



How younger elderly realize usefulness of cognitive training video games to maintain their independent living



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ABSTRACT

The objective of this paper is to understand the perception that younger elderly persons have towards the usefulness of playing Xbox Kinect video games as an assistive technology that is designed to maintain their cognitive abilities. Available literature highlights two kinds of assistive technologies; the first being *Supportive Technologies* that provide aid for already-declined functional abilities (such as hearing aids), and the second being *Empowering Technologies* that maintain functional abilities which have not yet declined (such as Xbox Kinect cognitive games). The difference in the nature between supportive and empowering technologies plays an important role in perceiving their benefits. For instance, while hearing aids as a supportive technology are perceived as useful through the improvement of hearing abilities, cognitive training games as an empowering technology have a long-term usefulness for cognitive abilities. This study conducts twenty-one qualitative interviews (range 65–87 years; mean = 71; SD = 3.81) and introduces *perceived transfer effect*. This effect allows the elderly to perceive the usefulness of playing cognitive training video games, which are designed to cultivate the cognitive abilities. In addition, this study found that the elderly value their independent living, and through cognitive video games, the elderly may remain capable of living independently.

1. Introduction

As the world's population continues to age, the quantity of elderly persons is estimated to increase dramatically to 20% by 2050 (OECD, 2012). Unfortunately, cognitive ability impairments related to the Alzheimer disease are highly prevalent amongst older people. It has been reported that more than 60% of seniors in first world countries are suffering from some degree of the Alzheimer disease (Asghar, Cang, & Yu, 2018; Ervin, Finlayson, & Cross, 2012; Robillard & Hoey, 2018). Although adverse side effects such as disorientation and increased falls have been reported from the use of expensive, anti-psychotic medications (Kanagaratnam et al., 2016), those medications are still being largely prescribed (Axmon, Kristensson, Ahlström, & Midlöv, 2017). However, there is a body of research on the positive impact of intellectual exercise and learning that helps maintain cognitive abilities in the elderly (Fleiner, Leucht, Foerstl, Zijlstra, & Haussermann, 2017; Öhman et al., 2016; Shen & Li, 2016). In recent years, video games and motion-based technology that are designed to implement intellectual exercises – such as Xbox Kinect – have gained attention in both commercial (Shah, Weinborn, Verdile, Sohrabi, & Martins, 2017) and

research communities (Dove & Astell, 2017). Unlike traditional exercise therapies that must be conducted in clinics, video games are appealing, inexpensive and easy to access (Hamari & Keronen, 2017). In addition, video games involve entertainments and social contexts.

Video games have shown positive impacts on elderly cognitive abilities (Ballesteros et al., 2014; Basak, Boot, Voss, & Kramer, 2008; Charness, 2015; Maillot, Perrot, & Hartley, 2012; McDougall & House, 2012; Zelinski & Reyes, 2009). This is demonstrated through literature that focuses on how untrained capabilities required for independent living – such as driving (Sue, Ray, Talaei-Khoei, Jonnagaddala, & Vichitvanichphong, 2014a; Vichitvanichphong, Talaei-Khoei, Kerr, Ghapanchi, & Scott-Parker, 2016), reading and writing (Maillot et al., 2012) – are improved by playing cognitive training video games. This is designated as a *Transfer Effect* (Mayas, Parmentier, Andrés, & Ballesteros, 2014): an effect in which the impact of an intervention (e.g. *cognitive training video games*) on a condition (e.g. *cognitive abilities*) can be extended or has a synchronous impact on a capability (e.g. *driving or reading capability*) (Woo, Mak, Cheng, & Choy, 2011). In this paper, the improvement of elderly cognitive abilities transferring to their daily capabilities – such as reading and writing – is considered a *transferred*

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effect.

Despite extensive research in the *transfer effect* of cognitive training video games, acceptance among seniors is a challenging task (Laver, Ratcliffe, George, Burgess, & Crotty, 2011) for not only the effectiveness of the intervention, but also the socio-technical issues (Zhao, Ni, & Zhou, 2017) involved in the perception of these games as useful by the elderly (McKay & Maki, 2010). There is a topic of literature for adoption of assistive technologies among seniors (Panopoulos & Sarri, 2013), and while there have been several definitions of assistive technologies, the approach of this paper defines assistive technologies as “a product, equipment or device, usually electronic or mechanical in nature, which helps older people to maintain their independence or improve their quality of life” (DOHA, 2008). The determination of technology as supportive or empowering is central towards assisting elderly in perceiving the usefulness of playing cognitive training video games (Venkatesh, Davis, & Morris, 2007).

Systematic literature review (Vichitvanichphong, Talaei-Khoei, Kerr, & Ghapanchi, 2014a) has classified assistive technologies into two kinds; the first being Supportive Technologies, and the second being Empowering Technologies. There has been a body of literature (Broekens, Heerink, & Rosendal, 2009; Leist, 2013; Magnusson, Hanson, & Borg, 2004) for the adoption of technologies that aim to support the elderly whose functional abilities have already declined (e.g. hearing aids that help the elderly in their poor hearing). These technologies are called *Supportive Technologies*. The literature in this area broadly presents perceived usefulness as one of the main constructs of adoption (Mostaghel, 2016; Yusif, Soar, & Hafeez-Baig, 2016). However, the *transfer effect* between the driving done by the elderly and Xbox Kinect video games has demonstrated long-term impacts that are difficult for seniors to perceive as useful (Khosravi & Ghapanchi, 2016; Lee & Coughlin, 2015).

Vichitvanichphong et al. (2017) believe that the existing adoption theories do not pay sufficient attention to the context of such empowering technologies. *Empowering Technologies* – as opposed to *Supportive Technologies* – aim to assist the elderly in maintaining their functional abilities that have not yet declined. Perceiving the usefulness of empowering technologies is different than supportive technologies. This is because of the long-term effect of empowering technologies in comparison to the short-term effect of supportive technologies (Vichitvanichphong, Talaei-Khoei, Kerr, & Ghapanchi, 2014b). For example, there is a difference between realizing the effectiveness and usefulness of hearing aids (e.g. *supportive technology*) versus Xbox Kinect cognitive training games (e.g. *empowering technology*). The usefulness of hearing aids allows for the maintenance of already lost or weakened hearing while Xbox Kinect cognitive training games allow for the maintenance of daily life capabilities that have not yet been lost.

The concept of *transfer effect* for cognitive training video games requires a different theoretical approach in explaining *usefulness*. The main objective of the present study is to investigate the perception of the elderly regarding the *transfer effect* (e.g. *Perceived Transfer Effect*) of playing cognitive training video games for maintaining their daily life capabilities (e.g. *driving, reading, housework etc.*) that they need in order to continue living independently. As such, this paper is an attempt to answer the following research question:

- **Research Question:** How do the elderly perceive the effect of playing cognitive training video games as a tool for maintaining their daily life capabilities, which are required in order for them to remain living independently?

From the theoretical perspective, adoption theories for empowering technologies that offer positive, long-term effects highlight the role of perceived usefulness but fail to explain the development of perceived usefulness. However, the current study develops *perceived transfer effect* wherein an individual perceives the usefulness of an empowering technology by understanding its *transfer effect* that allows her/him to

remain capable of living independently in a standard of living that she/he values. The *perceived transfer effect* of cognitive training video games for maintaining daily-life capabilities – such as driving and reading – has been investigated in this study. Therefore, from a practical perspective, studying the *perceived transfer effect* of Xbox Kinect cognitive training video games on the daily life of the elderly has assisted nursing professionals to better understand how to help the elderly realize the usefulness of empowering technology. Having comprehended the elderly's *perceived transfer effect*, nurses can then help the elderly to realize the usefulness Xbox Kinect cognitive training video games offer towards maintaining their daily life capabilities, thereby improving the use of this intervention.

The remainder of this paper is organized in the following way: Section 2 presents a literature review that includes Table 1 regarding definitions and literature support which closes the gap being addressed in this paper. Section 3 presents the research method used in data collection and analysis of this study. Section 4 presents the results. Section 5 summarizes the findings and discusses the academic and practical implications of this paper. Section 6 concludes the paper, recognizes the limitations of the study, and suggests future work.

2. Literature support for perceived transfer effect of cognitive training video games for seniors' independent living

Literature suggests that the elderly value their independent living (Huang & Dong, 2014; Kim, Lee, & Bonn, 2017; Leeson, Harper, & Levin, 2004; Moulton et al., 2016; Porteous & Brownsell, 2000; Vichitvanichphong, Talaei-Khoei, & Kerr, 2017). In this study, we define independent living as a choice that seniors have over their lives. However, one of the issues facing elderly's independent living is age-related cognitive decline (Ervin et al., 2012). This study was based on the support of literature for positive impact of intellectual exercise and training on the maintenance of cognitive abilities in elderly people (Fleiner et al., 2017; Öhman et al., 2016; Shen & Li, 2016). However, Vichitvanichphong et al. (2017) believe that the existing adoption theories lack sufficient attention towards the context of empowering technologies such as cognitive training Xbox Kinects games, due in large part to the difficulty of the elderly for understanding the effectiveness or *transfer effect* of empowering technologies. Therefore, this study supports that the elderly perceive cognitive training video games as a useful intervention if they believe that (1) playing training video games helps their cognitive abilities and that (2) those abilities can then be transferred to their daily life capabilities, required for independent living. This will be further elaborated on in Section 2.2. *Perceived Transfer Effect*.

Table 1 presents the definitions and literature support for this study. Table 1 also demonstrates the logical rationale in developing the objective of this study for investigating the *perceived transfer effect* of cognitive training video games to help with the independent living of the elderly.

Conventionally, “elderly” has been defined as a chronological age of 65 years old or greater. Orimo et al. (2006) have discussed the differences between those from 65 through 85 years old who are referred to as “younger elderly” and those over 85 years old who are referred to as “older old”. Votruba et al. (2016) differentiate between younger and older elderlies and believe that cognitive training exercises are more successful in younger adults when they have not yet developed memory performance decline. However, for the purpose of this study, “elderly” refers to people between 65 to 85 years old that have not yet shown significant decline in their memory performance and that are similarly treated as seniors (Votruba, Persad, & Giordani, 2016). This definition connects elderly to the empowering technology definition, which helps the elderly to maintain their functional abilities (e.g. *memory performance*).

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