and perceived ease of use - "the extent to which a person believes that using a technology is free of effort". Based on a study involving 1012 seniors, Chen and Chan demonstrated that technology acceptance and usage behavior in elderly people are predicted by user characteristics (age, education, gerontechnology related self-efficacy and anxiety, and health deficiencies) and environmental factors (accessibility, assistance and guidance), rather than attitudinal factors (perceived usefulness and ease of use) (Chen & Chan, 2014).

In the Human Factors community, it is only recently that a book summarizing a series of recommendations for the design of gerontechnological systems was published (Charness et al., 2011) (see also Scherer, 2012). These recommendations give a basis to formulate requirements for designing interfaces (hardware and software) and instructional supports dedicated to the characteristics of the older user, such as vision, hearing, cognition, motor performance and the attitudinal aspects.

The HCI and Human Factors communities have been proposing design techniques to address user characteristics and environmental factors. These techniques include *user-centered* and *participatory design*; they actively involve users in the design process for a clear understanding of technology and user requirements. This participatory design takes the form of focus groups, scenario building, idea writing and sketching, and mock-ups (Demirbilek & Demirkan, 2004; Newell et al., 2011; Vredenburg, Mao, Smith, & Carey, 2002). However, a potential limitation reported on these techniques is the lack of generality of the results because they often involve small sets of users, not necessarily representative of the target population (Mackay, 2004; Newell et al., 2011). This concern is even more pronounced in the context of older adults, where a wide inter-individual variabilities have been reported (Lindenberger, Lövdén, Schellenbach, Li, & Krüger, 2008).

To circumvent these limitations, gerontechnologies need to target a specific segment of older adults to delimit a range of interDownload English Version:

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