

# The adoption of a serious game to foster interaction between the elderly and the youth

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**Abstract**— The number of lonely elderly is growing. Young people could provide part of the solution for this problem by spending more time with the elderly but negative intergenerational perceptions prevent this and create a generational gap. Serious gaming has the potential to develop positive intergenerational perceptions as shared leisure activities and improve health and well-being of elderly. Therefore the research question for this paper is what factors are essential for the adoption of a serious game to bring elderly and youth together? The qualitative study conducted 36 interviews amongst elderly (above 65) and youth (below 25) applying the USE IT interview protocol. The theoretical value of this paper found 13 design factors, from which five factors were found to correspond with the interviews: Weighing of different motivations young and old; Need for a learning component; Options for a short game; Ease of Use and Communication and nature of social interaction. The empirical study also found that the awareness of intergenerational games is very low and must be addressed. The games must be fun and secure and be available on a multiplatform in the browser so computers are not excluded.

**Keywords**—serious gaming; Intergenerational play; Intergenerational perceptions

## I. INTRODUCTION

Our current society consists of a growing number of elderly people who are lonely and isolated. The United Nations (2009) [1] has projected that worldwide, the number of people above the age of 60 years will increase from 739 million to 2 billion by 2050. In more developed countries like the Netherlands, the ratio of elderly people is expected to grow from 22% today to 33% in 2050. However also many developing nations are facing the challenge of a hyper-ageing society. The ratio of elderly people in developing countries is expected to double from 9% today to 20% in 2050.

Young people could provide the solution for this problem by spending more time with the elderly, but the youth view communication with the elderly less than satisfactory and problematic [2] while the elderly feel patronized and prejudiced by ageist sentiments [3] which together contributes to a generational gap. A generational gap is commonly perceived to refer to differences between generations that cause conflict and complicate communication. William Safire [4] provides a more positive definition: “A generation gap can be a frustrating lack of communication between young and old or a useful stretch of time that separates cultures within a society, allowing them to develop their own character.” However

despite of this stretch of time these separate age groups have something in common.

In recent years digital devices like a computer, tablet or smartphone have become a daily part of life for health, fun and retrieving information [5]. Having fun can be experienced by playing digital games and this is a good example of how digital devices can be used to enhance the mental and physical health, but also social well-being of all both young and old [6]. Serious gaming is defined as: “any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment” [7]. The casual playing of a game allows both groups to connect on basis of mutual interest and stimulates communication through a shared experience.

The context of this topic relates to behavioral science, communication science and computer science with regards to serious gaming and intergenerational perceptions. Serious games have the potential in developing positive intergenerational perceptions as a means of shared leisure activities when the young and old participants play together [8]. The research question for this paper will be the following:

*What factors are essential for the adoption of serious gaming to bring elderly and youth together?*

First, the methodology is given followed by a structured literature study. The results reflect the 36 interviews followed by an analysis and conclusions.

## II. METHODOLOGY

The structured literature study uses a Grounded Theory approach will result in a thorough and theoretically relevant analysis in section III [9]. The databases used are Scopus and Web of Science. These databases were searched using the following keywords: serious gaming, serious games, GAM\* gamification, intergenerational, video games, digital games, elderly and young. These keywords were used in different sets of combinations and with the AND / OR function that the databases have. While searching the snowball method was applied, this means that new keywords were used based on the literature found. On the niche topic of fostering interaction through serious gaming between elderly and young there were four papers (table 2) relevant in the intersection [10][11][12][13]. The qualitative interviews were conducted by applying USE IT interview protocol [14]. The model shown below in figure 1 is based on a large body of knowledge including extended TAM [15], the Information System Success Model [16] and the innovation diffusion model [17].

USE IT-adoption model		Domain dimension	
		<i>User</i>	<i>Information Technology</i>
Innovation dimension	<i>Product</i>	Relevance	Requirements
	<i>Process</i>	Resistance	Resources

**Table 1, USE IT model [14]**

A qualitative research interview seeks to cover both a factual and a meaning level, though it is usually more difficult to interview on a meaning level [18]. The analysis was done with cross verification which improves the validity [19].

### III. BACKGROUND

#### A. Serious gaming

Games used for serious purposes, hence the name “serious gaming” date back multiple years. The upcoming popularity of digital games made this to become a substantial industry over time. These digital serious games are defined in section I [7] in compliance with Connolly who defines serious gaming as games that are not only used for entertainment purposes but are also used for learning objectives as well [20]. According to Susi and Johannesson [21] most agree on a core meaning that serious games are (digital) games used for purposes other than mere entertainment “with the intention of serving learning goals, behavioral goals, organizational goals and or intervention goals set by its developers” [22]. The use of game design elements in non-game contexts is called “gamification” [23] and can also be used to serve the behavioral goal of fostering communication between elderly and youth by providing a new way of interaction between the generations. To explore this topic further the following sections will describe more extensive what the current body of knowledge is on intergenerational perceptions.

#### B. Intergenerational perceptions

Primarily, the study of intergenerational perceptions has to two broad perspectives [24]. The issue can be approached from the intergroup perspective or from the family perspective. Prior research has been done on the intergroup perspective to explain negative perceptions and communication between elderly and youth [25]. Research has exhibited that the youth view communication with the elderly less than satisfactory and problematic [2], while the elderly feel patronized and prejudiced by ageist sentiments [26]. Youth also report that they feel patronized by the elderly and feel that elderly convey undesired stereotypes about their age group. Furthermore, the elderly might be recognized by the youth as non-accommodative, authoritarian, dismissive and inattentive to the concerns of others [27]. The problem of negative intergenerational perceptions is however not cultural specific, but has been

found in other cultures around the globe [3]. Creating a setting where these negative stereotypes do not apply is essential for the successful adoption of serious gaming to foster interaction between the youth and elderly.

Studies in the family perspective show that the grandparent can reduce the negative stereotypes young people associate with the elderly. Increasing the interaction children have with their grandparents could improve their perceptions about the elderly in general [24]. The participation in various types of leisure activities influence the perception of family satisfaction differently for different age groups. Gaming has been popular with the youth since the early stages, but also elderly are becoming more interested into playing video games. This dates back as early as the study from Goldstein [28] who noticed that elderly were still enthusiastic about their gaming experience after the research ended. So how does playing video games affect elderly and especially with the youth. The next section will explore the effect of playing video games between elderly and youth on intergenerational perceptions.

#### C. Intergenerational gaming

An example of a serious game designed for intergenerational play is called “TranseCare” [29]. This game is designed to offer a fun way to connect the elderly (suffering from a chronic or degenerative illness) with their family list which they need to memorize. The innovation of video games as serious game can result in a change of general perceptions [8]. The novelty of elderly playing video games may help break down negative stereotypes that youth have regarding elderly, while on the other hand the learning aspect for elderly might result in developing attraction towards the individual youngster what results in a more positive attitude in general regarding youth. Videogames can provide common goals and intergroup cooperation (needed for successful intergroup interactions). The benefits of intergenerational digital games can be divided into four categories[12]: reinforcing family bond, enhancing the reciprocal learning, increasing understanding of the other generation and reducing social anxiety. Playing entertainment games can change behavior in a positive way[30]. The model of social games and intergenerational communication [31] predicts that age is a moderating factor for the effect of task enjoyment and experience enjoyment on intergenerational perception and the intention to communicate. The actual communication may change as the two generations spend more time together and know more about each other even though both are reserved at the beginning [10]. Nguyen’s [31] predicts that when elderly

play the game with a young person it is more satisfying and enjoyable for the elderly than playing the game just by themselves. Therefore the experience enjoyment for them has more effect on their perception of the other and intention to communicate with them. This can create a positive feedback loop for the elderly, but for the youth it is uncertain. The youth will have a stronger effect by the actual task enjoyment, for them the actual game tasks and particular guiding the elderly to play are more important [10]. Older adults traditionally adopt the roles of organizer, instructor, caregiver, playmate or teaser when playing a game. But when intergenerational play is mediated by new digital technology like (online) digital games, the traditional roles of older are reversed with their younger player. This corresponds with the task enjoyment in the model [31] where the youth finds game tasks and particular guiding the elderly to play more important.

As in the challenges of design there is no one size fits all game for intergenerational play [32]. However a number of common characteristics of intergenerational digital games were found by [10] such as short game sessions, easy to get in and out, provide learning opportunities and last supporting the various roles of both age groups by weighing in different motivational factors, but also the important on design factors to achieve goals like knowledge sharing, relationship building or single/multiplayer mode.

The game design principles of Chiong [11] for intergenerational interactions show similarities such as short-duration of games, learning opportunities embedded in the game and accommodating different interests from both generations. But also add new factors such enabling asymmetrical and asynchronous play and creating socially desirable reward systems.

The review from Costa and Velosa [13] for designing intergenerational digital games also found that collaboration and learning is important, because it stimulates the cognition of both generations. Also that both generations should be involved in the design, because handling a player-centered approach by involving both generations helps to blur intergenerational gaps and fosters a sense of togetherness between players. They also found that there should be low time commitment, asynchronous play and the ability for passive/watching play to balance the both users skills and challenges. Furthermore the review adds to this by first, prioritizes physical, mixed-reality games and multi-modal interaction as important design factor, followed by prioritizing collaboration, peer-to-peer mentoring in a game, because it helps with the individual sharing of knowledge experience. Third, having shared context and meeting places enhanced social interactions between different generations towards a communal activity. Fourth, provide an easy-to-use interface and adaptable game controllers. Finally by adding video chat functionality and computer mediated communication to a game helped to developed positive intergenerational perceptions and positive changes in intergroup anxiety and attitudes, but also act as reminder in the current status of family members when seen online.

Similarities were found by the review of de la Hera et al. [12] who classifies them into two types of factors that are important to take into account. Player-centric and secondly game-centric factors. The important player-centric

factors for designing intergenerational games are: the nature of interactions between the two generations, for example are they strangers or family. Their motivation to play digital games, older players were against playing reflex-oriented games like fighting or racing games and are less competitive than younger players. Finally the difference in abilities, elderly have not grown up with all the technology and thus are less comfortable playing with digital devices. The two most relevant game-centric factors [12] are goal-related and space-related forms of interaction. As stated before elderly are less competitive and collaboration games with a common goal were found to be the best fit for both generations. This corresponds with the study of Peng and Hsieh [33] who found that games with a cooperative goal structure led to higher motivation than those with a competitive goal structure and the study from Dolgov et al. [34] even showed that cooperative gameplay increased future spontaneous helping behavior between players. So a cooperative structure seems to be an important design factor, but Cohen [34]

stated that overall the most important factor for serious games is enjoyment or simply stated fun. In the end enjoyment encourages players to continue playing over a longer period of time, which is needed to positively influence the interaction and in term the communication between both age groups.

To allow players to continue playing over a longer period of time the usability of a serious game is also an important factor. Providing an easy-to-use interface and adaptable game parameters is essential to balance both the users skills and challenges [13]. The rising age of elderly is often accompanied with physical and mental decline, but despite of this Broady et al. [35] state that elderly have the eagerness to adopt to technological developments and show the same positive attitudes towards the use of digital devices as the youth. However making a game easy to understand and to use is essential for elderly, because technological anxiety is one reason for elderly to avoid the use of new technology. Making a game easy to use (high usability) does not automatically mean simple interaction between players, but does mean that games should not burden older people with difficult to grasp interfaces [36]. The study described [36] has shown that video games can change intergenerational perceptions and foster interaction between elderly and youth. The literature also provides a picture of what design factors need to be implemented to allow an optimal fit for both generations. These results are summarized in figure 1.

Researcher / Factors	Chiong (2009)	Zhang & Kaufman (2016)	Costa & Velosa (2016)	de la Hera et al., (2017)
Weighing in different motivations from both age groups	x	x	x	x
Learning embedded in the game	x	x	x	x
Short game sessions	x	x	x	x
Easy to use interface		x	x	x
Collaboration games with common goals have best fit for both		x	x	x
Peer-to-peer mentoring by teaching each other		x	x	x
Enable social interactions, shared context and meeting places			x	x
Video chat and computer mediated communication helps			x	x
Asymmetrical and asynchronous play	x		x	
Nature of interaction is important		x		x
Enable passive watching play		x	x	
Prioritize physical, mixed-reality games and multi-modal interaction			x	
Create socially desired reward systems	x			

Fig. 1. summary of design variables

#### IV. RESULTS

The qualitative results are coded and transformed to data model by using Miles, Huberman & Saldana [19]. First step is to code the results, codes are labels that assign symbolic meaning to the descriptive or inferential information. For the first cycle of coding both Vivo and Emotion coding are used. Vivo coding is one of the most well-known qualitative coding methods. Vivo coding uses words or short phrases from the participant's own language in the data record as codes. It is appropriate for virtually all qualitative studies but particularly for beginning qualitative researchers learning how to code data, and studies that prioritize and honor the participant's voice. Phrases that are used repeatedly by participants are good leads; they often point to regularities or patterns in the setting.

Secondly, emotion coding is used. This method labels the emotions recalled and/or experienced by the participant. Emotion coding is particularly appropriate for studies that explore intrapersonal and interpersonal

participant experiences and actions. It also provides insight into the participants perspectives, worldviews, and life conditions. Below the summarized results will be presented according to the interview structure.

##### 1.1 Results Elderly

Starting with **process**, 73% of the elderly is positive about the fit of a serious game in their daily routine. However it must be noted that only 25% of the male respondents answered the question positively. Elderly participants mostly use their computer for communicating with others by sending emails but often use a regular phone for verbal contact, texting is used least. Elderly prefer face2face contact, this is the most common exception to connect via other ways than online communication tools.

**Relevance**, from the females 70% found a serious game relevant to them personally and believes it could improve their personal life, however amongst male respondents only 40% was positive. The most referred reason by females was that it will improve their personal life by having more contact with younger people, getting insight into the youth and learning from each other. From the elderly only 44% believes it will be easy to use a serious game.

**Information needs**, in addition to the previous statement only a third of the elderly believes it has enough knowledge to play the serious game. Getting medical information through a serious game or insight into personal health is something only 20% of the elderly agrees with. Most of the elderly are prepared to share either identity, habits or environmental information even though 80% thinks that the information can be misused.

**Means and people**, more than 90% of the elderly has personal hardware. Ranging from a PC or laptop (80%), a smartphone (60%) or a tablet (40%) and 80% has access to either Wi-Fi or 3/4G. There is no clear favorite device to play the serious game on. Amongst the elderly 90% has time to use, on average 1 hour a day, but only a small percentage is willing to spend money on the game. Positively 60% feels they would get enough support if they want to use a serious game.

**Attitude**, overall 85% of the elderly (90% female, 67% male) has a positive attitude regarding the use of ICT. A common theme is that ICT is good for supporting and making life/communication easier. However the negative consequences of ICT are that it causes us to be less social and some feel and I quote "smartphones are a plague on our society". Amongst the elderly only 17% had ever heard from a serious game before or discussed a serious game with someone this is quite low.

Finally the respondents were asked what the essential factors are for a serious game or not. Ascending the most stated phrases by elderly were: "easy to play", "need for both parties", "it must be fun" and "the data must be secure". First off easy to play was named most by elderly because they realize that if the if the game is too difficult to use they will be not be able to play it at all on their own. This is also partially because elderly are nervous using ICT, so they must be assured the game is easy to play. Secondly

was named need for both parties. Elderly are aware that without that need, no-one is going to play the game. Both parties must get something out of playing the game that is valuable enough to spend their time on. A respondent named as an example the exchange of information about topics of mutual interest. For instance youth could learn about household tasks, were elderly on the other hand could learn more digital related tasks from the youth. Thirdly was named fun to play. This is partially addressed in the previous factor need for both parties, but is named often enough by elderly as a separate factor. A fun game is important because otherwise elderly lose interest in the game. Finally was named the data must be secure. Elderly also realize that their online data can be hacked. The interviews showed that 80% thinks that their information can be misused, so this is an important point to elderly.

### 1.2 Results Youth

Starting with **process**, 75% of the youth (88% female, 63% male) is positive about the fit of a serious game in their daily routine. Youth participants answered that they mostly use their computer for school related activities and secondly entertainment purposes like music, games and movies. To contact other people the youth mostly uses WhatsApp, secondly social media like Facebook, Snapchat or Instagram. Mail is used for more formal activities like work or school. Exceptions to connect via other ways than online are when there is no connection, data or battery life.

**Relevance**, 63% of the youth (75% female, 50% male) found a serious game with elderly relevant to them personally and stated it could improve their personal life. Most females stated that they think their respect and understanding for elderly will increase and the game would provide more insight into the life of elderly. Males however mostly think a serious game could improve their personal education and general knowledge. Only 2 males mention social life or understanding of elderly. Nearly 90% of the youth respondents think the game will be easy to use, the most named problem is that it will be hard for elderly to adopt new technology needed for a serious game.

**Information needs**, in compliance with the previous statement the 80% of the youth think they have sufficient knowledge to play the game. Getting easier access to medical information through a serious game is something 85% of the youth agrees with and 67% thinks this could lead to synergy with the doctor. However only 29% thinks a serious game can give a good insight into their personal health. Regarding the sharing of information, most males are not prepared to share identity information, however 50% of the female respondents has no problem with this. The sharing of general habits or environmental information is no problem to most youth, even though 80% answered that information can be misused.

**Means and people**, all respondents had a smartphone and nearly all have access to a second device like laptop or tablet. Also every respondent had Wi-Fi access or mobile internet like 3G. The preferred device to play the serious game on is a smartphone. The amount of time willing to spend on the game varies between male respondents from 50% playing an hour a week to 25% an hour a day. Amongst female respondents 50% is willing to

spend couple of hours a week and also 25% an hour a day. Together 67% feels they would get enough support if they want to play a serious game.

**Attitude**, all of the youth participants are positive regarding ICT. From the males 50% states they cannot live without ICT anymore. Females answers more that it made their life easier, but improving the quality of life must be done by people themselves. Both males and females agree that ICT helps a lot in communication. Only 30% of the youth had ever heard of a serious game or discussed it with someone else before the interviews.

Finally the most named essential factor is ease of use. The youth realizes it will be challenging for elderly to work with the new technology. The second factor is fun to play, in combination with the game must be relevant/challenging for the youth to make it appealing. The third factor is security especially about information and privacy. Finally the fourth factor is that the game should not cost too much time, so it will be easy to incorporate in their schedule.

## V.<sup>n</sup> ANALYSIS

In this section the results of both the elderly and youth will be compared with the results found in the literature and analyzed. The literature showed 13 factors that are important for the adoption of a serious game. The interviews show that a serious game fits in the routine of both elderly (73%) and young (75%). Especially female respondents (90% elderly and 88% young) were positive about this. This corresponds with the research of Broady et al.[36] who stated that elderly have the eagerness to adopt technological developments and show the same positive attitudes towards the use of digital devices as the youth.

Weighing in different motivations from both age groups is the first factor stated in figure 1. The majority of females both elderly (70%) and young (88%) found a serious game relevant to them personally. They even have similar motivation were both groups stated it would improve their personal life and that having more contact would lead to more insight and understanding for each other. This is also found in the review of de la Hera [12] who identified understanding of the other generation as one of the four benefits as a result of serious digital gaming. The male respondents however are less positive and have different motivations. Only 25% of the elderly males and 50% of the male youth thought it was relevant to them personally. Noticeable is that the motivation for playing a serious game is more focused on personal education and increasing general knowledge amongst male youth respondents. This could be the focus on task enjoyment as stated by Nguyen et al.[31]. This has a greater influence on the youth and the actual task performed then on elderly and the results show this is especially strong among male youth respondents. This is also what links to the second factor summarized in figure 1 learning embedded in the game. It is important that players have a need to play the game and keep playing it in order to enable long time success.

Short duration of games is something that was also found in both in the literature and in the interviews. The interviews showed that especially the youth had preference for shorter games. Suggestions were given by the youth for a form of a “tinder app” where elderly and young can swipe easily wanting to find another player. So when a relatively short game is finished, the elderly might want to play again, but the youth not. Then the elderly can easily swipe for another “match” and play new game with a different player. This could help the youth to incorporate a game more easily in their schedule.

An easy to use interface is also often named in the literature. Amongst elderly 44% believes it will be easy to use the serious game and 33% thinks that he or she has the sufficient knowledge to play. Young people double that percentage with 88% think it will be easy to play and 80% believes they have enough knowledge to play. The most named problems are that elderly are most likely not familiar with the technology. This is something both groups agree on, so the game should be easy accessible preferably on a format that elderly are familiar with. This is also stated by Khoo et al.[36] who wrote that games should not burden elderly with difficult to grasp interfaces and in compliance with [13] who stated that providing an easy-to-use interface and adaptable parameters is essential to balance both users skills and challenges to make the game viable for elderly. This was also found in the review of de la Hera [12] as elderly have not grown up with all the technology and thus are less comfortable playing with digital devices. However an easy game does not automatically mean simple interaction between players, but does mean that games should not burden older people with difficult to grasp interfaces [36].

The youth named fun to play and the game must be relevant/and challenging to make it appealing as essential factors. This also corresponds with the second factor named by the elderly “need for both parties” and “it must be fun”. Cohen [35] also stated that the most important factor for serious games is fun. Though the literature prioritizing collaboration [13] or cooperative games, because they were found to have to best fit for both generations [12], let to higher motivation [33] and even showed future helping [35]. Cooperative collaboration games thus will result in the most fun. Working together creates a need for playing with a partner and the possibility of learning from each other while having to communicate. This then also works well with the factors peer-to-peer mentoring, teaching each other and having shared context.

Communication with family and friends is shown in the interviews as main use for ICT by elderly. This happens mostly by mail, but also social media or texting apps like WhatsApp. This is also how elderly receive most of their information through ICT and where they like to use it for. This factor is also in figure 1 as the nature of interaction is important. Elderly like to stay in touch with their family and this something they care more about than the actual game. Youth respondents answered that they receive nearly all of their information through some form of ICT and use it for communication, the searching of

information and personal development. So communication combined with the sharing and receiving of information is something both groups can relate to. That communication is important is also found in the review of [13] who stated that adding video chat functionality and computer mediated communication to a game helped developed positive intergenerational perceptions and positive intergroup anxiety and attitudes which are needed for successful intergroup interactions [11]. De la Hera et al.[12] also found that virtual communication is an important factor and that elderly are especially interested in communication.

The security of personal data is something that was not found in the literature. In both groups more than 80% believes that the information can be misused and this could be a reason why sharing medical information is something elderly are not positive about. Youth rather keep their identity information private, specially male respondents. The sharing of habits like personal hobbies and environment information is something both groups have in the most cases no issue with.

When both parties are willing to play and/or communicate with each other raises the question on what platform or on what hardware this should happen. More than 90% of the elderly has access to hardware and 80% has a viable internet connection. The preferred device however differs between elderly participants. Youth participants all have hardware and access to internet, but the smartphone is mentioned the most as preferred device. To not exclude someone the game should be accessible in the browser which can be accessed by PC’s, laptops, tablets and smartphones. On both groups participants are willing to spend time rather than money.

The attitude between both age groups regarding the need for ICT applications to improve the quality of life differs. Even though 85% of the elderly is positive about the use of ICT, they see it more in a supporting role or nice gimmick and not as essential factor to improve the quality of life. Elderly also mention that is society becoming less social with each other and everyone is drawn increasingly more into their phones. Prioritizing physical, mixed-reality games and having multimodal interaction is stated in the review of Costa and Velosa [13] and could counter the negative perception of playing on digital devices. However on the contrary youth respondents are a lot more convinced of ICT being necessary to improve the quality of life. On most all stated that the technological developments make life easier in many different aspects ranging from medical care to communication and thus significantly improve the quality of their life.

The awareness of a serious game for intergenerational play is very low, also something not found in the literature. Only 17% of the elderly and 30% of the youth had ever heard of a serious game with the goal of bringing elderly and youth together. This percentage needs to be addressed in order to make the game a viable option by having enough players. The results found are complemented by the literature who states that females are more likely to share the game with others than males and in fact females were more likely to share the game during the week

following first playing the game[34]. This is consistent with some qualitative evidence that females may be more inclined to pass along messages to their friends [37]. These facts make females players early adopters.

Together the factors found in the literature (figure 1) and the interview results combined help paint a picture of what factors are essential to bring elderly and youth together for the adoption of a serious game. In the conclusion this picture will be completed by transforming the individual results into a advice by answering the research and sub questions of this paper.

## VI. CONCLUSIONS

The loneliness and isolation experienced by elderly in our society can be partly solved by having more interaction with young people. This interaction can be created by playing a serious game together.

These generations are divided by intergenerational perceptions which often come from negative stereotypes combined with the age and cultural difference. However research has shown that video games have the potential of developing positive intergenerational perceptions as a means of shared leisure activities when the young and old play together. The literature further showed complimentary benefits such as reinforcing family bond, enhancing the reciprocal learning, increasing understanding of the other generation and reducing social anxiety.

So how do both age groups feel regarding the adoption of a serious game? The interviews show that both elderly and young have a fit for a serious game in their life, but as stated especially females find it relevant to them personally. The research goal of this paper was to find out what factors are essential for the adoption of serious gaming to bring elderly and youth together.

The theoretical value is that the literature provided 13 design factors summarized in figure 1. From these factors 5 were confirmed in the interviews results:

Weighing in different motivations from both age groups was found to correspond with the interviews because different ages and genders apply to different gaming needs, seeing that males were more focused on personal development and females were actually interested in the other age group;

The need for a learning component in the game was also found in the interviews seen in that there has to be a need for both parties and the playing must be challenging and relevant to the youth;

Having the option for short game sessions was named specifically by the youth in order to incorporate the game in their schedule.

Having an easy to use interface was named as essential factor by both elderly and youth because both groups understand that elderly are not as technological able as the current generation.

Finally the importance of communication and the nature of interaction were found to correspond with the interviews because both use ICT for communication, but elderly stated that they use ICT mostly for communication with family and friends.

The interviews additionally showed that the game must be fun, while the literature showed that collaboration games with common goals have best fit for both, needless to say one does have to exclude the other.

The game must be secure since both age groups think their privacy could be at stake. The game must be available on a multi-platform because the hardware of elderly and youth both varies and traditional PC's should not be excluded.

There is a low awareness among both age groups about intergenerational games, this needs to be increased to have a viable amount of players. As a recommendation the optimal start for a digital serious game should be an easy to use, secure, cooperative, learning game that requires (computer-mediated) communication between both players and can be deployed to connect elderly with their family, starting with elderly females and their granddaughters since they showed most interest.

Future research in Finland and the Netherlands will study a new model on intergenerational gaming with seven factors, five from theory and two from this empirical study.

Weighing of different motivations young and old
Need for a learning component
Options for a short game
Ease of Use
Communication and nature of social interaction
Fun
Security

Table 2. five confirmed theoretical factors and two new empirical factors for future study.

## LIMITATIONS

This study was done with rigor and the results are well validated but please note that the interviews were only done in the Netherlands. From an international point of view differences can be noted and that is also why future study of this subject will be done in Finland.

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