

Discussing on Gamification for Elderly Literature, Motivation and Adherence

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Abstract: Gamification and Serious games techniques have been accepted as an effective method to strengthen the performance and motivation of people in education, health, entertainment, workplace and business. Concretely, exergames have been increasingly applied to raise physical activities and health or physical performance improvement among elders. To the extend of our understanding, there is an extensive research on gamification and serious games for elderly in health. However, conducted studies assume certain issues regarding context biases, lack of applied guidelines or standardization, or weak results. We assert that a greater effort must be applied to explore and understand the needs and motivations of elderly players. Further, for improving the impact in proof-of-concept solutions and experiments some well-known guidelines or foundations must be adopted. In our current work, we are applying exergames on elderly with frailty condition in order to improve patient engagement in healthcare prevention and intervention. We suggest that to detect and reinforce such traits on elderly is adequate to extend the literature properly.

1 INTRODUCTION

In recent years, a rapid increase of consumer software inspired by the video-gaming has been perceived. Gamification emerges from this phenomenon as a powerful tool for Human-Computer Interaction research such playful design, serious games, purposeful games, pervasive games, and exergames, inter alia. In a nutshell, gamification refers to game structures and components to solve user problems. From an industry-based perspective, gamification and serious games methods have been used to increase participation and to encourage behavioural changes from the audience. From a scientific point of view, gamification reinforces and improves behaviours and user capacities with special focus on learning and health (Kasurinen and Knutas, 2018). Concretely, exergames are a set of gamification components from the family of serious games defined as virtual games that require physical exertion to be played.

The World Health Organization (WHO) defines “Healthy Ageing” as the process of developing and maintaining the functional ability that enables well-being in older ages. In other words, to maintain and

preserve the intrinsic capacity of the individual, its environmental characteristics and their interaction. In parallel, by 2050 life expectancy will surpass 90 years and one in six people in the world will be over age 65 (WHO, 2019; UN, 2019).

As far as we are concerned, although extensive research on gamification for health exists, there are many concerns about gamification focused on elderly. While there are remarkable research in this topic, i.a. guidelines (Czaja and Lee, 2002; Ijsselstein et al., 2007), study of engagement and adherence (de Vette et al., 2015), and rehabilitation (Laver et al., 2017; Skjæret et al., 2016), literature still remains poor due to low-quality evidence, assumed biases, and lack of user adherence, among others. In addition, to apply gamification for ageing becomes challenging due to the lack of familiarity of the elderly with games and its components, metaphors and mental processes, i.a. points, status, stages, badges. etc. However, exergames sound promising to fill this gap, motivating elders to do exercise because of its fun, aiming for a proper adherence and motivation that enforce the mentioned capacities.

We conducted a qualitative analysis using secondary data from a literature review that includes both scientific and grey literature. The search and the initial analysis were conducted separately by the main researchers, whilst the discussion and positioning were concluded by the all the authors. As our early conclusions, a greater effort on gamification for ageing must be conducted. Concretely, our position is twofold: to ensure usability for seniors through gamification given their capacities as players and, in parallel, to explore and understand the needs and motivations of elderly players in order to improve user adherence and extend the current theory. In addition, further well-controlled studies are required to establish unambiguously the effects gamification on different types of elderly users. Moving forward, our current work aims to extend exergaming to tailored intervention for elderly with frailty condition. Frailty condition is an intermediate state in the ageing trajectory with increased vulnerability and preceding the onset of disability. In contrast to permanent disability, frailty advance can be potentially reversed through appropriate interventions (Fried et al., 2001). Accordingly, we aim to apply gamification techniques tailored to elderly given their functional status and motivational trait. Indeed, the long term goal is, through these techniques and extensions, be capable to recognize the motivational trait itself. Indeed, we want to demonstrate that engagement and adherence on elders are linked with concrete traits such personal mastery and failure avoidance. To do so, exergames are proved to be suitable to improve patients motivation as well as their health.

2 BACKGROUND

Gamification is defined by the use of design elements from games in non-game contexts. This broader definition emerges from the industry and research approaches, i.a. productivity games, surveillance entertainment, gameful/playful design, behavioral games, serious games, and pervasive games. Over recent years, gamification techniques have been accepted as effective methods to develop the performance and motivation of people. Different research approaches have applied gamified systems, such as education, health, entertainment, business, and exercise (Deterding et al., 2011).

Several studies shows how gamification literature are becoming popular in different research areas. Trendiest approaches in gamification are studies based on proof-of-concept prototypes (computer science education, ecology and sustainability, and

motivational reinforcement), theoretical analysis of components, and applicability on e-learning education (Seaborn and Fels, 2015; Kasurinen and Knutas, 2018). Most frequent objectives in the literature are aimed to comprehend how gamification affects user performance, mainly the intrinsic motivation and need satisfaction. Indeed, some effort has been applied to empirically study through experiments and evaluation in mentioned concepts from a psychological (Hamari et al., 2014; Sailer et al., 2017; Mekler et al., 2017) and neurological perspectives (Mondéjar et al., 2016), among others.

2.1 Gamification for Elderly

Serious games are defined as any form of playful resource, mainly interactive or computer-based, to be used with the intention to be more than entertainment. Games for Health are a subset of serious games, where the purpose of the game is to improve the health of the player, either via exercise inducing games or via promoting the health-enhancing activities (Kasurinen and Knutas, 2018). Exergames are defined as virtual games that require physical exertion to be played and emerge from the hypothesis of motivating adults to do exercise because of its fun. Literature shows how gamification through exergames in health has emerged as a popular strategy, both in commercial culture and research as a means of influencing behaviors (Lister et al., 2014). Other studies aims to improve adherence through long-term and sustainable user motivation to workout through exergames (Göbel et al., 2010).

As introduced below, to care and develop the intrinsic capacity of the individual is crucial to maintain and preserve the functional ability on elderly. Intrinsic capacity comprises all the mental and physical capacities that a person can draw on and includes their ability to walk, think, see, hear and remember. The level of intrinsic capacity is influenced by a number of factors such as the presence of diseases, injuries and age-related changes (WHO, 2019). Physical activities are a vital element at all ages, particularly in elders to manage their daily life. This includes an adequate strength, balance, and flexibility, among other requirements. Exergames have been increasingly applied to raise physical activities and health or physical performance improvement among elders, through motivating elder people to do exercise and mightily acquire sufficient physical exertion (Kirk et al., 2013).

Despite the remarkable set of casual games that are not adequately designed in terms of speed, amount of information, and movement options (Wollersheim et al., 2010), recent research has measured the in-

fluence of interactive video games and virtual reality games in the rehabilitation of diseases on elders. For example, from the stroke literature, there are studies about using gamified technology and exergames to research about rehabilitation in stroke recovering (Laver et al., 2017). Several reviews have indicated that the engagement of older adults in exergaming is feasible and safe or mightily raise the balancing potential of participants. Although exergame programming might be a substitute for many joint exercises with balance features, research on exergaming proposes methodology alternatives on protocols of intervention for users (Laufer et al., 2014; Skjæret et al., 2016). These factors have supported the efficiency of exergames to boost the physical functioning in older adults. Thus, exergames are a proper exercise technique for older patients and as a tool to maintain physical functions, health, and independence (Molina et al., 2014; Skjæret et al., 2016).

2.2 Motivation, Pros, and Cons

The approach of gamified apps for health has fundamentally questioned or subject to debate by the scientific community. In addition to entertainment value, there are evidences of a substantial therapeutic value in playing digital games. However, definitional subjectivity, diverse or unstated theoretical foundations, incongruities among empirical findings, and inadequate experimental design remain matters of concern.

Digital games allow elderly people, like other users, to bond socially, either by online or physically co-located with their companions, thereby enhancing their social connectedness and potentially enlarging their social support structure. Despite this potential, seniors are proportionally underrepresented as consumers of digital games, creating a significant and largely untapped market opportunity. One of the reasons for this has been the focus of game developer studios to develop games primarily for adolescent users, where games which do not usually resonate well with the interests, needs, abilities and limitations of elders. As a consequence of both functional limitations and a simple lack of technological experience, seniors are hurt more by usability problems than younger users.

Results through gamification justify its popularity in healthcare, such as telemedicine (Tabak et al., 2015), cognitive therapy (Gerling and Masuch, 2011), and motivation (Minge et al., 2014), among others. While gamification has been extensively used regardless the age condition, focus on elderly still remains reduced in terms of adherence, engagement, and final products. In fact, studies shows how elderly population are under-represented as customer of digital

games, since the games do not fulfil their needs, interest, and usability demands (Ijsselsteijn et al., 2007).

On the other hand, although this area has an emerging tendency of research, a remarkable set of studies shows low-quality evidence, potential biases, lack of user adherence, or even harmful situations with users. Reviews, either systematic or not, tend to assume the high variability between studies in different aspects, i.a. context, methodology, experiments procedures, intervention protocols, outcome, and other limitations (Hamari et al., 2014; Laufer et al., 2014). Indeed, even with the widespread use of gamification principles, the lack of professional guidelines or standards enforce such biases on the comparisons (Lister et al., 2014). The studies are significantly heterogeneous regarding the technology and the games used in their experiments. This leads to a dependence on the results to such assets attached to the interventions, from well-known game consoles to tailored proof-of-concept prototypes. Lack of extensive gamification researches has signalled the requirement of potential usage of gamified apps for elderly to change their health behaviours. Following the recent studies, game console and mobile apps have been confirmed to be useful and complementary to health interventions. However, the majority of rigorous researches have been used to define the efficacy and to establish evidence of best practices. The conclusion is limited by the variety of reporting of adherence and usage data. We understand that probably gamification for health literature possesses significant heterogeneity, according to the selected perspective-based between studies. Concerning health symptoms, studies found some negative cases have been presented along with the researches like mild transient dizziness, headaches, pains, showing that interventions must be specifically controlled for elderly (Laver et al., 2017). These adverse events are common but casual and not be of great concern. However, it becomes relevant in elderly population for an effective adherence, even critical in users with frailty condition.

3 POSITIONING

Despite a few more studies concerning gamification and exergames, most of them lack of an appropriate methodology. Most game developers are still unaware of basic game accessibility guidelines and obviating certain age ranges of potential users such seniors. This situation can should be drastically improved through extensive user testing with elders and the use of design guidelines that are specifically tai-

lored to the elderly population. There is a substantial body of literature focused on elderly, including interface design guidelines and game design techniques (Deterding et al., 2011; Gerling et al., 2012; Mondéjar et al., 2016; Ruzic et al., 2016). Several design recommendations can be distilled from this literature. Mainly, the interface design for elderly users should minimize the burden on functions that may have suffered decline, such as demands on spatial memory, working memory, visual functions or motor ability. Furthermore, interfaces should be adaptable to compensate for particular functional limitations (sensory, motor or cognitive) of elderly users. Regarding the health goals using exergames on elderly, there is a need of results in terms of effectiveness, according to the widespread perception that exergames is a potential candidate as a training tool beside the applied popular games and gaming consoles (Laufer et al., 2014).

We assert that, in parallel to ensuring usability of games for seniors, community need to make sure that there are substantial perceived benefits for elderly users, so that they are willing to invest their valuable time and energy in what can potentially be a rewarding experience. To explore and understand the needs and motivations of elderly users, there is a great need for a substantial research effort, which includes focus group studies, interviews, surveys and general market segmentation research. In addition, further well-controlled studies are required to establish unambiguously the effects of different genres of digital games on different types of elderly users, putting the various hypothesized benefits to a much more detailed test.

For example, one remarkable application of exergames for elderly is fall prevention. As mentioned before, elderly people are subject to fall frequently and consequences are raised with ageing. Afterwards, ageing is related with both impaired movement dynamic and with a deterioration of cognitive processing, involving working memory and concluding to a frailty condition. Falling prevention training programs in seniors have included balance, muscle strength, flexibility and endurance, but also reinforce falls occurrences given a high dose of exercise and challenging balance exercises. Indeed, exergames are promising for home designed strength and balance training on both elders and healthy adults.

An interesting scenario is coming in the following years: due to the irremediable aging of the first generations of players, this community may preserved knowledge, skills and experiences that possibly changes the adherence implications when they become elderly. For example, the first generation of players (Pong, Atari, Coleco, Odyssey...) are from 70's. It can provoke a change in the premises and

a new way to encourage engagement through techniques and resources based on by such familiarity.

4 ONGOING WORK

As explained before, frailty condition is an intermediate state in the ageing trajectory with increased vulnerability and preceding the onset of disability, potentially reversed through appropriate interventions (Fried et al., 2001). Our current work consists on a larger effort to improve the patient condition and exercise engagement through his motivational trait in falling prevention. In our context, patient interventions are based on his functional status from clinical data during visits. Foremost, we aim to adapt interventions given the patient motivational trait. That is, to provide a tailored treatment including physical exercises where, by exergaming techniques, patients are expected to maintain their adherence. Afterwards, we raised to extend and improve such interventions recognizing the patient motivational trait. That is, to recognize patient behaviours, intentions, effort and persistence over the time from frailty patients. By transforming motivation input from a constant to be assumed to a variable to be inferred our objective is twofold: First, we aimed to provide healthcare professionals information for not solely tailored interventions, but also prevention. Second, strengthen patient motivation to guarantee his engagement. To the extend of our understanding, motivation reinforcement on elderly is mainly based on failure avoidance and personal mastery, rather than other gamification components related with game difficulty, challenges, or competitiveness. Accordingly, these goals can be achieved if we focus on such traits.

5 CONCLUSIONS

In this paper we discussed on the current state of the art on gamification for elderly. Further, we question the accuracy of literature due to different contextual factors in the studies, concluding to low-quality evidence, biases, and lack of user adherence, among others. From our qualitative analysis, we assert that more effort in this topic is needed through a deeper study using different approaches, i.a. study of elderly condition related to games, and applying well-known guidelines on gamification and game design for elderly. Based on our concerns, to apply gamification focused on reinforce motivation such personal mastery and failure avoidance are the best traits to im-

prove and guarantee engagement, specially useful in healthcare contexts.

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