LILIANA FILIPA
VALE COSTA

OS VIDEOJOGOS EM REDE PARA O CIDADÃO SÉNIOR

NETWORKED VIDEO GAMES FOR OLDER ADULTS

**Universidade de Aveiro
2013**

Departamento de Comunicação e Arte

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ADULTS**

Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Comunicação Multimédia, realizada sob a orientação científica da Doutora Ana Veloso, Professora Auxiliar do Departamento de Comunicação e Arte da Universidade de Aveiro.

Dedico este estudo a si, leitor. Tal como eu, foi assaltado pela dúvida e por um olhar mais demorado sobre determinado fenómeno. Reportou o problema mas ninguém acreditou, renunciou contentar-se com o sossego das verdades absolutas, formulou hipóteses, envolveu-se com a audiência e consumiu grande parte do seu tempo na procura de respostas.

I dedicate this study to you, reader. Like me, you were assailed by doubt and by a longer look at a certain phenomenon. You reported the problem but nobody believed, resigned settling for the quiet of absolute truths, formulated hypotheses, became involved with the audience and consumed much of your time searching for answers.

o júri

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palavras-chave

resumo

Na atualidade, o envelhecimento da população ativa é uma realidade omnipresente. Recentemente, o estudo de produtos ou serviços comercializados para o cidadão sénior começa a despertar o interesse junto da comunidade científica e empresarial. A mesma tendência poderá surgir na indústria dos videojogos em que os seniores, especialmente os reformados, poderão tornar-se nos próximos consumidores de videojogos. Até ao momento, vários estudos têm-se debruçado sobre o papel dos videojogos na manutenção ou melhoria das capacidades cognitivas. No entanto, a ausência de informação sobre a utilização dos videojogos em rede numa idade mais avançada parece prevalecer. A componente social dos videojogos em rede neste público-alvo tem sido descurada bem como o seu potencial na promoção da inclusão digital e minimização das barreiras sociais. O objetivo desta investigação é compreender as componentes de *design* de videojogos em rede que estimulam o cidadão sénior a jogar, utilizando o método de investigação social aplicada. Deste modo, dois grupos etários (G1: 50-64 anos e G2: idade igual ou superior a 65) com elevada literacia foram envolvidos neste estudo, com a finalidade de compreender as tendências do futuro cidadão sénior enquanto jogador. Esta investigação oferece uma nova perspectiva do perfil de jogador, ao aplicar um questionário a 245 jogadores com idade igual ou superior a 50, dois *focus group* e técnicas de análise de conteúdo aplicadas na contrução da prova de conceito para o *game design* de um jogo em rede para esta faixa etária. Os resultados indicam que não há diferenças significativas entre jogadores de diferentes faixas etárias relativamente às preferências de jogo, sendo que os jogos de aventura são preferidos. As capacidades cognitivas que mais gostam de praticar são a resolução de problemas e a memória, estando relacionadas com o tipo de jogos que jogam. Além disso, os desafios cognitivos são valorizados e a colaboração entre jogadores deve ser enfatizada em relação à competição ou combate. A informação recolhida por esta investigação permitiu a observação de que um novo perfil de jogador emerge e que novos desafios aguardam os *designers* de jogos.

abstract

We are witnessing an increasingly ageing society. Recently, there has been a growing interest in studying products or services marketed to older adults either by the scientific community or by enterprises. In the video game industry, the elderly, especially retirees, tend to become the next generation of avid consumers. Many recent studies have focused on the role of video games in maintaining and improving cognitive capacities. However, there is a lack of information about the use of networked video games in later age. No real attention has been paid to the collective component of video games and their power to promote digital inclusion and eradicate social barriers. The aim of this research is to understand the main game design components of networked video games that encourage older adults to play, using an applied social research methodology. Thus, two age groups (G1: individuals aged between 50 and 64 years and G2: individuals aged 65 and over) with higher levels of education have been involved in this study, aimed at understanding the tendency of the next generation of older adults as gamers. The study provides insight into a new video gamer profile by employing a survey questionnaire with 245 gamers aged 50 and over, two focus groups and content analysis techniques used to the proof of concept of a networked video game addressed to this audience. Findings indicate that there were no significant differences between a younger age group and older adults in their choices of video games played. Adventure games are preferred and problem-solving and memory span were the skills that participants liked to practise. Cognitive challenges are valued and collaboration between players should be prioritized over competition and combat. These data support the view that a new older adult's gamer profile is emerging and it will bring new challenges for game designers.

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LIST OF ACRONYMS

AI	Artificial Intelligence
BF	Battlefield (video game)
CMC	Computer - mediated communication
ECG	Electrocardiography
EEG	Electroencephalography
EMG	Facial Electromyography
FPS	First person shooter
GEQ	Game Experience Questionnaire
GSR	Galvanic Skin Response
GW2	Guild Wars 2 (video game)
HUD	Head-up display
ICT	Information and Communications Technology
IM	Instant Messaging
MMORPG	Massively multiplayer online role-playing game
MOO	MUD object oriented (multiplayer game and object oriented)
MUDs	Multi-User Dungeon/Multi-User Dimension
NAT	Network address translation
NPC	Non-player character
PICTIVE	Plastic Interface for Collaborative Technology Initiative through Video Exploration
PD	Participatory design
PvE	Player versus environment
PvP	Player versus player
RPG	Role-playing game
SEDUCE	Senior Citizen Use of Computer-mediated communication and information in web ecologies
SNS	Social Network Sites
SIP	Social Information Processing
UCD	User centred design
UN	United Nations
UX	User experience
WHO	World Health Organization
WOW	World of Warcraft (video game)

«The beauty of being elderly and
playing video games is that no one
tells me I have to go to bed»

– Anonymous

INTRODUCTION

The world population is ageing. It is becoming increasingly difficult to ignore the fact that longer life expectancies and decreasing birth rates have led to growth in the ratio of the number of elderly to youngsters.

According to the United Nations' report (2007), the number of older adults will rise considerably by 2050. The data from UN database (2003) reveal that in 2009, the population aged 60 years or over was 737 275 inhabitants and it is expected to reach 2 008 244 in 2050. Simply put, the percentage of people aged 60 or over will more than double over the the next years. The trend is such that the percentage of population aged 60 or over in the total of population will range between 11% (this value is registered in the Africa continent) and 34% (in Europe). The number of people aged 15 to 64 years per person aged 65 or over will decline by 9 (to 4 people). Asia and Europe are the continents most affected by ageing.

The elderly population is now becoming a generation of gamers and networked video games seem to have potential to promote interaction between players of this age

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group. In recent years, researchers (Baecker et al., 2010; Farris, Bates, Resnick, & Stabler, 1995; Nouchi et al., 2012; Pires, 2011) have become interested in the effects of video games and how they can overcome some unavoidable constraints related to the ageing process, such as the reduction of cognitive functions.

So far, these investigations have been confined to the cognitive and physical effects. However, social support promoted by video games hasn't been looked at yet. The ageing process may be defined as a global phenomenon (Kinsella & Phillips, 2005) that is a result of better health options and living conditions, longer life expectancies (Lubitz, Cai, Kramarow, & Lentzner, 2003) and decreasing birth rates (Grant et al, 2004). This process often involves dealing with communication problems and social isolation (Heine & Browning, 2002). Given that a high level of connectivity between players improve their social networks (Sum, Mathews, Pourghasem, & Hughes, 2008), video games with a multiplayer dimension (via the Internet, Intranet or shared games) would be of great value in the social lives of older adults.

Video games can also strengthen the relationship between older adults and youngsters (Repetto & Trentin, 2009) by easing the interaction between players with diferent levels of technology skills. This age group also seem to have more free time to play. Their motivations to video games are: spending time, getting the highest score, keeping in touch with society and having fun (De Schutter, & Abeele, 2010).

Furthermore, networked video games can enrich immersive experiences and have a positive influence on the feeling of wellbeing. According to Aison, Davis, Milner and Targum (2002), video games also increase the short-term memory capacity, attention, hand-eye coordination and autonomy in problem solving.

The purpose of this research is to understand the main game design components of networked video games that can encourage older adults to play. It also pretends to explore the potential of networked video games to promote new ways of having fun and provide social support. This study will focus on: (a) new techniques of participatory design involving an older public; (b) the games preferred; (c) what motivates them to play; and (d) the main guidelines for designing video games with a multiplayer dimension adapted to this audience. Throughout this master's thesis, the term 'G1' refers to individuals aged

between 50 and 64 whereas the term 'G2' refers to the group of individuals over the age of 64. The following research is supported by the SEDUCE project (Senior citizen use of computer-mediated communication and information in Web Ecologies), PTDC/CCI-COM/111711/2009 approved by the Foundation for Science and Technology (FCT).

The research problem statement

A UN (2007) report from the Population Division predicts the percentage of older adults will more than double worldwide over the next half century. In Europe, people aged 65 and over are predicted to grow 70% (European Commission, 2009). Meanwhile, researchers (Meadow, Cosmas & Plotkin, 1981) have shown an increased interest in analysing older adults' consumerism over the years. In fact, due to the rapid change of society, designing products or services catering for their needs and motivations is more and more in demand.

Cognitive functions change over our lifetimes and with age, older adults may experience their decline. Many previous studies (Baecker et al., 2010; Farris et al., 1995; Nouchi et al., 2012; Pires, 2010) indicate that video games improve mental health and stimulate the activity of elderly brains. Dr. Ryuta Kawashima, a neuroscience researcher, partnered with Nintendo, after discovering that playing challenging games could improve cognitive capacities (Pearce, 2008). The game Brain Age was created based on that assumption (Nouchi et al., 2012). Nintendo had also the strategy of widening the target audience to all ages by spreading intergenerational games through Wii.

Despite these developments, a central issue in the video game industry is social gaming for older adults. As a growing number of this target group become players in order to pass their free time and maintain their mind sharp (Eldergames, 2006), there is a need to study their motivations and behaviours as gamers. Thus, given a survey with 245 gamers aged 50 and over and two focus groups with ten participants, it was possible to understand gamers' preferences and experiences while playing (video) games. In this research, there is a mixture of a qualitative and quantitative approach in order to answer the main aspects that should be considered when designing video games addressed to this audience.

This research encompasses three stages:

i. **The expectations concerning the proof of concept.** Those expectations are based on hypotheses from literature review and an online survey of 245 respondents aged 50 and over, who play games, video games, networked video games or both;

ii. **The design phase.** This phase is initiated with problem solving led by the researcher and a team of gamers. The participants and the researcher generate game-ideas and, consequently, co-design the selected ideas into game concepts (participatory design sessions);

iii. **The proof of concept.** A networked video game is finally designed and presented. This process takes into account the sessions of participatory design with gamers aged 50 and over.

The research aim and its goals

The aim of this research is to study networked video games adapted to older adults. Therefore, this research has the following goals:

The main goals answered by the survey and literature review are:

i. Analyse the potential of networked video games for older adults;

ii. Understand the preferences and aims of this target group to play;

iii. Explore the main guidelines to create a networked video game adapted to this audience.

The survey conducted and the literature review will help on answering these goals.

The specific goals answered by the participatory design sessions are:

i. Involve users in the video game's design process (the design of challenges, characters and heads-up display (HUD)). A group of novice and a group of experienced gamers will attend a focus group, aimed at discussing the game storyline, challenges, outcomes, characters and other game elements;

ii. Draw up a networked video game concept adapted to older adults. A proof of concept is designed regarding participants' answers, collected from the focus group discussions;

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iii. Know the reasons, which lead this age group to play video games. These data are collected through the questionnaire ("What motivates you to play?") and the focus group discussions ("Please introduce yourself to the rest of the group. For example, tell us where you live; areas of interest; whether you play games or video games; your favourite (video) games; and what motivates you to play");

The research question

Considering the research problem statement and the intended goals, a research question was outlined according to the quality criteria of clarity, feasibility and relevance. (Campenhoudt & Quivy, 1992).

What are the main game design components of networked video games, which can encourage older adults to play?

This question will be answered by mixed methods such as literature review, participatory design sessions and a survey. The proposed study will, then, address the following sub-questions:

i. Is there any relationship between the type of (video) games participants like to play and their age?;

ii. Is there a correlation between who participants live with and the mode of playing?;

iii. Is there a correlation between the type of games preferred and the skills that gamers want to practise?;

iv. What are the main difficulties that these age groups have with games' interfaces?.

The research methodology

From a methodological point of view, multiplayer video games for older adults have received little attention in the academic literature. As mentioned before, there are very few reports or studies on the potential of video games with a social component for older adults. For this reason, this study calls for applied social research.

Applied social research is a method that "aims to contribute towards practical issues of problem solving, decision-making, policy analysis and community development" (Blanche&Blanche, Durrheim, & Painter, 2006, p. 45).

Therefore, the reasons that led to this type of research were: (a) use of the research findings in a contemporary reality (Ritchie & Lewis, 2003) – *the ageing of society;* (b) establish a connection between theory and practise (Miller & Salkind, 2002); (c) address the audience needs and provide practical solutions (Bickman, Rog, & Hedrick, 1998) to video game designers.

Qualitative and quantitative data were collected and analysed. A cycle of planning, action and data analysis was taken. Firstly, a plan of action was designed and developed based on the research aims, its scope and information gathered during the literature process. Then, hypotheses were formulated. Focus groups were held and a survey was conducted. Then, a networked video game was designed.

The research strategy comprised three key stages. The aim of the first stage – The expectations concerning the proof of concept – aimed to answer the preferences and the game routines of older adults. In this stage, a theory was defined, objectives and variables were determined as well as a set of hypotheses that was identified. The data collection and analysis was also planed. Then, the second stage was followed by participatory design sessions with novice and experienced gamers. In this stage, a focus group was conducted with both groups in order to design game mechanics and aesthetics. Finally, the third stage is related to the proof of concept. A networked video game was designed, taking into account the survey and focus group sessions.

The analysis model

The analysis model is aimed at organizing and clarifying the research-based concepts, dimensions and indicators (Campenhoudt & Quivy, 1992). The study of the phenomena is ensured by hypotheses in response to the research question. Their indicators are directly related to the research keywords.

As a growing number of older adults become players, they tend to play games more often (Lenhart, Jones, & Rankin Macgill, 2008). From an initial observation and considering the lack of information about the game routines of this age group, the main goal of this study was to analyse the play patterns and game preferences of G1 (individuals aged 50-64 years) and G2 (individuals aged 65 years and over). Comparing these groups, G1 seems to play different types of video games. Thus, a new older gamer profile is emerging and it will bring challenges for game developers in terms of both accessibility, content and game mechanics.

The hypotheses formulated below concern: (a) gamer preferences according to age groups; (b) who participants play with; (c) the game preferences and the skills that players aged 50 and over want to practise and (d) the main game design components that encourage older adults to play.

On the question *Is there any relationship between the type of (video) games partcipants like to play and their age?*, the first hypothesis was formulated (H_1).

H_1: **There is a correlation between the types of games participants like to play and their age.** This hypothesis is supported by the differences in the type of games that over 49s players like to play. On the one hand, previous studies (Gajadhar, Nap, Kort, & IJsselsteijn, 2010; Nap, Kort, & IJsselsteijn, 2009) have indicated that most of their participants preferred casual games. On the other hand, some studies with a younger age group (Marston, 2012; Pearce, 2008) have found that their participants preferred another type of video games: role-playing, games of mystery and adventure.

Relative to the question "Is there a correlation between who participants live with and the mode of playing?", the second hypothesis (H_2) was formulated.

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H$_2$: There is a correlation between who participants live with and the mode of playing. In an experimental study with frail elderly, Gerling & Masuch (2011) explain that their respondents preferred solitary over multiplayer games. However, much of the research up to now does not compare the preferences about modes of playing (alone against the computer, against another player or as a team against another team) and who participants live with (in a residence for the elderly (full time), alone or accompanied at home).

The third hypothesis (H$_3$) is relative to *Is there a correlation between the type of games preferred and the skills that gamers want to practise?*.

H$_3$: There is a correlation between the type of games preferred and the game skills that players want to practise. This hypothesis is supported by a study under the Eldergames (2006) project. The study has reported that older adults' favourite games were word and memory games, followed by games of chance. Memory and attention span were the skills that older adults would like to practise. However, none of the studies reviewed so far mention whether there is a correlation between the types of games played and the skills that this target group want to practise.

The fourth hypothesis (H$_4$) is relative to *What are the main difficulties that these age groups have with games' interfaces?*.

H$_4$: Older adults are encouraged to play by facing cognitive challenges and customizing their virtual worlds and their main difficulties are related to accessibility issues. Older adults are encouraged to play by a (a) game storyline that translates their daily lives and culture into game concepts; (b) the creation and customization of virtual worlds and avatars and (c) cognitive challenges. The head-up display (HUD) should not include number of lives and time control. Instead, game progression and mini-maps are valued. A set of guidelines for designing video games for older adults can be: (a) simplify the menu area and reduce the number of decision options; (b) have a minimum size for fonts and game objects; (c) avoid virtual violence; (d) place game objects visible in the angle of the camera; (e) avoid game objects, which do not have a purpose on the gameplay and (f) allow the user to choose between text-based and voice communication. This hypothesis was based on the field study conducted by the researcher in two day-care centres in Aveiro.

My personal motivations

In 2012, I embarked on a project called SEDUCE - Senior citizen use of computer-mediated communication and information in web ecologies. I became so involved with the project that now I still believe that developing multimedia applications with the elderly target in mind and, at least, trying to create products designed for all is worthy and the only way to succeed. Then, during my bachelor studies and MSc, I have been wishing to take part of a project related to video games. Luckily, it happens that video games are one of the main areas of interest and mastering of my supervisor. It also occurs that it is one of the areas of the social network site under development in the SEDUCE project. Finally, I wanted to study something risky, new and unexplored. There it was − Networked video games for older adults.

The Master's thesis structure

This master's thesis is divided into six Chapters and it includes an Introduction and a Conclusion. From Chapter 1 to Chapter 4, the literature on general aspects of ageing and video games is reviewed. Chapter 5 and Chapter 6 cover empirical studies, the proof of concept as well as the presentation, analysis and discussion of results.

Thus, the Chapter 1 is devoted to the general aspects of ageing. It presents the demography of population ageing and physiological, psychological and social effects. Then, in Chapter 2, information about the use of information and communication technologies (ICT) by older aduts is provided. This Chapter also concerns the use of computer-mediated communications and social network sites. Video games with a multiplayer dimension (MUDs) are covered in Chapter 3 (MUDs concept, origin and its potential for older adults). Chapter 4 gives an overview of designing video games for all, player-centred design, accessibility and usability.The last Chapters (Chapter 5 and Chapter 6) cover the applied social research method used, the proof of concept and discuss the main results. It concludes by summarizing the motivations and routines relative to video gaming when people are aged 50 and over and the game design components that game developers must consider when designing products for this target group.

Table 1 systematizes the concepts in their dimensions and variables.

Table 1. Analysis Model

CONCEPTS	DIMENSIONS	INDICATORS
Older adults	Socio-demographic	Age Geographic distribution Literacy Causes
	Physical	Visual impairments Audition Tactile
	Psycho sociological	Friendship networks Social support Companionship
	Cognitive	Memory Attention Language Numerical skills
Video games	Video games genres	Action Adventure Role-playing games Simulation Strategy Advergames Music games Sport games Casual games Educational games MUDs Single-player
	Game design	Storyline Gameplay Interaction Rules Goals Challenges Accessibility
	Game experience	Interaction Learnability Satisfaction Flow
Communication	Synchronous communication	Instant Messaging Online Communities Networked video games

«Aging is not lost youth but a new
stage of opportunity and strength.»

– Betty Friedan

CHAPTER 1: GENERAL ASPECTS OF AGEING

The demography of population ageing

People are living longer. According to the United Nations (2003), almost two billion individuals aged 60 and over will inhabit the world in 2050. In 2009, one out of nine individuals in the world was aged 60 or over and it is expected that this ratio becomes one out of five, by 2050. Moreover, there is an increase in longevity over time and female life expectancy outnumbers male life expectancy. As a consequence, the incidence of widowhood seems to be higher among women. In addition to this reality, an estimated fourteen per cent of world's older adults live alone. The continents where the percentage of older adults living alone is the highest, are Oceania (16% men and 34% women) and Northern America (15% men and 34% women), followed by Europe (14% men and 34% women). The population aged 60 or over is expected to increase sharply over the period 2000-2050. The chart (*Figure 1*) shows the current and predicted number of people aged

60 or over (divided into world, more developed regions and less developed regions) during
1950 until 2050.
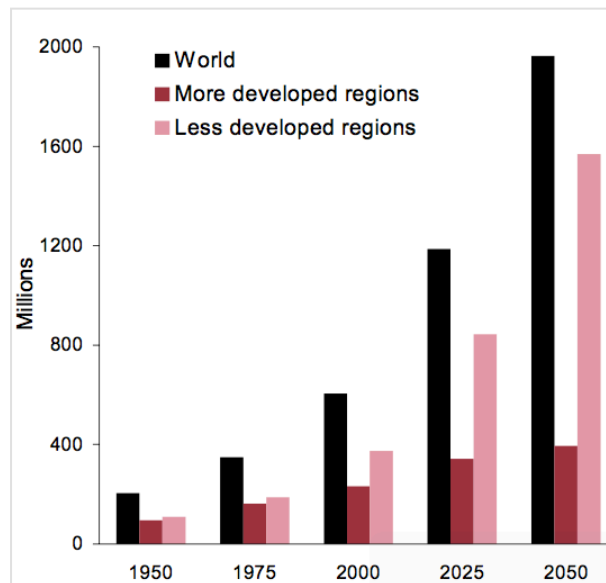
Figure 1. Population aged 60 or over, 1950-2050. Adapted from
"World population ageing 1950-2050" *(UN, 2002)*

In 1950, the population aged 60 or over gradually rose by 350 million (to almost
400 million) in 1975. Twenty five years later, the number was quite high, coming top with
550 million. The main causes for this steady growth were the lowered fertility,
emancipation of women (work status), increased life-expectancy and better health options
(Kinsella & Velkoff, 2001).

By 2025, those numbers will begin to leap upwards (1200 million) and reach a peak
of 2 billions in 2050. Throughout this period, the majority of older adults seem to live in
less developed regions, comparing to urban areas.

Overall, this ageing demographic scenario will bring new needs and require special
attention dedicated to the elderly. Nowadays, older adults are more prepared to cope with
ageing (Cable News Network, 1996, as cited in Aison et al., 2002) and these changes in
society create both challenges and opportunities.

The illiteracy rates are high. In Portugal, there is still a great number of illiterate
older adults.
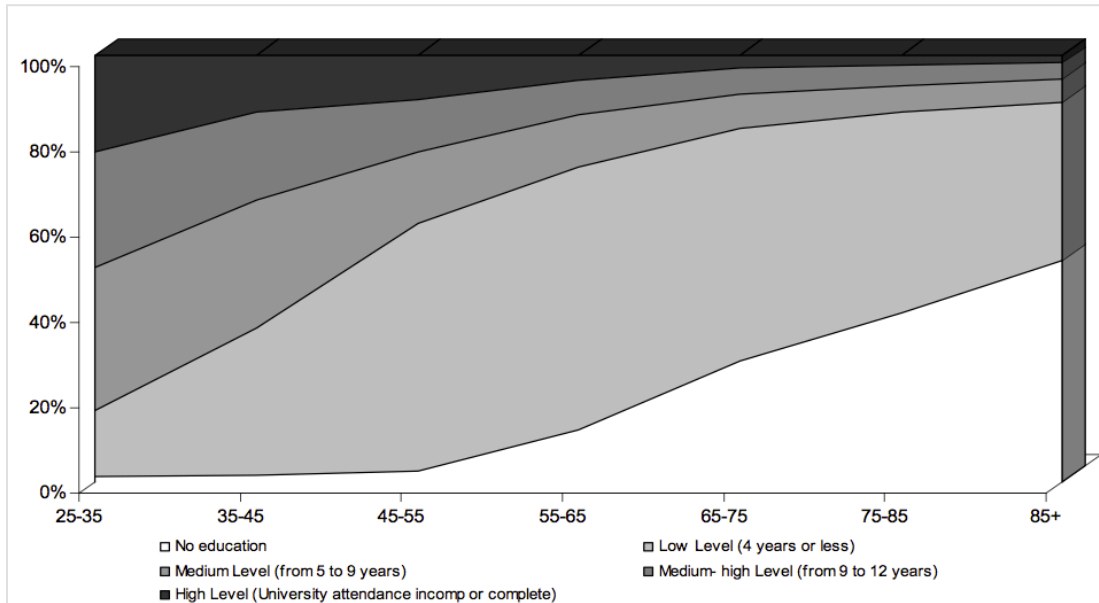
Figure 2. Portuguese Educational level by Age structure -2001. Adapted from "Eurostat – Work session on demographic projections" (Eurostat, 2010)

The chart in *Figure 2*[1] shows that the population aged 65 and over registers higher rates of illiteracy compared to the other age groups. The majority of oldest old adults (+85 years) have no education or the first four years of school. A similar reality is verified in the age groups of: 75 to 85 years; 65 to 75 years ; and 55 to 65 years.

This scenario may be due to the fascism period lived in the 30s until 1974. After the overthrow of Portuguese fascism, the younger generations had more opportunities, women's access to education has been recognized as a right and the level of education slightly increased to a medium level.

In sum, it is clear that it will take a long time to have higher rates of literacy among older adults. However, despite this fact, the convenience sample used in this study has high levels of education (between 15 and 19 years of school) and caution must be applied when analysing the results.

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[1] From "Eurostat – Work session on demographic projections" by Eurostat, 2010, Copyright 2010: Luxembourg: Publications of the European Union by the European Commission.

Physiological, psychological and social effects of ageing

We age from the moment we born. Ageing is a personal trajectory built throughout the years, dependent on our choices, decisions and results, which are shown in physical and psychological wellbeing (Hsu, 2010).

Older adults are becoming active in their daily lives and the population is becoming better prepared to cope with ageing (Demirbilek, 1999; Cable News Network, 1996, as cited in Aison et al., 2002). Nevertheless, many changes in the ageing process can take place in routines and skills during later life.

According to the World Health Organization (2008, p.10), active ageing is a "process of optimizing opportunities for health, participation and security in order to improve the older adults' quality of life". Besides that notion, being active implies communicating, interacting with others and having access to information (Ribeiro & Paúl, 2011).

The ageing paradigms have evolved in a progressive adjustment of what was considered in the last century, the fate of ageing (Paúl & Fonseca, 2005).

It is worth noting that, in the past, the ageing process drew the attention of a number of early philosophers. As cited in Paúl and Fonseca's (2005) book, entitled "Envelhecer em Portugal" [Ageing in Portugal], we outline the main ideas about ageing that ancient authors defended and that changed over time.

• According to Plato, ageing has been considered a continuity of life. Spiritual pleasures have progressively replaced physical pleasures.

• Aristotle listed four stages in human life and the last corresponded to senility and deteoration of capacities. Due to an accumulation of mistakes committed in the past, older people were seen as indecisive, suspicious, selfish and incapable of love.

• Hippocrates studied medical hypotheses concerning the ageing process. He defined age as a loss of heat and moisture in the body and he compared it to a clear flame that became tenuous and needed less fuel (to be fed up). The energy (internal heat, vital spirit) was given to each individual at birth and with their growth, this energy would extinct. This was a purely natural and irreversible phenomenon.

• Galen combined the Aristotelian theory and the Hippocratic observation method to explain ageing. According to him, elderly was a result of body's dehydration, which was progressive until the skin shrivelled, the body waned and the members became weak and shaky.

Other thoughts about age have been followed over decades. Erikson's stages of psychosociological development associated both contrast feelings of ego integrity and despair to the wisdom generation (late adulthood). He believed that in order to achieve ego integrity, people needed to take responsabilities for their actions. Older adults, who arrived at this sense of achievement, would feel complete. According to him, later life was related to retrospective moments and the existential question: "Is it ok to have been me?" . Then, Schaie (1992 as cited in Paúl & Fonseca[2], 2005) emphasized that although cognitive decline occurs in many individuals after 60 years old, it does not reach all functions to all individuals uniformly, even after 80.

Nowadays, there is a new perspective of ageing. It is seen as a result of years of life with health and independence, functionality and participation. In Portugal, the legal aspect supports the concept of older adult as being the population aged 65 or older. This indicator is also used by 75% of world countries (UN, 2003). This chronological age is used as a standard for comparison in most scientific studies, however, this indicator is limited because getting old is a continuous process of changes and varies from people to people.

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[2] From "Envelhecer em Portugal" by M.C.Paúl and A.M.Fonseca, 2005, Lisboa: Climepsi. Copyright 2005 by the Climepsi Editores.

Physiological effects of ageing

In later life, there is a decline in physical functioning. Many physical changes encompass the general decline in the senses of sight, hearing and balance and in the function of important organs (such as heart, lungs and kidneys, muscle mass, hormone levels and brain).

As we can see from *Figure 3*, visual impairments are the biggest constraint faced by the elderly. It is followed by dementia and hearing problems (WHO, 2012). The changes that occur in perceiving visual elements and hearing are very important to game design. Thus, **Table 2** gives an overview of some physiological effects of ageing and the implications for game design.
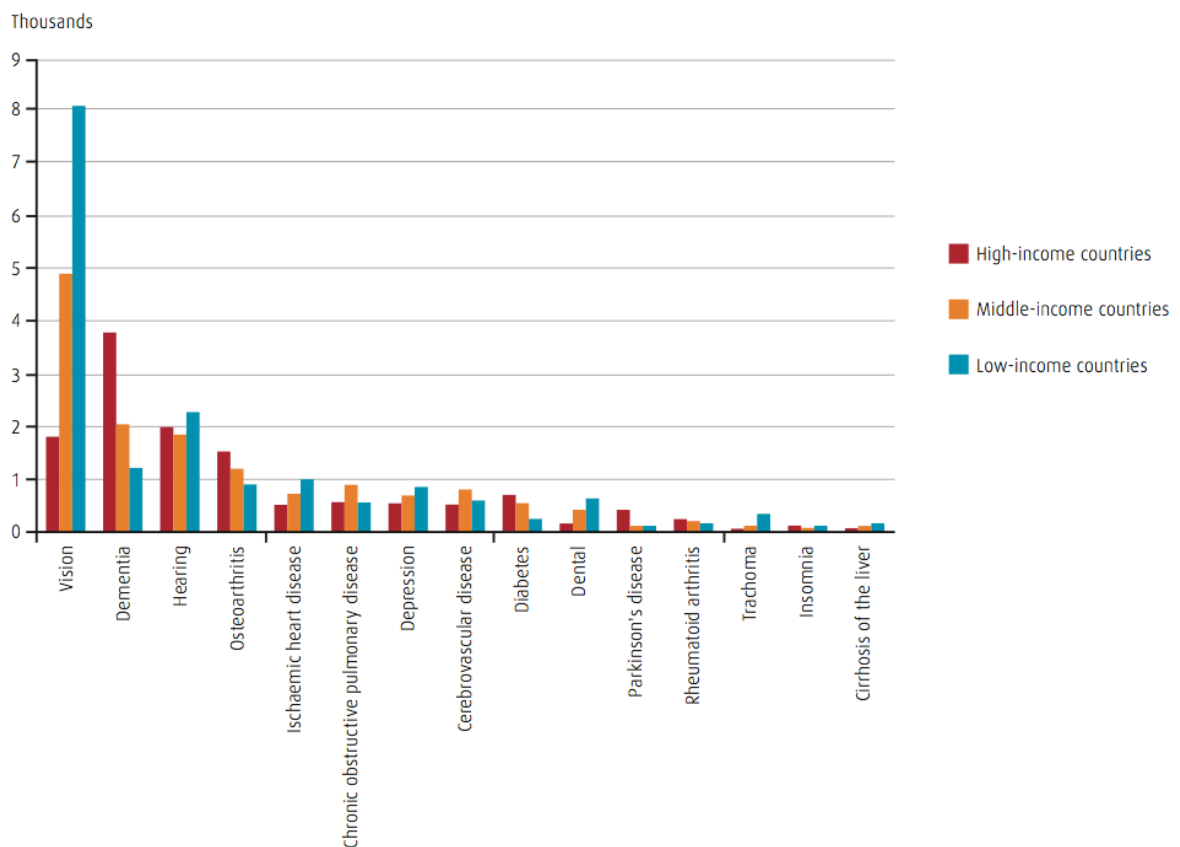
Figure 3. Years of life due to death per 100 000 adults aged 60 and older by country income group. Adapted from "Good health adds life to years: Global brief for World Health Day" (WHO, 2012)

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Table 2. The physiological effects of ageing and the implications for game design

(Haegerstrom-Portnoy, Schneck & Brabyn, 1999; Fisk et al, 2009; Helfer & Freyman, 2008; Ablegamers, 2012)

EFFECTS OF AGEING	DESCRIPTION	GAME DESIGN
Visual impairments	- Difficulty in adapting to darkness and large changes in illumination; - Low contrast; - Colour vision; - Sensitivity to glare; - Reduction in peripheral vision, field of view and speed processing; - Difficulty in focusing.	- Games scenarios should be balanced in terms of darkness and light; - Provide colour blind options; - Establish a minimum size for game objects; - Adjust the field of view of the camera; - Be consistent to quantity of light/darkness in different scenarios.
Audition	- Sounds above 4000 vibrations per second or low-range tones are inaudible (100 cycles); - Peripheral hearing loss; - Pure-tone hearing loss; - Difficulty in perceiving speech sounds distorted by noise.	- Incorporate subtitles; - Separate ambient noise from the character speech; - Identify the speaker;
Tactile	- Decrease in sensitivity of touch, vibration and temperature; - Loss of kinesthetic sensitivity; - Movements are less precise and slower.	- The challenge of the game should not be on speed/time (avoid *"twitch"*[3] games); - Change keyboard settings; - Give the option of either interacting with keyboard or mouse;

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[3] Games that test reaction time

Cognitive and psychological effects of ageing

Previous studies (Van Hooren et al, 2007) have demonstrated that the ageing process is usually accompanied by a decrease in certain cognitive functions. Often these changes may result in a decline of older adults' quality of life.

Older adults usually have difficulty in tasks that involve reaction time, motor coordination, short-term memory, and abstract or complex conceptualization (Lezak,1983, as cited in Aison et al., 2002). The cognitive skills more affected to decline are: perceptual speed, memory, visual-perceptual functions, verbal and numerical skills (Pires, 2011).

However, brain's plasticity and neural flexibility maintain throughout later life (Schaie and Willis, 1986, as cited in Aison et al., 2002). The **Table 3** presents the relationship between the cognitive effects of ageing and implementations for game design (p.19).

Concerning the psychological effects, several studies (Forsell, Jorm & Winblad, 1994, as cited in Pires, 2011) revealed that cognitive decline seems to be associated with depressive symptoms. Older adults have more difficulty in understanding complex or long messages, reasoning tasks involving logical analysis, capacity of recognition, selecting information and task performance involving time and speed (Vaz-Serra, 1996, as cited in Pires, 2011).

Furthermore, according to Junqué and Barroso (2011, as cited in Pires, 2009), there is a decrease in the dopamine[4] levels and alls enzymes related to neurotransmitters, during the ageing process. Video games can play a leading role to solve this problem. Crawford (2003) and Green and Bavelier (2006) highlight that the substance of dopamine is released in the players' brain when they feel being rewarded by their efforts. In addition, Green and Bevelier (2006) also performed a series of experiments in lab rats that suggest that these levels of dopamine released can be crucial to the modifications in the brain after training.

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[4] Chemical in the brain that acts as a neurotransmitter

Table 3. The cognitive effects of ageing and the implications for game design

(Fisk et al, 2009; Helfer & Freyman, 2008; Spence & Feng, 2010; Dye, Green & Bavelier, 2009; Crawford, 2003)

EFFECTS OF AGEING	DESCRIPTION	GAME DESIGN
Memory	- Loss of working memory; - Long term memory is also affected (e.g. historical and cultural facts); - Difficulty in manipulating objects in space (spatial cognition); - Declines in knowing how to perform tasks (procedural memory);	- Through the repetition of in-game tasks, older adults can train working memory; - Games-based learning can improve long term memory and simulators can stimulate procedural memory; - Video games can be beneficial to spatial tasks/skills. They place every object and character on space (virtual environment); - Promote procedural memory trough tutorials *("well learned procedures")* or training *("extra learning time")*.
Attention	- Decrements in selective and divided attention.	- Video games enhance visual selective attention skills and help on decision-making.
Language and Numerical skills	- Difficulty in speech and language comprehension; - Numerical skills decline with the ageing process.	- Video games speed the process of decision-making; - Games can stimulate reading comprehension and spelling through the game story and descriptions of the scenario.

Social effects of ageing

Friendship networks also dwindle as life goes on (Kalmijn, 2003). Recent studies (Shaw, Krause, Liang, & Bennett, 2007) state that social support levels and older adults' contact with friends decrease with age. However, the emotional support given and close relationships maintain stable. Older adults can experience different types of social losses, such as: loss of others (death and distance) and social support (isolation). In later age, it seems that people with socio-economic disadvantage have smaller social networks and are less satisfied with the support received (Antonucci, 2001, as cited in Pires, 2011). As these successive losses occur, the greater the chance of perception of isolation and depression. **Table 4** illustrates some social effects of ageing and its implications for game design.

Table 4. The social effects of ageing and the implications for game design

(Rook, K. S., & Ituarte, 1999; Griffiths, Davies & Chappel, 2004; Crawford, 2003; Jansz & Martens, 2005)

EFFECTS OF AGEING	DESCRIPTION	GAME DESIGN
Lack of social support *(In some cases)*	- Friendship networks dwindle as life goes on; - Older adults' families are associated to social support whereas friends to the sense of companionship.	- Online game-playing promotes new social relationships between players; - Women are more attracted to the social component of video games than men; - Game designers should consider the players' context and preferences when thinking about digital identity, gamers' avatars, anonymity and computer-mediated communication services; - Social isolation is often seen as consequence of playing video games.

As described on this Chapter, ageing combines a demographic, physiological, psychological and social phenomena. However, it takes part of an individual process that varies considerably among different people.

«The machine does not isolate man
from the great problems of nature but
plunges him more deeply into them.»

− Antoine de Saint-Exupery

CHAPTER 2: THE USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGIES (ICT) BY OLDER ADULTS

Information and Communication Technologies (ICT) enable older adults to socialize without the interference of mobility barriers. Therefore, ICT has a direct bearing on older adults' wellbeing, quality of life and sense of independence (Karimi & Neustaedter, 2012).

Concerning the representation and use of digital technologies by different groups of Portuguese older adults, Dias (2012) stresses that the types of equipment which predominate in households, are televisions, mobile phones and landline telephones. The laptop and desktop are present in younger age-bracket groups' (55-65 years old) households. Overall, there is a lack of computer access and, as a consequence, a

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Portuguese technology illiterate audience (see *Figure* 2). According to Dias (2012), the reasons for using technological devices by this age group are: (a) communication; (b) need for research; (c) information retrieval; (d) entertainment and (f) leisure.

Information and communications technology (ICT) can enhance knowledge sharing as it lowers temporal and spatial barriers between users (Hendriks, 1999). As modern life has become digital, the independence of older adults is being threatened by digital divide.

Nowadays, older adults rely on ICT to learn, increase the number of friends and eradicate loneliness. In most cases, they use the Internet to research and send e-mails (Yao, Qiu, Huang, Du, & Ma, 2011).

Nevertheless, many factors seem to affect ICT use by this age group. According to the authors Yao et al (2011), some of the psychological barriers related to the use of technological devices are:

i. Anticipation and anxiety verified during the difficulty in interacting with technological devices;

ii. The assumption that age negatively influences learning;

iii. Fear of criticism and humiliation, considering this age group's slower learning pace;

iv. Disinterest for learning.

Furthermore, older adults tend to assume that Internet is a tool to achieve functional goals (e.g. payments, sending emails, reading news) and they do not seem to consider it as a source of information and social interaction at first (Gibson et al., 2010). In most cases, older adults only recognize the advantage of e-mail and they fear other tools for complex tasks (e.g. information sharing, blog and videos).

As a matter of fact, older adults learn more easily through interaction with society than the traditional learning, such as books or final assessments (Chen, 2009). In order to overcome some difficulties in interacting with technological devices, they must take part of the development process of multimedia applications, contributing to its improvement (Xie, 2003). The challenge for interface designers is to ensure that the information is easily accessible, visible and clear.

Computer-mediated communication (CMC)

Computer-mediated communication (CMC) can be defined as alternative means of managing social relationships and using a medium to transmit the message. According to December (1996), it is a process by which people create, share and grasp information using telecommunication systems via the Internet. Moreover, they ease the encoding, transmission and decoding of messages. Júlio (2005) points out that CMC only brings new ways of interpreting what is being written and shared.

The main advantage of CMC is to enable the interaction across long distances and reduce time constraints due to asynchrony (Daft, Lengel et al, 1987, as cited in Vlahovic, Roberts, & Dunbar, 2012). The effectiveness of different modes of CMC can have a huge impact not only on the number of social connections but also on building emotional and intense relationships (Pollet et al, 2011, as cited in Vlahovic et al., 2012).

Technologically mediated communication tools provide social support. Bordia (1997, p.99) states that discussions on CMC seem to "take longer, produce more ideas and have greater quality of participation". Moreover, the use of CMC tools such as email, chat rooms and instant messaging may be associated with the decrease of depressive symptoms. These services facilitate the communication in time of people who are not in the same location.

The text-based tools are best suited for task scheduling, considering the fact that they reduce the social context and ease the development of closer and intimate relationships with the absence of visual cues on emotions. On the other hand, face-to-face is more suitable for complex tasks, in which interactions are intensive (Xie, 2008).

Communication media can be arrayed along a hierarchy of richness (Face-to-face, telephone, addressed and unaddressed documents). This hierarchy is based on the multiple communicative cues, immediacy of feedback, language variety and personalization of messages (Vlahovic et al., 2012). Thus, the richest medium is face-to-face meetings, followed by telephone, e-mail, memos and letters.

Moreover, CMC is divided into asynchronous and synchronous communication services. For the purposes of this study, only instant messaging, online communities and multiplayer video games are covered.

Instant Messaging

Instant Messaging is a service of synchronous communication (which works in real time on a computer network (e.g. Internet)) whose messaging is done through different types of media: text, video, voice and embedding hyperlinks (Lipschultz & Musser, 2007). In this type of computer-mediated communication (CMC) mode, users do not have to share the same physical space to communicate with one or more users and they assume an online identity that can be real, fictional or anonymous.

This service consists essentially of two areas of interaction (Dewsbury, Sommerville, Bagnall, Rouncefield, & Onditi, 2006): i) the dialog window in which users exchange messages and ii) the status window that informs the user about their status (who's online, (in) available to communicate and who sent the message).

A set of users registers is connected to the network server - the Internet. In general, the software checks their names from a contact list and all logins are reported to the community - notifying the users. Clicking on the icon representing the individual or group, it initializes the conversation and users can represent themselves with *avatars*. Their communication occur in real time, whereby the scroll plays a crucial role in viewing old messages (Preece, 2000).

In synchronous communication, participants have to share the same timeslot in order to maintain the conversation flow between users. However, there is no need to share the same spatial dimension. There is no time for delays or corrections and this format is difficult for the majority of older adults who write the text slowly.

According to Xie (2008), the Instant Messaging is used to enhance communication and interaction with friends or family whereas chat rooms are intended for new relationships and the creation of weak ties in the community. Whereas Instant Messaging and online forums serve as emotional and informational support, voice communication is associated with fellowship and fun.

Synchronous communication tools also allow informal discussions and socialization. A study conducted by the University of Dundee (Prior, Arnott, & Dickinson, 2008) revealed that their respondents found that the traditional interface of instant

messaging was easier to interact than a metaphor-based interface[5]. However, they preferred the metaphor-based.

The design of synchronous communication interfaces should take into account some guiding principles, such as the linear progression of tasks, number of choices and clarity of the language used (Prior et al, 2008). Therefore, the following requirements (Norman, 2007) should be considered:

i. Aesthetic and emotional design: the appearance of the multimedia application should be appropriated to the context of older adults. This audience should feel confident while interacting with the service for the first time. At the same time, it should be conservative and authentic;

ii. Usability: the multimedia application should be easy to use without the need for auxiliary aids. The interaction should be natural and intuitive;

iii. Familiarity: It must be adapted to vision and hearing abilities of older adults. Feedback messages should be familiar and products must always ensure their operation.

Online communities

The term "online community" addresses several areas, such as psychology, sociology and human-computer interaction. Hence, there is not a scientific and universal definition (Preece, 2000). In this study, we will consider that online communities are virtual spaces. Kim (2000) states that communities can be physical or virtual. However, its social dynamic is very similar. Both involve relationships between people with common interests (e.g. hobbies, political causes and neighbourhood).

Preece (2000, p. 348) defines 'online community' as "any virtual social space where people come together to get and give information or support, to learn or to find company. The community can be local, national, international, small or large." They encompass many advantages and disadvantages. On the one hand, online communities can overcome barriers created by distance and time, enabling members to maintain contact with others and develop social relationships.

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[5] The term is used by the authors to refer to an interface that combines a virtual environment, avatars and chat balloons.

On the other hand, due to its anonymity and intimacy, they can enhance the best and worst behaviour of its members. Communities can be of interest, relationships, fantasy or transaction (Iriberri & Leroy, 2009).

There is a life cycle for every online community, which is not linear and it integrates an iterative process, involving four stages. Those stages are (Iriberri & Leroy, 2009):

i. Inception: In this stage, a vision for an online community is formed due to the user's need to disseminate information, support, recreation and relationships. For example, gamers' communities bring video game players together to discuss and improve game strategies. For it, there are some online community elements that must be considered: a written purpose of the online community; codes of conduct, funding and revenue;

ii. Creation: Technological components that support the online community must follow its purpose;

iii. Growth: The creators have to ensure that the new members join and visit the online community. For it, up-to-date and quality content must be provided;

iv. Maturity: Members generate content, form subgroups and organize online events;

v. Sustainability or Death: Online communities can continue to grow or cease.

Similarly, Preece (2000) also divide online communities into four components of sociability framework that go in hand with the stages proposed by Irriberi and Leroy (2009). Those proposed components are:

i. People: They generate ideas, discussions and new content. People interact with each other and develop social relationships;

ii. Purpose: The main goals of the online community are related to the reasons for joining the community;

iii. Policy: they are established in online communities and regulated by a facilitator. These rules define how members should behave and interact with each other;

iv. Software: social interactions are mediated through software.

Overall, developers of online communities must take these stages of communities' life cycle into account and adapt new strategies to encourage a long-term participation. An up-to-date content should be provided, catering current and potential members' needs.

Turning now to another form of computer-mediated communication, the term social network sites (SNS) is frequently used in the literature (Ellison, 2007) to denominate virtual spaces where users' offline relationships are reinforced or maintained. SNS differs mainly from online communities (Ellison, 2007) by (a) being organized around people, instead of their interests; and by (b) having the main purpose of extending offline relationships. Facebook, twitter and linkedIn are some examples.

A social network:	An online community:
■ has an organizational structure focused around an individual user's one-to-one relationships ■ has weak secondary connections between members ■ allows its users to be members of many communities in the network at the same time ■ is good for sharing activities ■ is less effective at activities requiring cooperation and collective action ■ makes it easier for users to build communities	■ has an organizational structure focused around a shared purpose rather than one-to-one relationships ■ has strong, predictable secondary relationships among members ■ is distinct from other communities because of differences in purpose, policies, and computing environment ■ is good for activities requiring sharing and cooperating ■ is effective at providing the framework for activities requiring collective action ■ should not be confused with "adhocracies," "discussion groups," "forums," or "lists"

Figure 4. Comparison of Social Networks and Online Communities. Adapted from "Design to Thrive – Creating Social Networks and Online Communities that Last" (Howard, 2010)

Compared to social networks, online communities are focused on a common interest among participant. Online communities also strengthen weak social ties[6] between new members; they have a purpose, policies and are mediated by software; they regulate members' activites and promote a cooperative and collective encironment.

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[6] Granovetter (1973, p. 1361) defines social ties as the strength of a tie that results from the "combination of the amount of time, the emotional intensity, the intimacy and the reciprocal services which characterize the tie"

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Networked video games

Video games with a multiplayer dimension (MUDs) are also considered a form of computer-mediated communication (Utz, 2000). They can help on overcoming the lack of social cues and emotions as well as impersonality of other services.

The author Bruckman (1992) suggests that games are "*identity workshops*", considering the fact that they portray an analogy to real life. Moreover, video games tend to enhance the development of strong relationships among "digital tribes" of gamers.

The advent of the Internet brought players together (Jansz & Martens, 2005; Konijn, Utz, Tanis & Barnes, 2008). In fact, gamers build and strengthen relationships. They have an in-game social status and they share a sense of belonging to a gamers' community that provides social and emotional support. Players' context, difficult-to-express thoughts and emotions are brought to an online behaviour (Walther, 1996).

Nonverbal communication can be transmitted through avatars (Guye-Vuillème, Capin, Pandzic, Thalmann & Thalmann, 1999; Fabri, Moore & Hobbs, 1999; Mannien, 2003) and verbal communication can be done using videoconference, audio or/and text that is embedded on the in-game experience (Mannien, 2003).

Walther (in Utz, 2000) offers the Social Information Processing Theory (SIP) that explains how people interact, using computer-mediated services. In his theory, he argues that CMC can equally strengthen relationships comparing to face-to-face communication, whether prolonged in time. Video games encompass different challenges that maintain the player in gamers' community and, thus, they have the potential of stimulating "hyperpersonal" and intimate relationships.

Players seem to be more prone to provide positive feedback rather negative during their gameplay experience (Pena and Hancock, 2006, as cited in Konijn et al, 2008).

Because a social support network can influence the wellbeing of individuals (Paúl, 2005), networked video games can play a leading role in enhancing older adults' communication skills and provide social support.

According to Christou et al (2012), there are six requirements to design the communication system of a networked video game: (a) In-game communication, which is related to sociability between players during gameplay; (b) Off-game communication that

also involves extended support from online forums, wikis and other services; (c) Empathy: the sense of belonging to a group (e.g. Alliances); (d) Grouping and rewards: Players form groups in order to achieve their goals and be rewarded for their actions; (e) Word design: Game is designed around social activities and group formation and (f) Designed relationships: The game play should encourage internal and external relationships between players.

In short, the advance of new forms of communication over time can enhance older adults' social presence, strengthen their relationships and increase their wellbeing and the sense of belonging to a community.

«David: Is this a game… or is it real?

Joshua: What's the difference?»

– WarGames

CHAPTER 3: VIDEO GAMES WITH MULTIPLAYER DIMENSION (MUDs)

Before proceeding to examine the concept of video games with multiplayer dimension (MUDs), it is necessary to discuss general concepts of games and computer games.

Games and computer games

The terms Play and Games are difficult to define and they seem to be intertwined. Play transcends any physiological or psychological phenomenon by going beyond physical or biological activity (Huizinga, 2004).

Given all the add-ons to the game concept, only the most popular will be highlighted in this Master's thesis. Some of these contributes to the game concept include

the founder of modern cultural history, Huizinga and the author of "Man, Play, and Games", Roger Caillois.

According to Huizinga (2004), play is a free and unserious activity, almost situated outside of everyday life. Indeed, it has no profit and it is spatially and temporally independent from real life. Reined by fixed rules, games also promote the formation of social groups.

Caillois (2001, p.63) goes further in his definition by saying that "play is a parallel, independent activity, opposed to the acts and decisions of ordinary life by special characteristics appropriate to play". Those characteristics are: (a) being free and voluntary; (b) independent from everyday's life; (c) uncertain - that is to say that the results are not predictable; (d) unproductive; (e) reigned by rules and (f) it creates an imaginary world towards "real life".

The author also lists four categories to classify different types of games:

• Agôn serves games, which reinforce the competitive element and involves feats of prowess (e.g. hunting, several sports, chess problems, duels, tournaments and war). There is a desire to win as the player relies directly on his will and his resources;

• Alea is the latin name for the game of chance. It demands calculation, regulation and total surrender to the whims of chance, fate and superstition. Dominoes and card games are an example;

• Ilinx creates a pursuit for motion, thrill and excitement. It fascinates and maddens the player by feeling "*directed, dominated and possessed by strange powers*" (Callois, 2001, p.78). The mountain climbing or tightrope walking are some examples of Ilinx;

• Mimicry provides simulation, illusion, imaginary and a make-believe world. Games, in which the player imagines being somebody else and living in an imaginary universe, are an example.

Video games are games mediated by some technological device. Two criteria are comprised in the term: the status as a "game" and the use of "video" technology.

Beyond the concepts given by Huizinga and Caillois, other insights are also considered.

The authors Salen and Zimmerman (2003, p.80) describe video games as "*a system in which players engage in an artificial conflict, defined by rules, that results in quantifiable outcome*".

Juul (2003, p.5) advocates that a game is "*a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values*". In his perspective, the player tries to influence the outcome. The consequences are a result of negotiable decisions. The game designer and programmer Sid Meier (n.d. as cited in Juul, 2003) states that a game encompasses interesting choices.

The idea of interactive electronic games has begun in the end of the fifties. It is believed that in 1958 (Wolf, 2001) the physicist Willy Higginbotham created a game on an oscilloscope in which people could interact. His aim was to captivate a group of visitors from Brookhaven National Laboratories. Then, tennis for two was born.

Meanwhile, television became an interactive gaming system due to the invention of Baer. He created a game that had the same mechanic of the current game called Pong. It was Home TV Game (Wyckoff, 2010).

The video game industry found its way through the arcade. In 1961, Steven Russel developed Space War and Nolan Bushnell adapted it to the arcade and renamed it to Computer Space. In 1972, Atari was founded and created Pong. The coin-operated machines met a golden age. Then, it followed consoles, portable consoles, and online games (Vaughan-Nichols, 2009).

Moreover, to this study of "Networked video games", it is important to highlight two events in the game history. In 1975, it is believed that Gun Fight was the first arcade shooter game using a microprocessor. At the time, duels in real time were possible (Kent, 2010).

In video games, the machine monitors game dynamics, rules, visuals and objects. The universe is virtual and the player interacts with others in order to achieve a given set of goals. Salen and Zimmerman (2004) have attempted to encompass different elements of game definitions proposed by several authors.

Elements of a game definition	Parlett	Abt	Huizinga	Caillois	Suits	Crawford	Costikyan	Avedon | Sutton-Smith
Proceeds according to rules that limit players	√	√	√	√	√	√		√
Conflict or contest	√					√		√
Goal-oriented/outcome-oriented	√	√			√		√	√
Activity, process, or event		√			√			√
Involves decision-making		√				√	√	
Not serious and absorbing			√					
Never associated with material gain			√	√				
Artificial/Safe/Outside ordinary life			√	√		√		
Creates special social groups			√					
Voluntary				√	√			√
Uncertain				√				
Make-believe/Representational				√		√		
Inefficient					√			
System of parts/Resources and tokens						√	√	
A form of art							√	

Figure 5. Elements of a game definition. Adapted from "Rules of Play: Game Design Fundamentals" by Katie Salen and Eric Zimmerman (2004), published by The MIT Press

Figure 5[7] shows the elements of a game definition outlined by different authors. From this data, we can see the most consensual information about video games: (a) it procceds according to rules that limit players; (b) it is goal and outcome – oriented; (c) it has a conflict; (d) it is a voluntary activiy/process/event; (e) it involves decision-making and (e) it is artificial/safe/outside from ordinary life.

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[7] Fom "Rules of Play: Game Design Fundamentals " by Katie Selen and Eric Zimmerman, 2004, USA: MIT Press. Copyright 2004 by MIT Press. Reprinted with permission.

Crawford (1984) considers that the four common features to all video games are:

- Representation: it refers that games model every day's life situations as a "subset of reality". The player can be somebody else, living in an imaginary world;

- Interaction: The player has some influence on the game's world by seeking outcomes from his actions;

- Conflict: It is inherent in game goals. There are several obstacles hampering the achievements. Conflicts can be "direct, indirect, violent or nonviolent", however, they are always present;

- Safety: Video games can be a way of experience real situations through a virtual environment, without real damage.

Moreover, the authors Hunicke, LeBlanck & Zubeck (2004) created a MDA model that explains the way games work through three separate dimensions:

- Mechanics: The game mechanics is related to the vast amount of code, algorithms and rules that goes into constructing the world of the game;

- Dynamics: It is the function of mechanics. Dynamics explain how the game is played, the interaction between players, based on the mechanics;

- Aesthetics: It is related to the player's emotion state during the game. There are many elements, which can influence the emotional design of the game such as: sensation, fantasy, narrative, challenge, fellowship, discovery, expression and submission.

Above all, video games should have a conflict (even if it is against an opponent or a circumstance), rules, goals and skills that determine the player ability or luck and lastly, an outcome. This outcome can be translated into achievements, winning or loosing and attaining the highest score.

Video games genres and taxonomy

Within game studies, there has been a lack of consensus in categorizing video games. Indeed, when a video game comes on the market, which does not fit into the existing categories, it draws attention to a new genre of video games (Veloso, 2006). Taxonomy is a way of grouping and dividing related objects by its properties into categories.

In the field of video games, games are categorized based on their gameplay and challenges. Because the game design is very mutable, it is "impossible to devise a single or absolute taxonomy" and "many taxonomies are admissible" (Crawford, 1984).

According to Crawford (1984), video games are divided into two major categories: Skill-and-Action Games and Strategy Games. Thus, Skill-and-Action games use motor skills and Strategy games may not.

The author Myers (1990, as cited in Duin, Hauge, Hunecker & Thoben, 2011) proposes the classification into Arcade, Adventure, Simulation, Role-play, War and Strategy games.

As for Rollings and Adams (2003), the video game genres are action games, strategy games, role-playing games, sports games, vehicle simulations, construction and management simulations, adventure games, artificial life, puzzle games and online games. Among those different video game categories, a brief definition of the most known genres is presented according to the gameplay criteria as well as its purpose.

Considering the gameplay, video games can be classified as:

• Action games: The emphasis of gameplay is on the action. It demands for quick reflexes and timing to overcome obstacles. This category encompasses Hack and slash games (combats), First-person shooters (fps), Fighting games, Pinball and Platform games.

• Adventure: Unlike action games, the focus is not on action-based challenges and time constraints. They often require solving puzzles by interacting with people or the environment. They are characterized by dialog boxes and sprites, which determine the speaker (a special feature from visual novels – *Figure 6*). Games like Adventure (1979), Zork series (1980); Myst (1993) and The Longest Journey (1999) are some examples.
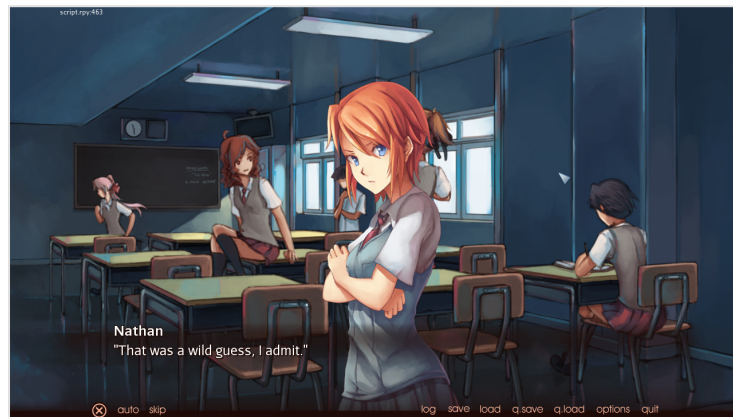
Figure 6. Visual novel. Adapted from "Cradle Song, New Visual
Novel/Game for Linux" (http://www.ubuntuvibes.com/)

The category of Action-Adventure games resulted from the combination of action
and adventure game elements. These games tend to focus on the exploration of the virtual
environment and may involve item gathering, puzzle solving and combat. Besides that,
they allow different endings according to players' actions and resemble mixed-media
novels.

• Strategy: Strategy games can be focused on strategy or military tactics. To
achieve victory, it requires skilful thinking and plans from the player. The games Battle for
Wesnoth and Civilization are some examples;

• Role-playing games (RPG): In RPGs, the player manoeuvres the character
through an adventure. The gamer specializes in specific skills and progresses through the
storyline. Final Fantasy is an example;

• Vehicle simulation: Vehicle simulations allow operating various types of
vehicles (e.g. flight simulations, car race, piloting a spacecraft);

• Music games: It consists of a sequence of movements and rhythms that the
player has to follow (e.g. the game Simon says).

Considering the video game purpose, they can be classified as:

• Advergames are promotional and its aim is to advertise a product, service or
even a viewpoint (e.g. the Nesquik and the Coke Zero game);

- Art games emphasize on art and stands out for aesthetic beauty. Video games are seen as an artistic display. Velvet Strike is an example;

- Casual games has the purpose of entertaining and no commitment is required (e.g. puzzles and word search);

- Educational games and Serious games: In educational games, there is an attempt to teach the user. Serious games intend to educate or train the player. An example of serious games is CityOne (IBM);

- Sport games: These games are usually competitive and adopt as a concept sport activities.

MUDs concept and its origin

MUDs concept

MUD (Multi-User Dungeon or Multi-User Dimension) is a game category used to describe multi-user, text-based and networked computer environments with highly developed social systems. These games are designed with a "*real-world metaphor*" (Curtis & Nichols, 1994 p.1). The *mudder*[8] has to log into the server hosting the MUD via telnet or special MUD software. MUDs database is shared and contains several rooms (places), mobs (characters), exits and other objects. The emphasis of these games is on gathering and chatting in a virtual social environment.

According to Bartle (1990, as cited in Ammer, 1996, p.6), MUDs and similar networked games are defined as:

"Interactive, multi-player computer games' are those computer-run games where the individual players can issue commands which affect the way the game treats other players"

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[8] Mudder is the name used to refer to players who play MUDs.

However, Curtis (1992, p. 347), points out that MUDs are:

"(...) not goal-oriented; it has no beginning or end, no 'score' and no notion of 'winning' or 'success'. In short, even though user of MUDs are commonly called players, a MUD isn't really a game at all."

There are several games elements, which define MUDs (Curtis, 1992[9]):

• There is a description of where the player is. Objects are spread in the scene and the player can interact with other characters (called mobs);

• The character's actions can be typed and those commands entered in the client program are sent to the server. Then, the server uses a *parser*[10] to interpret the command, queries the database and sends the answer to the client screen;

• The scenario is composed of connected locations, called rooms, in which characters sign their presence and conquests through their names in the particular location, move and interact with other players;

• The exits allow character's move between rooms;

• MUDs are not directed to a single goal. They are extensible, regarding the fact that users can add new objects, rooms and descriptions and have more than one user connected (Curtis, 1992);

• There is a Master. The master creates goals translated to missions/quests, such as: looking for someone or a particular item. Known by "God" or "Wizard", this entity can judge, warn and punish players who disrupt the game progress;

• MUDs establish the interaction in real-time and have a history mechanism which allow the log of communications and save the place where the player was;

• In MUDs, people construct their personal identities, establish friendships and exchange the valuable items.

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[9] From "High Noon on the Electronic Frontier: Conceptual Issues in Cyberspace" edited by Peter Ludlow, 1996, Sabon: Northeastern Graphic Srevices, Inc. Copyright 1996 by Massachusetts Institute of Technology . Adapted with permission [Scholarly Publishing –"Fair use"].

[10] A program that is used to compile, divide and analyse each online command

- In MUDs, status quo is measured through the experience of the character. The server stores where the registered player was and his owned items for future meetings. As time passes, characters grow, learn new things and gain life experience;

Moreover, the MUD typology includes four characteristics (Bartle, 1996):

- Achievement within the game context. The achievers are also called Diamonds and they are always seeking achievements – treasures, coins and points. They concentrate on the game's action;

- Exploration. The explorers are known as Spades and they explore the environment, digging around for information;

- Socialization with others. Socialisers (Hearts) are focused on empathising with other players;

- Imposition upon others. The Killers (Clubs) are concentrated on helping or attacking other players.

MUDs have a crucial role in projecting inner fantasies, expanding a social reach, bringing intimacy and constructing virtual experiences for new identities.

MUDs origin

The origin of MUD lies on Adventure games. Developed in late 1970's, adventure games were text-based and consisted of many labyrinths in which the player had to find a treasure. In 1978, Roy Trubshaw and Richard Bartle, two students from Essex University, developed the first MUD *(Figure 7)*.

As mentioned before, MUD stands for "Multi User Dungeons" and for that reason, many authors state that what inspired these students was the RPG called "Dungeons and Dragons". However, there is also a theory that Dungeon refers to the game Dungeon – the origin of the text-based adventure game, Zork *(Figure 8)*.
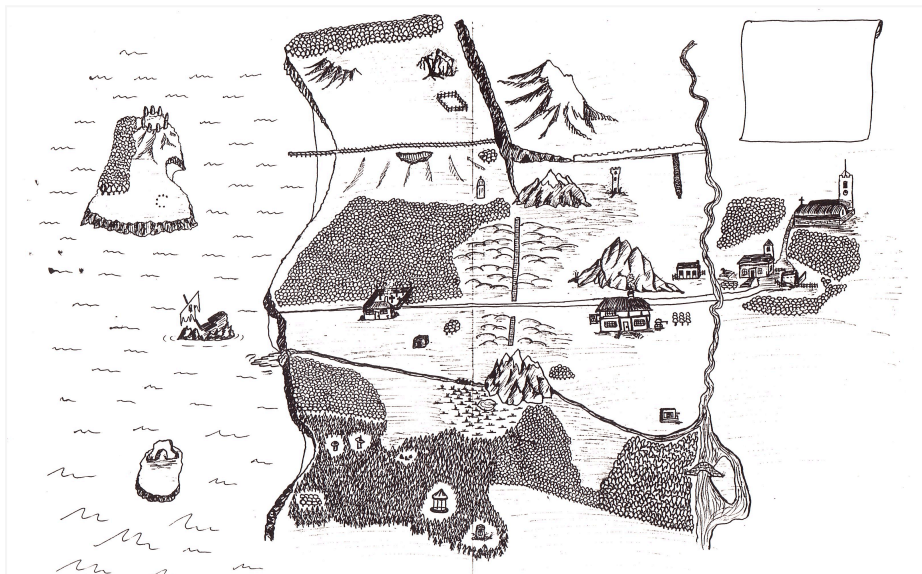
Figure 7. Map that originated MUD1. Adapted from "Essex MUD"
(http://www.mud.co.uk/richard)[11]

Thus, the first MUD, "MUD1" was developed in 1979. The original was known as "British Legends" and evolved to MUD1 and MUD2. The aim of the game is to fight, kill the game's creatures and become a wizard or a witch.
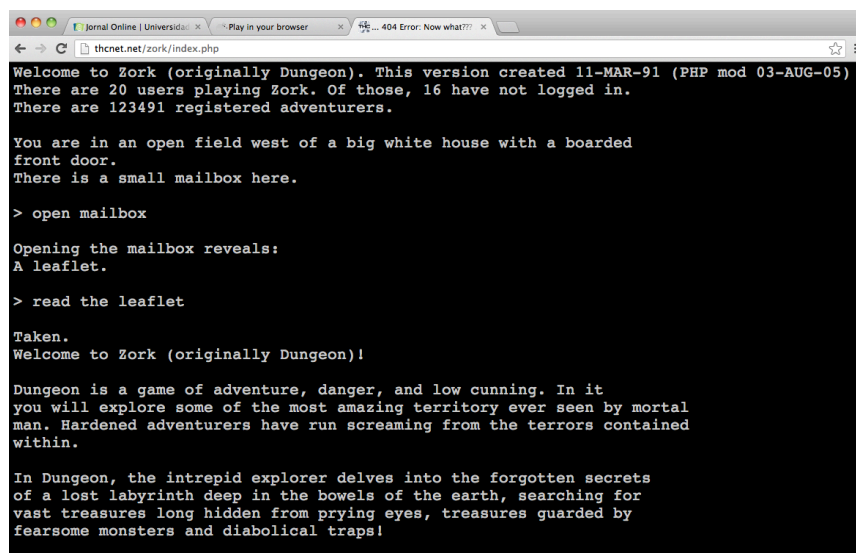
Figure 8. Screenshot of Zork gameplay (http://www.thcnet.net/zork/index.php)

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[11] From "Essex MUD" by Richard Bartle. Copyright 1983 by Roy Bartle. Adapted with permission.

In the mid 1980s, playing most MUDs demanded a modem connection to an online service (i.e. Compuserve/Micronet). In order to have access, players had to pay to the proprietary network or the telephone company.

In 1989, Jim Aspnes, a student at Carnegie Mellon University, created the TinyMUD. This category of MUD allowed individuals to contribute to the virtual world building by adding locations and objects through scripting language. Then, it followed some important features such as teleporting and character recycling. Islandia, a TinyMUD from the University of Berkley, had a huge success in this category.

Then, in 1990, Stephen White created the MUD object-oriented (MOO). It supports graphical interfaces and it is primarily social. Players take part in role-playing and meetings with the aim to communicate, socialize, build houses and solve quests.

Today, thousands of gamers join together and they are connected to the same server. Massively multiplayer role-playing games are growing fast (Achterbosch, Pierce & Simmons, 2008) and they have evolved from the MUDs concept.

Multiplayer video games for older adults

Older adults are likely to be the next generation of gamers. Younger generations tended to dominate the gaming world, however, as a growing number of older adults become players, they tend to play games more frequently (Lenhart et al., 2008). Despite the fact that there have been few empirical studies about video games for older adults, Nintendo and developers of casual games have also begun to cater for the older player.

Due to the social component of video games with a multiplayer dimension, they have a huge potential on the older adults' community. Nevertheless, playing MUDs has not been regarded as serious cultural activities and they are known to be hard to play (Calleja, 2008).

Video games can also have benefits to the elderly. New studies indicate that a better cognitive functioning is positively correlated with the fact whether older adults play video games (Whitlock, McLaughlin, & Allaire, 2012). Memory is trained and games may stimulate playing with friends (Gamberini, Barresi, Maier, & Scarpetta, 2008). Thus, networked video games could be of great value for isolated and less mobile older adults.

Furthermore, games can also challenge the thinking process, exercise hand - eye coordination and enhance self-esteem (Gamberini et al., 2009).

According to De Schutter & Abeele (2008), there is a model that indicates the three elements chosen by older adults as values of video games. The Meaningful Play in Elderly (MPE) model can be translated to:

• Connectedness. Video games should promote the connection between players, friends and others (i.e. multiplayer options and forums);

• Cultivation. Games should stimulate learnability and progression through cognitive challenges;

• Contribution. Older adults value video games that contribute to society.

Studies on older adults and video games have suggested that games should have a purpose or values (De Schutter & Abeele, 2008). Intellectual challenges must predominate over reflex-based games (De Schutter & Abeele, 2010). Moreover, older gamers seem to prefer computers to play and virtual worlds "have yet to catch on" (Lenhart et al., 2008).

A recent study (Derboven, Van Gils, & De Grooff, 2011) which establishes a comparison of the gamer experience between older adults and their grandchildren, showed that video chat provided opportunities for youngsters to assist the elderly during the game. The intergenerational TranseCare shopping game was created and the main goal was memorizing items on a common shopping list. As a result, the study's participants highly valued this direct communication for knowledge sharing and in-game collaboration.

Several studies have emphasized that multiplayer video games can help older adults to overcome communication problems and social isolation (De Schutter & Abeele, 2008; Derboven, Van Gils, & De Grooff, 2011; Ijsselsteijn, Nap, De Kort, & Poels, 2007a; Whitcomb, 1990). Nonetheless, some authors have pointed out that this target group did not react particularly positively to the online co-play experience (De Schutter & Abeele, 2010; Gajadhar et al, 2010).

According to Derboven et al (2011), older adults seem to be less concerned about their performance compared to other players. In an experimental study with frail elderly, Gerling & Masuch (2011) explain that their respondents preferred solitary over multiplayer games.

However, playing against other players seemed to have increased the flow comparing to the computer opponent.

It is believed that four players is the ideal number for a game as it allows the perfect dynamic for feeling involved and having a fluid communication (Eldergames, 2006). Anonymity is very important in order to facilitate the social support and thus, it should be considered when designing multiplayer video games (Pfeil, 2010, as cited in Siriaraya & Ang, n.d.).

Overall, the main reasons, which lead older adults to play, are the escape from reality (Pearce, 2008) and social fun (Marston, 2012) and designers of video games should focus on a cooperative play instead of competition (Gajadhar et al., 2010). This target group also enjoys teaching and helping other players (Gajadhar et al., 2010). Finally, exploring the possibility of bringing up positive memories and simulate the world in a 3D virtual environment can help older adults on gaining control over environment and stimulating spatial memory.

As was mentioned in this Chapter, games with a multiplayer dimension seem to attract millions of people. The game's concept, its different types and targets have evolved in time and they are predicted to change in the next years. Thus, the social component of video games can help on overcoming older adults' loneliness and on increasing their social capital.

«People ignore design that ignores people»

– Frank Chimero

CHAPTER 4: DESIGNING VIDEO GAMES FOR ALL

Universal design has become a trend (Mace, 1997; Story, Mueller & Mace, 1998; Aslaksen, Bergh, Bringa & Heggem, 1997; Crews & Zavotka, 2006). Developing multimedia applications regarding the context and "everydayness" of users is a more productive way to direct the final product towards its costumer. The expression "designed for all" does not indicate that it is supported to all impairments, however, it overcomes some system's difficulties by respecting specific target's needs and, thus, trying to be accessible to a wider audience. Beforehand, it seems appropriate to design for a specific target group and then widen the audience (Grammenos, Savidis, & Stephanidis, 2009).

Video games demand a lot of mental and interaction skills. In many cases, they are inaccessible to people with permanent or temporary disabilities. The International

Gamer Developers Association (2004, p.3) aims to "develop methods of making all game genres universally accessible to all, regardless of disability". Therefore, a video game designer must consider that a game which appeals to mass audiences is different from saying that a game is for everyone (Grammenos et al., 2009).

In order to address video games to older adults, video games must provide a positive gaming experience.

Designing game accessibility and usability

Game experience involves evaluating its effectiveness, efficiency and learnability (IJsselsteijn, De Kort, Poels, Jurgelionis, & Bellotti, 2007b). However, evaluating only the usability components (effectiveness, efficiency and satisfaction) is insufficient when making video games accessible to the population.

Accessibility issues have also become of great importance to make games more playable by a wider audience. According to the association of Ablegamers (2012), 60% of adults use accessible features on computers even if they don't need them. Nevertheless, there is a cost associated with accessibility and usability. These worries demand time investment and knowledge in both areas. Despite the fact that the return on investment may be low, customer loyalty can be achieved through usability and accessibility evaluation.

The term accessibility describes opening games up to the disabled. Many people with impairments are excluded from computer games because of accessibility problems. Initially, games' accessibility has been regarded as an area of minor importance, although, games had been developed under the slogan "designed for all". Games should be playable by people with and without disabilities (Glinert, 2008) because among the users, it may be people who are impaired and people who are unable to use a mouse or keyboard and rely on assistive technology.

The Ablegamers association published an accessibility checklist, which can help adding accessibility for disabled gamers. For example, giving the option of customizing the keyboard, the camera or mouse sensitivity control can help with the mobility of players.

As for usability testing, it is one of the methods for "evaluating the ease of learning and use of products" (Sears & Jacko, 2007 p. 1130). It is related to the users' interaction with the system (e.g. video games, website interface). Shackel and Richardson (1991) defined the term as: "the capability to use by humans easily and effectively". According to the same author, the system must have some characteristics, such as: (a) Effectiveness (performance of executing tasks); (b) Learnability (the amount of user training and support); (c) Flexibility by allowing variation in tasks and; (d) Attitude/Satisfaction to use the application.

Wixon (2003 as cited in Newell, Arnott, Carmichael, & Morgan, 2007, p. 798) reinforces that "it is not accident that most usability testing involves encouraging entire design teams to watch the test, and it is well known that much of the effectiveness of the test comes from this active participation".

Regarding the video game context, the aim of testing on games is to remove constraints to play and having fun. For it, Csikszentmihalyi (1990) studied the optimal state of enjoyment where people are completely absorbed in the activity, called flow. The game elements that characterise the flow are: (a) a challenge, (b) a task, (c) the ability to concentrate on the task, (d) a sense of control over actions and of worry about losing control, (e) a loss of self-consciousness and (f) the transformation of time.
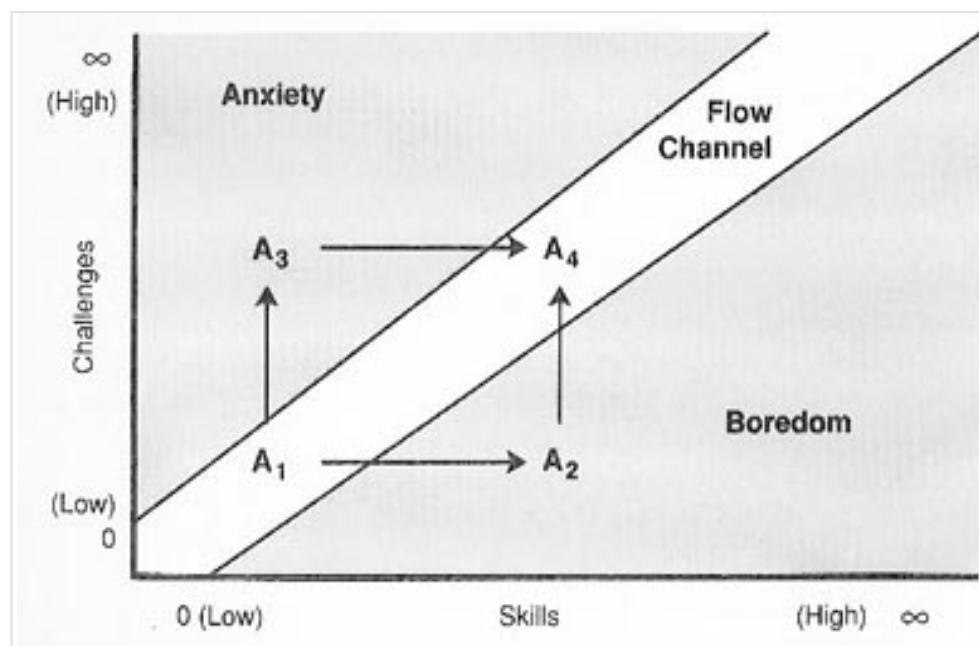
Figure 9. The flow channel. Adapted from "Flow" by Mihalyi Csikszentmihalyi (1990), published by HarperCollins

Figure 9[12] illustrates the flow channel. It compares the variables 'challenge' and 'boredom' during the game play experiences. A_1, A_2, A_3 and A_4 represent the player in different moments of the game.

- A_1 represents the moment when the player starts the game. At this moment, players have the initial skills and because the challenge is new, it overpasses their skills;

- A_2 indicates the moment when the player masters the challenge or his/her skills are stronger than the opponent. As a consequence, gamers may feel bored;

- A_3 moment occurs when the challenge is so high that the gamer can feel anxious or frustrated;

- A_4 is related to the optimal experience that occurs when the players' skills and games' challenges are balanced.

The most successful games are those in which participants can start at a level (Weisman, 1983) and there are some recommendations that can improve video games in terms of accessibility (IGDA, 2004). Kurniawan and Zaphiris (2005) also report some of these applied to other multimedia applications. These recommendations are:

- Provide a high contrast between the font and the background colour;

- Establish a minimum size of 3D objects, lower the density of objects in images and display elements closer to the centre;

- Simplify instructions, enhance the social component and create new learning;

- Allow the self-regulation of the levels of difficulty and the ability to move and resize the interface elements;

- Provide *remapable* keys, customizable configurations and the option of saving the game;

- For first person shooters (fps) and MMORPGs, the user has to be able to control the speed, angle and distance of the character in relation to the field of view;

- Display sound and dialogs in the form of text;

- Guide the user through the game by in-game tutorials and provide extra feedback;

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[12] From "Flow" by Mihalyi Csikszentmihalyi, 1990, HarperCollins Publisher.

Some of these recommendations were considered in the video game Dragon Age. In 2009, it was awarded with the title of 2009 Mainstream Accessible game of the year by presenting full subtitles, multiple alternative controls, diverse colour schemes, a "click-to-move" interface, the ability to pause the game and auto-save features (IGDA, 2004).

In the specific case of older adults, there are some other guidelines (Eldergames, 2006) to review: (a) Add categorization processes and problem solving in order to maximize the abilities of selective and divided attention as well as short-time memory; (b) Predominate collaborative dynamics over competition; (c) Integrate a 3D perspective of game elements with the aim of improving visual-spatial orientation, logical reasoning, perception, attention, concentration and strategic ability. Finally, (d) Enlarge the visual symbols.

Player-centred design

In order to design rich and rewarding experiences, we need to understand users so that, we collect data. In this regard, Jakob Nielsen (1993 as cited in Pruitt & Adlin, 2006 pg.8) states that:

> "It's necessary to know the class of people who will be using the system…
> By knowing the users' work experience, educational level, age, previous computer experience, and so on, it is possible to anticipate their learning difficulties to some extent and to better set appropriate limits for the complexity of the user interface…"

Older adults tend to want to praise developers and be positive about prototypes (Newell, Arnott, Charmichael, & Morgan, 2007). Thus, a User Centred Design (UCD) approach can facilitate the implementation of tasks and ensure that the person is able to use the product with minimal effort of learning (Abras, Maloney-Krichmar, & Preece, 2004).

As Preece, Rogers and Sharp (2004, p.285) states: "real users and their goals, not just technology, should be the driving development of a product". The term is also used to describe the influence of the user on the design process (Abras, Maloney-Krichmar, & Preece, 2004).

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As reported by Jokela, Iivari, Matero and Karukka (2003), UCD method encompasses four phases (Jokela, Iivari, Matero, & Karukka, 2003):

- Understand and specify the context of use: identify the users who will use the product, for what and in what circumstances;

- Specify the user and organizational requirements: identify the business and product requirements to be successful;

- Produce design solutions;

- Evaluate the design by usability testing to end-users.

Preece, Rogers and Sharp (2004) go further in these principles of user centred design, focusing on users and its tasks. According to them:

- The development of the final product is based on user's tasks and goals;

- The system is designed according to users' behaviour and the context of use;

- Information about users' characteristics is collected in order to design the software;

- From the earliest to the latest phase, users are involved in the design process;

- Users' context must influence all design decisions.

The Participatory design (PD) technique actively involves directly the end-user in the collaborative design process. According to Abras, Maloney-Krichmar & Preece (2004), PD (Muller, 1993) is a form of UCD that involves users as "design partners" in all phases of the design. This technique can enhance communication, teamwork, freedom to explore new ideas and provide new insights as well as different perspectives and knowledge (Sears & Jacko, 2007).

The literature on the subject suggests multiple ways to involve users in participatory design sessions, such as through high-fidelity prototypes, drama, games, sketches, brainstorming and scenarios. Among the techniques that can be used, there are some very well known. The mock-up design has the ability to provide users and designers fun, ease of understanding and they are low cost.

The contextual inquiry is used more in the areas of psychology and sociology. The process is guided by three main principles: (a) the context; (b) the dialogue between the designer and user and; (c) the focus of the study (Schuler & Namioka, 1993).

Another model used in the context of participatory design is the Plastic Interface for Collaborative Exploration Technology Through Video (PICTIVE), a technique that makes use of everyday materials like pieces of paper or plastic, scissors among others. The advantage of PICTIVE is in avoiding the need for specialized knowledge of users (Schuler & Namioka, 1993). In the next Chapter (Chapter 5: Empirical studies), the participatory design process of this study will be described in detail.

Game experience

Game experience is a term used to describe people's personal experiences while playing video games. Players build and exchange their experiences by bringing moments of their lives, knowledge, feelings, thoughts and desires into games. For Ermi and Mäyrä (2007, p.37), it "(…) *emerges in a unique interaction process between the game and the player."* Like user experience (UX), it involves immersion, presence, fun, engagement and flow.

The audio and visual elements are very important to create the game atmosphere (Almeida, 2009). Rolling and Adams (2003) state that aesthetics is more important than psychological analysis to the user experience. According to Griffiths, Gerald & James (1983), the video game experience is defined either occasionally or daily. Gamers do not have experiences if they have never played video games.

Despite the fact that studies on game experience have focused only on a single dimension (such as flow or immersion), Mäyrä (2007) advocates that this experience is pre- defined and (post) modified by multiple dimensions.

In this master's thesis, summaries of the concepts that characterize game experience (such as immersion, flow, learnability and satisfaction) are presented.

Regarding the concept of immersion, a research conducted by Brown & Crains (2004) related immersion to the game's realism. However, this assumption has not been

confirmed because there are games with realistic worlds in which immersion is not achieved. Whereas immersion can be felt in time, presence is just a state of mind felt by individuals.

In terms of flow, this concept is used to define a mental state of being involved. As mentioned in the beginning of this Chapter ("Designing game accessibility and usability"), when the gamer feel a sense of mastery, the moment of optimal experience (A_4) occurs (Csikszentmihalyi, 1990).

Learnability is a component of usability (Nielsen, 1993) that defines the ability to use the software (based on the number of tasks completed and time taken to master the interaction with the system). Controlling players' freedom and focusing their attention on game elements is also likely to improve their learnability (Andersen et al, 2012). Therefore, game tutorials (such as interactive hints) can accelerate this learning process.

Satisfaction is related to whether or not is pleasant to play a certain game. Nevertheless, evaluating user satisfaction in games differs from other multimedia applications in a number of important ways. First, the goal is entertainment and not productivity (Federoff, 2012) Then, whereas in other multimedia applications users are satisfied when they master some skills and accomplish tasks, in video games context, users' satisfaction lies in surpassing challenges and difficulties (Federoff, 2012).

It has been very difficult to evaluate the game experience. Nacke and Lindley (2008) quantitatively analysed the experience through Facial Electromyography (EMG), Galvanic Skin Response (GSR), Electrocardiography (ECG) and Electroencephalography (EEG). Meanwhile, IJsselsteijn et al (2008) elaborated the Game Experience Questionnaire (GEQ) which encompass Sensory and Imaginative Immersion, Tension, Competence, Flow, Negative/Positive Affect and Challenge and that way, it easier to evaluate user experience.

To sum up, understanding user's context is crucial in order to provide user-friendly interfaces.

COMMENTS ON LITERATURE REVIEW

"Video games for an older public" is still an emergent topic of research. As was pointed out in the Chapter 1: The demography of population ageing, there has been a considerable growth in the number of older adults over the years. Indeed, this perceived reality is also international and omnipresent in every culture.

As central to the entire subject of communication sciences and technologies is the concept of human-computer interaction and their behaviour. Thus, in order to facilitate the interaction of older adults with technological devices, the general aspects of ageing (biological, physical, cognitive and psycho-sociological) covered in Chapter 1: General aspects of ageing must be, previously, known.

Simply put, a player-centred design approach should be undertaken. Xie (2003) remind us that the best way of having software, which corresponds to users' needs, is to involve them in the design process.

So far, most studies in the field of video games have only looked at the violence in video games and their use and impact on children or teenagers. Moreover, the few studies, which are extended to older gamers, are likely to narrow their focus on how video games can overcome either physical or cognitive effects of ageing.

To date, researchers do not seem to cross the data about social effects of ageing and social gaming. A possible reason for this gap in research may be due to the fact that social isolation is often perceived as a consequence of playing video games (Jansz & Martens, 2005). However, recent evidence suggests that online game - playing promotes relationship between players (De Schutter & Abeele, 2008; Derboven, Van Gils, & De Grooff, 2011; Ijsselsteijn, Nap, De Kort, & Poels, 2007a; Whitcomb, 1990) and women tend to be attracted to this type of games.

In later age, friendship networks of many older adults dwindle and successive losses of others can lead to social isolation and depression (Kalmijn, 2003). Information and communication technologies can help this target public on being socialized without the interference of mobility barriers. This fact corroborates the idea of Karimi & Neustaedter

(2012) who state that ICT can be associated to the wellbeing, quality of life and sense of independence of older adults.

Dias (2012) found that the reasons for older adults to use technological devices, were: (a) Communication; (b) Information retrieval and; (c) Entertainment.

These motivations are important in order to determine the main goals of a video game. Gibson et al (2010) highlights that this audience considers the Internet as a tool to achieve functional goals. Thus, these findings go in hand to the model of *Meaningful elderly play* offered by De Schutter and Abeele (2008). According to them, video games should foster connectedness (communication), cultivate themselves (information retrieval) and contribute to society (have functional goals).

The author Utz (2000) mentions that video games with multiplayer dimension are a form of computer-mediated communication. They encourage long-term participation and as other CMC services, they provide emotional and intense relationships. Christou et al (2012) lists four types of communication reinforced by games (in-game communication, offline game communication, empathy and sociability through groups). This raises questions about the game elements that should be prioritized in video games, aimed at designing sociability through games for an older public.

In addition, it is important to ask whether video games with social component have potential for this target, as some studies (De Schutter & Abeele, 2010; Gajadhar et al, 2010) reported that their respondents did not reacted well to online co-play experience and prefer solitary games. Nevertheless, the existing experiments fail to understand players' routines and context. A serious weakness with this assumption is that it does not explain whether this fact can be due to (a) the fear of failure (in case of intergenerational video games); (b) the tools used to communicate (video chat, which is more appropriated to fellowship and fun or text-based, which is associated to emotional support [Xie, 2008]); (c) anonymity (Pfeil, 2010, as cited in Siryaraya & Ang, n.d) or (d) the use of competition instead of collaborative dynamics (Gajadhar et al, 2010). Hence, the empirical studies seek to remedy this gap and provide an in-depth insight into the next generation of video gamers' profile.

«Study hard what interests you the most in the most
undisciplined, irreverent and original manner possible»

– Richard P. Feynman

CHAPTER 5: EMPIRICAL STUDIES

This research aims to understand the context of gamers aged 50 and over as well as to involve them in the design process of a networked video game. Thus, a mixed-method of quantitative and qualitative data was used.

Methodological approach

To answer the research question "*What are the main game design components of networked video games, which could encourage older adults to play?*" it was required a methodological framework from which we could examine their preferences and game routines. For this reason, an applied social research was conducted.

Applied social research

The applied social research method was chosen because it prioritizes the practical application of the knowledge in a contemporary reality (Ritchie & Lewis, 2003). In this study, the knowledge produced about networked video games for older adults aims to help game designers to create interesting solutions that cater their needs and preferences. Furthermore, working with stakeholders during the early phases of the product is fundamental to understand the needs of society (Bickman et al, 1998).

Table 5 (p. 58) presents the schedule of the main activities, the method used and the instrument of data collection in the different stages of this applied social research.

As can be seen from the table, other methods were also involved in the different stages. This applied social research encompasses three stages: (a) The expectations concerning the proof of concept; (b) The design phase and (c) The proof of concept.

1st Stage - The expectations concerning the proof of concept

As mentioned before, the expectations concerning the proof of concept begin with the literature review process and an online survey of 245 gamers aged 50 and over. In the literature review process, relevant information was collected, underlying the keywords: older adults, video games, computer-mediated communication, multiplayer real-time virtual worlds, information and communications technology and accessibility. A netnographic method was also conducted in order to understand the importance of this study and know what society thought about playing games and video games in a later age.

2nd Stage - The design phase

During the design phase, gamers and the researcher generate game-ideas and discuss game concepts. The participatory design sessions encompass brainstorming and scenario building. Video game is "a complex mix of technology, art and interactive storytelling and the constraints of the economics and mass entertainment must meet its artistic values, creative contents and technological virtuosity" (Burger-Helmchen & Cohendet, 2011, p.317).

Participants produce ideas and define their needs and preferences of video games. It is expected that a prototype designed by users and for the users will give better results (Eason, 1995) with higher success rates (Demirbilek & Demirkan, 2004). The netnographic method also extended to this stage, because during that process, the researcher collected several opinions reporting the main difficulties of interacting with games and video games.

3rd Stage - The proof concept

After reviewing the literature on co-designing games, the results of the survey and the participatory design sessions, a proof of concept is developed considering the game design literature and the results of quantitative and qualitative data (obtained from the focus groups and the survey). The main goal of this stage is to exemplify how data gathered from theoretical sources could be translated into practise.

During this stage, it was needed to understand the gamer behaviour when playing video games. A participant observation was carried out, involving two day- care centres from Aveiro.

Explanatory study

This study is also explanatory as it has the purpose of identifying a casual relationship between variables and getting an explanation of certain phenomenon (Blanche et al., 2006). Thus, the survey was followed, in order to discover the relationship between the interest and the context of older gamers (1st stage – The expectations concerning the proof of concept).

Then, qualitative data was used due to the involvement of stakeholders in the study as design partners. Players were invited to bring their own contexts to a networked video game prototype. It was considered that a qualitative analysis would strengthen and explain some data obtained by quantitative measures.

Table 5. Schedule of the main activities

APPLIED SOCIAL RESEARCH

STAGES	DATE	ACTIVITIES	METHOD	DATA COLLECTION
1st stage The expectations concerning the proof of concept	Nov 2012 – May 2013	1. Consult several statistical studies used to describe the profile of younger gamers; 2. Consult the recommendations for further research in the area; 3. Define the criteria for selecting the subjects; 4. Design the questionnaire; 5. Administer questionnaires by an online contact (email, online forums); 6. Analyse data and report the results.	Survey Explanatory study	Questionnaire
2nd stage The design phase	Jan 2013 – Jun 2013	1. Consult online forums and several entities related to video gaming, older adults and ageing; 2. Contact the forum administrators; 3. Publish forum threads; 4. Gain members' trust; 5. Collect opinions about the topics related to gaming and older adults; 6. Code and divide the text into categories; 7. Analyse the data.	Netnography	Questionnaire (open-ended questions) Text extraction
3rd stage The proof of concept	Mar 2013 – Jun 2013	1. Review the literature on co-designing video games; 2. Planning the focus group sessions and determine its goals; 3. Writing the focus group moderator guide; 4. Recruitment process; 5. Select the software in order to conduct the online focus group; 6. Send the email to check participants' availability and the email for the invitation; 7. Conduct the online and face-to-face focus groups; 8. Analyse the data.	Participatory design	Focus group[13]
	Sep 2012 – July 2013	1. Daily report of every occurrence of the subjects and the researcher on the field; 2. Prepare classes of Introduction to Multimedia; 3. Write a plan of tasks and observation.	Participant observation[14]	Field notes

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[13] Note that Focus groups can be consider either a method or a technical tool for data collection

[14] There is a discussion whether participant observation should be considered a method or a technical tool for data collection (Jorgensen, 1989)

Survey

A survey, with thirty questions, was conducted to cover a broad array of play patterns and preferences of older adults.

Netnography

To assess a subset of questions that are necessary to answer the main research question, the qualitative method Netnography was also used in the first and second stage.

Netnography is defined as "a new qualitative research methodology that adapts ethnographic research techniques to study cultures and communities that are emerging through computer-mediated communication" (Kozinets, 1998, 1999, 2002 as cited in Langer & Beckman, 2005).

Langer and Beckman (2005) identify some advantages of this method. It is appropriated to know people's attitudes and opinions about sensitive topics and to reach communities that would be difficult to have a face-to-face contact. However the solely use of this method restricts the number of cases (it may not cover all the channels about that topic and it does not include people who do not have a "digital presence").

There is still *ageism* and *techno-ageism* toward the gamer aged 50 and over. Whereas the term *ageism* is used to refer to stereotypes or discrimination against older adults, *techno-ageism* refers to stereotypes or discrimination against the use of Information and communications technologies by older adults (Pires, 2008)

These stereotypes against older gamers also affect the data obtained for this research.

A participatory design approach (PD)

In most recent studies about video games, game design has only been tested during later phases of the game design cycle (evaluation and post-production phase). One criticism of this linear process is the lack of innovation in creating new products. Participatory design aims to involve users as "design partners", following the philosophy "for, with and by the users" (Parra, D'Andrea, & Giacomin, 2012).

With regard to the theme of this research, participatory design sessions were done through two focus groups with two types of players (novice and experienced). The construction of scenarios and open-ended discussions were some of the techniques inherited in these group discussions.

Participant observation

Participant observation can be de defined as a technique of collecting data, which involves the daily report of every occurrence of the subjects and the researcher on the field.

According to Gobo et al (2004**,** p.218), participant observation involves knowing:

(…) what ["their"] people believe; what they do at work and in their leisure time; what makes them laugh, cry and rage; who they love, hate and fear; and how they choose their friends and endure their relations. This is done by living with the people being studied, watching them work and play, thinking carefully about what is seen, interpreting it and talking to actors to check emerging interpretations.

Technical tools for data collection

In order to answer the research question, several techniques and tools, appropriated to each stage of development, will be used for data collection.

Questionnaire

Instrumentation. A survey method, using a questionnaire as a data collection tool was used.

Pak & McLaughlin (2010) have reported that surveys were the most appropriate method for assessing older adults' characteristics and their attitudes toward technologies.

The design of the instrument was based on several statistical studies used to describe the profile of younger gamers. Moreover, recommendations for further research mentioned on papers related to video games and older adults have also been considered

(Aison et al., 2002; De Schutter & Abeele, 2008; Gajadhar et al., 2010; Gerling & Masuch, 2011). Thus, a self-administered online questionnaire with thirty questions was administered to cover a broad array of play patterns and preferences of this age group.

It has four categories:

The first category deals with socio-demographic data related to the individuals (date of birthday; gender; education; country of residence; nationality; marital status and "Who do you live with");

The second category, comprises gamers' routines and preferences ("Do you play games?"; "What games do you play?"; "How often do you play games?"; "How many hours per day do you spend playing games?");

The third category is related to video games and networked video games ("Do you play video games?"; "What motivates you to play?"; "How often do you play video games?"; "Have you ever played networked video games that allowed communication between players?"; "What games did you play?"; "How do you prefer to play?"; "With whom do you prefer to play?"; "What type of video games do you like?" and "What kind of skills would you like to practise using (video) games?");

The fourth category focuses on the skills to be practised through video games, which devices are used for playing, the connection between book preferences and the plot of the game, feeling comfortable with different technological devices and the use of CMC ("What devices do you use for playing video games?"; "If you had to choose a book, what genre do you prefer?"; "Rate from 1 to 5 your level of comfort with the following devices (1=*not comfortable* and 5 = *very comfortable*) – Computer, Mobile phone and Tablet"; "Do you use any tools to communicate via computer or other technological devices?" and "What tool do you use for communication when you are using a computer or other technological device?").

A 5-point response was used for the questions to indicate the frequency and use of the technology (e.g. "How often do you play (video) games" and "Rate from 1 to 5, how comfortable you are with the following devices"). A series of dichotomous (yes/no) and some open-ended questions were also used.

Data management and analysis was performed using SPSS 20 (2011).

Returning to the initial sub-questions of the research question (p.5) and the hypotheses formulated at the beginning of this research (p.7), the dependent and independent variables were identified. For each sub-question and hypothesis, relationships between dependent and independent variables were determined using Chi-square tests.

In the first sub-question "Is there any relationship between the types of (video) fames participants like to play and their age?" and in the correspondent hypothesis (H_1), the dependent variable is 'the types of games that participants like to play' and the independent variable is 'the participant's age group'.

Regarding the second sub-question "Is there a correlation between the types of games preferred and the skills that gamers want to practise?" and the second hypothesis (H_2), the dependent variable is the 'mode of playing' and the independent variable is 'with whom respondents live'.

In the third sub-question "Is there a correlation between the types of games preferred and the skills that gamers want to practise?" and in the correspondent hypothesis (H_3), the dependent variable is 'the games preferred' whereas the independent variable is 'the skills to be practised'.

Subject characteristics. All the participants were aged 50 and over, and the initial convenience sample consisted of 250 of gamers of whom 4 did not complete all the questions and 1 did not play games or video games. Criteria for selecting the subjects were: (a) being more than 50 years old; and (b) playing games, video games, networked video games or both.

Questionnaires were administered by an online contact (email, online forums and websites) from November 2012 until May 2013. Given the sensitive nature of the subjects were informed that their responses would be anonymous and confidential.

The sample was collected from online forums such as: the Oldergamers, Sodahead, some organizations like the California Retired Teachers Association and Elderwise. In addition, several agencies and organisations related to the elderly were contacted for help with answering this survey. These contacts were very important in order to gain member's trust, provide further information about the research and test previously the mentioned criteria for selecting the subjects.

Gamers were divided into two groups based on their age. Even though the number of G1 is much higher than G2, they have different characteristics and the results would be equally applicable if only 52 respondents of G1 were used.

The **Table 6** gives some of the main characteristics of the sample.

Table 6. Sample demographics (N = 245)

	G1: Gamers aged between 50 and 64 (N = 193)	G2: Gamers aged 65 and over (N = 52)
	Mean of % (N)	Mean of % (N)
Gender		
Female	22.3(43)	38.5 (20)
Male	77.7 (150)	61.5 (32)
Level of education[15]	5	5

The majority of respondents in G1 were male (77.7%, N=150) and 22.3% (N=43) female. As for G2, just over sixty percent of the sample was male (61.5%, N=32) and 38.5% (N=20) female. The average age of the sample was 59 (SD = 8.16; minimum = 50; maximum = 95) and the majority of respondents in both groups had between 15 and 19 years of schooling. However, this convenience sample precludes generalizing beyond these 245 gamers as the sample is not representative and the participants' level of education differs from the population and the reality of some countries (e.g. Portugal) described in Chapter 1, p.3.

Considering the 245 participants who completed the questionnaire, just over half (58%, N=142) indicated that they were married with the majority living accompanied (56.7%, N=139) by spouse (47.8%, N=117) and children (20%, N=49).

Regarding demographic distribution of the sample, as expected, the participants live in different countries. Nearly forty-seven percent of the sample (46.5%, N=114) was

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[15] 1: No schooling; 2:1-4 years; 3: 5-9 years; 4: 10-14 years; 5: 15-19 years; 6:>19 years

from United States of America and 23.7% (23.7%, N=58) from Australia. The other countries of residence were Canada, Finland, France, Germany, Iran, New Zealand, Portugal, Russia, Slovakia, Sweden, Thailand, The Netherlands, United Kingdom, Brazil and Belgium.

Focus Group

Following the participatory design (PD) approach, two focus groups, with expert and novice gamers aged 50 and over, were conducted in order to provide insights into the design of a networked video game.

Focus groups may be defined as a qualitative research technique, which allows the interaction between participants. According to Debus (1995 , p.8), focus groups "allow a small group of respondents to be guided by a skilled moderator into increasing levels of the research topic". This technique evolved from discussion groups and interviews narrowed on a single topic (Gallangher, 2005) to a new technique of also involving worldwide participants in decision processes.

However, one question that needs to be asked is whether focus groups are a methodology or a technique for data collection. The authors Galego & Gomes (2005) remind us that if, on the one hand, some authors consider focus groups as a method, on the other hand, others define it as a technique. They report that group discussions can be both, depending on the aim of the research.

Moreover, Morgan (1997) identifies three functions that focus groups can assume. They can be summarized as follows: (a) act as the main technique of data collection; (b) give consistency to data from other sources (e.g. survey); and (c) take part of a mixed-method approach, which combines multiple sources of data. In this research, focus groups act as one of the techniques of data collection to achieve the main goals of the applied research and a participatory design approach.

Nowadays, with the advent of Internet, researchers have at their disposal new ways of involving their participants in a focus group. An online focus group uses computer-mediated communication services to bring individuals from different cultures, contexts and backgrounds together and answer questions posed by a facilitator (Rezabek, 2000). That

way, participants can discuss their experiences and new knowledge is produced based on the user experiences.

Electronic focus groups differ from those conducted face-to-face by providing access to geographically distant participants and provide an openness and comfortable environment (Rezabek, 2000). Nevertheless, few academics use online focus groups and this technique seems to be confined to a market research (Bloor, Frankland, Thomas, & Robson, 2001). **Table 7** compares the face-to-face and the online focus groups.

Table 7. Face-to-face and online focus groups

	Face-to-face focus group	Online focus group
Advantages	- It is possible to see facial expressions; - Traditionally used in academic research;	- Reach a broad geographic audience; - Speed up the process; - Can provide anonymity; - Openness;
Disadvantages	- Limits the range of participants (homogeneity in culture, local and context);	- Extends over time if discussion boards are used; - Different time zones; - Disregarding digital illiterate users.
When to use	- When the research demands heterogeneity in participants' backgrounds	- Involve participants from different geographic places

As can be seen from the table above, online focus groups are more appropriate for involving broad geographic audience.

Online focus groups can be conducted using either synchronous or asynchronous communication services. In sessions, which are conducted synchronously, participants share the same time (e.g. chat rooms), whereas, asynchronously focus groups allow participants to share their opinions at any time, by using email, listservers, mailing lists and discussion groups.

Regarding game design, focus groups can be a valuable source of innovation for game ideas and concepts instead of trying to validate them (Fullerton, Swain, & Hoffman,

2008). Involving gamers and potential players in participatory design sessions through focus groups can benefit the player's gameplay experience.

Three groups of players should be taken into account, when designing different levels of experience of online games: (i) hard-core gamers, (2) moderate and (3) mass-market (Mullingan and Patrovsky, n.d., as cited in Sotamaa, 2007). However, because involving gamers aged 50 and over in this focus group was difficult due to several constraints (not knowing the researcher, being of different time zones and assuming that this interest was commercial and not for academic purposes), only two groups of players (novice and experienced players) participated in the two focus groups. Five experienced players composed the first online focus group whereas the second focus group was face-to-face with five novice players.

The first focus group involved five experienced gamers from USA and Australia. These gamers also answered the survey and they agreed on participating in an online focus group. Then, the researcher contacted them in order to check their availability and send the invitations to the platform. The focus group was held asynchronously during one month.

The second focus group involved novice gamers from Portugal. These participants attended a course of Introduction to Multimedia, in the University of Aveiro. Then, the researcher contacted them for posterior face-to-face meetings. Again, it is important to highlight the level of education of these participants (between 15-19 years of school) and thus further research into the involvement of participants with different levels of education in the design process is strongly recommended.

Recent developments in the software for online groups have led to a renewed interest in this method. However, most of them are paid and are on beta phase. VisionsLive was the most suitable software for the purpose of this research. It had the option of synchronous and asynchronous focus groups and the track of users' activities. Furthermore, during the process of participants' recruitment for a focus group, VisionsLive contacted the researcher, providing support and help.

Regardless the means used to conduct the focus group, there are some recommendations, which were crucial in enhancing the interactivity among groups.

When conducting focus group with an older public, attention must be paid to the number of topics to cover (between 5-7) and the session should not take more than 2 hours (Pak & McLaughlin, 2010).

The moderator must be able to create an environment which promotes the equality of participant engagement in the discussion topic, the quality of data provided, the level of participant satisfaction and manage the intra-group conflict (Gallagher, 2005). The facilitator guide has also to reassure that all data will be kept confidential and that there are not right or wrong answers.

Table 8 shows the general characteristics of focus groups.

Table 8. Characteristics of focus groups

	Focus groups
Number and composition of the group	The number of participants should be between 5-7 (Debus, 1995); It should be an heterogeneous group (different characteristics and opinions); Led by a moderator;
Duration	90 – 120 min
Preparation	Prepare tigger questions in advance; Online focus groups' moderators should pay attention to threads on forums and "netiquette" issues; (Oringderff, 2008) Divide the online focus group into the following parts: welcome, ice-breaker questions, overview of the topic, the purpose of the study, ground rules, questions and exercises and non-symbolic communication recognition (Doyle, 2009)

The use of asynchronous communication in focus group facilitated the interaction among participants by being non-intrusive (Dewsbury et al., 2006).

Text-based communication not only helps with anonymity but also eases the thinking process to solve complex problems (Xie, 2008).

Procedures. The focus group technique was used during the second and the third stages (Table 5, p. 58) The main goals were: (a) generate new ideas for a networked video

game; (b) validate the relevancy of game concepts; and (c) provide insights into design issues of the proof of concept. The recruitment began with initial forum threads. Figure 10 shows a question posed by the researcher in the discussion forum – Sodahead. This process took three months in order to conquer participants' trust and communicate with the game forum administrators and video gamers. Meanwhile, this phase was important to understand the participants' context and collect opinions about the acceptance of networked video games for older adults.
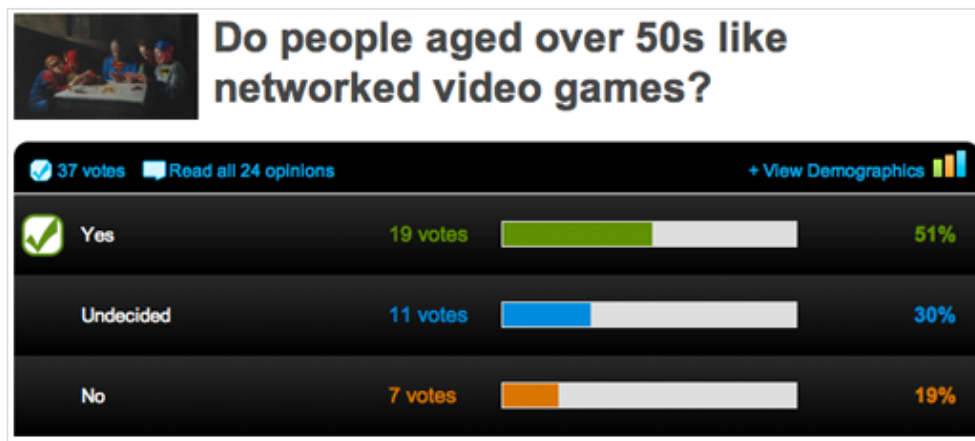
Figure 10. Example of an online discussion about networked video
games for people aged over 50 (Sodahead community)

Online forums and social network sites such as Oldergames, 2old2play and Sodahead collaborated with the researcher in this process of recruitment. Then, the researcher contacted the gamers via email.

As explained earlier, a synchronous focus group was planned. However, there were some constraints to this process:

• Participants did not know the researcher. Despite the fact, they have been assured that this study was for academic purposes (not commercial) and have already participated on the online survey, they did not want to be exposed in real time;

• It was very difficult to manage different time zones;

• Some participants do not feel comfortable to admit that they play video games because they had a bad connotation over time and there is some prejudice against older people who play video games.

An alternative to overcome these constraints was to conduct the focus group asynchronously. Thus, an asynchronous focus group was held during one month. The focus group comprised the following sections:

Welcome. This section welcomed the participants, invited them to introduce themselves to the group (*Figure 11*) and gave an overview of the main topic and a set of rules.
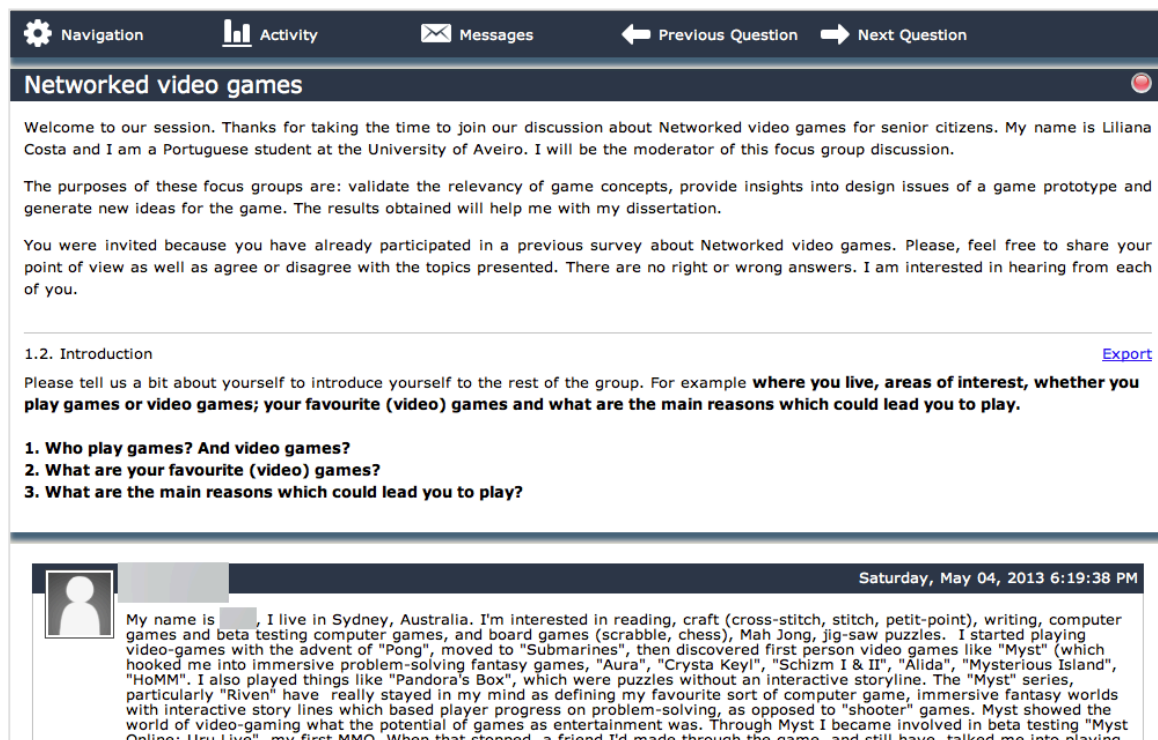
Figure 11. First task: Participants introduce themselves

Networked video games. This section asked participants to rank from 1 to 5, what concepts should be more valuable in video games (Achievement, Exploration, Socialization or Imposition). For each choice, there was a set of sub questions (*Figure 12*). For example, if the player chose Achievement, the moderator would ask:

« (…) And what would you like to achieve? Do objects have to have a meaning or a connection to the plot? Be related to avatars? If so, your avatars or the other players' avatars? And what about coins? What do you think about having virtual money? »

Then, they were presented with a scenario related with the game storyline.

«I wrote the storyline of a game proof of concept, which I am developing for the dissertation. I want you to read the story that follows and just imagine… If you had a valuable treasure and there was a group of people looking for it, where would you hide it? What barriers would you create to prevent people from finding it? The second task is to imagine that somebody else had stolen and hidden your treasure, what would you do to recover/find it? Let us know your answers, by replying this post.»
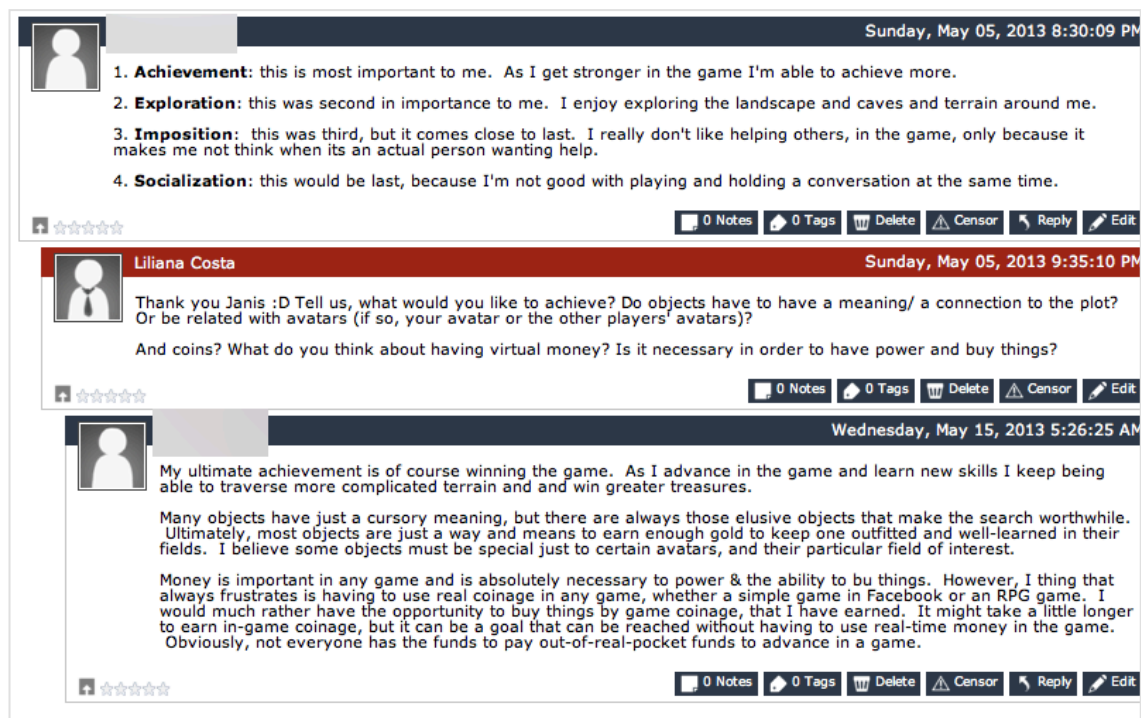
Figure 12. Sub questions posed by the moderator

Then, participants had to list the characteristics of a group of game characters, regarding the game storyline.

«A professor, a Jewish, a journalist and an archaeologist compose this group of people who are in search for this treasure. For each character, please discuss their characteristics and define: (a) age; (b) gender; (c) physical characteristics; (d) Why does he/she want to find the treasure?; (e) skills; (f) knowledge and (g) experience.»

Game elements. This section was related to camera perspective and communication through games.

«Would you prefer to have a first perspective camera or third perspective? Please, move the tick to the front of the image you prefer and a cross to the one you do not like. 1st image: First perspective camera, 2nd image: Third perspective camera. »

Concerning communication through games, gamers were asked whether they would like to have the possibility of chatting in a video game (*Figure 13*).
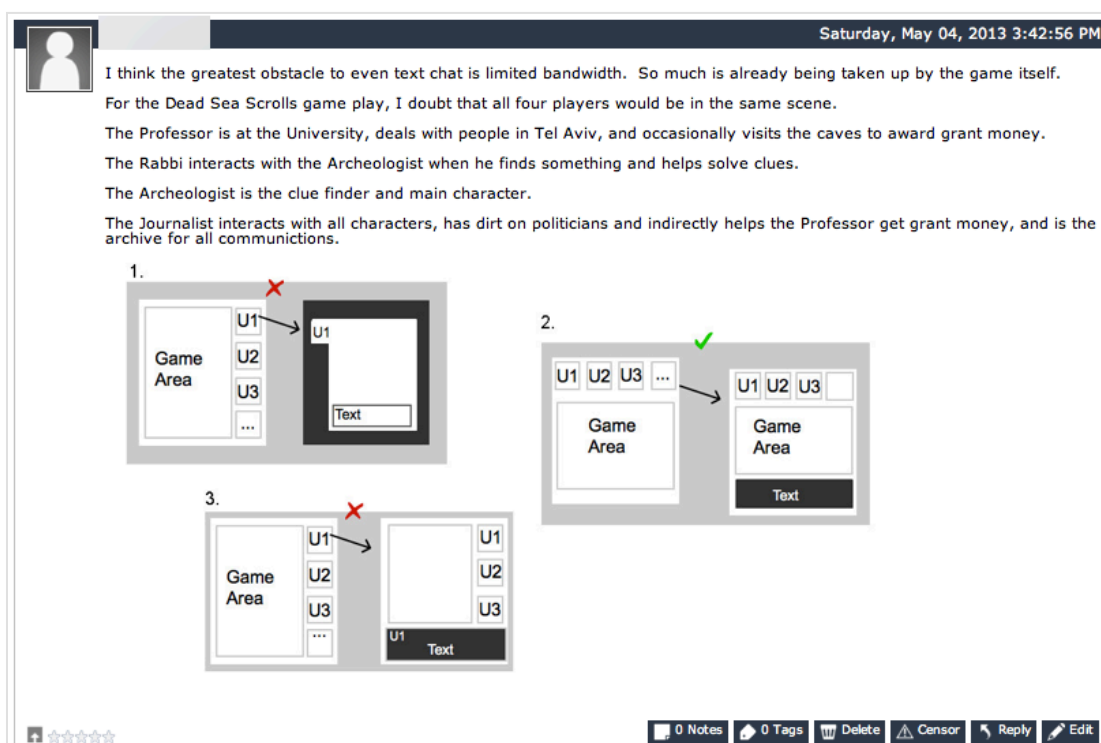
Figure 13. Answer to the question about communication through games

«Would you like to have the possibility of chatting in a video game?; Would you prefer a text-based communication or a video call?; Would you like to chat (a) before the game, (b) during the game, (c) after the game?; Would you like to have the possibility to create game tournaments? Would you go to a game tournament (online or face-to face)? In case of text-based communication, where do you think the chat elements should be? At the top? At the bottom?

On the right side or on the left side? And what about the information presented: only avatars? Real names? Or both? »

 Acknowledgements. This section thanked participants for their help.

«That is the end of our focus group. Is there any comment, information or doubt that would you like to share? I hope you have enjoyed. Thank you all for your participation. Feel free to contact. **»**

The same focus group was conducted face-to-face with novice players. This session lasted ninety minutes. It differed from the online focus group in the way in which the moderator introduced game concepts. Because these participants were not familiar with video game concepts, the focus group comprised two parts. The first part was related to (a) game concepts; (b) games and challenges; and (c) how video games have evolved until now. The researcher lectured on the history of video games and the main design components (*Figure 14*).

The second part was related to the main reasons that could encourage people to play video games, the game storyline and the same questions of the online focus group.

Participants. Semi-structured interviews were conducted with five experienced gamers and with five novice gamers (N=10). All participants were aged between 52 and 77 and they had between 15 and 19 years of schooling. The characteristics of participants from both groups are presented, with the aim to understand their game context.

Figure 14. Lecture slide

The following is a brief report on the participants' characteristics as gamers. This information was relevant to design the proof of concept of a networked video game. Participants were asked to introduce themselves, by answering to "Where do you live?"; "What are your main interests?" and to say in a short paragraph their game preferences and routines.

Online focus group

Five gamers aged 50 and over from America and Australia composed the online focus group.

U1 | 62 | Female | Australia (Sydney)

Interests: Reading, craft (cross-stitch, stitch, petit-point), writing, computer games, beta testing computer games, board games (chess, scrabble), Mah Jong, jigsaw puzzles. Gamer characteristics: Started playing video games with the advent of Pong. She likes immersive problem-solving fantasy games (e.g. Myst series). She plays video games with other players. The main factors she looks for in a game are (i) high degree of graphic realism; (b) interactive storyline and (c) problem-solving as means of progression as opposed to shooter games;

U2 | 61 | Female | USA (Southern California)

Interests: Reading, sew, do needlecraft, crochet, knitting, computer games (especially role-playing games – RPG).

Gamer characteristics: Started on Nintendo. She has a PSP and plays games on a Kindle Fire and Android phone. However, she prefers computer games. Her favourite games are Morrowind, World of War and Stone Keep. Her mother of 89 years old used to play Myst. Her children do not play games, but her grandchildren and siblings do.

U3 | 54 | Female | USA (New Hampshire)

Interests: Fiber arts, gaming.

Gamer characteristics: She enjoys games that are more cooperative and tend to avoid the player vs player (PvP) parts of MMO. Currently, she is playing World of Warcraft and uses Skype to chat. She enjoys the socialization aspect of MMOs and a good

storyline. She has been playing Live Action role-playing games for 20 years. She plays games for social reasons.

U4 | 52 | Male | USA (Florida)

Gamer characteristics: He has played plenty of video games, including the old arcade games. His favourite games on the computer have always been WW1 and WW2. He prefers simulated technology which is "very human scaled and requires real strategy and tactics".

U5 | 52 | Female | USA (Washington State)

Interests: Reading, exercise.

Gamer characteristics: She plays creative and funny games with family (e.g. Apples to Apples, Gloom, Trivial Pursuit). She plays some computer solitaire or mahjong games. She also plays interactive Facebook games (e.g. Garden of Time). U5 plays "strictly for entertainment purposes".

Focus group (Face-to-face)

Five participants aged over 50 from Portugal composed the focus group, conducted face-to-face.

U6 | 69 | Female | Portugal (Aveiro)

Interests: Gardening, reading, watching movies, travelling and going to theatre/ musicals.

Gamer characteristics: Sometimes, she plays dominoes and checkers with friends. U6 does not play video games because according to her, they are violent. Her children are video gamers and she would like to play games that have cognitive challenges.

U7 | 77 | Male | Portugal (Aveiro)

Interests: Reading, watch sports, travelling and being with family.

Gamer characteristics: U7 likes playing cards (King), poker, checkers, chess and dominoes. He plays for entertainment purposes.

U8 | 62 | Female | Portugal (Aveiro)

Interests: Travelling, Singing, Dancing, Reading, Cooking, Gardening and "everything that is true and of value"

Gamer characteristics: She has played SimCity and Farmville but now, she does not have time for games or video games. However, she would like to know other people through games and share their experiences and interests.

U9| 53 | Male | Portugal (Aveiro)

Interests: Art, Music, Poetry

Gamer characteristics: When he was younger, he played arcade games. His friends play chess. At this moment, he does not have time to play video games. He would like to play games that distract, relax and deviate from the routine.

U10 | 64 | Female | Portugal (Aveiro)

Interests: Gardening, painting, reading, doing crosswords, talking with friends, listening to music

Gamer characteristics: U8 likes playing Bejewelled and solitaire games. During her childhood, she used to play football, ringer and ping-pong.

Game design: A proof of concept

In the third stage of this research – The proof of concept, two methods were involved – (a) the focus groups and (b) the participant observation.

The results of the focus groups determined the game storyline, its goals and premise, the game rules and characters, the conflict, outcomes and the progression of action.

As for participant observation, ten older adults (aged 65 and over) attended several sessions of Introduction to Information and Communication technologies (ICT) that included the module of video games. The participant observation helped on understanding the main difficulties when interacting with the game. Thus, these main difficulties have to be taken into account in the proof of concept.

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In terms of the results of the focus groups, the main components and formal elements of the video game are presented.

Storyline. The game storyline has adapted the history of the Dead Sea Scrolls to a game context (*Figure 15*). When the survey respondents were asked whether they had to choose a book, which genre they would prefer, history was the elected. Thus, a game with historical settings was designed. The choice of the story to adapt to a game concept was based on the following criteria: (a) it should not have been yet explored in a game; (b) it should be easy to introduce context-aware and cognitive challenges and (c) it should captivate the interest of a worldwide audience (e.g. captivate them by choosing a place with a strong religion connection – Jerusalem).

Figure 15. The Dead Sea Scrolls game

«The hot dry air of Qumran brings to the surface a set of Dead Sea Scrolls, describing unimaginable treasures in the hills east of Jerusalem. Among the ruins of eleven caves, there are pieces of Jewish history. The arid land is the key of survival to this mystery. It is believed that in 1947, a Bedouin, desert dweller, was the first to discoverer the Dead Sea Scrolls. Nobody expected that

the search for a lost goat, his anxiety and curiosity as well as the sound of a rock in a cave could lead to the first of the Dead Sea scrolls, with two thousand years of history. A professor, a Jewish, a journalist and an archaeologist are seeking the treasure. But what does it contain? If you knew your friends and all the secrets of history, you would know. »

Players cannot change the game plot, however, they can change the outcome and some challenges are dictated by the storyline. Some examples are followed:

«At the beginning of the game, players have to acquire different skills by succeeding in specific challenges of their character. The skills and the challenge vary with the character chosen (e.g.: The Jew is the one who knows the Armaic language and can help other players with Armaic. For that, before having cooperative challenges, he has to train his skills); »

«At certain moments of the game, there are problems with the communication systems. On those moments, the player cannot chat or they can only send messages to one/two players. Depending on the character chosen, the player has different dilemmas (e.g. The journalist can have the dilemma between not chat on that moment or adding a contact to her conversation but this choice implies a message being broadcast on a local TV station). »

Goals and Premise. The goal of this game is to:

«Be the player who finds the real treasure of the Dead Sea Scrolls. To win the game, the player has to meet different challenges (mini-games) and cooperate with other players, in order to succeed on tasks, which demand the skills that only the other characters have. »

The game goals have been established, attending the main reasons for online game-playing found by Bartle (1996). The focus group revealed that participants' strongest reasons were (a) Achievement and (b) Exploration. The achievement reason has been associated to the sense of control, strength and power. Collecting objects and key items were also pointed out to be a way of achievement. In participants' opinion, objects must be special to avatars and bring an individual and collective meaning. The focus group participant (U4) suggested that one concept that has been explored on the game Silent Hunter III and it could be interesting to adapt to cooperative challenges was giving the

opportunity to players to reward who was worthy to receive promotions or medals. The game premise is that players are characters with different reasons to find an unknown treasure, in the desert.

Start the game. To join the game, players have to register in the platform, login and then choose a character (*Figure 16*). Then, the user will be asked whether he will play with known players of their circle of friends or unknown players of the community ("select (1) I brought friends with me or (2) Only by myself"). If the player chooses the first option, he must know friends' nicknames and choose the player from a list of all players available.

The system also allows making groups (e.g. "family group", "friends" or other category defined by the user). Then, at the second time, the player has only to choose the group and the gamers selected appear by default).

Players. Four players cooperate against the game system. Four was the number chosen by the study of Eldergames (2006) in order to prioritize collaborative dynamics over competition.
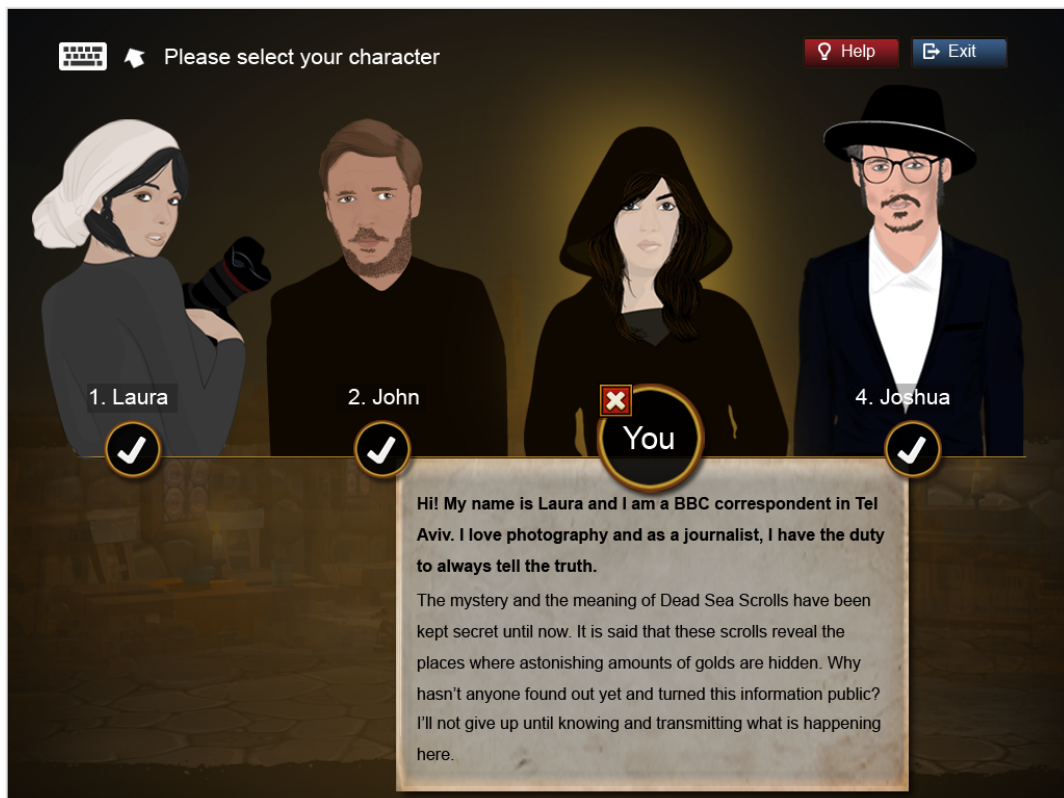
Figure 16. Select the game character screen

Characters are defined by their behaviours, experiences, physical appearance and their dialog (Fullerton et al., 2008). Because game characters play a leading role in adventure games, the characteristics of each character were defined with the participants.

Archaeologist

«Female, 30.Weathered, very stable, strong physically, attractive and earnest. She is focused on her work, yet able to communicate plainly. She holds a PhD. She is very up-to-date with the latest techniques and has valuable skills at living in the desert. She has worked in the area for 2 years. She is very well qualified as a field archaeologist and has geological skills. She does not know any Armaic. Finding the treasure would mean huge grants to her department back at the University. She is in it for ambition and fame. She has always dreamed of finding the treasure of a lifetime and resting on her laurels. She wants to find the treasure because she seeks discoveries in the field. She is hungry for knowledge, but only as it serves her end and her needs. She is not a believer in God. She only sees the treasure as a means to an end – ultimate recognition by her peers. She is psychologically bent towards not always speaking the truth. She will lie without thought if it would get her the treasure. She knows the materials, the history and geology. She must find the Dead Sea Scroll and she is always trying to know what the jew is doing (reading every clue that can lead to the treasure). »

Jew

«Male, 48. Fit, wiry, ascetic. He's studying rabbinical studies in Yeshivah – Talmudical academy in Jerusalem. He has knowledge where past scrolls have been found and he can read ancient manuscripts to determine where other scrolls might be. He is zionist, radical with a passion for preserving the culture of Jewish people. He is a specialist in linguistics, with a particular interest in finding, translating Aramaic inscriptions. He wants to ensure that any treasure found stays in Israel. He can translate and knows a bit about the preservation of old scrolls. He is an acknowledged world authority on Aramaic inscriptions and scrolls. He has strong ideas about women and their place in society,

leaning towards a women's place being in home, while at the same time being courteous and kind to women. With strong convictions, but not skilled in diplomacy, he is strong in his cultural beliefs and he has much experience on leading people on expeditions. (Figure 17) »

Professor

«Male, 40. He has academic lack of interest in appearances. He is the signatory authority for finding the treasure and he provides the funding for the search. He needs to publish papers. Departmental rivalry threatens his position. He has historical knowledge. He is strong-minded and he does not like to take direction. He is seeking the treasure because it promises great things, although it is unclear what those things are. He is good at symbols and historical information. He is conversant in most Middle East languages and knowledgeable about the area, the terrain and customs of the area. However, he has no experience on the field. His main reason for seeking the treasure is for personal gain. »

Figure 17. Character: The jew

Journalist

« Female, 25; Young, slim, good-looking; She is a BBC correspondent who has contacts in high places in Tel Aviv. They also want to find the treasure. She has an American accent and she likes photography. She is extremely fearful about damage to her cameras. She has no archaeology or linguistic skills but photography skills are high. She has strong convictions in seeking truth. She is used to the city life and not the country. She wants to find this treasure because by doing so she can help to find the truth. She is good at finding information and getting people to tell secrets. She worked in the field for 5 years. She has been a correspondent in area and she is familiar with desert. She is very determined to do whatever it takes to get her story, even if it kills her (*Figure 18*). »

Figure 18. Character: The journalist

Rules. The rules of the game are:

• When facing a challenge, each player only may ask for help, one at a time, risking that the player might not get any help or feel lost if he/she does not have a skill acquired/any knowledge to share or exchange;

• Players learn the rules of playing before the game (information about the purpose of the game and how it is played is given) and during the game (through non-player characters -NPCs);

• In the cooperative challenges, the player who has more coins and gold is the first to play followed by the second who has more than others. The exception is to the player who has found the Copper Scroll. He is the first to play;

• There are physical boundaries in the game. Players do not decide the places where their characters are. In other words, they cannot move to different places (rooms) on their own decision.
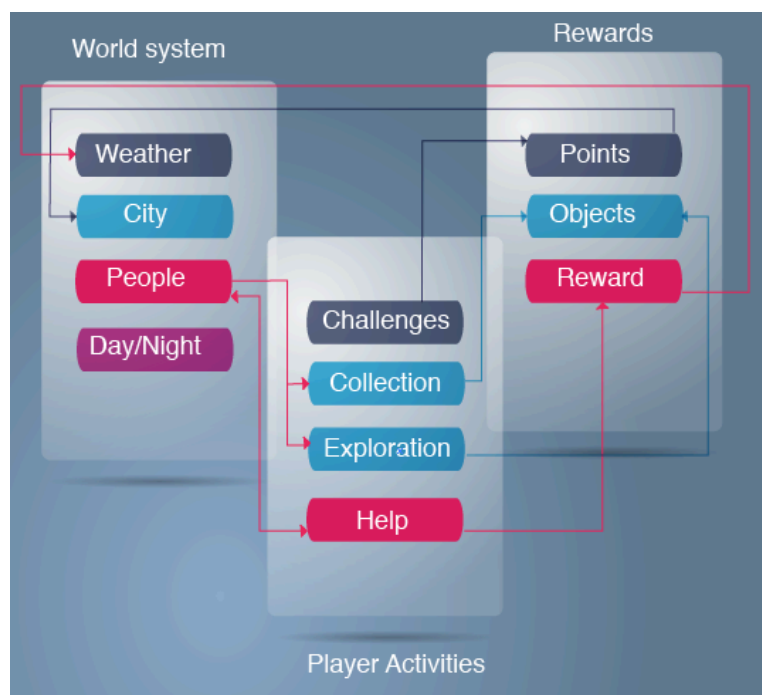
Figure 19. Core gameplay

As can be seen from the *Figure 19*, there is a connection between the player and a set of actions – collect, explore and help. Those actions are connected to rewards and the rewards have an impact in the world system. If the player helps other players, he/she has a reward and that influences the weather of the scenario. The player collect and explores game objects and the challenges are related to achievement (points) and depending on the number of achievements, he/she can move to other *rooms* (places).

Conflict. In this study, we found that players aged 50 and over seem to prefer a Player versus the Environment (PvE) than a Player versus Player (PvP) scenario. To find the treasure, players are forced to accomplish several challenges. Only revealing an enigma

that comprises all character's skills, unlock the real treasure. Another conflict is to know what the treasure is. In brief:

- The gamer does not know what the treasure is;
- During the game, the gamer knows that somebody had stolen the treasure. He does not who, why and where. That is the moment he knows the reasons of other characters to find the treasure;
- There are false clues, false maps and dilemmas;
- The player may get lost in the desert.

Outcomes. The outcomes are temple vessels, silver coins, photos of different places to post in a diary and skills. The treasure is metaphorical and it is found by following a goat. It brings the player to a piece of grass in the desert and it appears a question/ message about the meaning of life, nature or the waste of resources by humankind. This message is left by the previous player who wan the game. This outcome tries to follow the Meaningful play in elderly life model given by De Schutter & Abeele (2008) – (a) Connectedness, (b) Cultivate oneself and (c) Contribute to society. By exploring networked video games for older adults, we are "fostering connectedness". Challenges cultivate their minds and by allowing players to send messages about contemporary problems or to bring concepts of the games to their daily lives, video games allow players to contribute to society.

Procedures. In brief, the game summarizes to the following events:

- The player chooses a game character and three other gamers to play;
- Depending on the game character chosen, the player will have to face different mini-games (*Figure 20*) that will help him/her to acquire different skills:

« The archaeologist will have to complete mini-games that will help her how to survive in extreme conditions in the desert. For example, she has to go from Jordania to Qumran by car and know how to save fuel and water. The Jew will have to complete mini-games related to Aramaic language, symbols and history. The journalist will have to face some challenges related to photography, select the right information and ask the right questions. She also has to learn how to transmit the communication to radio station when there are failures in the communication process between players. The professor has

challenges related to symbols, history of Israel, the culture and the history of Dead Sea Scrolls. »

*Figure 20.*Example of a game challenge

Progression of action. After accomplishing different mini-games, the character gets skills, vessels, coins, photographs and knowledge. That way, gamers can join in the desert and have to play together Question and Answer games (turn-based games) and exploring different places of Qumran. As mentioned earlier, the final treasure is found by following a goat. The goat only appears when the challenges are completed. The goat was the animal that led a Bedouin to find the scrolls and now will conduct the player to a important warning of a contemporary problem.

In order to augment the sense of immersion in the game, unexpected events on the scene will happen (such as: the sky reflects the characters' emotions (related to the number of rewards) and interactive NPCs, which act by their three impulses – perception of the game's world, their memories and emotions (Fullerton et al., 2008).

Turning now to the work on the field, ten older adults attended classes of Introduction to information and communication technologies (ICT), which included the module of video games. The purpose of the video games sessions was that, on the one

hand, older adults played different types of video games and on the other hand, they would understand how video games could overcome their cognitive and mobility difficulties. Each session took about 90 minutes and encompassed different exercises. The following types of games were played (i) brain training games, (ii) action games and (iii) social games.

Participants were observed while playing. The results have shown that:

• Feedback messages, indicating participants' progress in game and congratulating them when the task is accomplished, are valuable;

• Help systems and realistic graphics should be considered as well as an alternative way of interaction with the game (e.g. remap keys). Many commands change the focus of gamers from the play to the keyboard;

• Messages with a positive and encouraging meaning should replace negative indicators of the play. In other words, instead of announcing the number of mistakes that players committed, the number of right answers must be reinforced;

• Any blocked element on the game screen that appears most often in puzzle games (e.g. Mahjong) must inform the player that the element is blocked and how he can unblock;

• These players do not like side scrolling in games and the head-up displays (HUDs) – number of lives or time – should be avoided;

• The focus of their attention is used to be at the centre and the top of the screen.

These experiences with video games are very important in order to design better solutions to the current video games.

«What we find changes who we become»

– Peter Morville

CHAPTER 6: ANALYSIS AND DISCUSSION OF RESULTS

To answer the sub-questions of the research question and the inherent hypotheses, a questionnaire was used. The main findings are covered in 'Presentation and analysis of quantitative data'.

As for qualitative data, its collection aimed to understand people's opinion about playing games in later age and support the quantitative results. This information is presented in the 'Presentation and analysis of qualitative data'.

Overall, the mixture of different types of data will help on answering the main research question.

Presentation and analysis of quantitative data

Descriptive and inferential statistical analysis was used to characterize different gamer profiles of both groups. Concerning the first hypothesis ("H_1: There is a correlation between the types of games that participants like to play and their age"), comparisons

between the two age groups (G1 and G2) and their game preferences were made using chi-square (x2) tests.

As shown in **Table 9**, there are only significant differences between age groups, when it comes to choosing Action/Adventure games (x2=13.16, p=.000) and Memory games (x2=9.4, p=.002). No significant differences were found between the other types of games.

Table 9. Analysis of game preferences by age group

Variable	Pearson Chi-squared value
Action /Adventure games	13.16**
Memory games	9.4**
Fighting	3.28
Economic	2.58
Platform games	0.19
Racing games	0.21
Strategy	0.46
World build games	2.88
Math	0.01

n=245; df=1; **p<0.00

When the subjects were asked to state their video game preferences, the majority elected action/adventure games with problem solving elements, followed by strategy and memory games.

Most interesting in these data is that most of the respondents in G2 who played video games (84.6%, N=44) preferred strategy (51.9%, N=27) and then action/adventure games (34.6%, N=18), whereas the first choice for video gamers in G1 (96.4%, N=186) was action/adventure games (62.7%, N=121) and second came strategy games (46.6%, N=90). It may suggest that as we get older and older, there is a change in preferences for cognitive challenges (strategy) over actions.

In addition, this study has found that the G1 group played more networked video games (85.6%; N=167) than G2 (14.4%, N=28). A chi-square test found that there is a correlation between the age group and whether they played networked video games

(x^2=26.94, p=.000). The results suggest that networked video games that allow communication between players will delight the over-50s generation of gamers (x^2=26.94, p=.000).

Concerning the interconnectedness between gamers' motivations to play and the genres of video games they play, it was found that action/adventure games with problem-solving were mainly played by the respondents who prioritized "Immersion in a virtual environment" (x^2=23.93, p=.000). Fighting games seemed to be for those players who selected "Competing with others" (x^2=17.401, p=.000),

Meanwhile, Economic/Management games attracted gamers who preferred "Learning new things" (x^2=4.07, p=.04) The same reason was given by Maths gamers (x^2=5.499, p=.02) and players who liked memory games (x^2=15.173, p=.00).

For racing gamers the motivation was "Competing with others" (x^2=4.688, p=.02). In addition, the strongest motivations indicated by players who preferred Strategy game, were a "Fun way to spend free time" (x^2=7.829, p=.00) and "Helping maintain an active mind" (x^2=5.642, p=.01). Lastly, the reason for opting for World builder games was "Immersion in a virtual environment" (x^2=5.034, p=.003).

As for games, board games are still popular. Comparing different age groups, over sixty percent of gamers aged over 64 surveyed reported that they play games (65.4%, N=34). The majority of the sample plays games daily (23.1%, N=12). By contrast, gamers aged between 50 and 64 (47.7%, N=92) are less likely to play traditional games and play once in a while (15%, N=29). Similarly, the majority of respondents in both groups play cards.

The second hypothesis, relating to who do participants live with and the mode of playing (H$_2$: There is a correlation between who participants live with and the mode of playing), a chi-square test did not show any significant differences between the dependent variable (mode of playing) and independent variable (who participants live with).

The results, as shown in *Figure 21*, indicate that the majority of players live with a companion and they prefer to play alone against the computer or in a team against another team. Overall, who they live with does not affect the preferred playing mode.

How do you prefer to play– * Who do you live with– Crosstabulation

				Who do you live with–				
			Alone	Accompanied	In a residence for the elderly (full time)	In a residence for the care	Other	Total
How do you prefer to play–	Alone against the computer	Count	31	58	2	2	14	107
		% within How do you prefer to play–	29,0%	54,2%	1,9%	1,9%	13,1%	100,0%
		% within Who do you live with–	57,4%	46,4%	66,7%	66,7%	45,2%	49,5%
		% of Total	14,4%	26,9%	0,9%	0,9%	6,5%	49,5%
	Against another player	Count	3	11	0	0	2	16
		% within How do you prefer to play–	18,8%	68,8%	0,0%	0,0%	12,5%	100,0%
		% within Who do you live with–	5,6%	8,8%	0,0%	0,0%	6,5%	7,4%
		% of Total	1,4%	5,1%	0,0%	0,0%	0,9%	7,4%
	As a team against another team	Count	20	56	1	1	15	93
		% within How do you prefer to play–	21,5%	60,2%	1,1%	1,1%	16,1%	100,0%
		% within Who do you live with–	37,0%	44,8%	33,3%	33,3%	48,4%	43,1%
		% of Total	9,3%	25,9%	0,5%	0,5%	6,9%	43,1%
Total		Count	54	125	3	3	31	216
		% within How do you prefer to play–	25,0%	57,9%	1,4%	1,4%	14,4%	100,0%
		% within Who do you live with–	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		% of Total	25,0%	57,9%	1,4%	1,4%	14,4%	100,0%

Figure 21 Cross tabulation of gamers' preferences: how gamers prefer to play and who they live with.

Considering the null hypothesis "There are no significant differences between the preferred playing mode and who the gamer lives with" and the alternative hypothesis "There are significant differences between the variables", there is no significant difference between the playing preferences and who they play with (x^2 (prefer to play)= 3.338; p =0.911). Thus, the null hypothesis cannot be rejected.

Similarly, regardless of participants' age, both groups (G1 and G2) agree with the sentences: "Video games are related to real life because I meet other players" (46.5%, N=106); "It is possible to express feelings through Computer-mediated communication" (63.5%, N=145) and "It is possible to get to know other players through CMC" (80.7%, N=184). More than half of the respondents (62.4%, N=153) said they use synchronous communication services, such as Skype, Facebook chat and Teamspeak. In contrast, the majority disagree with the fact that "I and my game's character (avatar) are very similar" (57.9%, N=132) and "I take on different personalities with my game's character" (53.5%, N=122).

Lastly, the third hypothesis (H$_3$: There is a correlation between the type of games preferred by respondents and the skills that they want to practise) was tested.
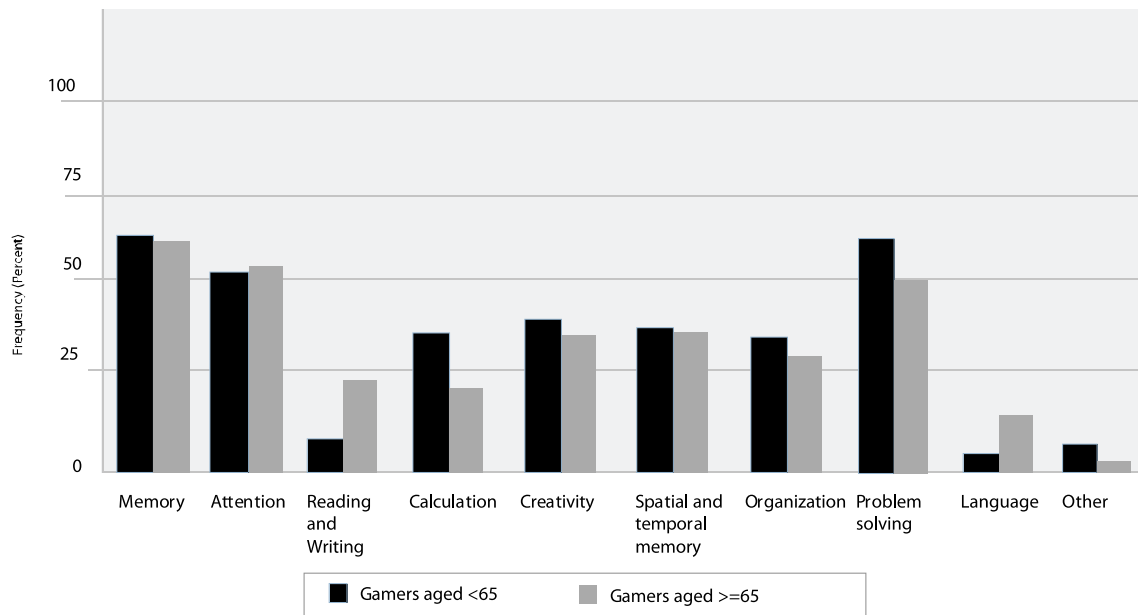
Figure 22 Percentage of respondents who stated wanting to practise each skill.

The bar graph in *Figure 22* shows the percentage of respondents who stated wanting to practise different skills with video games. It indicates that both age groups would like to practise problem solving (63.7%, N=123 for G1 and 50%, N=26 for G2). The respondents would also like to practise memory through games (60.1%, N=116 for G1 and 59.6%, N=31 for G2).

Changes in the skills that participants wanted to practise and the video games they played were compared using the Chi-square tests.

The respondents who prefer action/adventure games with problem solving elements tended to want to practise problem solving (x^2 = 35.216, p =.000), creativity (x^2 = 10.963, p =.001), spatial and temporal memory (x^2 = 7.460, p =.006) as well as calculation (x^2 = 6.989, p =.008). Economic/management gamers also seem to want problem solving (x^2 = 11.331, p =.001), organization (x^2 = 5.798, p=0.016) and calculation (x^2 = 5.48, p =0.019). The respondents who liked board games suggested spatial/temporal memory (x^2 = 3.963, p=.047) and problem solving (x^2 = 3.363, p =.067), whereas those who elected strategy games, wanted to practise problem solving (x^2 = 9.632, p =.002) and organization (x^2 = 5.821, p =.016).

Concerning world building, gamers apparently chose to increase their creativity (x^2 = 9.745, p =.002) and problem solving capacity (x^2 = 11.56, p =.000). Maths games often appeal to those respondents, who enjoy calculations (x^2 = 5.861, p =.015), reading and writing (x^2 = 8.711, p =.003) as well as spatial and temporal memory (x^2 = 9.608, p =.002). Finally, memory games tend to attract the individuals who like to improve attention span (x^2 = 7.168, p =.007), reading and writing (x^2 = 14.23, p =.000) and language (x^2 = 6.944, p =.008) skills.

These results go in hand with the strongest reasons which lead the over-49s gamers to play. If, on one hand, subjects consider their games' motivation: "A fun way to spend free time", on the other hand, they prioritize "Helping maintain an active mind". To answer the question, subjects were given a list of reasons why they might play or they could indicate other reasons in the "Other" option. The items included "Making friends", "Learning new things", "Obtaining high status", "Socialising with others", "Competing with others", "Collaborating with others", "A fun way to spend free time", "Helping maintain an active mind" and "Immersion in a virtual environment". Participants could also choose more than one answer.

Regarding the plot of the games, if respondents had to choose a book, they would prefer the genres of history, science/science fiction and mythology/fantasy. A predetermined number of preferences were chosen from the options of (a) history, (b) fiction, (c) science, (d) health, (e) cooking, (f) current events/politics, (g) biography, (h) poetry, (i) horror, (j) art, (k) animals/plants, (l) mythology and (m) other.

Furthermore, the device most used for playing continues to be the computer (89%, N=218), followed by tablet (20.8%, N=51) and Wii (13.9%, N=34). These findings can be a result of participants' feeling at ease with different devices. The majority of respondents (65.7%, N=161) stated being very comfortable with the personal computer, 45.3% (N=111) with tablet and 37.1% (N=91) with mobile phones.

Presentation and analysis of qualitative data

This section presents the results of the qualitative research. It was considered that a qualitative analysis would supplement and extend the quantitative measures. Thus, data were collected from the survey's open-ended questions, threads in discussion forums and two focus groups.

Of the 245 survey respondents, 116 gave their opinion about "*Is there anything you find particularly difficult in video games? And easy? What? Do you have any suggestions for improving video games?*". Meanwhile, 243 respondents answered to "*What is your favourite video game?*" and 48 subjects to "*What is your favourite game?*". The same questions were posed during the focus groups of 10 participants.

To assess people's opinion about playing video games in a later age, a *netnographic* study was conducted and the grounded theory was used. That is to say, data analysis emerged through data collection. The term "Grounded Theory" is used by Strauss and Corbin (1990 as cited in Pandit, 1996, p.23) to refer to a theory "discovered, developed and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon".

After collecting data, participants' answers were divided into words, phrases or sentences (open coding). Then it followed their compilation in different categories according to its context and number of occurrences. Data collection and analysis was performed using the WEBQDA software. **Table 10** summarizes the questioning process and the tools used to answer each question.

1. **Guild Wars 2 was the video game most cited when asked about favourite video games**

When asked about favourite video games, the most cited were Guild Wars 2 (13.6%, N=33), World of Warcraft (12.2%, N=30), Battlefield (5%, N=12) and Elder Scrolls: Skrym (5%, N=12). During the coding process, abbreviations, such as "gw2", "wow" and "bf", were also considered. However, caution must be applied. Respondents' answers were diversified.

The video game Guild Wars' storyline is related to the dominance of human civilization by other races. Although it seems to be a player vs player (PvP) game, this video game offers the option of levelling by crafting or combating. In Guild Wars 2, the gameplay and fate is dependent on the character features that the player has chosen at the beginning. Moreover, Guild Wars is well classified in terms of accessibility by the AbleGamers association.

Table 10. The questioning process and WEBQDA tools

QUESTIONS	WEBQDA TOOL	SEARCH RESTRICTION
What are the respondents' favourite video games?	Search for frequent words	Only on the category "Favourite video games"
What are the respondents' favourite games?	Search for frequent words	Only on the category "Favourite games"
Is there any relationship between the type of difficulties felt while playing games and participants' age?	Data matrix	Categories: Age (G1 and G2) Difficulties (Accessibility, communication, visual and technical)
Is there any relationship between the type of difficulties felt while playing games and participants' gender?	Data matrix	Categories: Gender (Male and Female) Difficulties (Accessibility, communication, visual and technical)
Do people who are against of playing in later life, base their opinions on game experiences or reasons for not playing?	Compound Query	Categories: Being against and game experience; Being against and reasons for (not) playing
Do people who are in favour of playing in later life, base their opinions on game experiences or reasons to play?	Compound Query	Categories: Being in favour and game experience; Being in favour and reasons for (not) playing

2. Board games are the type of games preferred

This qualitative result corroborates the findings of the survey, regarding what type of games do older adults play. Backgammon, cribbage and go were some of the games mentioned.

In order to distinguish between age groups and the type of difficulties felt while playing video games, it was needed to divide respondents' answers into categories (a) accessibility; (b) communication/social; (c) visual; and (d) technical. **Table 11** shows this process by compiling some respondents' answers into each category.

Table 11. Example of attributing categories to the respondents' answers

CATEGORIES	EXAMPLE
Accessibility	"Fast pace games are challenged by arthritic hands and nerve damage"
	"Jumping puzzles is difficult"
Communication/Social	"I do not like about the anonymity."
	"(…) and really would prefer to play alone."
Visual	"3D"
	"Need a larger tv to see small 'pick up' items."
Technical	"When the engine is incapable of seeing similarities in answers."
	"I'd come out with one piece of hardware that played any game by any company."

Each sentence can be coded into one or more categories. Then, the game difficulties' categories were crossed with the age group (G1 and G2), aimed at knowing the differences and similitude between groups.

3. None of the differences between players' difficulties and their age or gender were significant.

As shown in **Table 12**, both groups reported more difficulties in accessibility. However, no comparison between groups can be made. Data are not robust enough to make comparisons between groups, whose difference in the number of respondents is significant.

Table 12. Players' difficulties x Age (N=59)

CATEGORIES	G1 (Individuals aged between 50-64)	G2 (Individuals aged 65 and over)
Accessibility	31 ref	9 ref
Communication/Social	6 ref	1 ref
Visual	2 ref	1 ref
Technical	8 ref	1 ref

The **Table 13** shows the players' difficulties by their gender. Both groups reported difficulties in accessibility. However, men reported more problems with video games related to technical aspects (bugs, hardware, system and artificial intelligence). Women seemed to give more importance to visual graphics.

Table 13. Players' difficulties x Gender (N=57)

CATEGORIES	FEMALE	MALE
Accessibility	11 ref	28 ref
Communication/Social	3 ref	4 ref
Visual	1 ref	2 ref
Technical	0 ref	8 ref

In general, the difficulty that seems to affect the majority of gamers is hand-eye coordination that is demanded in "twitchy" games. In terms of social aspects, they prefer player versus environment (PvE) to player versus player (PvP) games. Collaboration could be a way of progression in games, instead of velocity. They are not attracted to violence.

Game scenarios and characters that are the most similar to reality are valued. Game elements should not be small and be customizable. Moreover, Artificial Intelligence (AI) and compatibility between platforms should also be considered.

4. The majority of subjects who stated being in favour of playing in later age based their opinion on reasons to play whereas those who were against, based on game experience. The following table gives an overview of the most cited reasons to play video games in later age and the game experiences referred from those who were against.

Table 14. Overview of the respondents' opinions

IN FAVOUR OF VIDEO GAMES IN LATER AGE	AGAINST VIDEO GAMES IN LATER AGE
" (…) helps keep our mind active."	"No. I'm sorry grandma but I just can't see you playing mariokart with me and cousin mikey"
"Why not? It may make for a nice way to spend the time. Considering how they can't really spend that much time outside and all."	"No. If the elderly begin to play interactive games in their home I suspect 911 will become overburdened in every town and state. Can you imagine a 75 year old shut in playing the bowling game or the tennis game or dancing (…)."
"Videogames keep the mind sharp and improve one's cognitive abilities."	
"Video games are good for brain activity! Studies have shown benefits to elderly gaming."	"No. "What'sh da dere on da screen? It'sh a ball. (…) this is what happened when I went to my Grandpa's nursing home... I finally told them it was a ball".
"Why not???? It is good for dexterity, keeps the mind sharp, most can be interactive for workouts (…)"	

Discussion

Earlier studies (Gajadhar et al., 2010; Göllner, Lindenberg, Conradie, Le, & Sametinger, 2010; Nap et al., 2009) have noted the importance of studying the gamer profile and an online co-play experience among older adults. However, in reviewing the literature, no data was found on the association of player game patterns and motivations with video game design components.

In the current study, when comparing gamers aged between 50-64 (G1) and gamers aged 65 and over (G2), no significant differences were found between age groups and their choices of video games. The most cited video games were action/adventure games with problem solving, strategy and memory games. Board games remain the most popular games and accessibility issues are the most cited when thinking about main game difficulties.

Contrary to expectations, this research did not find a significant difference related to who participants live with and the preferred playing mode. The majority of subjects prefer to play alone against the computer or as a team against another team. Qualitative results revealed that these players found the player-vs-environment (PvE) more attractive than player-vs-player (PvP) games. Furthermore, gamers aged 50 and over are likely to recognize that video games can be related to their real –life and that it is possible to express feelings and know other players through CMC. The findings corroborates the ideas of De Schutter & Abeele (2008), who suggested that video games should allow connecting people, cultivating personal growth and contributing to society. Although, this sample disagrees on every similarity between themselves and the game's character as well as taking on different personalities. On the question of the game preferences and gamers' skills, the study found that respondents who preferred action/adventure games tended to want to practise problem solving, spatial and temporal memory as well as calculation. The strongest reasons that seem to encourage these gamers to play are the fun factor and the fact that games can help maintain an active mind.

The finding have important implications for developing video games targeted to gamers aged 50 and over as well as for changing the stigma of the video gamers' age. Further studies, which consider the older gamers' lifestyle, will need to be undertaken with a wider sample.

«Gamers' soul never dies»

– Participant

CONCLUSIONS

In this section, the research outcomes regarding the initial hypotheses and goals are revealed. Final thoughts, the research contribution in the field, its limitations and future work are also presented.

Addressing research questions and hypotheses

This Mater's thesis has been concerned with the main game design components of networked video games that can encourage older adults to play. To answer the research question, this investigation was oriented by a number of specific sub-questions.

The initial hypotheses and sub-questions are addressed and reviewed in this section.

The first sub-question asked whether there was any relationship between the type of (video) games participants liked to play and their age. The corresponded hypothesis stated that there was a correlation between the type of games that participants like to play and their age group (G1: individuals aged between 50 and 64 and G2: individuals aged 65 and over). The results have shown that only significant differences between age groups were found when it comes to choosing action/adventure games and Memory games. The majority of video gamers in G1 preferred action/ adventure games and then strategy games. As for G2, strategy games were the first choice compared to action/adventure games (their second choice). It may suggest that as we get older and older, there is a change in preferences for cognitive challenges (strategy) over actions. Furthermore, the first group (G1) played more networked video games than G2. This finding of the current study is consistent with those of Martson (2012) and Pearce (2008) who found that their participants preferred another type of games (such as role-playing, games of mystery and adventure) beyond casual games.

The second sub-question asked whether there was a correlation between who participants lived with and the mode of playing. The corresponded hypothesis stated that there was a correlation between who participants live with and the mode of playing. The results indicated that who participants lived with (whether accompanied, alone, in a residence for the elderly or in a residence for the care) did not affect the preferred playing mode (play against the computer, play as a team against another team or play against another player). The majority of respondents seem to prefer playing either alone or as a team against another team.

The third sub-question was related to the correlation between the type of games preferred and the skills that participants wanted to practise. The results confirmed the hypothesis that there was a correlation between the type of games preferred and the skills that participants wanted to practise. The respondents who preferred action/adventure games with problem solving elements tended to want to practise problem solving, creativity, spatial and temporal memory as well as calculation.

Economic/management gamers also seemed to want to practise problem solving and calculation. The respondents who liked board games suggested spatial/temporal memory and problem solving, whereas those who elected strategy games, wanted to

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practise problem solving and organization. Concerning world building, gamers apparently chose to increase their creativity and problem solving capacity. Maths games often appeal to those respondents, who enjoy calculations, reading and writing as well as spatial and temporal memory. Finally, memory games tend to attract the individuals who like to improve attention span, reading and writing and language skills.

The skills that participants wanted to practise the most were problem solving and memory. Therefore, there are similarities between the skills most cited in this study and those described by Eldergames (2006) project – memory and attention.

The fourth sub-question was related to the main difficulties that these age groups have with games' interfaces. The corresponded hypothesis stated that older adults were encouraged to play by facing cognitive challenges and customizing their virtual worlds and their main difficulties are related to accessibility issues. This study has shown that accessibility problems were the most reported by respondents, followed by communication and technical problems.

Slightly differences were found regarding participants' gender and their difficulties. Whereas men reported having more problems related to technical aspects, women seemed to be concerned with visual graphics. Fast games are challenges for gamers with arthritic hands and nerve damage. Thus, video games should be stimulating through problem solving as these players seem to be motivated by the fun factor and the fact that they can maintain their mind active.

Overall, the game design recommendations that can motivate these players to play may be: (a) Video games that promote problem-solving capacity and memory span; (b) Cognitive challenges; (c) Collaboration between players over competition activities; (d) Feedback messages, indicating their progress in game and congratulating them when the task is accomplished; (e) The option of customizing HUDs and keys; (f) Realistic graphics and Player versus environment mode; (g) The option of levelling by crafting instead of combating; (h) The sense of exploration and achievement and (i) Games with historical settings.

This finding also accords to the researcher's earlier observations, which showed the main difficulties of this audience when interacting with video games.

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Final thoughts and research contributions

This study set out to determine the main game design components of networked video games, which could encourage older adults to play. It then comprehends the types of video games preferred and participants' age group, their skills, modes of playing and older adults' difficulties with games' interfaces.

One of the most significant findings to emerge from this research is that adventure and strategy games are the favourite type of these gamers aged 50 and over. These preferences are likely to be related with the abilities they want to practise through games. Problem solving, memory and attention were the most cited skills. It was also shown that the device most used to play continues to be the computer, followed by the tablet and Wii.

Action oriented and violent games are not inviting to this target. They prefer in-game exploration and mental stimulus.

As for multiplayer video games, this target group seem to prefer player versus environment to player versus player games. In-game achievements and exploration should be prioritized, as subjects emphasized that these game components provided a sense of control and power. They are also more aware of the leading role of CMC in expressing feelings and know other players in online-game playing.

These results corroborate earlier findings of some previous studies (De Schutter & Abeele, 2008; Derboven, Van Gils, & De Groof, 2011; Ijsselsteijn, Nap, De Kort, & Poels, 2007a; Whitcomb, 1990) that suggest that online game - playing promotes relationships between players and have potential for this target group.

Additionally, the main concerns about playing video games reported by this target group are related to accessibility issues. Thus, the progression in game should not be dependent on time control or the number of lives; virtual violence should be avoided and game elements must be movable and customizable, being, at least, accessible to the impairments that affect most of older adults (visual and hearing).

Taken together, these results suggest that a younger age group (50-64) begins to play networked video games, which can be predicted that in a near future, there will be a different profile of the older adult gamer. Game developers will hopefully be better prepared to correspond to these gamers' needs and preferences.

This research contributes to an understanding of how can the video game industry cater for over-50s gamers' needs and preferences. By providing this information and developing networked video games that correspond to the next generation of older adult gamers, we can help on reducing the sense of loneliness in later age through video games.

Limitations and Future work

Limitations

A number of limitations need to be considered. Firstly, the research used a convenience sample and caution must be applied, as the findings might not be transferable to other contexts. Considering the fact that this study has an international dimension, getting a random sample of each country would be unfeasible. For that, the research would need to be extended in time.

Secondly, another major limitation of the study lies on focus group. As mentioned in Chapter 5, it has been expected to conduct it synchronously. However, due to a number of constraints (e.g.: (i) the researcher was unknown; (ii) some players have the suspicion that the study could have a commercial purpose; (iii) many participants were unavailable, as it was difficult to manage different time zones), the synchronous focus group has been cancelled. Instead, it has been conducted asynchronously. Because of the difficulty to have participants in the focus group, heterogeneity (in gender and country of residence) could not be verified. For the same reason, the involvement of three groups proposed by Mulligan and Patrovsky (n.d., as cited in Sotamaa, 2007), (a) hard-core, (b) moderate and (c) mass-market gamers, in the participatory design process, was not possible.

Thirdly, one source of weakness in this study was the change of methodology. The study has begun with an action research approach because it was predicted to involve a group of older adults from the elderly care centres of Aveiro in participatory design sessions and redesign the proof of concept according to playtest. Despite the fact that the researcher has been acting as an insider in two elderly care centres, they were not prepared to discuss about video game concepts. That training has evolved and at this time, they already play casual games. In a near future, this group may provide insights to game design, plus acting as usability testers.

Lastly, a technical limitation was the development of a networked video game in Unity 3D. A NAT problem (the translation of a private to a public IP) could not be solved in time.

Future work

Further research is recommended in the following areas:

Psychology/ Neurology/ Social Sciences:

• After the development of the proof of concept of a networked video game, it is needed to understand whether networked video games affect older adults' anxiety, level of depression and communication skills;

• Evaluate the video game characters, using the scales suggested by Cheong, Jung & Theng (2011) aimed at evaluating anthropomorphism (human form), androgyny (perceived gender of an object), credibility, homophily (relate themselves to the character) and attraction. Then, cross the data with the results of the survey (Agree/Disagree with the sentences "I and my game's character are very similar" and "I take on different personalities with my game's character";

• Further work needs to be done to discuss online focus groups as a technique of participatory design sessions.

Game Studies/Usability/Accessibility:

• Explore the role of non-player characters (NPCs) as a visual aid to impaired gamers;

• Explore the potential of crowdsourcing in video game design;

• Examine accessibility issues in networked video games;

• Understand the potential of live action games, live action role-playing games (LARPs) and alternate reality games (ARGs) in promoting the communication among gamers' community;

• Compare experiences between casual games and networked video games within a group of older gamers: contact different researchers who investigate video games for older adults and involve them in a study that compares different older gamers' profile;

• Analyse serious games and digital based learning games as promoters of an intergenerational play;

History/Field work:

• A further study investigating the history of Dead Sea Scrolls is needed and bringing tourism experiences to the games' challenges would be very interesting. Older adult gamers could be involved in this process as the respondents manifested interest in history. This experiment could be translated into another research: "Senior tourism experiences brought into the video game context";

Computer science:

• Development of the video game prototype and introduce artificial intelligence (AI) to the video game (e.g. creation of NPCs, game scenarios that are dependent on avatars' emotions); provide in-game tutorials/feedback and translate input voice communication to a text-based communication output.

REFERENCES

Ablegamers. (2012). *Includification - A Pratical Guide to Game Accessibility* (Vol. 14).

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications.

Aison, C., Davis, G., Milner, J., & Targum, E. (2002). Appeal and interest of video game use among the elderly. *Harvard Graduate School of Education, (May 2002)*, *i-28. DOI= http://www. jrmilner. com.*

Almeida, S. J. (2009). Augmenting video game development with eye movement analysis.

Ammer, A. R. (1996). Multi-User Adventures as Interactive Fiction.

Andersen, E., O'Rourke, E., Liu, Y.-E., Snider, R., Lowdermilk, J., Truong, D., . . . Popovic, Z. (2012). *The impact of tutorials on games of varying complexity.* Paper presented at the Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems.

Achterbosch, L., Pierce, R., & Simmons, G. (2008). Massively multiplayer online role-playing games: the past, present, and future. *Computers in Entertainment (CIE), 5*(4), 9.

Aslaksen, F., Bergh, S., Bringa, O. R., & Heggem, E. K. (1997). Universal design: Planning and design for all.

Baecker, R., Shim, N., Tonon, K., Pandeliev, V., Birnholtz, J., Stern, Y., . . . Moffatt, K. (2010). Serious' online gaming environments to enhance brain fitness in senior citizens. Gerontechnology, 9(2), p. 190.

Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit MUDs. J*ournal of MUD research*, 1(1), 19.

Bickman, L., Rog, D. J., & Hedrick, T. E. (1998). *Applied research design: a practical approach.* Handbook of applied social research methods, 19.

Blanche, M. M. J. T., Blanche, M. T., Durrheim, K., & Painter, D. (2006). *Research in practice: Applied methods for the social sciences*: Juta and Company Ltd.

Bloor, M., Frankland, J., Thomas, M., & Robson, K. (2001). Focus groups in social research: SAGE Publications Limited.

Bordia, P. (1997). Face-to-face versus computer-mediated communication: A synthesis of the experimental literature. Journal of Business Communication, 34(1), 99-118.

Brown, E., & Cairns, P. (2004). A grounded investigation of game immersion. *Paper presented at the CHI'04 extended abstracts on Human factors in computing systems*.

Bruckman, A. (1992). Identity Workshop: Emergent social and psychological phenomena in text-based virtuality reality. Retrieved June 2013, from http://www.douri.sh/classes/ics234cw04/bruckman.pdf

Burger-Helmchen, T., & Cohendet, P. (2011). User Communities and Social Software in the Video Game Industry. Long Range Planning, 44(5), 317-343.

Caillois, R. (2001). Man, play and games: University of Illinois Press.

Calleja, G. (2008). Virtual worlds today: gaming and online sociality: Universitätsbibliothek der Universität Heidelberg.

Campenhoudt, L. V., & Quivy, R. (1992). Manual de investigação em ciências sociais. [Handook of research in social sciences] Lisboa: Gradiva.

Chen, J. (2012). 50 Digital Team-Building Games: Fast, Fun Meeting Openers, Group Activities and Adventures using Social Media, Smart Phones, GPS, Tablets, and More: John Wiley & Sons.

Chen, Y. (2009). Usability Analysis on online Social Networks for the elderly: Technical report, Helsinki University of Technology.

Cheong, W. L., Jung, Y., & Theng, Y. L. (2011). Avatar: a virtual face for the elderly.

Christou, G., Lai-Chong Law, E., Zaphiris, P., & Ang, C. S. (2012). Challenges of Designing for Sociability to Enhance Player Experience in Massively Multi-player Online Role Playing Games. *Behaviour & Information Technology*(just-accepted), 1-34.

Crawford, C. (1984). *The art of computer game design.*

Crawford, C. (2003). *Chris Crawford on game design*: New Riders Pub

Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience: Harper Perennial.

Curtis, P. (1992). Mudding: Social phenomena in text-based virtual realities. High noon on the electronic frontier: *Conceptual issues in cyberspace,* 347-374.

Curtis, P., & Nichols, D. A. (1994). MUDs grow up: Social virtual reality in the real world. *Paper presented at the Compcon Spring'94, Digest of Papers*.

De Schutter, B., & Abeele, V. (2008). Meaningful play in elderly life. status: published.

De Schutter, B., & Abeele, V. (2010). *Designing meaningful play within the psycho-social context of older adults*.

Debus, M. (1995). Methodological review: a handbook for excellence in focus group research: Academy for educational development.

December, J. (1996). Defining Internet-based computer-mediated communication. Retrieved June 2013, from http://www.december.com/john/study/cmc/what.html

Demirbilek, O. (1999). *Involving the elderly in the design process: a participatory design model for usability, safety and attractiveness* (Doctoral dissertation). Bilkent University.

Demirbilek, O., & Demirkan, H. (2004). Universal product design involving elderly users: a participatory design model. Applied Ergonomics, 35(4), 361-370.

Derboven, J., Van Gils, M., & De Grooff, D. (2011). Designing for collaboration: a study in intergenerational social game design. Universal Access in the Information Society, 1-9.

Dewsbury, G., Sommerville, I., Bagnall, P., Rouncefield, M., & Onditi, V. (2006). Software co-design with older people. Designing Accessible Technology, 199-208.

Dias, I. (2012). O uso das tecnologias digitais entre os seniores: motivações e interesses.

Doyle, J. (2009). Using focus groups as a research method in intellectual disability research: a practical guide. The national federation of voluntary bodies providing services to people with intellectual disabilities. Retrieved April, 5, 2010.

Dye, M., Green, C., & Bavelier, D. (2009). The development of attention skills in action video game players. *Neuropsychologia, 47*(8-9), 1780.

Duin, H., Hauge, J. B., Hunecker, F., & Thoben, K.-D. (2011). Application of Serious Games in Industrial Contexts. *Business, Technological, and Social Dimensions of Computer Games: Multidisciplinary Developments*, 331.

Eason, K. D. (1995). User-centred design: for users or by users? *Ergonomics, 38*(8), 1667-1673.

Eldergames (2006) Game Typologies to be developed and their relationship with the parameters to measure. *Development of High Therapeutic Value IST-based Games*

for Monitoring and Improving the Quality of the Life of Elderly People: Information Society Technologies.

Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication, 13*(1), 210-230.

Ermi, L., & Mäyrä, F. (2007). *Fundamental components of the gameplay experience: Analysing immersion. Worlds in play*: International perspectives on digital games research, 37.

European Commission (2009). The 2009 Ageing Report: economic and budgetary projections for the EU-27 Member States (2008-2060). European Economy, 2, 27.

Eurostat (2010). Work session on demographic projections: Eurostat.

Fabri, M., Moore, D. J., & Hobbs, D. J. (1999). The emotional avatar: non-verbal communication between inhabitants of collaborative virtual environments *Gesture-Based Communication in Human-Computer Interaction* (pp. 269-273): Springer.

Farris, M., Bates, R., Resnick, H., & Stabler, N. (1995). *Evaluation of computer games' impact upon cognitively impaired frail elderly*. Computers in Human Services, 11(1-2), p. 219-228.

Federoff, M. A. (2002). *Heuristics and usability guidelines for the creation and evaluation of fun in video games.* Citeseer.

Fisk, A. D., Rogers, W. A., Charness, N., Czaja, S. J., & Sharit, J. (2009). *Designing for older adults: Principles and creative human factors approaches:* CRC press.

Fullerton, T., Swain, C., & Hoffman, S. (2008). Game design workshop: a playcentric approach to creating innovative games: Focal Press.

Gajadhar, B. J., Nap, H. H., Kort, Y. A. W., & IJsselsteijn, W. A. (2010). Out of sight, out of mind: Co-player effects on seniors' player experience.

Galego, C., & Gomes, A. A. (2005). Emancipação, ruptura e inovação: o "focus group" como instrumento de investigação. Revista Lusófona de Educação, 5(5), 173-184.

Gallagher, P. (2005). Synchronous computer mediated group discussion. Computers Informatics Nursing, 23(6), 330-334.

Gamberini, L., Barresi, G., Maier, A., & Scarpetta, F. (2008). A game a day keeps the doctor away: A short review of computer games in mental healthcare. Journal of CyberTherapy and Rehabilitation, 1(2), 127-145.

Gamberini, L., Martino, F., Seraglia, B., Spagnolli, A., Fabregat, M., Ibanez, F., . . .
    Andrés, J. M. (2009). Eldergames project: An innovative mixed reality table-top
    solution to preserve cognitive functions in elderly people.

Gerling, K., & Masuch, M. (2011). When Gaming is not Suitable for Everyone: Playtesting
    Wii Games with Frail Elderly.

Gibson, L., Arnott, J., Moncur, W., Martin, C., Forbes, P., & Bhachu, A. S. (2010).
    Designing social networking sites for older adults. Paper presented at the
    Proceedings of the 24th BCS Interaction Specialist Group Conference.

Glinert, E. M. (2008). The human controller: usability and accessibility in video game
    interfaces. Massachusetts Institute of Technology.

Gobo, G., Gubrium, J. F., & Seale, C. (2004). Qualitative research practice. London [u.a.:
    SAGE.

Göllner, S., Lindenberg, J., Conradie, P., Le, J., & Sametinger, F. (2010). The Enchanted
    Neighborhood: Using Metaphorical Devices for the Inclusion of Seniors in the Co-
    designing Process.

Grammenos, D., Savidis, A., & Stephanidis, C. (2009). Designing universally accessible
    games. Computers in Entertainment (CIE), 7(1), 8.

Granovetter, M. (1983). The strength of weak ties: A network theory revisited.
    Sociological theory, 1(1), 201-233.

Grant, J., Hoorens, S., Sivadasan, S., van het Loo, M., DaVanzo, J., Hale, L., . . . Butz, W.
    (2004). *Low fertility and population ageing:* Rand Corporation.

Green, C. S., & Bavelier, D. (2006). The cognitive neuroscience of video games. *Digital
    media: Transformations in human communication*, 211-223.

Griffiths, M. D., Davies, M. N., & Chappell, D. (2004). Online computer gaming: a
    comparison of adolescent and adult gamers. *Journal of adolescence, 27*(1), 87-96.

Griffith, J., Voloschin, P., Gerald, D., & James, R. B. (1983). Differences in eye-hand
    motor coordination of video-game users and non-users. Perceptual and motor skills,
    57(1), 155-158.

Guye-Vuillème, A., Capin, T. K., Pandzic, S., Thalmann, N. M., & Thalmann, D. (1999).
    Nonverbal communication interface for collaborative virtual environments. *Virtual
    Reality, 4*(1), 49-59.

REFERENCES
NETWORKED VIDEO GAMES FOR OLDER ADULTS
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Haegerstrom-Portnoy, G., Schneck, M. E., & Brabyn, J. A. (1999). Seeing into old age: vision function beyond acuity. Optometry & Vision Science, 76(3), 141-158.

Hendriks, P. (1999). Why share knowledge? The influence of ICT on the motivation for knowledge sharing. Knowledge and process management, 6(2), 91-100.

Heine, C., & Browning, C. (2002). Communication and psychosocial consequences of sensory loss in older adults: overview and rehabilitation directions [Abstract]. *Disability & Rehabilitation*, 24(15), 763-773.

Helfer, K. S., & Freyman, R. L. (2008). Aging and speech-on-speech masking. Ear and hearing, 29(1), 87.

Howard, T. (2009). *Design to thrive: creating social networks and online communities that last*: Morgan Kaufmann.

Hunicke, R., LeBlanc, M., & Zubek, R. (2004). MDA: A formal approach to game design and game research. Paper presented at the Proceedings of the AAAI Workshop on Challenges in Game AI.

Hsu, H.-C. (2010). Trajectory of life satisfaction and its relationship with subjective economic status and successful aging. *Social Indicators Research,* 99(3), 455-468.

Huizinga, J. (2004). Nature and significance of play as a cultural phenomenon. *The performance studies reader*, 117-120.

Ijsselsteijn, W., Nap, H. H., De Kort, Y., & Poels, K. (2007a). *Digital game design for elderly users*.

IJsselsteijn, W., De Kort, Y., Poels, K., Jurgelionis, A., & Bellotti, F. (2007b). Characterising and measuring user experiences in digital games.

IJsselsteijn, W., van den Hoogen, W., Klimmt, C., de Kort, Y., Lindley, C., Mathiak, K., ... Vorderer, P. (2008). Measuring the experience of digital game enjoyment. Paper presented at the Proceedings of Measuring Behavior.

Instituto Nacional de Estatística. Statistics Portugal.(2009). Report of the INE of *Projecções de População Residente em Portugal 2008-2060* [Projections of the Resident Population in Portugal 2008-2060].

International Game Developers Association (2004). Accessibility in games: Motivations and approaches: IGDA.

Iriberri, A., & Leroy, G. (2009). A life-cycle perspective on online community success. *ACM Computing Surveys (CSUR)*, 41(2), 11.

Jansz, J., & Martens, L. (2005). Gaming at a LAN event: the social context of playing video games. *New Media & Society, 7*(3), 333-355. Jorgensen, D. L. (1989). *Participant observation: A methodology for human studies* (Vol. 15): Sage.

Jokela, T., Iivari, N., Matero, J., & Karukka, M. (2003). The standard of user-centered design and the standard definition of usability: analyzing ISO 13407 against ISO 9241-11. Paper presented at the Proceedings of the Latin American conference on Human-computer interaction.

Jorgensen, D. L. (1989). Participant observation: A methodology for human studies (Vol. 15): Sage.

Júlio, B. G. d. O. (2005). Identidade e interacção social em comunicação mediada por computador. Universidade Nova de Lisboa [Identity and social interaction in computer-mediated communication].

Juul, J. (2003). *The game, the player, the world: Looking for a heart of gameness.* Paper presented at the Level up: Digital games research conference proceedings.

Kalmijn, M. (2003). Shared friendship networks and the life course: An analysis of survey data on married and cohabiting couples. Social Networks, 25(3), 231-249.

Karimi, A., & Neustaedter, C. (2012). From high connectivity to social isolation: communication practices of older adults in the digital age. Paper presented at the Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work Companion.

Kent, S. (2010). The Ultimate History of Video Games: from Pong to Pokemon and beyond... the story behind the craze that touched our lives and changed the world: Three Rivers Press.

Kim, A. J. (2000). *Community building on the web:* Peachpit Pr.

Kinsella, K. G., & Phillips, D. R. (2005). *Global aging: The challenge of success* (Vol. 60): Population Reference Bureau.

Kinsella, K. G., & Velkoff, V. A. (2001). *An aging world: 2001* (Vol. 1): Government Printing Office.

Konijn, E. A., Utz, S., Tanis, M., & Barnes, S. B. (2008). *Mediated interpersonal communication*: Routledge.

Kurniawan, S., & Zaphiris, P. (2005). *Research-derived web design guidelines for older people*.

Langer, R., & Beckman, S. C. (2005). Sensitive research topics: netnography revisited. *Qualitative Market Research: An International Journal, 8*(2), 189-203.

Lenhart, A., Jones, S., & Rankin Macgill, A. (2008). Pew Internet Project data memo: Adults and video games. Pew Internet & American Life Project, 7.

Lipschultz, W., & Musser, T. (2007). Instant Messaging: Powerful Flexibility and Presence. NACADA Clearinghouse of Academic Advising Resources.

Lubitz, J., Cai, L., Kramarow, E., & Lentzner, H. (2003). *Health, life expectancy, and health care spending among the elderly.* New England Journal of Medicine, 349(11), 1048-1055.

Mace, R. (1997). What is universal design. *The Center for Universal Design at North Carolina State University.*

Manninen, T. (2003). Interaction forms and communicative actions in multiplayer games. *Game studies, 3*(1), 2003.

Marston, H. R. (2012). Older adults as 21st century game designers. The Computer Games Journal: Whitsun 2012.

Mäyrä, F. (2007). The contextual game experience: On the socio-cultural contexts for meaning in digital play. *Paper presented at the Proceedings of DiGRA.*

Meadow, H. L., Cosmas, S. C., & Plotkin, A. (1981). The elderly consumer: past, present, and future. Advances in Consumer Research, 8(1), p742-747.

Miller, D. C., & Salkind, N. J. (2002). *Handbook of research design and social measurement:* Sage Publications, Incorporated.

Morgan, D. L. (1997). Focus groups as qualitative research (Vol. 16): SAGE Publications, Incorporated.

Muller, M. J., & Kuhn, S. (1993). Participatory design. Communications of the ACM, 36(6), 24-28.

Nacke, L., & Lindley, C. A. (2008). Flow and immersion in first-person shooters: measuring the player's gameplay experience. *Paper presented at the Proceedings of the 2008 Conference on Future Play: Research, Play, Share.*

Nap, H., Kort, Y. d., & IJsselsteijn, W. (2009). Senior gamers: preferences, motivations and needs. Gerontechnology, 8(4), 247-262.

REFERENCES
NETWORKED VIDEO GAMES FOR OLDER ADULTS
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Newell, A., Arnott, J., Carmichael, A., & Morgan, M. (2007). Methodologies for involving older adults in the design process. *Universal Acess in Human Computer Interaction. Coping with Diversity*, 982-989

Nielsen, J., & Hackos, J. T. (1993). *Usability engineering* (Vol. 125184069): Academic press Boston.

Norman, D. A. (2007). *Emotional design: Why we love (or hate) everyday things*: Basic Books (AZ).

Nouchi, R., Taki, Y., Takeuchi, H., Hashizume, H., Akitsuki, Y., Shigemune, Y., . . . Yomogida, Y. (2012). *Brain training game improves executive functions and processing speed in the elderly: A randomized controlled trial.* PloS one, 7(1).

Oringderff, J. (2008). "My way": Piloting an online focus group. International Journal of Qualitative Methods, 3(3), 69-75.

Ribeiro, Óscar, & Paúl, Constança (2011). *Manual de Envelhecimento Activo.*

Pak, R., & McLaughlin, A. (2010). Designing displays for older adults: CRC PressI Llc.

Pandit, N. R. (1996). The creation of theory: A recent application of the grounded theory method. *The qualitative report, 2*(4), 1-14.

Parra, C., D'Andrea, V., & Giacomin, G. (2012). Enabling Community Participation of Senior Citizens through Participatory Design and ICT. Paper presented at the Community Informatics Conference, November.

Paúl, C., & Fonseca, A. M. (2005). *Envelhecer em Portugal* [Aging in Portugal].

Pearce, C. (2008). The Truth About Baby Boomer Gamers A Study of Over-Forty Computer Game Players. Games and Culture, 3(2), 142-174.

Pires, A. C. (2011). E*feitos dos videojogos nas funções cognitivas da pessoa idosa* [Effects of video games on cognitive function of the elderly]. (Master's thesis). Available from Repositório aberto U.Porto Dissertations and Theses database. (No. 050804003)

Preece, J. (2000). Online communities: Designing usability and supporting sociability: John Wiley & Sons, Inc.

Preece, J., Rogers, Y., & Sharp, H. (2004). Interaction Design: Wiley & Sons 2011.

Prior, S., Arnott, J., & Dickinson, A. (2008). Interface metaphor design and instant messaging for older adults.

Pruitt, J., & Adlin, T. (2006). The persona lifecycle: keeping people in mind throughout
        product design: Morgan Kaufmann Publishers.

Repetto, M., & Trentin, G. (2009). ICT and lifelong learning for senior citizens. Journal of
        e-Learning and Knowledge Society-English Version, 4(1).

Rezabek, R. J. (2000). Online focus groups: Electronic discussions for research. Paper
        presented at the Forum Qualitative Sozialforschung/Forum: Qualitative Social
        Research.

Ritchie, J., & Lewis, J. (2003). *Qualitative research practice: A guide for social science
        students and researchers*: SAGE Publications Limited.

Rollings, A., & Adams, E. (2003). Andrew Rollings and Ernest Adams on game design:
        New Riders Pub.

Rook, K. S., & Ituarte, P. H. (1999). Social control, social support, and companionship in
        older adults' family relationships and friendships. *Personal Relationships, 6*(2),
        199-211.

Salen, K., & Zimmerman, E. (2003). *Rules of play: Game design fundamentals:* MIT
        press.

Schuler, D., & Namioka, A. (1993). Participatory design: Principles and practices: CRC.

Sears, A., & Jacko, J. A. (2007). *The human-computer interaction handbook:
        fundamentals, evolving technologies and emerging applications*: CRC.

Shackel, B., & Richardson, S. J. (1991). *Human factors for informatics usability*:
        Cambridge University Press.

Shaw, B. A., Krause, N., Liang, J., & Bennett, J. (2007). Tracking changes in social
        relations throughout late life. The Journals of Gerontology Series B: Psychological
        Sciences and Social Sciences, 62(2), S90-S99. Abstract retrieved from
        http://psychsocgerontology.oxfordjournals.org/content/62/2/S90.short

Siriaraya, P., & Ang, C. S. (n.d.) Elderly users in Virtual worlds.

Story, M., Mueller, J., & Mace, R. (1998). The Universal Design File: Designing for
        people of all ages and abilities. *Design Research and Methods Journal, 1*(1).

Sotamaa, O. (2007). Perceptions of player in game design literature. Paper presented at the
        Situated Play: Proceedings of the 2007 Digital Games Research Association

REFERENCES
NETWORKED VIDEO GAMES FOR OLDER ADULTS
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Sum, S., Mathews, M. R., Pourghasem, M., & Hughes, I. (2008). Internet technology and social capital: how the internet affects seniors' social capital and wellbeing. Journal of Computer‑Mediated Communication, 14(1), 202-220.

United Nations, Population Division of the Department of Economic and Social Affairs of the UN Secretariat. (2007). Report of the *World Population Prospects: the 2006 Revision.* Retrieved from http://www.un.org/esa/population/publications/wpp2006/wpp2006.htm

United Nations (2003). Population aged 60 years or over. *Publications of the United Nations Population Division.* Retrieved from http://www.un.org/esa/population/publications/publications.htm

United Nations. (2002). World population ageing 1950-2050: UN. Retrieved from http://www.un.org/esa/population/publications/worldageing19502050/pdf/8chapteri.pdf

Utz, S. (2000). Social information processing in MUDs: The development of friendships in virtual worlds. *Journal of Online Behavior, 1*(1), 2002-2002.

Van Hooren, S., Valentijn, A., Bosma, H., Ponds, R., Van Boxtel, M., & Jolles, J. (2007). Cognitive functioning in healthy older adults aged 64–81: A cohort study into the effects of age, sex, and education. Aging, Neuropsychology, and Cognition, 14(1), 40-54.

Vaughan-Nichols, S. J. (2009). Game-console makers battle over motion-sensitive controllers. *Computer, 42*(8), 13-15.

Veloso, A. (2006). As tecnologias da comunicação e da informação nas brincadeiras das crianças.

Vlahovic, T. A., Roberts, S., & Dunbar, R. (2012). Effects of duration and laughter on subjective happiness within different modes of communication. Journal of Computer‑Mediated Communication, 17(4), 436-450.

Walther, J. B. (1996). Computer-mediated communication impersonal, interpersonal, and hyperpersonal interaction. *Communication research, 23*(1), 3-43.

Weisman, S. (1983). Computer games for the frail elderly. The Gerontologist, 23(4), 361-363.

Whitcomb, G. R. (1990). *Computer games for the elderly*.

Whitlock, L. A., McLaughlin, A. C., & Allaire, J. C. (2012). Individual differences in response to cognitive training: Using a multi-modal, attentionally demanding game-based intervention for older adults. *Computers in Human Behavior*.

Wyckoff, E. B. (2010). *The Guy who Invented Home Video Games: Ralph Baer and His Awesome Invention*: Enslow Publishers, Inc.

Wolf, M. J. P. (2008). The video game explosion: a history from PONG to Playstation and beyond: *Greenwood Publishing Group*.

Wolf, M. J. (2001). *The medium of the video game*: University of Texas Press.

World Health Organization.(2008). *WHO global report on falls prevention in older age*: World Health Organization.

World Health Organization (2012). *Good health adds life to years: Global brief for World Health Day* 2012.

Xie, B. (2003). Older adults, computers, and the Internet: Future directions. Gerontechnology, 2(4), 289-305.

Xie, B. (2008). Multimodal Computer-Mediated Communication and Social Support among Older Chinese Internet Users. Journal of Computer-Mediated Communication, 13(3), 728-750.

Yao, D., Qiu, Y., Huang, H., Du, Z., & Ma, J. (2011). A survey of technology accessibility problems faced by older users in China. Universal Access in the Information Society, 10(4), 373-390.

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APPENDIX A: CONTENTS OF ENCLOSED CD-ROM

On the enclosed CD-ROM, the online questionnaire, the SPSS files, the moderator's script for the focus group, presentations, an infographic with the results and high-quality images of the proof of concept are included. Three directories are included in the root directory:

- Scientific articles > A copy of the articles or abstracts produced with this Master's thesis

- Materials > SPSS files, moderator's script, presentations and an infographic

- CV > Curriculum vitae