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Wii Like to Play Too: Computer Gaming Habits of Older Adults

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A thesis submitted in partial fulfilment of the requirements of the University of Teesside for the degree of Doctor of Philosophy

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Declaration

No part of the material in this thesis has been submitted for any degree or other qualification at any other institution by the author or, to the best of her knowledge and belief, by any other person. The thesis describes the author's original work.

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ABSTRACT

This thesis introduces the innovative idea of the use of computer games and interactive entertainment by second-and third-age adults, specifically in the area of game content and interaction. This form of entertainment and technologies has become varied recently, with increased and widening participation of groups such as older adults of differing ages. The purposes of using technology involve well-being, intergenerational relationships and learning; these are some aspects primarily associated with the study of gerontology and game studies.

This investigation encompassed two phases. Phase One examined the type of computer games older adults would like to play relating to hobbies, dreams and interests. Qualitative and quantitative data was collected in a step-by-step approach enabling participants to design their own game idea in an informal, jargon-free environment allowing for ease of understanding and coherence. Phase Two of the investigation involved older adults playing one of two consoles (Wii and PS-2). The games chosen were from the sports genre (golf, tennis and boxing) and were required to play for 15 minutes each. Results from Phase One indicated that participants were able to devise and design a number of game genres, and having prior knowledge of gaming did not necessarily aid when trying to design a game concept. Results from Phase Two indicated participants' playing on the Wii was easier due to the nature of the console pad, rather than the traditional game pad used on the PS-2. Qualitative and quantitative data analysis interaction mechanism was far more influential on participants' experience of *flow* than content.

Extensive technological developments have enabled audiences in recent years to interact with gaming platforms easier than before, using motion sensor and natural body movement during game play. Preliminary design guidelines established from this investigation stipulate a multitude of aspects relating to interaction and content to enhance the experience of gaming for older adults.

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ABBREVIATIONS

ADVENT	Adventure
ACRS	Age Concern Research Services
ATL	Assistive Technology Lab
ASA	American Society on Aging
BBC	British Broadcasting Company
CD	Compact Disk
DIGROS	Digital Gerontechnology Opportunities, approaches and State of the Art
DS	Dual Screen
DSi	Dual Screen interactive
DVD	Digital Video Disk
ESA	Entertainment Software Association
FADT's	Formal Abstract Design Tools
FPS	First Person Shooter
FSS	Flow State Scale
GAD	Government Actuary Department
GEQ	Game Evaluation Questionnaire
GEQ	Gaming Engagement Questionnaire
GITQ	Gaming Immersive Tendency Questionnaire
ICT	Information Communication Technology
IDSA	Interactive Digital Software Association
M	Mean
MUDs	Multi-User Dungeon
NCOA	National Council on Aging
NES	Nintendo Entertainment System
NHS	National Health Service
ONS	Office for National Statistics
PC	Personal computer
PS	Play Station
PSP	Play Station Portable
N	Nintendo
SAGA	
SNES	Super Nintendo Entertainment System
SPA	State Pension Age
SPSS	Statistical Package for the Social Sciences
SD	Standard Deviation
UTOPIA	Usable Technology for Older People: Inclusive and Appropriate
VE	Virtual Environment
VR	Virtual Reality
Wii	Pronounced – wee

Definitions

Immersion

Immersion is the mental state of one, ceasing to be aware of physical self. This term is widely used amongst computer/video game playing environments, focusing upon an alteration of sense of time and action.

Arousal

Arousal is how intense the feeling is, i.e. low intensity or high intensity.

Valance

Valance is whether the feeling is positive or negative, or good or bad.
http://www.uclic.ucl.ac.uk/distinction-projects/2007-boguslawski.pdf

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CHAPTER 1

INTRODUCTION

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1.0 – General

This chapter states the research questions addressed in this thesis. The research reported in this thesis combines the fields of game studies with gerontology and includes two empirical studies. The identification of this research is discussed within the respective fields and shows the impact that this investigation may have upon the study of games as an academic field, the games industry and gerontology. The literature review will discuss research from both disciplines, giving an insight into the lack of work within the study of computer games for older adults.

1.1 – Structure of Thesis

The body of this thesis is divided into eight chapters. Following the introduction the research presented in Chapter One, outlines four research questions; tying together the advancements of technology throughout the last forty years, enabling gamers/users to interact with games through a variety of methods. Research questions one, two and three address the nature of game interaction (taking advantage of technology developments, and two different game consoles will be used in the controlled experiments) and the content which is addressed in Phase One of this investigation, and was a commissioned project by CODEWORKS ATL. The objective of the project was to identify and establish if older adults do play computer games and what types of games they themselves would like to play. Research question four addresses the work conducted in this investigation (Phase One and Two), bringing together the data collected coupled with recent studies carried out by researchers in Canada, who have established preliminary design guidelines for future gaming concepts and developments.

Following on from this is Chapter Two explores the field of gerontology, specifically the various definitions of ageing and the rise of a growing population within the UK. This chapter sets out to understand the various definitions of ageing and to state how this cohort of people will be addressed throughout the thesis. In addition Chapter Two also discusses the current and future ageing projections together with potential problems which may occur for example retirement and welfare support. The initial project 'Computer Games and older adults' (Marston, Fencott, van Schaik, 2006) commissioned by CODEWORKS ATL[1] investigated computer gaming trends if any, with older adults and computer games; this formed part of this PhD investigation. Further to this, the DIGROS project discussed in Chapter Two conducted at the University of Sunderland, identified the difficulties encountered between technology and, current products, needs of users and potential technological opportunities, linked with older adults in the North East region. Chapter Two discusses the consequences of retirement for older adults and introduces the various products, which have recently being studied and released, such as the popular computer game *Brain Training*, and products such as *MindFit*, and *Brain Fitness Program*.

Following on from Chapter Two, Chapter Three examines and considers computer-game theory in relation to Virtual Reality (VR), a simulated environment experienced by individual's senses and computer games. This thesis is concerned with two very different subjects, firstly introducing the history of the games industry and secondary how game interfaces have developed rapidly throughout a short space of time due to

1 Codeworks is a centre for digital innovation based in North East England. We work with technologists, digital companies, entrepreneurs, university researchers, venture capitalists, economic developers, rationalists and visionaries in the development and creation of digital companies. http://www.codeworks.net/ , http://www.codeworks.net/atl

technological advancements which has enabled many to experience and enjoy a variety of hardware and software. A number of aesthetics are introduced that are commonly experienced by individuals during interaction of digital media. Computer games and hardware from the 1960s to the present day are reviewed, including consoles, games and handhelds.

Chapter Four discusses previous studies which have investigated older adults, gaming and the potential effects that games such as; *Brain Training* and other similar software may have on an ageing society, especially in terms of cognitive impairment (short-term memory). In addition the chapter further discusses statistics of computer game growth in the UK and the USA between 2004 and 2008, involving the take-up of genres for both video and computer game usage by American older adults. Furthermore, relevant research relating to this subject matter by Copier (2002) and Tiwarim, Asthemimer, File (2004) is identified. The objective of this chapter is to bring Chapters Two and Three together (ageing and gaming), with the investigations illustrating where this investigation sits in relation to the work currently been studied in the areas of gerontology and game studies as discussed in Chapters Five and Six (design workshop, controlled experiment).

Chapter Five reports the results of an empirical study commissioned by CODEWORKS ATL, Newcastle, UK. The objectives of the project were to establish current trends (if any) of older adults playing computer games. At the time of the report (2006) little work been studied within this arena and the expansion and development of the project idea formed the basis of this PhD investigation. This chapter discusses the methodology implemented (design workshop) to identify gaming concepts and purchasing/ownership habits of an ageing population. Data collection involved both qualitative and quantitative data, through game design concepts and a survey identifying confidence levels of older adults' when using technology, demographic data and the different genre of game(s) they play or would consider playing, relating to both hobbies and interests.

Chapter Five addresses the facet of content in relation to this investigation and was the grounding for Chapter Six which addresses game interaction through the use of two different consoles (Nintendo Wii and Sony PS-2). Understanding the importance of content and game genre favoured by older adults it facilitates the choice and decision in which genre of game(s) to be used in Phase Two, which is discussed in Chapter Six.

Chapter Six presents' empirical data collected from a controlled experiment investigating the effects of computer-game platform and game type on an older adult's experience of and behaviours playing computer games. From the data collected and presented in Chapter Five, it was possible to implement the appropriate game genre into the controlled experiment which is titled Phase Two. In addition observational data is collected, which is used to gauge participant's reactions to the game playing experience.

Chapter Seven discusses the connections between the results of Chapters Five and Six. Links are identified between the two studies, bridging content, interaction and technology developments, which are transforming gaming in the Twenty-First Century, and what is now perceived to be interactive entertainment. In addition this chapter discusses recent studies being conducted by researchers in Canada and coupled with the work in this investigation it has identified preliminary design guidelines for future computer games/interactive entertainment.

Chapter Eight summarises the findings from this investigation, addressing each research question individually and highlighting the author's contribution to knowledge. Further discussion addresses the recommendations of change within the study and potential future work.

1.2 – Research Questions

In this thesis four related research question about older adults' use of computer games are addressed.

1.2.1 – Research Question One

Research Question One is related to the development of hardware and software for game consoles.

What is important to older adults, computer game content or game interaction?

The release of the Wii console followed on from the success of the DS in 2005 and provided many people and audiences the opportunity to interact with a console easier than before. The development of hardware technology, containing motion sensors in game playing, has transformed gaming to a new level. In 2005 Nintendo released the DS, which integrated a touch screen and stylus to interact with the computer game *Dr Kawashima's Brain Training* this catapulted gaming into a different dimension. The success of the Nintendo brand, DS, and *Dr Kawashima's Brain Training* lead to the further excitement of the release of the Nintendo Wii console in 2006.

The excitement for many with the upcoming release of the Wii was the mode of interaction. How gamers/users would interact with games. Previous game consoles and gamers interacted with a game by using a game pad, pressing a series of buttons and moving a joystick to control the character in a certain direction. Interaction on the Wii used motion detection; gamers/users would hold the remote control in their hands in a certain position depending upon the game being played. When playing golf the remote would be swung like a golf club towards the screen; the swing, through motion detection, would be transferred through the game. The Wii and the DS have both been successful since their respective releases, and, with easier interaction being implemented within gaming during the Twenty-First Century, this is likely to widen gaming audiences.

Gamers and non-gamers will have different desires in respect of gaming; for some, predominantly hardcore gamers, the main concern and importance within the gaming environment will be content, more so than interaction. Gaming in recent years has evolved, to embrace diverse audiences, for instance older adults/elderly. For the purpose of this thesis, using the term older adults, is referring to adults who are categorised as second age (working, active individuals), and in some cases third age (retired, active individuals). Both second and third age can and do encompass the term baby boomers, which is also a term used throughout this thesis. To exhibit successful interaction with technology, comprehension is required by older adults in a simple and effortless environment to report positive feedback. Chapter Five and Six will address this idea through analysing game content, perceived important to older adults and the means of interaction, identifying whether it is one or the other that older adults, prefer or perceive to be important.

1.2.2 – Research Question Two

What is the effect of the interaction design of gaming platforms on older adults' experience and behaviours playing computer games?

The two consoles used in this investigation are distinctive from one another. The PS-2, developed and released in the 1990s, uses a game pad with several buttons and two joysticks. Games created for this console, within the same genre, will use similar button patterns to complete movements. The Wii, released in the early-Twenty-First Century, uses a different controller from the conventional game pads. Very few buttons are on the Wii controller; most game mechanisms are conducted through motion by the gamer/user. The buttons on the controllers are used during games depending upon the nature of the game itself; a gamer has to press buttons very infrequently while playing on the Wii.

There have been four studies examining players' engagement using consoles of this nature. Releasing games such as Mario Bros and Sonic the Hedgehog in the 1990s, on the Nintendo Entertainment System (NES) and Sega Master System in the future, lead to sequels and re-releases of games for the DS and Wii technologies, possibly achieving the same success as previously in the 1990s.

During the evolution of the games industry frictions and competitiveness have dominated companies. In the 1990s Sega/Sony and Nintendo competed for market dominance, releasing improved consoles regularly and forming respective brands such as Mario Bros and Sonic the Hedgehog. Little has altered between Nintendo and Sony, both catering for different market audiences. Sony now develops games for the PS-2 and PS-3 platforms for hard-core gamers; this group is predominately 35 years old and understands the nature of game mechanics when playing with friends or online.

Although, there are still the hardcore gamers who enjoy and play this brand, the nature of games is very different from games available for other platforms. The primary strategy of Nintendo has been to produce consoles which integrate hardware and software, forming one entertainment package (http://www.nintendo.co.jp/ir/pdf/2008/annual0803e.pdf). Sony has predominately targeted young audiences. Nintendo's focus upon a wider spectrum of users is primarily through software such as *Touch Generation* exemplified on the DS by titles such as *Dr Kawashima's Brain Training*, appealing to both gamers and non-gamers. The expansion to wider audiences has continued through the release of the Wii, also known as the home entertainment system. The goal is that users of all abilities are able to interact with the console including a wide range of software incorporating the intuitive remote sensor (http://www.nintendo.co.jp/ir/pdf/2008/annual0803e.pdf).

1.2.3 – Research Question Three

What gaming facets and requirements do older adults require from computer games?

CODEWORKS ATL based in Newcastle, UK commissioned a project to identify the current trends within the computer games sector and specifically what game genre, interaction and content older adults want within computer games.

The games industry has witnessed several developments throughout the history of this medium be it through interaction or content. Throughout this form of entertainment facets of games such as the mode of interaction and content varied through the hardware and software development of leading companies such as Atari, Nintendo, Sega and Song. The type of genres in which gamers were playing was predominately situated within the First Person Shooter (FPS), Adventure and Strategy. Games within this genre, through the nature of hardware and software developments enabled gamers to play within realistic environments and scenarios which may not be conceived in the real world.

There has been little data collected which outlines the type of content and interaction older adults want from computer games. This question has been posed to identify and collect information relating to the type of genre, content and interaction older adults of an ageing population would want from computer games, which could potentially be used to design and develop games. Knowing and understanding the requirements of older adults in relation to this entertainment may entice take-up and enhance game design in the future.

The data collected from the commissioned project by CODEWORKS ATL is discussed in Chapter Five of this thesis and is titled Phase One throughout. The data will be used to build upon and design the methodology of the controlled experiment which is addressed in research question four.

1.2.4 – Research Question Four

What are the implications for the design of computer games/interactive entertainment based upon the data collection in this investigation stated as preliminary design guidelines?

The controlled experiment addresses the above research question and titled is Phase Two throughout this thesis. The results identified in Phase One and addressed in research question three follows onto Phase Two implementing the results identified from participants in Phase One into Phase Two. Gaming has predominately been seen as a mode of entertainment for young adults, mainly boys and young men. Computer games have over the years developed from been spatial, simple interfaces similar to that of *Pong* or *Spacewar* to complex, realistic interfaces of the 1990s. The realism of games during the last forty years has developed and become very accurate graphically, and many games mirror the realism of the movie industry.

The Twenty-First Century saw a change in attitudes toward games and the nature of interfaces, due to the developments and release of Next Gen consoles from Sony, Nintendo and Microsoft. The release of gaming/communication technologies and gaming/interactive entertainment has developed, more so during the last four years. Many new genres and games which have been released onto the DS and Wii and more recently the DSi, including the IPhone/ IPod have enabled gamers/users to play games/interactive entertainment either in single player mode or multiplayer using Wi-Fi capabilities. Additional enhancements to hardware have enabled a variety of games to be developed and played by wider audiences for example, *Dr Kawashima's Brain Training* and *100 Classic Book Collection.* These two games are very different from each other, the first enables older adults to carry out puzzles such as anagrams and mathematics, the latter facilitates older adults to enjoy a variety of literature both genres, fostering the notion of well-being, mental stimulation, sociability and pleasure.

Collating the data collected from Phase One and Two from this investigation coupled with research conducted by experts in the fields of gerontology and virtual reality will bring together future design guidelines for future computer game design/interactive entertainment, enabling wider audience take-up of this form of entertainment.

1.3 – Summary

This chapter has presented and identified the field of research, embracing two fields of study. The take-up of gaming and new gaming hardware like the DS and the Wii has instigated wider demographics to participate in an entertainment medium generally perceived to be appealing to younger audiences. Combining the fields of study will bring a different perspective to both areas of gerontology and game studies. Games studies has been perceived as an academic field for some time, but the nature of this investigation, using hardware to study players' interactions by older adults is still new.

CHAPTER 2

GERONTOLOGY

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2.0 – Overview

This chapter discusses the field of gerontology. It identifies and defines the nature of ageing, and discusses the appropriate terms used for ageing within this field. This chapter examines several aspects of gerontology, including an ageing population, the CODEWORKS project, retirement and previous research in gerontology.

2.1 – Introduction

There are many definitions to the meaning and study of gerontology. Gerontology is defined by the free dictionary.com as "the study of all aspects of the ageing process, including the clinical, psychologic, economic, and sociologic issues encountered by older persons and their consequences for both the individual and society".[3] The Wichita State University[4], describes the study of gerontology as a multi-disciplinary field, investigating numerous areas of the ageing process including social, physical and mental changes as people age. Technology is another aspect of this multi-discipline of gerontology and in recent years, instruments and aids which can assist in the home, have become more prominent. This has become known as assistive technology. Gerontology incorporates many individuals from multi-disciplinary fields and areas such as researchers, academics and practitioners and in subjects such as biology, health care (medicine and nursing), social work and policy, psychology, economics and anthropology. Individuals from these fields are concerned how to enhance and improve quality of life for older adults and the future of an ageing population (Hooyman, Kiyak, 2007).

[3] http://medical-dictionary.thefreedictionary.com/gerontology
[4] http://sca.wichita.edu/geron/introduction.htm

This chapter examines the nature of an ageing society, deliberating intergenerational relationships, cognitive and the psychology of ageing. The chapter will review research which explores ageing in relation to technology, and finally how the two combine.

2.2 – What is Ageing?

In its simplest form, there are four defining stages of ageing. These are referred to as the first, second, third and fourth age. Marston, (2007) cited several news articles from the BBC website. One in particular outlines the four stages of ageing, as the first stage being, "young people's years in full-time education, the second stage when financial independence is tempered by family and other commitments, the third stage is still independent but without such ties – for most of us the fourth stage a state of relative dependency, such as being in a care home" (Morgan, Kunkel, 1998, Parkinson, J, 2004, Marston, 2007).

Gerontologists, over many decades, have endeavoured to define the concept of ageing, and for many people, this concept is perceived as a life process, the creation and birth of a baby, until the inevitable part of the life course resulting in death. Death knows no age barrier. Vincent, (2003) recommends defining ageing as, being a measurement of time, signifying a progression of sequences or stages through a process, a course of action, which an individual would experience in their own life.

Age in Great Britain is seen to be important to people; significant birthdays are recognised and celebrated as passages through one life stage to another. Individuals celebrate their eighteenth birthday as a mark of passage from teenager to adult hood, and with it the appropriate responsibilities. At eighteen years the law of the country permits them to buy alcohol, tobacco, vote and claim Government benefits. This for a young person is the start of their adulthood, which, with other memorable birthdays, 40^{th}, 60^{th}, 80^{th} progress them into old age. Celebrating significant ages throughout the life course entitles individuals to receive certain discounts or benefits. Certifying age is part of the British bureaucratic system; when a child is born it is the responsibility of the parents to register the birth; in the case of death it is the responsibility of the next of kin to register the deceased. Certification of age with the state gives data to the government, facilitating records to be updated. Examples include, update of pensionable age-thus enabling bus companies to issue passes to those of state pensionable age, for free or discounted travel at certain times.

There are age-defining moments for older adults. For example, adults attaining seventy years old are required by law to renew their driving licence every three years, and are able to receive a free television licence after seventy-five years. Vincent, (2003) concludes that due to the nature of organisations and government establishments, the citizens play a responsibility of assigning categories through classification of age.

Retirement in Western society is a development of the Twentieth Century, presiding over society's thoughts and perceptions of old age. For some people retirement is sooner than statutory government regulation. For example, police officers have to retire at the age of fifty-five even though they are unable to receive a state pension. For other men it is sixty-five and women sixty years. The nature of retirement signifies the classification of age, and for some the reason for taking early retirement is that they desire a new challenge.

Means of age classification by gerontologists, such as Phillipson and Baars, (2007) differentiate ageing through social contexts, thus being to appreciate and recognise that ageing can only be through social environments, when combined together, shapes the life course of a person's journey. According to Phillipson and Baars, (2007), ageing and society should not be viewed or treated separately, but as one. Vincent, (2003) suggests ageing can be classified within organisations or institutions, such as education, unlike Phillipsons and Baars, (2007) who suggest classification can be constructed within social organizations, providing the understanding of young, middle and old aged.

Bond, Peace, Dittmann-Kohi and Westerhof, (2007) discuss theories of social ageing, offering a European and North American perspective of the past Twentieth Century. Between the 1940s and 1960s ageing was perceived as an individual problem. The 1970s and 1980s were perceived from an economic and employment outlook, and from the 1990s onwards ageing has been viewed in both Western and developing countries and continents as a global concern. Since the 1940s the aspect of an ageing society has had an impact on many individuals, institutions, governments and economies. The Second World War had a vast impact on how future demographic populations would differ in many countries (Amann, 1984; International Association of Gerontology 1954; thane, 2000) in relation to future trends, and economic demands, recovering from a time of constant conflict (Judt, 2005). Lowe, (1993) and Walker, (1999) suggest the growing problem of an ageing society became more apparent during the identification and development of pension systems, and the construction of the welfare state.

Stuart-Hamilton, (2006) denotes humans have always aged throughout the centuries, as far back as the pre-historic era. People did age, but there was very little ageing in comparison to today's modern society, where in the Twentieth Century the conception of ageing and living well into the eighties and nineties is common. It is estimated that in Britain today there are 11 million (around 16%) people aged 65 or older, which is due to rise by 2060, where approximately 17 million (around 25%) people will be over the age of 65 years (2006). Naturally, the consequences of an ageing society involve the economy, health service and housing. Stuart-Hamilton, (2006) suggests that as the balance shifts from an increase of young people to older adults, there is the potential for an economic and social distress, including the decrease of younger generations, suggesting a smaller portion of workers paying taxation. A small demography, paying government taxes will have an effect on the welfare state, in particular state – pensions and health care.

2.3 – CODEWORKS Project

The project was part of several projects funded by CODEWORKS ATL across three universities in the North East: Teesside University, University of Sunderland and University of Northumbria. The topics of these funded projects varied across universities and departments. The project was titled "Older adults and computer games".

There were three components which encompassed the commission by CODEWORKS ATL. These were "engagement – making existing products more accessible to older users, wellness – using digital technology to increase healthy lifespan and to aid in rehabilitation, and independence – developing assistive digital products to overcome age-related impairment"[5]. Results from this investigation are documented in Chapter 5 of this report. CODEWORKS ATL had several rationales for conducting the investigation of ageing, digital technologies and social sciences (Jenkins, 2006). These are as follows:

- Undisputed global market growth based on demographic trends
- Longer lifespan
- Declining birth rates
- The 'baby boomer' effect, biggest single demographic change for most of the developed world
- Builds on recognised regional expertise across university sector
- UK industry leading in some existing areas (e.g. social monitoring)
- UK government agendas
- Low technology risk
- Mostly good applications of existing technology
- Short product development cycles, typically 12-18 months
- Key is good design – another UK strength

Jenkins, (2006) discusses the potential marketing segment of the third and fourth age. Classifying people sixty-five years and older as third age, Jenkins suggested people of

[5] http://www.codeworks.net/atl/index.php?option=com_content&task=view&id=28&Itemid=41

the third-age are consumers of a mass market. Third-age can also be defined by Dictionary.com as *"old age or the time of active retirement"*[6].

A further report published by CODEWORKS ATL and Age Concern Research Services (ACRS) outlines the top-ten issues facing older adults at present and in the future. The report reveals the apprehension older adults have in Great Britain now, and future concerns of society in 2025 (CODEWORKS ATL &ACRS, 2006). The results from the study suggests important factors for older adults at present and future were health, especially physical health, independence, access to local health-care services, the role of the family, crime and security and the right to exercise own choice.

Technology enhancements and developments, which are facilitating second-and third-age adults, continue in work and onto later life, achieving a more suitable balance between home life and employment making demands easier, and living healthier lives in a way that they wish, without creating isolation due to confinement within the home (CODEWORKS ATL & ACRS, 2006). Learning, motivation and the understanding of technology such as computers, e-mail, the Internet and communication developments, such as Skype, are made easier if older adults have experienced these technologies in their work environment, or in their own homes, at their own pace. Comprehending the purpose and benefit of learning a new piece of technology or skill is important to older adults, thus facilitating the transfer of skills into either retirement, new business ventures, or new employment (Mancini & Orthner, 1982, Malone, 1980, White *et al.,* 1999, Melenhorst, 2002, de Kort *et al.*,

[6] http://dictionary.reference.com/browse/third+age

2005, Khoo & Choek, 2006, Fozard & Kearns, 2006, de Kort, 2007, Gajadhar *et al.*, 2008, Gamberini, *et al.*, 2008, de Kort & IJsselsteijn, 2008).

Technology-related matters arising from the survey included social issues. The report suggests that communication will improve lives, and technology will enable the facility of communication at any time. Some older adults, especially those who have little physical contact with friends and relatives, may find the use of e-mail as a means of maintaining that contact beneficial, although they may have very little or no experience of the technology that provides this. The report also indicates there were concerns by the individuals regarding the lack of personal contact from the technology used with loved ones.

The phenomenon of an ageing population has been documented by many in the field. As people are living longer and with a decline in birth rates amongst younger generations, government services will start to become affected. Adults in the age group 50-65, who are aware of technology such as the Internet and e-mail, are also aware of the encompassing larger concerns regarding the welfare state, and the future of the economy through media such as television, radio, word of mouth, employment, children and grand-children.

One obvious question to ask is “Why are people living longer?” There are several answers to this question, but the main facet required is to understand that population growth is going to decline in the future and the number of people living longer will increase. As documented earlier, there has been a steady increase in life expectancy for decades, even more so since the end of the Second World War. Figure 2.3.1 illustrates this steady increase of life expectancy between 1901 to 2021.

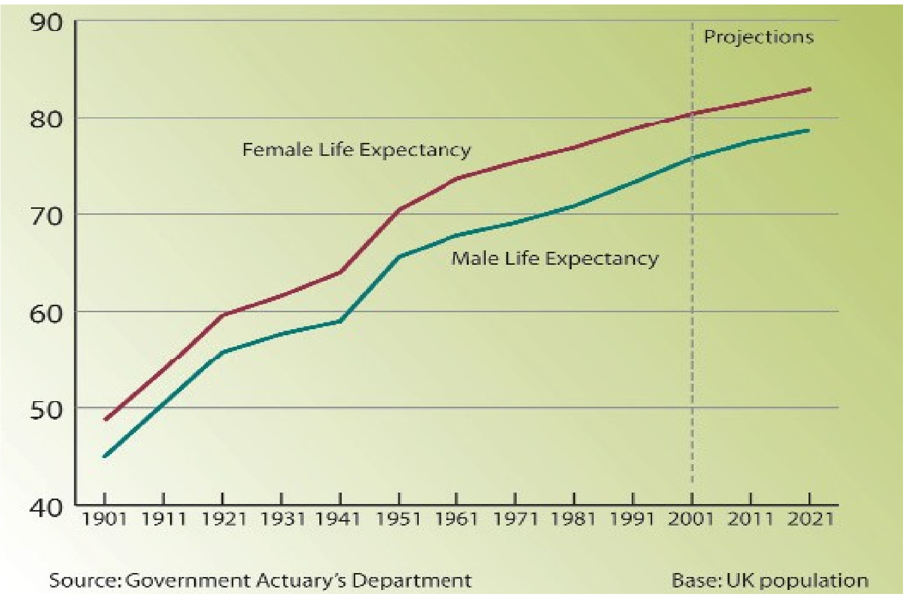

Figure 2.3.1– Life expectancy between 1901 – 2021 *(CODEWORKS ATL, ACRS, 2006)*

Developments within the health service and medical advancements have enabled people to live longer than ever before. After the Second World War the creation of the National Health Service (NHS) has enabled people to access free health care. Throughout the Twentieth Century many medical scientists and physicians evolved and developed medical advances, such as, transplants and antibiotics, which are (of course) given to patients to fight viruses which years ago would have caused death. The decline of birth rates within younger generations, starting families later than previous generations, suggests that adults over sixty comprise of a larger proportion of the demography than before. Figure 2.3.2 illustrates this widening gap between the generations with a vast increase of over-sixties, increasing over the next thirty to fifty years.

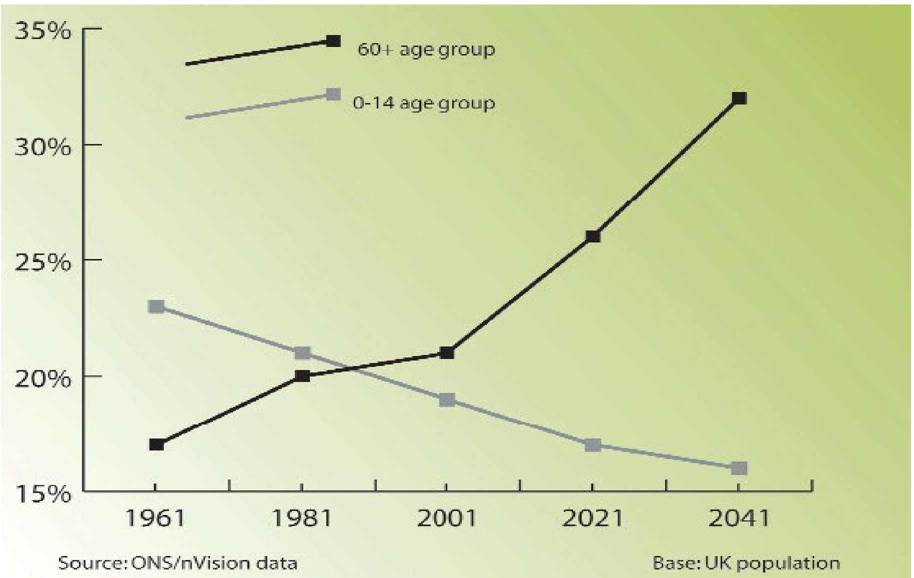

Figure 2.3.2 – Age profile of UK population 1961-2041 (CODEWORKS ATL, ACRS, 2006)

Another question that is asked in relation to ageing is "With the population living longer and birth rate declining what are the consequences, if any, to the population?" One of the many consequences of people living longer, and a decline in the birth rate, is the current average age of a person, which in 2005 was thirty-nine years old, and in 2041 will rise to forty-four years. In addition, there is an increase of life expectancy by one year, for sixty-five year olds inside 120 years. The life expectancy prior to 1960 had increased by one year each decade; the forecast of increased life expectancy in 2041, is due to increase by five years as set by the Government Actuary Department (GAD), taking the average life expectancy to seventy-one years (CODEWORKS ATL & ACRS, 2006).

Government statistics of life expectancy from the Office of National Statistics (ONS) presents information concerning current and future life expectancy in the United Kingdom (UK). Representing statistics in some cases have been split between England, Wales, Scotland and Northern Ireland and then the UK as a whole. Table 2.3.1 illustrates the break up of life expectancy between the years 2005 and 2007, from birth and then from the age of sixty-five years. Table 2.3.1 represents both male and female separately for both categories.

Table 2.3.1 – Life expectancy, 2005 – 2007 (ONS 2007)

	At birth		At age 65	
	Males	Females	Males	Females
United Kingdom	**77.2**	**81.5**	**17.2**	**19.9**
England	77.5	81.7	17.3	20.0
Wales	76.7	81.1	16.9	19.6
Scotland	74.8	79.7	16.0	18.7
Northern Ireland	76.2	81.2	16.8	19.7

According to Table 2.3.1, both sexes at birth in England have the highest life expectancy at birth, at the age of sixty-five years.

Figure 2.3.3 displays the increase of both male and female life expectancy from 1981 to 2005. The life expectancy in the UK, at the age of sixty-five, reached its peak for both genders. The expectancy for men in the future was a further 17.2 years and 19.9 for women. The ONS website discusses the population projections for those born in 2006, and who turn sixty-five in 2006, indicating the projections to be 88.1 years for males, and 91.5 for females born. The increase for males being 20.6 years and 23.1 years for females[7].

[7] http://www.statistics.gov.uk/cci/nugget.asp?id=168

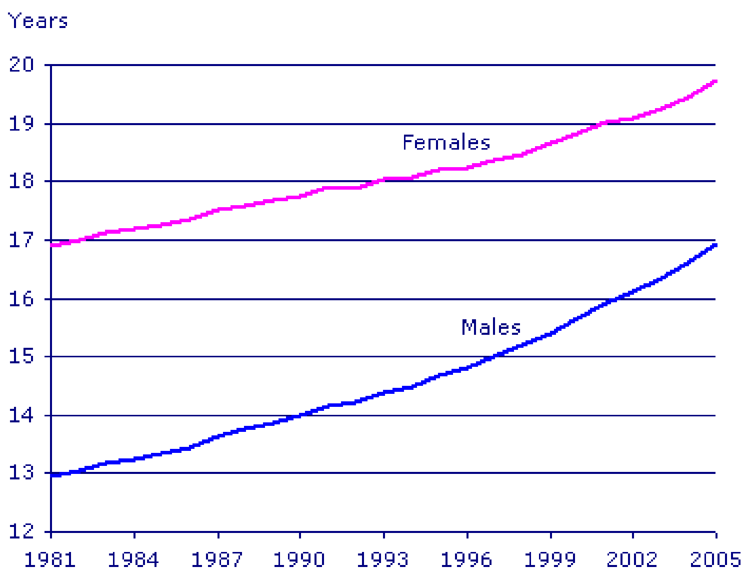

Figure 2.3.3 – Increase in Life Expectancy, UK

The projection of UK statistics for the future population (2016) suggests there will be 4.4 million people[8]. People aged 65 years and over in 2006 showed a predicted 16 per cent increase in 2016 which is set to rise by 22 per cent in 2031. The UK is not exceptional in having an ageing population and this increase is a direct result of the population living longer at the present time, in particular the large demographic group born initially after the Second World War and during the sixties, also known as the Baby Boomers[9]. Table 2.3.2 shows the overall UK projections for the population, including a break-down of the four countries (England, Wales, Scotland and Northern Ireland). The table shows different trends within the four different countries, indicating by 2016 the increase of people in England is anticipated to increase by 8 per cent, 7 per cent in Northern Ireland, 5 per cent in Wales and 3 per cent in Scotland, due to lower fertility and life expectancy than the UK as a whole[10].

[8] http://www.statistics.gov.uk/cci/nugget.asp?id=1352
[9] http://www.statistics.gov.uk/cci/nugget.asp?id=1352
[10] http://www.statistics.gov.uk/cci/nugget.asp?id=1352

Table 2.3.2 – Projected populations of countries within the United Kingdom

	2006	2011	2016	2021	2026	2031
United Kingdom	**60587**	**62761**	**64975**	**67191**	**69260**	**71100**
England	50763	52706	54724	56757	58682	60432
Wales	2966	3038	3113	3186	3248	3296
Scotland	5117	5206	5270	5326	5363	5374
Northern Ireland	1742	1812	1868	1922	1966	1999

In comparison to the UK, Mellor and Rehr (2005) predict the life expectancy of American Baby Boomers, for women to be 84 years old and 78 for men. Mellor and Rehr suggest by 2011 the continuation of growth, thus increasing the numbers of the elderly until 2030, and by 2020 the estimation of people eighty-five years to be seven to nine million, adding a further twenty years; the US could envisage in 2050 a further 835,000 persons aged one-hundred or over (2005).

To increase the retirement age of women from 60 to 65 years, and to increase the state pension between 2010 and 2020, and the future of retirement for both sexes is likely to increase to 68 years; the government is required to pass legislation. The ONS website suggests the future State Pension Age (SPA) will become minor between the sexes, and even out relative to SPA 2021 and 2051 onwards. Women tend to have a higher life expectancy than men, but future projections (see Figure 2.3.4) suggest additional years for both sexes; between 2021 and 2051, after the age of 65, life expectancy is expected to be around an extra twenty-three years for women and twenty-one for men[11].

[11] http://www.statistics.gov.uk/cci/nugget_print.asp?ID=1913

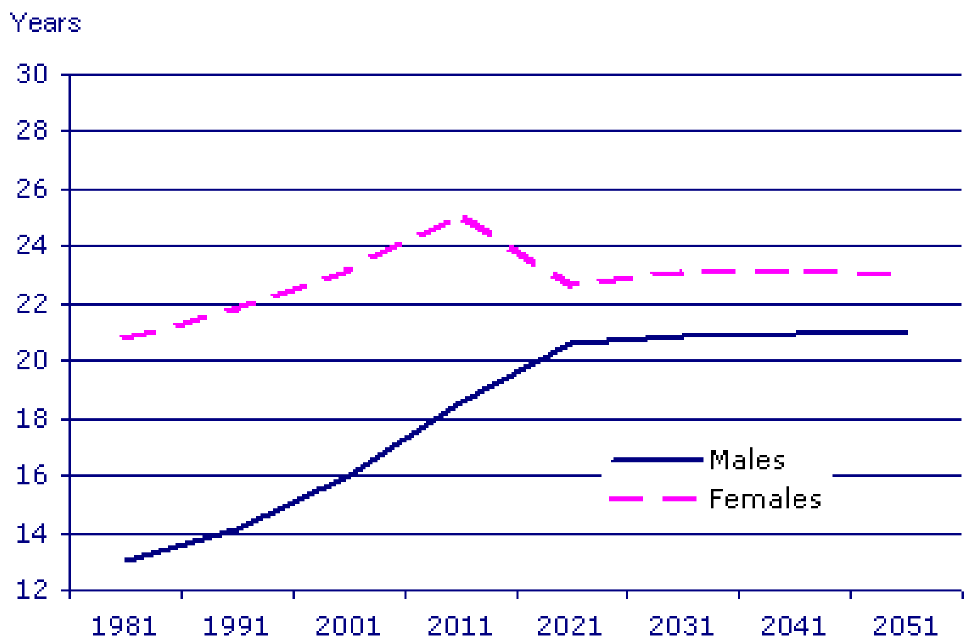

Figure 2.3.4 – Life expectancy after the age of 65, 1981 - 2051, UK

A variety of comments were made by CODEWORKS/ACRS (2006) relative to housing, welfare state and lifestyle. People regard their independence as an important aspect and want to remain independent for as long as possible, thus staying active. Technology has become an important element of many people's lives in recent years, and can aid people to stay independent, in the manner of remote monitoring within the home if technical problems occur and general day-to-day communication. Technology will and does play an important aspect when communicating with children and grand-children, especially for those who are between the ages of fifty and sixty-five, who will have used the Internet and e-mail through employment.

2.4 – Retirement, Leisure and Learning

In 2006 the first set of Baby Boomers turned sixty years old. Baby Boomers entered employment in the 1960s, increasing the growth and underpinning the welfare state. For many their employment will be finishing, therefore relying upon the economy for aid, such as, a state pension (Wallace, 2006). As previously discussed, when people retire or stop working, a shortage of people within the workforce and a 'rise in age-related welfare bills follow. Wallace, (2006) suggests "2006 saw the first wince with many countries and populations throughout the world starting to age at an extraordinary pace" (Wallace, 2006).

As an example of this rate of ageing, Wallace, (2006) presents a demographic forecast for Germany, stating that the previous thirty years, the ratio dependency of people sixty-five and over, to adults between twenty and sixty-four years has been twenty-five per cent. The next thirty years will increase to fifty percent and over. This is just one example of how an ageing population will affect the future economy and welfare of countries. The suggestion of a population upsurge is one approach to maintain the dependency ratio. Wallace, (2006) continues to discuss further implications of this problem, including the extension of the retirement age for women from sixty years to sixty-five.

From a business perspective, Wallace, (2006) states the main concern of prolonged employment, means rising the retirement age. The most appropriate method, with an economic problem and an increased demography, is to extend employment into their sixties and possibly later on. For this to be implemented, employers and organisations will have to change policies of retirement.

As stated earlier, retirement is seen as one of the most important transitions into old age (Vincent, 2003). Mellor and Rehr (2005) suggest that in the early part of the Twentieth Century retirement was viewed to be for several years, whereas now – be it through force or choice – retirement may be seen to encompass a third of people's lives.

For some Baby Boomers the choice of retirement will not be available and they will therefore have to work longer than expected due to insufficient finances. Mellor and Rehr, (2005) suggest this particular generation have spent more than their predecessors and have saved very little, therefore, having to work longer as a consequence. However, it is suggested that people between the ages of forty-five and seventy-four years would continue to work, even though they may be able to retire financially. For some people the prospect of retirement is daunting. Seminars and guidance are delivered to individuals to aid them with private pension advice and help for easing into retirement. This is very common within the UK Police Force. For example, Mr P A Marston retired from West Yorkshire Police Force September 29 2001. Several months, leading to retirement, Mr Marston attended sessions which guided him through a number of facets for life after employment. Mr Marston feels that this did benefit him regarding guidance of private pension, as this had been his employment for thirty years, entering this profession at the age of twenty-five years and having no option when he wanted to leave, as it is a requirement by the police force, when turning fifty-five years. Mr Marston had no say in whether he wanted to leave employment or not; it was government policy, even though he was still capable of carrying out his duties as a police officer. Rother, (2002) emphasizes this policy, stating that older workers frequently do not have an alternative once employment is due to end. Townsend, (2001) discusses the facilitation of retirement in many professions, enabling older workers to phase retirement into their lives, reducing their work hours and responsibilities. With an ageing population, flexibility may have to be considered by managers and national organisations. Townsend, (2001) states the introduction of this concept may support the working environment through adopting this idea as many people are ageing.

2.5 – Conclusions

This chapter has taken into account many aspects of gerontology, how to define gerontology and how many gerontologists in the field define ageing. It cannot be concluded that ageing is a progression of life, from childhood through to adulthood, and as one retires from employment at a specific age, dependent upon government legislation, individuals are perceived to be in old age, even though this may not be the case mentally and physically. For the purpose of this thesis, the terms for describing cohorts of ageing demography's are second, third-and fourth-age. It is also important to note that cohorts of demography's, classified as Baby Boomers, will be placed in either the second-or third-age category. Even though one may have retired and still be active through voluntary work or full/part-time employment, to describe and discuss ageing in this thesis, these terms are most appropriate.

The statistical data published by CODEWORKS and the ONS highlights the growing concern of an ageing population within the next ten to twenty years. The prospect of many people living longer, due to advances in health care, is terrifying not only for those concerned but also for society as a whole. The use of technologies could make the transition from employment to retirement easier than expected, encouraging active participation within the family and social networks. The project commissioned by CODEWORKS ATL, conducted by Marston, Fencott, van Schaik, (2006), highlight there is scope for further research investigating computer games and older adults.

Chapter Three discusses the history of computer games and the study of games theory in relation to gaming, and the variety of advancements within this form of entertainment.

CHAPTER 3

GAME SECTOR

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3.0 - Overview

This chapter examines the development of an entertainment medium which has had a short life span in comparison to other successful entertainment formats. Computer gaming has been around for the last forty years and in this short space of time has enlightened several demographics, predominately young males. This chapter will discuss the history of gaming from the creation in the 1960s to the present day, discussing the evolution of technology hardware and game content which, at specific moments in this short history, have transformed and uplifted gaming. The chapter also discusses handheld consoles such as the Nintendo Gameboy, DS and Sony PlayStation Portable (PSP).

3.1 – Introduction

This chapter will discuss two key characteristics of the computer games sector. These are technology in relation to interaction and game content.

Encompassing these aspects, the discussion of game theory studied by many such as Fencott (2007), Turkle (1997), Church (1999) and Poole (2002) in the field of Virtual Reality (VR) and computer gaming. Appendix II examines in depth the history of the gaming sector, discussing in decades the different technology developed and launched by many companies, some of which are continuing to embrace new technologies and producing innovative and intuitive consoles. It seems that from the offset of gaming in 1962, content and interaction were synchronised, using simplicity and understanding, but as the years and decades have progressed the development and the perception of computer games has drifted apart.

Fencott (2007) examines the nature of aesthetics and video games in relation to multi-user dungeons (MUDs) and virtual reality (VR). In the text Game Invaders, (Fencott, 2007), Turkle (1997) spoke to many players in relation to gaming, and one main aspect became apparent: gamers found pleasure during play with fellow gamers. Fencott (2007) recognises this need for pleasure aesthetically known as co-presence; a gamer can be absorbed in the environment with others during play. Co-presence, as defined by Fencott (2007) is a “state of mind being absorbed”. Fencott (2007) discusses MUDs and text-based adventure games such as ADVENT by the pleasure gamers receive from the co-presence as an important aesthetic pleasure way before 3-D graphics was even thought of.

ADVENT was first perceived in 1977 as a quest game, or what would now be classified by Fencott *et al.,* (2007), as an adventure genre, this was a single-player game. The image which represented the player on screen was a square cursor, the objective was to search and return a golden chalice to the castle. The game was played over a number of screens and both the chalice and keys to the castle were hidden; enemies, known as dragons, were also hidden within the castle and they could end the game at any point by eating the player. Weapons were available to the player but had to be located within the game and as a “final obstacle, a player could only carry one object at a time” (Herman, 2001).

Gaming hardware has advanced substantially over the last five to ten years in comparison to previous technologies on the market for over thirty years; many of the next-generation consoles (Xbox-360, PS-3 and Wii) have increased memory, faster processor speeds and superior graphics cards, there by enabling the production of a more realistic look to games. For some, gaming started with the hardware development which (some would say) enhanced games through interaction rather than content. In the last several years, for many, gaming has taken off with the release of the DS and Wii whereas the development of consoles such as the Xbox-360 and PS-2/3, gives gamers the choice and opportunity to experience a variety of platforms and games through content rather than interaction, and (as discussed in Appendix II) platforms such as the DS enables players to interact with a game through a stylus or by a microphone, depending upon the game being played.

The interaction of gaming throughout the history of this medium has changed only slightly over the last forty to fifty years and from the offset of gaming, interaction with hardware was very basic, simple to use and easy to understand. In the games *Spacewar* (1962) and *Asteroids* (1979), for example, a player's interaction was easily understood and the objective of the game easily identified but this began to change over the following decades when game content and interaction became complicated. For some, the new methods of interaction were more difficult to comprehend as the games became more complicated and they, the players, were used to certain consoles. Knowledge of these consoles was imperative within a particular genre, because knowing the combination of buttons to conduct one movement in a First Person Shooter (FPS) game was important if completing or understanding the basic objectives of the game(s) were to be achieved. Consoles such as PS-2, PS-3 and Nintendo have kept their mode of interaction the same through their game pads, therefore enabling gamers, who previously played on a platform, to be familiar with buttons on the game pad to execute a specific move in a specific genre of game. In recent years Nintendo have taken interaction to a step further which started in the handheld games market of the DS and consequently into the games console market with the Wii.

The mode of interaction used with the Wii is very different from that of its predecessors and other competitive platforms. The intuitiveness of play with the Wii through the use of a motion sensor, gives gamers a different experience of gaming which had never before been available. Swinging the remote, like a golf club or tennis racket rather than pressing a combination of buttons, is far easier for a wider demographic audience such as older adults who may previously have found gaming to be in comprehensible due to lack of knowledge of game pads and genre.

The following sections of this chapter discuss the nature of game content. Several games are highlighted throughout this discussion where, for one reason or another, they have made a significant impact within gaming history. The development of arcade machines in the seventies gave many gamers the opportunity to become skilful and to create a competitive environment amongst its peers; playing against the machine or a fellow gamer and in a specific time however, there was one drawback to this: gamers had to understand the objectives and aims of the game as well as mastering the controls before the money ran out. For some gamers this may have been relatively straightforward, adding the extra challenge of being a race against the clock. In 1980, the release of *Pac-Man* as an arcade game with its simple interface and interaction capsulated the gamer, prior to being transferred to a console, the method of interaction was the same as experienced on the arcade version so as not to confuse the gamers prior understanding. Appendix II discusses a number of new gaming companies who commenced development of games in the late 1970s to

1980s. They provided gamers the opportunity to learn and develop new skills and different controls within individual games. From the eighties into the nineties, many more game genres developed and with each new development the nature of content and mode of interaction became more complicated.

To answer the question of whether content and technology synchronised, the answer is no. Game content became more advanced creating environments which were very realistic, whereas the controls (although innovative at the time of release) became stagnate. A change occurred with the release of the DS and the Nintendo Wii where, although content was not as advanced as for games on the PS-2/3, PSP and Xbox-360, the technology advancements had progressed through the nature of voice, touch and motion sensor, creating an easier mode of interaction.

3.2 – Game Theory

This section will discuss what is termed by Fencott (2007) as games theory. Murray (1997) and Church (1999) have being cited during discussions of *Pac-Man*, *Tetris* and *Spacewar* (1962) as the aesthetics of games and what that brings to the game environment and to the gamer.

Fencott (2007), in the text Game Invaders, discusses genre and pleasure within games and what gamers experience in relation to pleasure and playing. The topic of genre has been analysed and classified, and as games progress in terms of content and interaction the defining of games has become a characteristic for industry professionals such as Rollings and Adams (2003) including academia. One question that many ask is "What is the basis for classifying a game under the classification of genre?" Genres, as stated by Fencott (2007):

> "…become established as part of popular game culture, it needs to go through a process of cultural acceptance so that all participants in a particular sub-culture – the game players and games industry professionals in this case – reach a collective agreement."

Genres are not solely found in the gaming community but are also found in the film industry, these are discussed at greater detail in Appendix II. A general film audience may not necessarily recognise that films are classified by genre, for instance, love, comedy or horror; many films have one or more genre classifications running through the main and sub-story lines. This in its self may create a new movie genre and the same can also be found in the development of games as discussed in the previous section and Appendix II.

Fencott (2007) discusses the FPS genre (a genre which emphasise shooting and combat from the character perspective) of which, for many gamers is played through the eyes of the gamer and entails shooting at the enemy. Once gamers have played a number of FPS games and they start to play a new game it is likely that the buttons for carrying out the game (whilst not the same) will have similar actions. This is the equivalent of keyboard instructions if playing on a PC. Therefore, the gamer has already identified what buttons to use to master the game, which has all derived from one piece of knowledge: the style of genre.

Genre is an important aspect of the game sector; it is used by professionals to distinguish one game from another, and the same can be said for gamers who are not only competitive during play, but also communicate with each other. Gamers, in particular hard-core gamers, use their knowledge of genres and game classification as a means of identifying themselves to one another. Newman (2005) states "extrinsic reinforcement such as praise and admiration from peers constitutes a motivation for play" (Loftus & Loftus, 1983). Being able to discuss and identify a number of genres in depth is a method of showing that they are part of the gaming society. There are many types of game available, some of which may be classified under the same genre but could possess different elements which may put them in another classification. Understanding how a game is to be played and how the controls operate is a technique and skill for many. Newman (2005) outlines "players indicated the ways in which they learned from others, and helped others to learn by sharing information on strategy and techniques through talk and observation of the play of others" and is a means of identification as part of being in the club or community (Fencott, 2007). Being able to pass on hints and viable information about a certain section in a game is useful to any gamer to complete a level or task within a game (Fencott, 2007). This differs from a film where the understanding of the narrative of the film can be understood by anyone without having prior skills or knowledge, unlike game playing which requires both (Fencott, 2007).

Computer games in relation to the experience and pleasure, and for many the aesthetics, are what drives the experience of gaming. Fencott (2007) confers the pleasure in the essence of an individual's preference to a component of the game. For example in an FPS, the gamer may enjoy the shooting aspect of an enemy. A driving game may give the player the pleasure of having control of a car and driving at high speeds, something which is not readily available in the real world. The actual pleasure that the individual will receive is usually what attracts gamers to a specific game or genre.

Murray, the author of "Hamlet on the Holodeck" (1997), discusses a number of aesthetics relating to new media as well as Church (1999), who Fencott (1997) cites devised several Formal Abstract Design Tools (FADT's), which Fencott (2007) discusses in great depth in Chapter Four of Game Invaders. To form an architectural basis for a digital environment, Murray (1997) proposed four facets. These are listed below:

- Procedural is rules and rule based descriptions of places, people and objects used by gamers during play.
- Participatory is described by the break-up of the digital environment enabling the gamer to value and understand the pleasure gained.
- Spatial is described as the portrait of a navigable space either in a game or digital format, for example a website, conversation or a 3-D environment.
- Encyclopaedic is the availability of digital environments offering the potential to deliver information which is too vast for the human mind.

Many videogames incorporate or illuminate aesthetics to their players. Murray (1997) deems environments, such as games, to incorporate three elements. These may be individual or a combined set of elements within one game, as Fencott (2007) outlines in Game Invaders:

- Immersion is experienced during play when a particular gamer experiences the feeling of being “lost” in the environment or story.
- Agency is described when control is occurred by the gamer in the digital environment.
- Transformation, which many gamers experience during play, is to feel or become someone else or something else.

For many, the experience of games and all three elements during the game will depend upon the genre and objective. For some, the experience of immersion and agency may not be felt due to the lack of understanding of the aims. Church (1999), an industry professional, has devised and outlined three FADTs which many would view as a set of aesthetics for games. Some may also be very similar to those listed by Murray (1997):

- Intention is the pleasure which a gamer feels when understanding the reason behind the game and deciding what the subsequent action should be to progress onto the next level.
- Perceivable consequence and agency are alike in gaming, gamers experiencing the pleasure of agency through the intent of actions and the perceivable consequences of the actions undertaken whilst playing.
- Story is obvious to many within a gaming environment; there may be countless stories, or a background story, which give the gamer an insight to the quest, but for some (as Fencott suggests) like *Tetris*, there is no background story or narrative during play. However, some could argue that, after playing, a story has

been formed from the player; the player is telling the story of how successful they were during the game.

Conducted by academics from both the fields of narratology and ludology[25] (Frasca, 2003) there have been studies for some time in relation to gaming. Some suggest that games cannot just be perceived as a standard narrative but more akin to a particular activity or sport (Dovey & Kennedy, 2006). Many tasks are conducted throughout games for one reason or another, to complete a task or level. Espen Aarseth (1997, 2001) developed his own methods for studying games. This method consists of three elements which should be found in a game: the rules, material and semiotic system (content), the game play created in a game world/environment and lastly game play which is formed from the first two elements.

Aarseth (2003) takes this further by suggesting three additional methods; examining the:

> "design, rules and mechanics of the game, insofar as these are available to us, e.g. by talking to the developers of the game. Secondly, we can observe others play, or read their reports and reviews, and hope that their knowledge is representative and their play competent. Thirdly, we can play the game ourselves".

Huizinga (1955) and Callois (1961), both experts in the field of play, discuss thoroughly the style of play, classifying games, which like chess, are rule-based and have a clear win-or-lose outcome. Ludus and paidia is the term classified for games which are open-ended, or there is no clear winner, the genre of game which would be

[25] To describe a yet non-existent discipline that would focus on the study of games in general and videogames in particular (http://www.ludology.org/articles/Frasca_LevelUp2003.pdf)

categorised at paidia is simulation or *The Sims*. Huizinga (1955) has, over time, catalogued different types of play within a game. Gamers who enjoy FPS games will have the knowledge and skills essential to compete either against the enemy or other players to reach the next level or objective. This type of game reveals clear goals such as winning. Huizinga (1955) classifies this as agon. Furthermore, Huizinga (1955) sees gamers who play sport or gambling genres as taking chances. For instance the chance of winning a ball enables gamers to move to the next stage. This is known as alea, and the games of this genre were used in the experiments for this investigation in particular the golf and tennis games. Dovey and Kennedy (2006) discusses the work by Juul (2003). This being very similar to the work of Poole (2002) in the nature of game structures, suggesting rules are aspects of the game structure, adding different elements. The basis of games as stated by Juul (2003) should include; player effort, attachment to outcome, negotiable consequences and values designated to probable outcomes:

> "It corresponds to the celluloid of movies; it is like the canvas of painting or the words of the novel. The game model doesn't mean that all games are the same, but that these six features are what games use, to be different from each other" (Dovey & Kennedy, 2006).

Rules are a part of any game either played on a board or an arcade game from the nineteen-seventies. Understanding the rules is imperative to the nature of play and the experience derived. When coin-operated machines were released gamers found the experience very positive as they had only a matter of minutes to understand the rules and play a game like *Asteroids* (1979), unlike the development of home consoles giving the gamer time to fully learn and understand the game play. Salen and Zimmerman (2004) have comparable concepts to that of Juul (2003) and Poole (2002) relative to game playing and gamers. Stating rules form the construction of a game and are tantamount to the pleasures of gaming.

3.3 – Computer Game Sector

Throughout the history of games many developments, innovations and advancements have been witnessed throughout the decades. The Twenty-First Century, has seen technological advancements and which are still being created, giving gamers more intuitive game play.

3.3.1 – The Early Years

The game *Spacewar* (1962), for many, is the first computer game to be accessed by the public. Interaction was very limited with minimal buttons acting as the controller of a space craft. The interface of the game was very simple, making it easy for gamers to comprehend the nature and purpose of the game. Being the first computer game created, Poole (2002) stipulates from a theoretical perspective, several elements forming the structure and aesthetic pleasure essential to many games today. For example, the gamer understanding the rules in a simple format for the game(s), having the opportunity to be competitive, and accomplishing the task through achievement or winning, both of which give the gamer the experience of pleasure. The mechanics of procedural and Artificial Intelligence (AI) challenges the reactions and skills of gamers which in turn develops their skill of gaming throughout, giving additional pleasure.

The pleasure which *Spacewar* (1962) delivered to gamers encompasses many aesthetics which Poole (2002) and Fencott (2007) discuss in their respective texts. For example, if the objective of the game is to destruct the opponent's space ship, then the pleasure of destruction is felt, and having proficient skills to control the space ship away from the black hole, is a necessity to complete the game. However, mastering these skills takes time, which will bring satisfaction to players and the necessary response to the actions during play, conducted through hand-eye co-ordination. This may seem a simple interface and game to play, but despite the simplicity and techniques required, the game itself is not necessarily easy, therefore testing gamers through their own skills and ability of game playing.

The technology used to deliver *Spacewar* was very different from that of its successors; Appendix II demonstrates that the machinery that was used to play the game was very large and bulky. The controllers consisted of two switches and a button which navigated the space ship and were used for firing. Fencott (2007) discusses in great detail the technology and interaction of the game. The game environment is set in space and the players are not only battling with each other, but are also fighting against the physics, which occurs in space, challenging gamers further when trying to manoeuvre away from the sun and to avoid being hit by the opponent. The opportunity of piloting a space ship is not something which is common to 'the average gamer' in the real world and in the game, the aesthetic transformation performed, implies the gamer is in control of a ship until the game ends. This leads onto presence and co-presence. An indication of presence was that the game was highly addictive and many hours were spent "lost in space" (Fencott, 2007). Participatory one of the four aesthetics defined by Murray (1997) or as

Csikszentmihalyi (1990) has defined 'flow', where gamers' lose track of time and/or oneself during game play. Experiencing flow or participatory through "a perceived match between the elements of the activity and the subject's skills" (Fencott, 2007, Csikszentmihalyi, 1990) encompassed in many elements within environments.
The game content was very simple with a basic graphical interface illustrating the two spaceships and the sun in the middle. The purpose of the game, using basic interaction, was for players to shoot at one another, and gravitate around the sun without being sucked in. With a simple interface, the pleasure which many gamers experienced came in several formats, for example, "destruction of mastering a simple interface that demands we develop skills to use effectively. We also see the pleasure of action – "as defined requiring rapid responses coupled with good hand-eye co-ordination" (Fencott, 2007).

3.3.2 –The 1970s

The nineteen-seventies saw the development and release of the first arcade machine. As discussed in-depth, in Appendix II, this was not entirely a success because players were inserting money into the game and having to learn how, including the use of buttons, to play the game in an allocated time. The release of *Pong* (1972) gave players pleasure, and the game structure as suggested by Poole (2002): simple rules, competition and testing of player reaction skills. *Pong* was created, from what some would call, the very first computer game, which was developed four years earlier than *Spacewar* (1962), known as *Tennis for Two* (1958). The objective was for both players to hit the ball across the net, the net was signified as a white line in the centre of the screen, and the score recorded for each player. Players interaction of the game consisted of paddles, which some may have found difficult, but the additional release of the arcade machine version of the game at the same time, was due to lack of patenting, giving players the opportunity to control the game through a joystick motion rather than paddles.

The release of *Pong* onto the home console formed the future of home consoling for future decades. Atari released *Pong* using a joystick controller which, for many players of arcade machines, was an easy transition, having the ability to understand how to play. Even though it was on a different machine the player experience did not change from that of the arcade version. Further expansion of controllers occurred in the mid to late seventies, initially from the company called Coleco, which developed a multi-arcade game controller, which gave players the opportunity of playing a multitude of games through access of the controller. Appendix II illustrates the multi-controller devised by the company.

Space Invaders was released in the late seventies. This particular game had many features embedded in it, enhancing the experience of playing. One main feature was the chance of showing the previous highest score of the player, giving current players the opportunity to reach and even score higher, creating a competitive atmosphere within the arcade environment. The creators of the game devised the interface to challenge players through each level, although the speed stayed the same with aliens advancing, once again, testing the skill and reactions of the gamer. Two other games were also released for the arcades known as *Lunar Lander* and *Asteroids*, both of which had simple interfaces and tested the skill of the player through the controls.

The technology developed during this era was still in its infancy, although the production of arcade machines was the start of many further developments for this period. The release of Computer Space used a variety of buttons which for the interface was more complicated, resulting in the gaming experience being less enjoyable, and therefore many gamers did not partake. At this time, a number of companies using enhanced technology, improved arcade machines that were available to the public and consoles used at home. The interaction for gamers and arcade machines were simplified, enabling easier and more pleasurable game play with titles such as *Pong* and *Asteroids*.

Controllers for gaming console market had similar and basic approach to that of the arcade machines, enabling gamers with knowledge of arcade-machine interaction to play games such as *Pong*. Console technology and the availability of colour screens, followed the development of colour televisions and added for many to the experience of gaming. The console controllers came in many formats, for example, joysticks and paddles, a necessity for playing distinct games such as *Asteroids*, *Space Invaders* and *Pong*. A multiple controller was released offering gamers the opportunity to play a number of games on one cartridge. Figure II.16 in Appendix II discusses this development of the controller.

The nineteen-seventies saw gaming content being further developed with many successful and popular games being developed and released. As previously mentioned *Asteroids*, *Tank* and *Space Invaders* were very successful. *Tank* was the first game to use joystick controllers, which gave gamers the impression of being in control of the tank. For many, the immersion within this game through the joystick controller will have provided an awarding pleasure. The huge success of *Space Invaders* was due to the nature of the game, giving gamers the feeling of realism that aliens were attacking and by killing them “they were actually saving the earth by destroying these creatures” (Herman, 2001). Competitiveness was the appealing feature of this game to gamers, not completing due to timing out, or because the player had reached the highest score. Releasing games such as *Asteroids* and *Space Invaders* initially onto arcade-machines, and consecutively the home console, ensured gamers would be able to understand the nature of interaction, which would transfer from one machine to the other. The release of *Lunar Lander* and *Asteroids*, with very different interfaces from that of Space Invaders, was still successful. The interface was very plain but effective, with the necessary graphics and simulation required. Due to the objective of the game *Lunar Lander*, the pleasure of gaming may not have been the same as for *Tank*, although the feeling of landing a ship on a particular area would still have given gamers pleasure.

The main aspect of the games in the seventies saw the creation of vector and rastor graphics, both of which are very different. Rastor graphics scan the screen 30-60 times per second, using an electron gun nestled in a cathode-ray tube to create a 2-D pixel image with less vector graphics, this had first been used in the *Space Wars* game, as well as *Lunar Lander* and *Asteroids*. A 2-D imagery formulated through mathematical commands and statements, where previously screens were divided up to produce the image vector graphics used the electron gun to pinpoint two points on the screen. The result of using vector graphics was less detail of images, but they were sharper and clearer (Herman, 2001).

This was a very exciting era for the games industry, with many developments in technology, hardware and content, so not only games changed but technology as well. In this decade there were many experimental factors occurring. With experimentation the result brought successful games such as *Asteroids* and *Space Invaders* to the audience, which were transferable to home consoles enabling gamers to play at home.

3.3.3 – The 1980s

In the nineteen-eighties many popular games were released, including a home version of *Space Invaders*, which was as successful as the arcade version. Atari released a game called Adventure or *ADVENT* for short. The reaction was different, gamers seemed less excited in comparison to previous game releases such as *Space Invaders* as Herman (2001) suggests, “it proved that Atari’s designers could still come out with new and interesting games” (Herman, 2001). Vector graphics were being used to create game interfaces and were used to create the game *Battlezone*, which had a realistic interface and gave the impression to gamers of a battlezone, so much so, that the “US Army ordered a modified version of the game for real combat tank training” (Herman, 2001).

The game *Defender* was created with a scrolling interface, a new method of presenting the game interface, and one which, some years later, would be adopted by the Japanese company Nintendo. The game play of *Defender* was different from previous games, with the use of seven buttons (which did not stop players from enjoying their experience). The majority of game play, as Herman (2001) explains, was conducted away from the main screen, although still visible to players. Alerts of enemy attack were through sound which added an extra dimension to the experience of gaming.

In 1980 a different type of game was released; this was known as *Pac-Man*. The object of the game was to collect or eat the yellow dots around the maze which would award a particular player with points. Once the player had travelled around the maze collecting the dots a new maze would appear. For the character to gain additional health, (to maintain life within the game) *Pac-Man* would have to collect cherries or fruit and so as not to lose a life. *Pac-Man* would have to avoid the ghosts which were perceived as the enemy. The seventies witnessed the success of *Asteroids*. The eighties perceived the success of *Pac-Man*. This was to supersede that of *Asteroids*. The essence of this success, as stipulated by Herman (2001), was due to non-violent content. The game *Pac-Man* widened the gaming demographic audience to include girls (Herman, 2001). As discussed, more in depth in Appendix II, the nature of the *Pac-Man* character itself, was seen as the first game character and one which players could associate themselves with, where previously, characters had been perceived as spaceships or tanks.

A new style of game was released by the company Nintendo, exemplified by *Donkey Kong*. The graphical interface was different from that of previous games and was evident as a platform game, where gamers, had to climb up on a number of ladders, avoiding a gorilla and trying to rescue a princess. Sega, a Japanese company, released on to arcade-machines, a game called *Zaxxon*, again with a different interface. The interface would scroll differently from that of previous games. As a particular gamer was piloting a spaceship, the interface would scroll from top right to bottom left, the player during flight had to destroy everything and try to avoid objects, by turning the aircraft left, right, up or down. Therefore, the scrolling interface gave the impression that the graphics were 3-D, a first for videogames at this time. *I Robot* was a game that, when released, had little success. As suggested by Herman (2001), the reason was the nature of the graphics displayed, which gave players the opportunity to create their own "abstract polygon-generated art". This was ahead of its time and this game did not have the success of *Pac-Man* or *Asteroids*.

Nintendo released the Famicom (Family Computer) in Japan and a version for both America and Europe was also released called Nintendo Entertainment System (NES), both featuring Mario, the now famous character associated with Nintendo. Mario was first introduced in the previous game *Donkey Kong*, the character that had to rescue the princess from the gorilla. The game which accompanied the NES was *Mario Bros*. This was a platform scrolling game which had been released on to the arcades and then transferred to the home market. The game play was the same as the arcade game, enabling gamers to understand the nature of the game from experience and not to learn new rules or controls. Appendix II discusses the aims of the game and the objectives that the character has to achieve. The control pads accompanying the NES were simple and easy to understand, encompassing an up, down, left and right button, a start button and A and B buttons which enabled gamers to shoot at enemies. Games developed for the NES such as *Mario Bros* and *Duck Hunt* were in a 2-D format, all of which had a clean and crisp appearance made possible from the initial development of graphical interfaces, vector graphics. Sega released their version of the home console called the Master System. The control pads were very similar to that of the NES with the additional peripherals such as a light gun.

The eighties observed a number of developments and releases assisting game play and interaction. These ranged from steering wheels for particular consoles to VR technology, including head-mounted gear, gloves, glasses and boards. Virtual-reality equipment, at this time, was very expensive and was solely used for experiencing VR in a different environment, not in a home environment. Motion detection, as a means of interacting, was also investigated. One in particular was called U-Force, which detected the movement of users' hands, controlling the actions seen on the screen and no controller being held in the hands. This piece of technology was connected through the NES console. Further releases of home console development were witnessed in the eighties. The development from the 8-bit to the 16-bit and then the initial addition of the 32-bit console, gave the opportunity of faster processing and better graphical interfaces. Companies, such as Sega, released the Genesis, which was not interchangeable in relation to games for previous versions of the console.

Development of games and content continued into the eighties and saw many exciting releases from companies. Games of this era came in a variety of content, from *ADVENT*, a text-based adventure game in which gamers used text to play the game, to *Super Mario Bros* which was a 2-D platform genre. In Appendix II, games such as *ADVENT* and *MUDs* can bring the gamer many pleasures as discussed previously by Fencott (2007) and Turkle (1997). Players of *Pac-Man* saw the character as the first game character and the creator of the game designed the content to be the simplest character possible, without any features such as eyes or limbs "rather than defining the image of Pac-Man for the player, I wanted to leave that to each player's imagination" (Fencott, 2007).

Games with a 2D interface, such as *Zaxxon*, were released experimenting with graphics and gamers' perceptions. The gamers visual perspective of the game, showed the screen scrolling from top right to bottom left, with the added content of objects the visual presented the gamer with a 3-D interface, although it was still 2-D. Console technology improved and although arcade machines were still being played with games such as *Pac-Man*, the mid to late eighties witnessed the additional developments of the home consoles from Nintendo and Sega, both offering gaming experiences through a number of peripherals and games such as *Mario Bros* and *Sonic the Hedgehog*. The actual controllers of both consoles were very alike; interaction was through pressing a button either up, down, left or right. Appendix II discusses the consoles in depth. Nintendo, with the release of *Duck Hunt*, had also developed a peripheral, a laser gun which was used as the controller rather than the pad.

It was not just gaming technology which was been developed but also hardware for VR environments in conjunction with games. Sega released 3-D glasses, an advancement of previous glasses, which were cardboard and used red and green film. Boards and gloves were also created and released, which interacted with the gaming environment as a replacement for a control pad. Coinciding with these developments were additional improvements to consoles, upgrades of processor and memory, which in turn improved graphics. The aesthetics, which would have been experienced by gamers through this type of upgrade and technology, would have changed even though similar. Throughout gaming, gamers may have experienced the pleasure of immersion within a game through VR and experiencing presence and co-presence, depending upon the game being played.

3.3.4 – The 1990s

Many home consoles in the nineties were predominately 16-bit and 32-bit technology, allowing for advanced gaming experiences. Nintendo released the Super Nintendo Entertainment System (SNES), and Sega the Genesis/Megadrive, and although Sega decided to develop a machine which was interchangeable for software and cost purposes, Nintendo only provided this at an additional cost to consumers, the adapter would be available facilitating previous games to be played. *Mario* was a main feature of the Nintendo brand, and Sega had created their own essence of Mario in the guise of a hedgehog called Sonic; with this the sales of Sega consoles increased.

The mid-nineties witnessed Sega releasing additional consoles. One in particular was initially titled Saturn, but then renamed to Dreamcast. It enabled users to gain basic Internet access. A new console from the company Sony was the PlayStation. It showed a variety of features which would be accessible to gamers. One interesting and innovative characteristic was the ability to connect, through serial ports, two PlayStations; thus allowing for two gamers to play the game simultaneously. This was not the only improvement to console hardware. Sega devised the Dreamcast console with Internet access, the PlayStation encased modem capabilities, but overall the enhancement of graphics now used 3-D geometric. Full-motion videos were instigated due to high-end chips and circuit boards as part of the hardware, thus creating a more realistic feel and gaming experience. Kirriemuir (2006) suggests that the materialization of the PlayStation "would limit the lifespan of SEGA's penultimate hardware platform". Additional releases on the home console from Nintendo were initially the Ultra, now known as the N64. The announcement by Nintendo of the controller "would be revolutionary as it had been specifically designed for 3-D games" (Herman, 2001). Herman (2001) discusses the speculation surrounding the controller. Although, featuring some of the previous buttons used on the NES, the controller also had an analogue joystick. The majority of all controllers which had been brought onto the market were digital. The problem with this, Herman (2001) suggests, is that gamers do not have full control over the interaction on the screen, for example:

> "Although a player could move an onscreen character by pressing a joypad in a certain direction, the computer always decided exactly how far that character would move. With an analogue controller, the on-screen character could move with prevision, exactly as far as the player wanted him to move" (Herman 2001).

Unlike the PlayStation and other consoles developed for the home console, which was now using CD rather than cartridges, the N64 was still using the cartridge. This caused many problems for development and cost of production, leading to a lengthy take-up of the console. As discussed in Appendix II, using the cartridge format it allowed for a number of classic titles to be released, such as *Super Mario 64*, *Golden Eye* and *Zelda: Ocarina of Time*.

The discussion throughout relates to graphical interfaces and during the mid-nineties many games were becoming, and showing, realistic content. For this to continue the move from cartridge to Compact Disc (CD) was essential, but using a CD to hold the necessary information, required for more technological and realistic graphics to be created, more than could be stored on a cartridge. Appendix II discusses the reasons why companies such as Sega and Sony had changed from cartridge to CD. They were quicker and cheaper to manufacturer. Sega and Sony were both using this method, as Herman acknowledges "knowing that if the games became hits they could quickly produce more copies. That wasn't the case with cartridges. If Nintendo produced too few of a given title, it would take weeks for that supply to be replenished" (Herman, 2001). An additional benefit of using a CD was that information could be stored eighty times more than the cartridges used by Nintendo.

As outlined in detail in Appendix II, there were still many developments in this era. In relation to technology upgrades, consoles were rapidly emerging from many companies. It could be suggested that due to the content of games being developed, the use of upgraded consoles was necessary to be able to play the games. As seen in previous years of gaming, the main focus was content rather than technology. Although hardware was important in the early days, during the late eighties both technology and content were united, being equally important. Content became more realistic therefore hardware had to improve to bring the demands of gamers to the screen. Content and technology, encompassing game theory, is important to gamers and more so in this era of gaming than previously. Although developments were occurring, it seemed as if the market had become stale, the method of delivering enjoyment and pleasure to gamers during game play was mainly through the game, predominately through aesthetics.

Technically the gamer has an idea of what they would like to do or see happen within a game. This type of aesthetic pre-genre was prevalent and occurred during play. The development of content became more complicated, coupled with the classification of genres; the pleasure of agency was impromptu. As content became more developed this is really the era where aesthetics became important, and gamers demanded more from a game. This era is definitely where the aesthetics, defined by Church (1999) and Laurel (1994), came into action. The nature of story or narrative within a game and intention becomes more important in this era as well as the experience of immersion, presence and co-presence. Narrative or story within a game may already be set up, but for many, depending upon the agency or actions taken during play, may possibly change the pleasure. For some story/narrative is not as important as other pleasures, but many games have some form of narrative and this for many gamers is an important element. Intention, depending upon the nature of the genre, is to comprehend and recognise the logic of the game; thus gamers are required to decide the necessary actions in the sequence.

There were three infamous games of the nineties which aided the N64 in its sales. These were, "*Super Mario 64* (a 3-D platform game), *Golden Eye* (a first person shooter) and *Zelda: Ocarina of Time* (a multi-genre game)" (Kirriemuir, 2006). Games from different genres had the capability to entice and immerse gamers during play through the nature of aesthetics. The aesthetics of story, intention, presence, co-presence and realism, had brought games to a different perspective, in particular, incorporating realism into game play. If this was correct, realism had reached the pinnacle in shock factor for gamers and therefore losing its appeal. Gamers were not shocked at the realistic content, which for some, may have been a start in changing gaming in a whole different manner. Games of the nineties brought pleasure as an aspect into gaming significantly in technology and although there were campaigns between companies, as upgraded consoles were released to gamers, for many, this was not important. It was more important to play the game with all its experiences, either with friends or individually.

3.3.5 – Gaming in the New Millennium

Sega, Sony and Nintendo released additional consoles for the home market. Sony in the late nineties and into the Twenty-First Century, saw the release of what the company was calling the 'future PlayStation', also known as the PlayStation 2 (PS-2). This type of console was very different, combining a number of entertainment mediums such as Digital Video Disc's (DVD) and USB ports, enabling connection to either a modem or Ethernet, giving access to the Internet. Supplementary to this was the ability to connect an extra disk drive, giving gamers the option to download game information and demonstrations. Appendix II discusses in depth the characteristics and difference of the two PlayStations, and technology advancements enabled Sony to increase and develop a superior console for the home.

Microsoft had also entered the gaming market with its release of the Xbox in 2001. This console again was different to what consumers had before. The Xbox was not just a console, but also the start of an entertainment system, which would be seen in the follow up addition of the Xbox-360, and categorised as a Next Generation console. The console allowed the gamer to store soundtracks and game components, which then could be used in games. The capability of the Xbox was twice as much as that of the PS-2 and Dreamcast, and by playing CDs (music) and DVDs gave the gamer more prominent and richer graphics during play.

Competition between Sony and Nintendo commenced during 2004 and 2005 with the release of the handhelds from both companies, the PSP from Sony and the DS from

Nintendo. The DS was a turning point, for what many would say, the whole of the games industry, in relation to second and third age audiences. The DS changed many people's perceptions of gaming. Computer games were not just for young hardcore gamers in their twenties, but also for older adults, some who experienced the first video game released onto arcade machines, also known as the Baby Boomers. The method of interaction on games, such as *Dr Kawashinma's Brain Training*, is predominately through the stylus, which is situated at the back of the handheld console, users touch the screen with the stylus and play the game; in some facets of the game voice is used as a characteristic to complete the task. Nintendo used the same style of buttons as found on previous consoles, whereas with PSP, users are required to press a number of buttons to play the game, which is very similar to what is expected on the PS-2 and PS-3. The development of the PSP was to create a handheld game, bringing a number of media formats together, similar to the PS-2 and the PS-3; including DVD format, photo viewing as well as gaming. The PSP gives the gamer the opportunity to connect to other PSP handhelds, which is also implemented in Sony console releases of the PS-3 and the Internet. There is a in depth discussion of the two handhelds in Appendix II, in relation to why the success of the DS was popular with different demographic groups and to the release of the game *Brain Training*, under the premise of playing the game for thirty minutes a day will keep your brain active. Chapter Four discusses this notion more in depth with similar products, which have been developed and marketed.

Nintendo followed up from the N64 with the release of the Game Cube. Once again, the company chose to follow suit with its competitors and although the console was aimed at the core consumer market, the console still did not play CDs or DVDs.

Nintendo were trying to reach out to other demographic groups such as the adult market. Further discussion of this can be found in Appendix II. One aspect which Nintendo did follow through was the infamous character Mario, which had come to be associated with the company. Updated versions of the games were released for the Game Cube. One in particular was *Mario Kart*, a racing game with a number of characters, which had been created in earlier versions from the NES and SNES.

In the early Twenty-First Century gaming reached a new level with consoles, termed by the industry as “Next Gen”, this predominately saw Sony and Nintendo both releasing new consoles called PS-3 and the Wii (We) respectively. Microsoft also released their version called Xbox-360. Appendix II discusses in depth about the advancement from the PS-2 to the PS-3, in technology terms, and the essence of improved hardware, bringing hardcore gamers content with a more realistic look than in the past. The Wii had been very successful since its release in December 2006, as previously stated this was due to the rise of older adults and new demographic audiences taking up gaming on the DS as a method of keeping their minds fit, and socialising with younger people and peers. Interaction with the Wii is very different from any previous console including the PS-3; the controller, which has a motion sensor implemented, allows gamers, if playing the golf game on the *Wii Sports*, to swing the controller as if swinging a golf club, unlike the PS-2 or PS-3 where gamers have to pull down on the analogue stick, situated on the game pad when playing *Tiger Woods PGA Golf*, to tee off. Appendix II discusses the interaction the remote can offer during a number of games, and the variety of accessories available which consumers can purchase additionally to enhance the gaming experience.

Within years of the new millennium a different type of gaming was introduced. This was due to the developments in technology, and with the release of the DS shortly followed by the Wii; the gaming experience took a different outlook. Content on both of these products was very similar. It was now more important how the gamer interacted, and therefore the relationship between aesthetics and hardware had being revitalized rather than through content. The PS-3 had concentrated more on the delivery of content, although the technology had improved from previous versions of the PlayStation. This was to process the development of content which had become quite superior.

In previous years, the experience of many aesthetics discussed in this chapter, had been experienced through game pads on consoles, whereas now (with the release of the DS and Wii), players were able to experience several pleasures through a stylus or a remote, which delivered gaming into a new area. The pleasure of co-presence and agency in games, such as *Wii Sports*, has brought many people together in a social environment which previously had not been the case except online multi-player.

The nature of gaming in the last four or five years has changed for the better due to the nature of interaction and the pleasures gained from the Wii. The future is very exciting, and players are wondering what future developments will be released to enhance the aesthetic pleasures of gaming. Gaming, at the moment, is certainly about the technology rather than the content, as analysing the Wii and the DS shows, but considering the PS-3 content it is still important to certain audiences, and as previously stated the realism of games became quite stagnated in the nineties, which is why the uptake of the Wii and DS has surged due to technology advancements rather than content.

3.4 – Ageing and Persuasive Technologies

Technology over the years has brought enjoyment, and aided many people throughout their personal and work life environment. In recent years, society has seen the development and implementation of the Internet with the use of e-mail, enhancing communication between friends, families and work colleagues.

Older adults may already be interested in learning and embracing new technology into their lives, which could in turn enhance and aid their curiosity. Incorporating new forms of technology may stimulate both the mind and the body with active physical participation.

The project Digital Gerontechnology: Opportunities, Approaches and State of the Art (DiGOAS) by the School of Computing and Technology department at the University of Sunderland was conducted on behalf of CODEWORKS ATL. The investigation was "to design and conduct an exploratory field study with the local older population, to identify difficulties with existing digital products, unmet needs and wants with existing products, and currently unaddressed product opportunities. A main goal was an initial triangulation[26] of existing literature on digital gerontechnology[27] via a small field study in the Sunderland area. The emphasis would be on in-depth qualitative interviews, with the intention of identifying differences between the experiences of a

[26] Triangulation typically involves combining one or more research methods in one study to compare findings. Data and participant triangulation are possible, but less common than method triangulation (used here), which can compensate for limitations and bias in the research methods and literature available for social-science research.

[27] Gerontechnology is the field of technology for the ageing population.

small group of older people and their representation in the literature on digital gerontechnology. A study conducted in Florida by Karavidas (2005), suggests the more experience older adults gain of computers the less anxiety they feel; as supported by Malone (1980, 1982), the study also concluded a further amplification of self-efficacy and life satisfaction as a result of computer use. A study by Richardson (2005) suggests the barriers and problems faced by older users with computers; they are willing to overcome, and to gain the benefits of being connected with peers and family and aid mental stimulation (Richardson et al, 2005). Hindmarch, Cockton, Young *et al.,* (2006) had a small sample of participants relative to an ageing demographic in the Sunderland area; therefore, the figures in the following tables cannot translate or relate to the UK population. A number of questions including attitudes, access, awareness and encouragement of technology were posed to participants.

The aims of the study were to check both, the negativity of users of technology, and the competence and poise of the appeal in digital technology. Several obstacles perceived to avert older adults from adopting technologies and (in effect) alienate them from particular aspects of society. The aims were to test existing reliable trends and findings (Hindmarch, Cockton, Young *et al.,* 2006). The results of the study are displayed in the following Tables, 3.4.3, 4, 5, 6, 7, 8, 9 and 10.

Table 3.4.3 presents the attitudes and opinions of the participants from the study. The majority agreed that computers and technology did impact upon individuals lives and half of the sixteen agreed that age affected the use of computers. As suggested by

Hindmarch et al. (2005), the participants based their perceptions and opinions from an indirect experience of ICT.

Table 3.4.3 – Attitudes/opinions of computing technology

Attitude/Opinion	Yes	No
Perceived difference, computers and other technologies	11	5
Computers impact participants' lives	11	5
Does age effect relationship with computers?	8	8

Table 3.4.4 displays the results of the participant's ownership and access to a computer. Over half had access to their own computer or friends computer, the majority having had access to a friend's computer. There are differences between access and usage of computer technology and suggest individuals having knowledge and/or familiarity of ICT.

Table 3.4.4 – Access to computer technology

Access to Computers	Yes	No
Own computer	11	5
Family owns computer	14	2
Friends own computer	11	5

Table 3.4.5 displays the results of participant's awareness of computers within public places. Over half stated a positive response and the majority having used a computer in public area.

Table 3.4.5 – Awareness of computers in public places

Computers in Public Places	Yes	No
Participants aware of computers in public places	11	5
Participants used computers in public	14	2

Table 3.4.6 indicates not all sixteen participants answered the questions. Over half of the participants (75%) had used a computer, a drop from the 87.5% who had access. The results also show participants who had received additional support and encouragement when working with ICT technology welcomed this, as it gave additional independence and was time well spent (Hindmarch Cockton, Young *et al.,* 2006).

Table 3.4.6 – Encouragement of computer usage

Encouragement and support	Yes	No
Ever used a computer	12	4
Encouraged in use by social network	9	7
Would welcome encouragement (of the 7 not encouraged)	1	6
Would like to use computer (of the 4 non-users)	0	4
Receive enough encouragement in computer use	6	6
Receive enough support in using computers	8	4
Feel comfortable when using the computer	9	3
Confident when using computing technology	8	4

Table 3.4.7 shows the results from twelve out of sixteen participants, and displays what the participants used a computer for? The results show the majority used a computer to search for information and communication with people and only a minority used computers for game playing, although Hindmarch *et a*l. (2005) does not stipulate exactly what type of game playing.

Table 3.4.7 – Activities performed using a computer

Activities Performed	Yes	No
Search for information	7	5
Keeping in touch with people	6	6
Stay informed (current affairs)	5	7
Playing games	4	8

Table 3.4.8 presents the positive benefits of using computing technology for this sample; the majority responded to ICT technology saying they found it enjoyable and it gave individuals additional independence.

Table 3.4.8 – Life enhancement

Life Enhancement	Yes	No
Computer use enjoyable	10	1
Computers provide benefit to life	7	4
Enhances independence	7	4
Enhances positive feeling	5	6
Provides company	5	6

Note. One computer-using participant provided no response for this section

Table 3.4.9 shows some of the negative effects of using a computer. The majority reported they felt helpless when using a computer and in the past had felt anxious of using this type of technology. However, there is a positive outlook from the results, suggesting that with time and encouragement (Table 6) feelings of anxiety are less.

Table 3.4.9 – Negative effects of computers

Negative Aspects	Yes	No
Ever feel helpless using a computer	9	2
Ever felt anxious using computers in the past	7	4
Still anxious using the computer now	4	7
Waste time on computer	2	9

Note. Computer using participant provided no response for this section

Table 3.4.10 shows the type of assistive technologies (hardware and software) which the sample of sixteen participants would find useful within their daily lives. Hindmarch, Cockton, Young *et al.,* (2006) state a positive response by participants regarding technologies and software such as wizards, virtual agents and learning software to be useful for participants.

Table 3.4.10 – Assistive technologies

Assistive Technologies	Yes	No
Software		
Wizards	8	4
Virtual agents	8	4
Interactive self paced learning software	7	5
Computer describes, charts, graphs	6	6
More explicit feedback from computer	6	6
Screen reading software	6	6
Visual enhancement software	6	6
Voice recognition software	5	7
Mind mapping software	5	7
Haptic feedback for alerts	4	8
Peripherals/Hardware		
Thin client	9	3
Copyholders	6	6
Mouse that supports whole hand	5	7
Additional diffused lighting	4	8
Wrist rest	3	9
Larger keyboard	3	9
Touch screen	3	9
Brightly coloured keys	3	9
Multiple coloured keys depicting different types of key	3	9
Chord keyboard	3	9
Text to speech scanner	3	9
Mouse that can be used in different positions	3	9
Track ball	2	10
Larger mouse	1	11

The above tables show an overall positive attitude towards technology. Concluding the qualitative results from the project, the authors stipulated there are positive attitudes, but still there is a lack of enthusiasm to using technology, and the concept of the digital divide is through self-exclusion, although the sample was very small. Quantitative findings from the study (Hindmarch, Cockton, Young *et al.,* 2006), outline the usefulness of technologies (hardware and software) by the sample of participants (sixteen) "is never unanimous, with some proposals receiving limited support, indicating the need for extensive and continuous involvement of the intended user base in the development of such support" (Hindmarch, Cockton, Young *et al.*, 2006). The technology aids shown in Table 3.4.10, were perceived by the participants as very few to be useful.

Further conclusions from the quantitative data suggest there are still issues arising in confidence, anxiety, discomfort and barriers of using technologies, such as personal computers, including the functionality of this type of technology. The data indicates access of technologies is via family or social networks;

> "One apparent solution to disposing of ageing PCs is to pass them onto ageing friends and family! This becomes a spur to usage and education, and is one effective way of meeting elderly aspirations, to become more familiar with computers, which have been apparent for several years now" (Hindmarch, Cockton, Young *et al.,* 2006)

A wide variety of research has been conducted and made in association with ageing demographic groups. Over the years, the answer to assist an ageing demography is through medical, assistive technologies and ergonomics. Medical technology assists in treatment and diagnosis, whereas assistive technology offers assistance through safety and security, maintaining support for individuals through activities, which have become complex or impractical to carry out individually (de Kort *et al.,* 2005, IJsselsteijn *et al*., 2006). The 1990s witnessed the area of gerontechnology evolve, the objective being prevention and enhancement. De Kort *et al.,* (2005) specify there has recently been a new faction of technologies, including persuasive technology, a group which has not been thoroughly researched. Van Bronswijk (2006) outlines persuasive technology as;

> "Interactive computing systems designed to change people's attitudes and behaviours" (Fogg, 2003).

This definition is supported by de Kort *et al*., (2005), Intille, (2004), outlining the function of persuasive technology is for individuals to intentionally change behaviours and attitudes in a certain situation, for example, exercise stimulation, learning more efficiently and stopping smoking (de Kort *et al*., 2005). This type of technology can offer other positive benefits to individuals as well as those already outlined, there is stimulation, motivation and engagement in behaviours, offsetting psychological concerns such as distress, depression and anxiety including social context (Intille, 2004, de Kort *et al*., 2005, IJsselsteijn *et al*., 2006). Van Bronswijk (2006) further indicates de Kort *et al.,* (2005) "introduced the concept in the domain of Gerontechnology without emphasising the role of older persons as co-designers".

The development of this technology, through the development of computer technology, has enabled it to be incorporated into domains, which previously may not have been possible, for example in bedrooms and bathrooms, as IJsselsteijn *et al*., (2006) suggest, and in more peculiar areas such as clothing or appliances within the home. The notion of social integration and intergenerational connections, De Kort *et al*., (2005) considers what is called 'social gaming'.

As previously discussed persuasive technologies can also assist in aiding with health and rehabilitation. Two articles published on the BBC News website[28] [29], both address the use of the Nintendo Wii console. The first of these articles relates to the

[28] http://news.bbc.co.uk/1/hi/scotland/north_east/7869445.stm
[29] http://news.bbc.co.uk/1/hi/health/7262770.stm

University of Aberdeen and the NHS Grampian, who recently (BBC News, 2009) started a study relating to balance and fall prevention amongst elderly people within sheltered housing.

The article announced the call for elderly people to contact the physiotherapist if wanting to take part. The research team decided to use the Wii balance board, as the preferred equipment used for such research activities was quite costly, and was unable to find sufficient funding for this equipment. According to the research team, the Wii balance board would be able to support the investigations, evaluating the efficiency of computer assisted exercise programmes, which are suitable and acceptable to elderly people (BBC News, 2009). The second article discusses the implementation of the Nintendo Wii into school PE lessons. Some pupils prefer not going outside for PE and therefore are able to conduct exercise through the Wii. Military re-habitation centres have introduced the Wii to soldiers who are returning from Iraq, having sustained serious injuries. The nature of using the Wii within this environment is to strength endurance and co-ordination. Physiotherapists are also using the Wii, suggesting patients who look forward to using the Wii will be more motivated, and treatment will be successful (BBC News, 2008). De Kort *et al*., (2005) indicate the use of persuasive technologies within Virtual Environments (VE's) to support rehabilitation for both cognitive and motor impairments.

Taking into account the discussion of persuasive technologies, the ability of the Wii ergonomic factors, need to be considered when designing for older adults. In the last ten years, society has seen the development and advancement of many technologies ranging from mobile phones, to television sets, to games consoles and many more, some of which older adults have welcomed in their lives. According to Pennathur

(2007) the purpose of ergonomics is to improve the interaction with humans at every possibility, allowing individuals to be at ease, secure of assistance, and valuable in their activity (Lesnoff-Caravaglia, Pennathur, 2007).

This is also supported by the conclusions of de Kort *et al*., (2005), outlining technologies are becoming more user-sensitive, very similar to that of the Wii, adding there are potential prospects in designing and developing particular products or systems for a specific use. Before the release of the Wii, game controllers were shaped to sit between the palms of player's hands. Figure 3.4.5 illustrates how console brands, such as Sony, Microsoft, and Nintendo in their former years, enabled players to interact with the games.

Figure 3.4.5 – PlayStation 3 controller[30]

Many young game players, who have played games for the majority of their life, will not have a problem holding the controller and understanding how to use it, pressing a number of buttons to carry out several actions within a particular game. In contrast, the Nintendo Wii controller allows gamers/players, when playing tennis, to hold the

[30] www.joystiq.com/.../05/ps3controller_inhands.jpg

controller as if they were actually holding a racket and playing tennis, as illustrated in Figure 3.4.6.

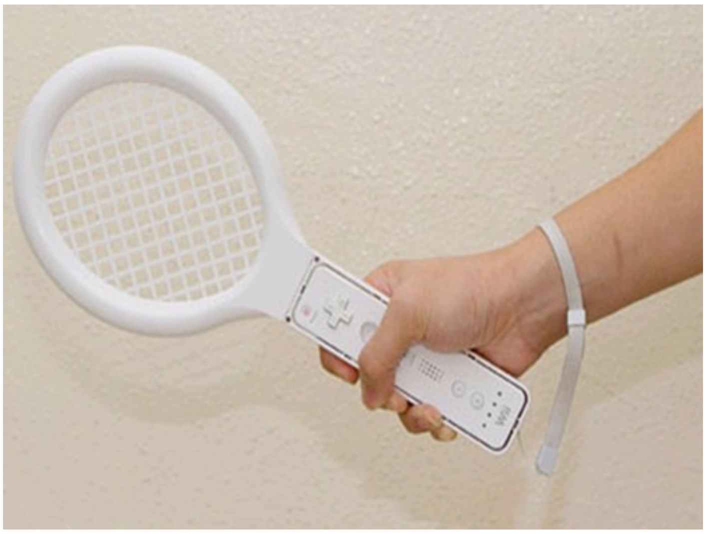

Figure 3.4.6 – Nintendo Wii controller with tennis racket accessory[31]

3.5 – Conclusions

This chapter has discussed the nature of the games industry, from its creation in the early sixties, up until the current day where new technologies, such as the Wii and the DS, have enticed gamers to continue experiencing virtual worlds in a more intuitive easier method. The advancement of gaming technology throughout the early part of the Twenty-First Century, has altered the gaming demographic audiences for the future. The take-up of the Wii and the DS consoles has enabled Baby Boomers and other demographic groups to play, as part of their leisure, individually and with friends and family. For many, who have never before experienced this form of entertainment, the nature of interaction which the Wii controller has, allowed gamers to understand the rules necessary to play and interact far easier than previous consoles such as the PS-2 and the Xbox. The discussion of theory showing examples and progression of game interfaces throughout the course of history and the nature of controller developments, can aid immersion and agency, including the understanding

[31] http://gizmodo.com/gadgets/video-games/

and learning progress of rules, in which the gamer has to identify with, to gain a pleasurable experience during the game.

The technology project commissioned by CODEWORKS ATL, conducted by Hindmarch, Cockton, Young *et al.,* (2006), highlight the need for further research on technology and older adults, and the use of technology, such as computers, for everyday life in communication with friends and relatives. The use of gaming consoles, such as the Wii, has been highlighted by companies through various media and is discussed more in depth in Chapter Four. The use of such technology can also enhance intergenerational relationships, which are beneficial to all those concerned, bringing a sense of fun and pleasure as well as pre-empting the downsides to ageing, for example loneliness and dementia which (in time) could bridge the technology divide between young and older adults.

The opinion that content is more significant than interaction or vice versa, will differ from one gamer, or user, to another, and the recent awareness of second-and third – age cohorts playing on the DS/Wii have, due to innovative development of technology, has driven gaming into a different demographic group. This is not only due to the nature of interaction, but also the release of the DS game *Brain Training*, and the vast publicity and celebrity endorsement aiding its success. Many people fear the onset of memory loss, and therefore believe that playing *Brain Training* for a certain amount of time each day, will prevent a decline in memory loss, as brain cells are being exercised; however, the success of this is firstly due to the ease of interaction using the DS stylus and the content being simple and easy to understand. Chapter Four will focus upon the main element of this thesis, discussing the specific nature of computer games for older adults.

CHAPTER 4

OLDER ADULTS AND COMPUTER GAMES

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4.0 – Overview

This chapter examines the relationship between gaming and older adults. Identifying recent growth in computer game genres from statistics primarily obtained from the US game sector market. This chapter considers current brain training products which are similar to that of the Nintendo *Brain Training*.

4.1 – Introduction

This chapter will discuss the latest statistics of gamers from 2003 to 2008; including the variety of genres, which are now established within the gaming industry. The chapter also discusses why older adults play computer games and why older adults and seniors should learn to play computer games.

4.2 – Statistics of Gaming by Older Adults

Game development within the industry has primarily targeted young audiences, predominately boys and young men, rather than alternative or mature audiences, such as those aged fifty years and over. Dodson (2004) highlights, "1993, half of all UK computer games were sold to under 17s, in 2002 half of all games were sold to 18-25 year olds."

Marston (2007) cites several newspaper articles reporting the take-up of older adults playing computer games, for example the article "grown up players push computer games into the mainstream;" featured in the business and finance section of the Irish Times identified "most gamers are 35 years old, another 28% / 18-35 and 13% / 50+." The article reports "a film maybe more expensive but the huge expenses involved in game

making still means that publishers are reluctant to try anything new, which makes the immediate future of the gaming industry look a bit dry" (Lillington, 2003).
There are several reasons why older adults find it difficult to accept computer games. Two of these reasons are many computer games are developed as sequels and have inappropriate themes as content. The reasons for this target audience and the game industry are, successful marketing/advertising strategies, encapsulating themes to be reached in a manner where second-and third-age adults are confident in purchasing computer games, and for the industry to gain successful market sales. Dodson (2004) considers "the rump of the market is in sales to children and teenagers" including young adults.

Data collection of gamers in the UK has been documented, including additional entertainment mediums, commissioned by the BBC Creative Research and Development department, titled "Digital play, Digital Lifestyles". The research, managed by the BBC Audience Research and conducted by Pratchett (2005) conducted in summer 2005, surveyed 3442 people between 6 and 65 years old. There were six age classifications, (6-10, 11-15, 16-24, 25-35, 36-50 and 51-65). Figure 4.2.7 shows to what extent different age groups play computer games.

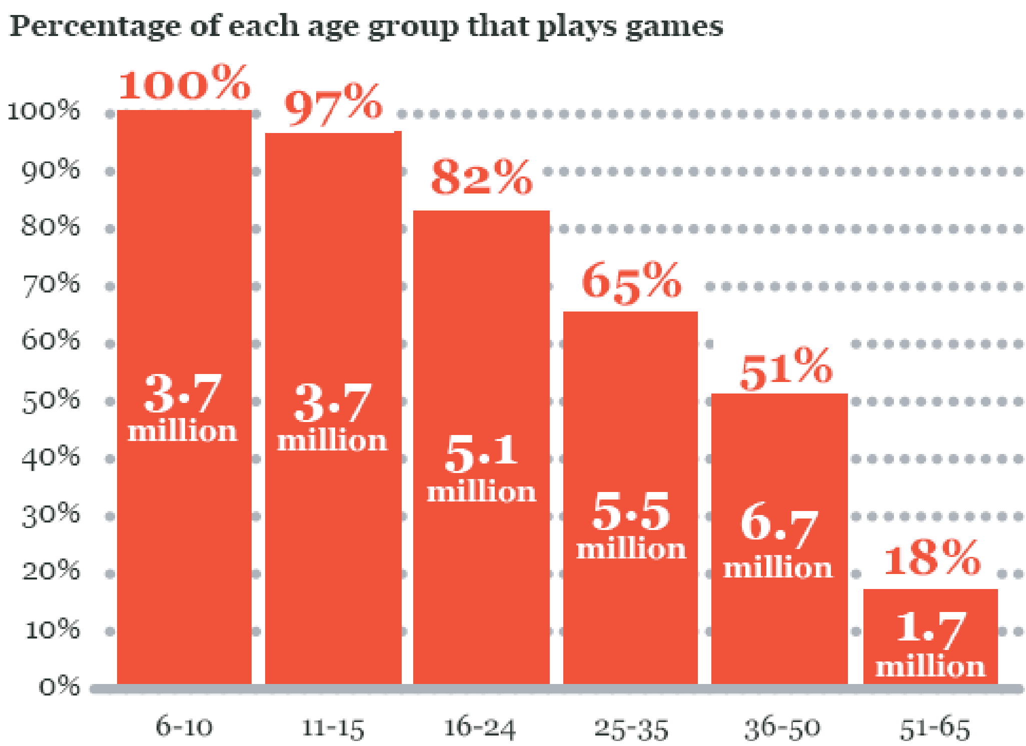

Figure 4.2.7 – Six age groups of UK gamers in 2005

The main point of this investigation is the last group the 51-65 age years. The study aimed to find out the size of the gaming market in the UK and to profile gamers. The report outlined how gamers were classified, those who had played games at least once in the last six months on different media formats (mobile, handheld, console, PC, Internet and Interactive TV) categorized as a gamer. The results from this section of the report indicate 69% were perceived as hard-core gamers, and 18% as casual gamers. The results of gaming on a particular platform showed 84% of gamers preferred playing on a PC, and 26% on a PS-2. The game genres, found to be the most played and favored , were puzzle/board games/quizzes (52%), sports (7%) and RPG (7%), (2005). Pratchett (2005) concludes, reporting a breakdown of the 51-65 years age group by stating, “this is the highest group of gamers who thought there are too many racing, shooting and fighting game genres published on the market”, (Pratchett, 2005).

Annual data collected since 2004 from the Entertainment Software Association (ESA) of America, provides a variety of statistics relating to game genres, online, unit sales and more importantly, the percentage of gamers by age. Figure 4.2.8 illustrates the growth in over-fifties playing computer/video games between 2004 and 2008. The statistics presented are based on data collection from the USA. Figure 4.2.8 demonstrates a steady increase of game players over fifty playing computer/video games. Although there was a dip in year 2007, this was only a slight dip and continued to increase in 2008.

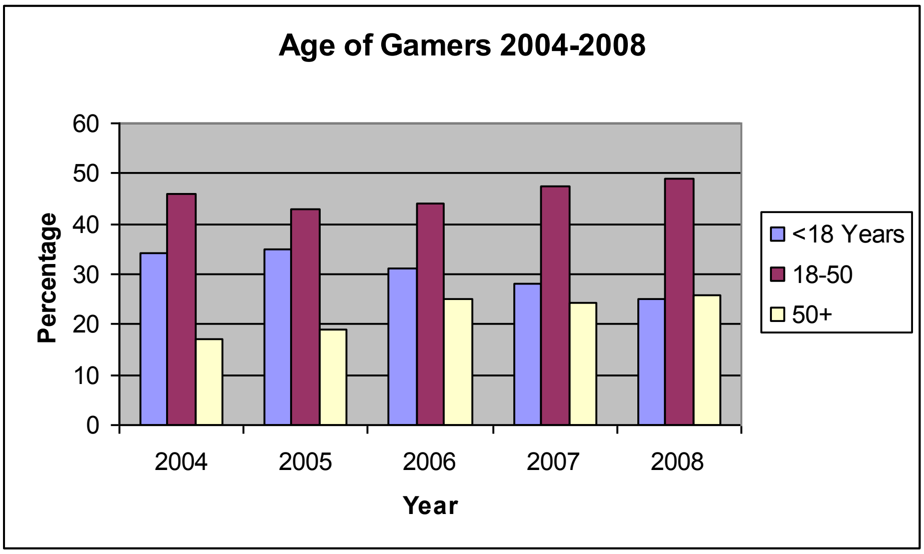

Figure 4.2.8 – Shows the distribution of American video game use by age

It is important to understand, when discussing and investigating computer/video games and target audiences, what type of genres are selling each year. This information has been presented in reports published by the ESA. These reports facilitate the mapping of potential genres for all demographic groups, including older adults. Figures 4.2.9 and 4.2.10 present both video and computer game genres between 2004 and 2008.

Figures 4.2.9 and 4.2.10 present figures for the sales of game genres between the four years. A comparison of the figures revealed some similarities of sales of genres. For example, the family entertainment and children's genres, in both charts the genres have been grouped, and un-grouped, depending on how the information has been reported from the documents themselves.

Figure 4.2.9 shows a number of statistics for the genres within the video game collection. In 2004, both action (27%) and sport (18%) genres had the highest percentages of usage and there was very little fluctuation between the two genres up until 2008, where ESA recorded a decrease with both action (22%) and sport (14%). There were additional genres which had been incorporated into the data collection from the year 2007; there was very little variation between the percentages apart from strategy which witnessed an increase of 2% within twelve months. The genre, titled family entertainment, has increased by 13% between 2004 and 2008, children’s entertainment started to feature from 2007 onwards, there was very little variation between the two years. Data collection of computer game genres was reported in a similar way to that of video games. The action genre reported an increase from 2005 to 2007 of 2% and sports from 2004 to 2008 had slowly started to deteriorate through the years; between 2006 and 2007 there was no change.

The highest percentage of genres, for the computer game statistics was children’s (12%), strategy (27%) and shooter (13%). Children’s genre between 2004 and 2005 had increased by 9% and from 2006 to 2008 the decrease was 16%. Strategy increased throughout the years of 7% and the final genre, shooter, seemed to follow a similar route of children’s, a 4% increase between 2004 and 2005, a decrease of 6% between 2005 and 2007, and a slight increase of 2% the following year (2008). The sports genre decreased by nearly 4% between 2004 and 2008, and action entered the statistics from 2005, showing an increase of 2% between 2005 and 2007, but by 2008 it had decreased by nearly 3% .

Further developments in 2007 identified additional genres entering the games chart(s). These were adventure, arcade, flight and other games/compilations; this also happened with computer-game sales for the same period. The new genres were racing, other games/compilations, flight and arcade. Analysing the report “Digital play, Digital lifestyles” (Pratchett, 2005) and “The Essential Facts about the computer and video game industry, 2004-2008” (ESA) reports, there is little annual data collection from the UK compared to the USA, and although the UK report gives some insight into gaming preferences, the statistics from the USA give a better overview of gaming over the last four years than the UK report. This is not to say that the data collected, is in any way of lesser substance, but trying to obtain annual data for the UK gaming market similar to that of the USA, has been some-what difficult.

The reports, published by ESA, give no explanation or summary for additional genres added. One possible reason for new genres appearing in 2007, is the advancement of gaming hardware/software, for example the Nintendo Wii and the PS-3, with the console developments gamers buying games for these consoles to play.

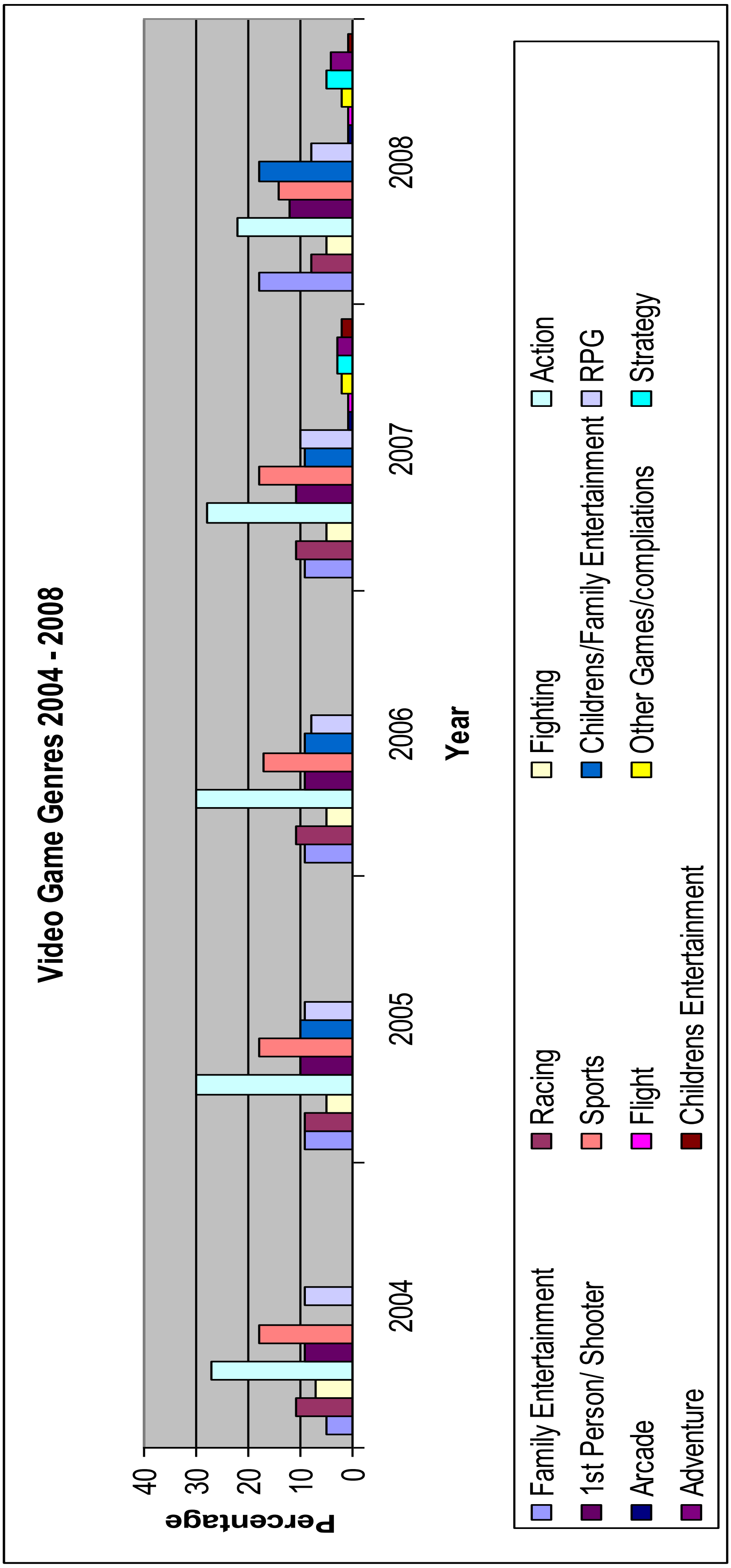

Figure 4.2.9 – Video game genres 2004 - 2008

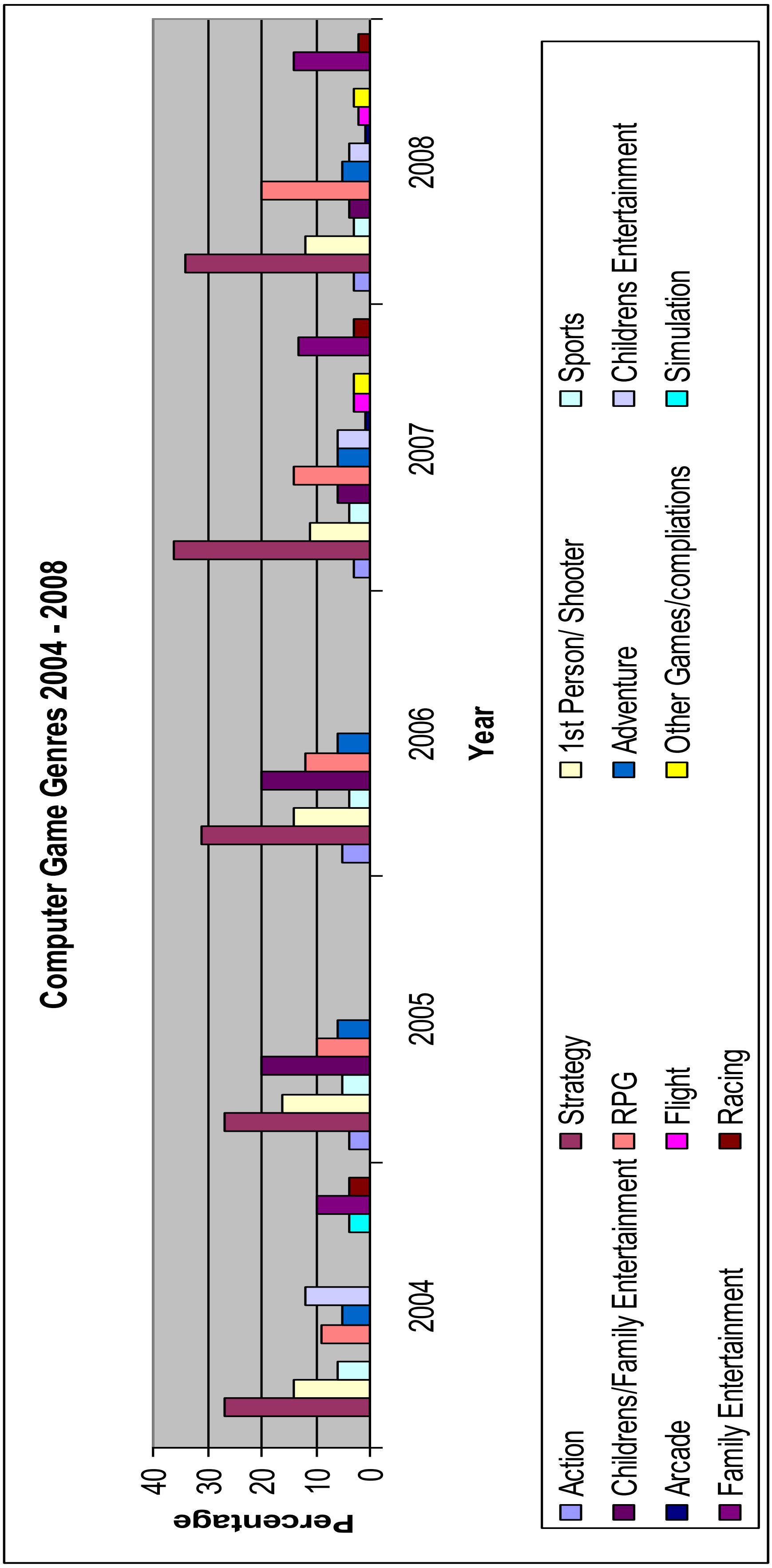

Figure 4.2.10 – Computer game genres 2004 - 2008

4.3 – Relevant Research Conducted in this Field

Little is known concerning second-and third-age adults interacting with computer games, and their reasons for playing, and preferences of genre(s).

Copier (2002) conducted an investigation relating to older adults and computer games; the project, 'Is Gaming Just for Kids?' 'Elderly people do play games'; concluded older adults and elderly people do play games. The project involved interviewing twelve elderly people between 50 and 76 years. Three questions were posed to the participants:

1. What kind of digital games do they play?
2. What motivates older adults to play digital games?
3. Does the playing of digital games lead to a wider social network?

The study concluded three main points; older adults/gamers are being excluded from the gaming market, older gamers do not refer to themselves as gamers, but as people who like to play digital games and it is important to combine the research into narrative and ludology[33], especially in the field of genre classification.

More specific conclusions from the report relate to gamers, motivation and social networking either with friends (fellow gamers) or intergenerational relationships (children, grand-children).

[33] To describe a yet non-existent discipline that would focus on the study of games in general and videogames in particular (http://www.ludology.org/articles/Frasca_LevelUp2003.pdf)

Games

Older adults play games from every genre: action, adventure, fighting, puzzle, role-playing, simulations, sports and strategy (Herz, 1997). However, most play cards, chess, puzzle and adventure games.

Motivation

Older adults are motivated to play games by their relatives or through a computer course.

Social Networking

Older gamers living on their own, only develop more social contact in the family and not through playing computer games.

Copier (2002) concluded the study;

> "The elderly do not feel that gaming is just for kids, most of them are not comfortable with this hobby. This is why most of them do not really talk about gaming and do not develop new social networks around this leisure activity. The only people they speak to about games are family members, who usually provide them with new games. The cultural idea seems to be that being over 50, and gaming, doesn't fit together, and this is why the elderly are being excluded from the gaming market and do not feel comfortable calling themselves gamers."

Tiwari, Astheimer, File (2004) investigated the "Considerations in Designing Games for Older People". The study objectives were to determine if older adults are interested in playing computer games, and if not, what necessary improvements are required to entice older adults to gaming. A workshop was conducted by the UTOPIA (Usable Technology for Older People: Inclusive and Appropriate) Project, a consortium of academics from the University of Abertay and the University of Dundee. In total eight games were used for the investigation, five computer games and three console games. The number of participants who attended and participated in workshops was eleven.

The paper "Considerations in Designing Games for Older People", explained demonstrations or functions were shown to the participants before playing the games, to aid play during the study. The findings included navigation, feedback, interface, game design and the perception of the games. The findings of interface problems were the difficulty of using the analogue stick on the console pad, pressing more than one button at any one time to conduct one action or movement, and for some, using the keyboard keys were not suitable as stated in the findings from observations recorded. Participants reported comparative to game design, the lack of understanding or concept of what their game objective was within the game, for example collecting points.

There were a number of questions arising from the paper "Considerations in Designing Games for Older People" which need to be questioned, for example how the computer games used for the study were chosen and the purpose for those particular games. The outline of the results reported further questioning relating to navigation, and games design is perhaps required. It seems, the authors have skimmed the surface of the investigation, and although this is similar to this study I feel that this study has not delivered sufficient information.

The following section will look at why older adults play games. The subsequent information was obtained from the study by Copier (2002) and Codemasters, a computer games company based in the Midlands, UK. The company placed a call on the Fifty-Connect website requesting older game players to contact the company regarding their gaming experiences.

4.4 – Why do Older Adults Play Games?

The following section discusses why older adults play games, analyzing articles from the BBC news website and a brief overview of an investigation conducted in the Netherlands by Copier (2002), as discussed in Section 4.2.

Copier (2002) concluded from her study a number of reasons why older adults play computer games.

- Their partner/husband plays;
- Their son/daughter play video games and they want to interact more with them by doing so;
- To support a hobby or pastime;
- To pass time, when they are bored;
- Just because they enjoy it.

Marston (2007) cites several newspaper articles relating to older adults and gaming; one in particular states: "Increasing numbers of over 60s are picking up joysticks to play videogames"[34] (BBC News, 2003a, 2003b). Codemasters nicknamed this particular audience "grey gamers", witnessing an increase of people over sixty "buying the more diverse games such as strategy and historical titles" (BBC News, 2003a, 2003b). The article discusses, "the type of games that get grannies and grandpas going, are the ones that require lateral thinking and problem solving, rather than shoot-em ups" (BBC News,

[34] http://news.bbc.co.uk/1/hi/technology/3287891.stm

2003a, 2003b). Codemasters found large audiences of "grey gamers" when profiling the age ranges of users on their website. There had been over 50,000 people who had ticked the over-35 box, leading the company to undertake further research. This involved contacting several newspapers and websites to place advertisements, requesting the audience to come forward with their views and opinions. Codemasters received over 250 email responses from the audience, some of which are listed below;

> "We've been playing for 15 years, having been introduced to computer games by our son," said Mrs Gill.
> "It keeps your brain active and we spend about two or three hours playing most days" (BBC News, 2003b, http://news.bbc.co.uk/1/hi/technology/3287891.stm).

Codemasters claims, "The gaming industry is big business in the UK, with more spent on computer and video games than on cinema tickets, as well as video and DVD rentals." (BBC News, 2003b, http://news.bbc.co.uk/1/hi/technology/3287891.stm). Therefore, designing and developing games to suit a wider demographic group, especially the "grey gamer" market, could potentially make a lot of money for the industry, there is a need to understand what older adults want from game titles, and the method of interaction has to be carefully considered.

Codemasters advertised on the *Fifty-Connect* website for "grey gamers" to come forward and talk about their gaming experience(s)[35]. Using the term "grey gamers" as used by CODEMASTERS reports, "they are buying the more diverse games around, like strategy and historical titles" (BBC News, 2003b). Richard Eddy suggested why older adults play

[35] http://www.50connect.co.uk/index.asp?main=http%3A//www.50connect.co.uk/50c/gamers.asp

games: “Because of the breadth of games now with more universal appeal, they are more enjoyable and social these days” (BBC News, 2003b). The BBC News website hosted a debate in September 2004 titled, “Games: Future of Entertainment?” There were several comments by readers four in particular which relate to this discussion, their comments are listed below;

> “I am in my 50s and have been a keen player of strategy games for years. I revel in *Command Conquer* and other real time strategy games (who says you have to be a teenager to have all the fun!). My reason for writing is to say that, computer games will continue to grow enormously in future years, and will take over as one of (if not the) premier form of entertainment. Why do I say this? Because a few weeks ago I got hooked on another form of PC game. I hooked up a force-feedback steering wheel and pedals, loaded up Colin McRae Rally 04 and went rally driving. I am a real life rally driver and this is the closest thing to driving a rally car without actually being in one. I can’t wait for virtual reality to get to speed, then no-one will get me out of my car (err... computer).”

> “Well, as a 50 year old female gamer, I really enjoy working through the adventure games I play (1st & 3rd person shooting games usually!) My teenage son says I am hopeless, but at least we have something to talk about and he still comes to me when he gets stuck. My husband decided a long time ago, that he is actually married to a teenage boy...”

> “I am a 54-year-old married female. I love PC games, both online and off, and my Playstation. After a hard days work, I love to game instead of watching TV. I play

> competitive sport, read, holiday and lead a full life. Now, why do I feel guilty when I play a game for a few hours? Maybe because my favourites are the ones when I commit multiple murders and love it!"

> "I'm a retired man of 54 and I get an enormous amount of pleasure from the online, role playing games that I indulge in. I enjoy the fantasy element (I'm a Sci-Fi fantasy book reader) and also the community element of the games I play. There seems to be little or no ageism, sexism or racism - and folk of any age or gender are always happy to help. The games do seem to be aimed at a young male audience (all the female character seems to be very, busty and alluring) but when you actually play the games they are fun - and that is what people seem to want, games give more input to the fun than passively watching TV"[36]

The comments and statistics shown in Figures 4.2.7 and 4.2.8 indicate there are older adults who are attracted to playing computer games, but for many it is still an industry which primarily targets a younger audience. With this in mind, the articles and data show a rise in the awareness of the fun, social, intergenerational interaction of playing games that older people would feel. In addition, there is the possibility that games designed for them would also attract new players from this group.

The Interactive Digital Software Association (IDSA) published a report in 2000-2001 called "State of the Industry" (2000-01). One of the most interesting points was in relation to demographics and gaming; a survey involving 2000 people, conducted by Peter D.Hart Research Associates states;

[36] http://news.bbc.co.uk/1/hi/talking_point/3616436.stm [Accessed May 2008]

> "The stereotypical image of a video game player - a teenage boy playing alone for endless hours - is finally fading away, as the broadening demographics of computer and video game players become more widely understood" (IDSA, 2001).

The above quotes and contributions obtained from the BBC News website, including website articles posted on the *Fifty-Connect* website, used by CODEMASTERS requesting older adults to come forward and share their experiences, indicates there is an alternative gamer.

Older adults are viewed as a neglected group, but second-and third-age adults were the first to experience the first video arcade game *Pong*. *Pong* was placed in public houses allowing people to play the game with friends in a social environment, which in today's society, computer and video games are played as a part of social context. The second- and third-age adults are in essence, the first computer and video game generation.

Another reason why older adults are viewed as neglected, may be that game developers do not know and understand what games may interest this group, and as a consequence, what would appeal to older adults. Game developers may not understand how to develop and market specific games to older adults. Conducting research to identify the type of games older adults would like to play could be a useful insight, if a game is aimed at this market.

Second-and third-age adults do not always regard themselves as gamers even when they do, in fact, play games (Copier, 2002). Many people perceive gamers as young males with highly developed computer skills, sitting in bedrooms and being a nerd, to whom games are effectively a leisure choice; computer games identify them socially, as previously discussed in Chapter Three; gamers identify themselves through understanding and discussing the interstices of genres, aiding fellow gamers with hints and tips of how to pass a certain level of a game (Newman, 2005, Fencott, 2007). Many older players see casual gaming and playing with younger relatives, for instance, as something different. Many, in fact, might be horrified to be identified with such a group. Publishing these types of games in a way which will be accepted, the take-up of gaming by second-and third-age adults will increase.

4.5 Why should Older Adults and Seniors Learn to Play Computer Games?

As discussed in Chapter Three, it is significant that older adults have encountered games since their creation in the nineteen-sixties. Games depending upon the content can be great fun, and as the statistics show from, "The Essential Facts of the Video and Computer Game Industry 2004-2008" there has been an increase of this demographic group participating in gaming. Gaming, for many, can be a form of socialising amongst peers and more importantly, intergenerational relationships amongst second and third age adults. Taking this into consideration the pleasure of playing in the form of aesthetics, experienced through immersion, perceivable consequence, agency and transformation (Murray, 1997, Church, 1999, Newman, 2005, Fencott, 2007) as discussed in detail in Chapter Three, can be rewarding for both young, second-and third-age adults.

In May 2007, the University of Strathclyde, hosted the Legacy of Learning conference, at which I presented and published a paper titled "Computer Games and Older Adults, Why?" The paper discusses the advancement of gaming technology in recent years with the release of the Nintendo Wii, and the DS, the added benefits for older adults playing computer games. A question that seems to be asked by a number of adults as well as industry professionals is;

> "Why would older adults and seniors want to learn how to play computer games?"

Keeping the mind and brain active throughout life is imperative to individuals, enabling learning, enhancing skills and knowledge and interaction with others. A younger, person learning to play computer games, can be a fairly easy process, brought about through observation, trial and error and through family members and friends. Young people may also find learning to play games easier by observation of the screen (Newman, 2005), and hand movements conducted on the console pad, for example, the PS-2 and PS-3. For an older adult, however, learning how to play could be more cumbersome and taxing, especially when they may not be used to this new form of hardware in the sense of game pads, and as technology is enhancing, hardware may become more difficult to comprehend and to use and therefore an older adult may find interaction more difficult to learn and operate (Marston, 2007).

To reiterate what was discussed in the paper at the conference, the paper "Strategies for maintaining cognitive health", (Chapman, 2002) supports what was stated in the paper;

> "As adults live longer and have more experiences, their brain has more information to sort through to retrieve those memories. The activities someone

has done for a lifetime have established connections in the brain, making them easier to recall. But people need to use newer information frequently to form that direct connection to memory. Keeping the brain agile in its ability to find and use information will help reduce the memory loss associated with ageing" (Chapman, 2002). To combat memory loss associated with ageing, and enhance mental stimulation, the report details the strategies to overcome this; "learn new things, read books and periodicals and do word games" (Chapman, 2002).

The question posed at the beginning of this chapter, "Why would older adults and seniors want to learn how to play computer games?" The answers to this, keeping in mind the comments from the public and Chapman (2002) is to keep adults minds active throughout the ageing process, including socialising and interacting with younger generations and friends. Learning new skills and knowledge can be another reason why an older adult would want to learn how to play computer games.

An article published in the Student BMJ[37] titled *"Mind Games: Do they Work?"* Butcher (2008) investigates whether programmes claiming to aid older adults improve their cognitive functions actually help or work. Butcher (2008) opens the discussion by stating many older adults are going to the doctor asking for preventative methods and advice regarding memory loss. Butcher (2008) states "grey gamers have become a powerful market force and computer games like Nintendo's Brain Age, which claim to improve users' cognitive performance with repeated use, have sold tens of millions of units" (2008;336:246-8).

[37] http://archive.student.bmj.com/search/pdf/08/03/sbmj103.pdf

Recent television advertisements have shown the use of celebrity endorsements, involving the actress Dame Julie Walters and Patrick Stewart of Star Trek playing the game *Brain Training* on a Nintendo DS, a console used by all age groups. In addition to this, Nintendo have used, as a marketing tool, a television advertisement showing the nuclear family playing *Mario Kart,* suggesting to consumers that anyone of any age can play and enjoy with the family. Figures 4.5.11, 4.5.12 and 4.5.13 show how both the DS and the Wii were advertised to the consumer, illustrating that anyone can play.

Figure 4.5.11 – Mario Kart Wii advertisement[38]

[38] http://uk.wii.com/wii/en_GB/tv/1363.html

Figure 4.5.12 Celebrity endorsement of the DS television advertisement

Figure 4.5.13 Celebrity endorsement of the DS television advertisement

http://www.youtube.com/watch?v=qMxfi7zs5ls&feature=related

Similar programmes to that of *Brain Training* have been released on to the market claiming they are able to aid cognitive ability and retrieval.

There are independent experts who are uncomfortable with the claims made about such programmes as *MindFit*, *Brain Fitness* and the marketing ploy carried out by Nintendo's *Brain Training* (Butcher, 2008). Butcher considers the marketing aspect by Nintendo, stating that a gentleman in the advertisement is unable to remember a colleagues name while introducing his wife. He then purchases the software for the DS and as a result his memory is improved. Marsiske, (Butcher, 2008) states;

> "That all the available data on cognition training show, that when a person practises something-for example, short term memory retrieval-the person can get better at doing that test, but that the improvement does not necessarily generalise into the real world" (Butcher, 2008).

Marsiske (Butcher, 2008) continues suggesting with any form of exercise muscle is built up and develops stronger. This is the same for the brain, through testing speed and visual response throughout the game(s) the ability to retrieve specific information within the memory will become quicker.

Butcher (2008) examines reducing the risk of dementia through suggested activities. These include having a good education in the first two decades of life and being active throughout an adult's mid-life is also a method of off-setting dementia. Professor Laura Fratiglioni (Butcher, 2008) of medical epidemiology states;

> "People with low education, but who have engaging jobs, have reduced risk of developing dementia" (Butcher, 2008).

There have been trials with adults and companies who have produced cognitive software showing claims made through marketing are supported. One trial, in particular, carried out was IMPACT (Improvement in memory with plasticity based adaptive cognitive training) investigation sponsored by *Posit Science* using the *Brain Fitness* software. The nature of this study, the longest running trial, involved three academics from American institutions, with 468 random healthy adults sampled over the age of sixty-five years; the trial was to either, conduct forty hours using the *Brain Fitness* software, or forty hours of educational training software on the computer.

The premise of *Brain Fitness* is to improve memory through increasing the speed and accuracy of processing aural data. Elizabeth Zelinski, (Butcher, 2008) a cognitive scientist based at the University of Southern California, explains one of the exercises in the trial, experienced by both the intervention and control group, is to identify sounds; "people hear sounds that either go up or go down and they have to identify the sequence that a pair of sounds operates." The participants assigned to *Brain Fitness* used the software for sixty minutes, five days a week over a period of eight to ten weeks. The results of the trial were presented at the sixtieth annual Gerontological Society of America (GSA) conference in 2007. Zelinski (Butcher, 2008) indicated the results from the intervention group of participants, had improved in the auditory memory, more so than those assigned to the control group. Zelinski (Butcher, 2008) believes "some people may benefit from as little 20 hours of training, where as other may need as much as 60 hours" (Butcher, 2008).

MindFit is a piece of software claiming to aid adults with improving memory. A trial was conducted using this piece of software and computer games such as *X-O*, *Tetris*, *Labyrinth* and *Sudoku*. The results were presented at the eighth international conference on Alzheimer's and Parkinson's disease. The number of participants was significantly lower than the previous trial discussed. A random selection of 121 healthy older adults aged (50+) was assigned to groups; the participants were not told which software/games they were playing. Each participant was required to play the software/games, three times a week, for thirty minutes over a period of three months in their home[39].

The researcher (Butcher, 2008) states both groups in the trail had improved from using both *MindFit* and the computer games selected, the participants using *MindFit* "experienced greater improvement in the cognitive domains of spatial short term

[39] http://www.mindweavers.com/index.php?p=s1/trials&s=show_brainhealth&c=

memory, visio-spatial learning and focused attention".[40] Results from the trial also indicated participants using *MindFit,* with a lower baseline cognitive performance, increased more than those participants with normal cognition, indicative of the prospective benefits for therapeutic effect within the home environment, using computer game instruction, of those "suffering the effects of ageing or more serious diseases"[41].

The largest trial to date consisted of 2832 participants, with an average age of seventy-four years. The independent trial was sponsored by the US National Institute on Ageing and the US National Institute for Nursing Research. As part of the trial, participants were assigned by Dr Marsiske and colleagues to one of four areas; (memory training, reasoning training and speed training, the fourth group received no training, called the, "control group", the nature of this group was to "see what the affects of repeated testing would be" (Butcher, 2008). Three of the four groups were given training in "exercises and strategies to improve the memory, reasoning or processing speed, twice a week over a five week study period. Each session of training lasted between sixty and seventy-five minutes".[42] The training involved every day's tasks, such as; shopping the four groups of participants received ten sessions of training. The outcome, after five years of training, resulted in those who did receive training, did improve, more than those who were situated in the control group who had not received any training.

Marsiske (Butcher, 2008) reports the results from the study, stating the three training programmes were successful at improving the participants training, and of the participants who had experienced one of the three training programmes, had maintained

[40] http://www.mindweavers.com/index.php?p=s1/trials&s=show_brainhealth&c=
[41] http://www.mindweavers.com/index.php?p=s1/trials&s=show_brainhealth&c=
[42] http://www.jhsph.edu/publichealthnews/press_releases/PR_2002/ACTIVE.html

to exhibit significantly five years later, than those participants who had received no training.[43]

The DS was a turning point in regards to the handheld games market, Nintendo and more importantly gaming demographics. As discussed in Chapter Three the DS, a concept for the handheld market, enables players to visualise the game over two screens using a stylus for touch-screen interaction, and speech recognition within games. With this in mind, a stylus and touch-screen technology enables interaction to become easier than pressing buttons, thus opening up the market audience.

A BBC news article discusses how the most-ageing population of Japan are searching for new methods of keeping themselves more active and alert throughout their lives. 2005 witnessed the release of the DS, and one of the many games aimed at an ageing society predominately in the West was *Brain Training*. The development of this genre/style of game was to assist players, gamers and the general public into training their brain(s) to do mathematics, anagrams and other small puzzles which incorporated hand-eye co-ordination "games developed by scientists will, it is claimed, help to delay the onset of dementia"[44] (Hogg, 2006). Dr Takao Suzuki states Japan "is pre-occupied by old age." Suzuki, an expert in the field of caring for older people, indicates if there is a possibility of *Brain Training* aiding individuals with mental capabilities "in an aged society like Japan and the UK, nobody wants to get dementia so even if there is a very small possibility that it might work, most elderly people will want to do something in order to prevent dementia"[45] (Hogg, 2006).

[43] http://www.jhsph.edu/publichealthnews/press_releases/PR_2002/ACTIVE.html
[44] http://news.bbc.co.uk/1/hi/technology/5041690.stm
[45] http://news.bbc.co.uk/1/hi/technology/5041690.stm

Namco, a games company from Japan, is aiding a facility with DSs to its residents, Kawamura a spokesperson for Namco, states that as there is little growth in birth rate, the population of older generations will increase, therefore “the computer game industry for the elderly is a growing market for us” (Hogg, 2006). As already stated, there is little scientific evidence to suggest that playing games such as *MindFit* or *Brain Training* will offset dementia, but as Kawmura states “most scientists agree it cannot do any harm, to learn a new skill, keep your joints active and of course to share”[46] (Hogg, 2006).

The Nintendo DS (a computer game handheld) was released in 2005; and one of the best selling games to have been developed for the handheld gaming market was *Dr Kawashima's Brain Training game*. The game itself involves a number of exercises to enhance the brain, allowing gamers and non-gamers to play a number of small games which have being designed to stimulate the brain. The type of mini-games developed range from a simple math conundrum, involving counting, drawing and reading literature through the in-built device of the microphone. Gamers can view how their brain is performing and improving with time, as they are given a brain age reflected from their performances throughout the games; the better scores gamers have, the younger their brain age is shown on the DS screen. Since the release of the game, it has sold 1.8 million copies, and a year after the release, the game was still in the top-ten Japanese market (Bennallack, 2006, Marston, 2007).

With the development of persuasive technologies reports on the entertainment media, such as computer games, suggest players who played the brain training games on the DS

[46] http://news.bbc.co.uk/1/hi/technology/5041690.stm

could ward off mental conditions, such as dementia and Alzheimer's. Marston (2007) discusses the success of the Nintendo DS and of the games developed for this handheld console, suggesting (from a number of reports within the media) that the use of the DS and games such as *Brain Training* can aid adults in mental stimulation, by exercising brain cells which may not have been used for some time. Hogg (2006) suggests there are very few records in which the prevention of dementia could be controlled through game play and in many societies which are experiencing progressive ageing within society such as Japan and the UK.

With regard to the use of games in training the brain, one question people may ask is; "Why would this demographic group want to play games in the first instance?" A Namco (game-development company based in Japan) representative, Yoshiaki Kawamura (Hogg, 2006) stated, due to the decline in birth rate, it is apparent there are going to be many more people aged sixty and over in the target market audience of the games industry, where as at the moment, it is relatively small in comparison to children and young adults. Therefore, the need to entice older adults into playing, either through intergenerational or peer interaction or on their own using games, such as *Brain Training*, is greater. Alternatively, similar products could aid cognitive and mental stimulation, including enjoyment and fun for older adults, either on their own or with friends and family. The attention paid by the computer-game sector to second/third-age adults and the elderly, is an emerging trend in the concept of preferred game genres by this group, and one which both the industry and the field of gerontology could investigate further, for the future demographics. In conclusion, Hogg claims that there is still little evidence to say that game playing with children and grand-children, will keep the brain healthy for long periods. According to scientists, using the brain in this manner cannot do any harm, as learning a new skill and keeping physically active will aid the joints (Hogg, 2006).

A new game has been released for the Wii console titled *Big Brain Academy – Wii Degree*. The game is set in a college environment, and using the Wii character (mee), finds a number of activities which players can play, there are also three levels of difficulty.

Additional media websites have discussed and reviewed a recent release of the *Big Brain Academy-Wii Degree*. The title of the game suggests a move towards casual gamers. These are gamers seen to be more aware of user-friendliness, preferring the mode of interaction, rather than the look of the game. The title and the nature of the game are likely to entice people to play with friends and family. Casamassina (2007) suggests Nintendo recognise the casual gamer market and encapsulates the older demographic group within this, enabling the ability to exploit and apply the Wii controller effectively, allowing players to feel the tangible and palpable receptiveness of the controller.

Similar games have also been released for the DS, based on the same idea of keeping the brain active; they too use the setting of a college. The mini games, in *Big Brain Academy*, have simple mental puzzle problems such as counting coins, and remembering numbers against a sixty-second clock; there are varying levels of difficultly which initially challenge players, and over time will be successful in achieving the goals and objectives required by the gamer through the increased level of ability, this concept is also supported by Malone (1980, 1982) and IJsselsteijn *et al.,* (2007a, 2007b)[47]. *Brain Age* is very much like *Dr Kawashima's Brain Training*; players are required to carry out

[47] http://www.nintendo.co.uk/NOE/en_GB/games_1617.html

a number of small games, ranging from basic mathematics and syllable counting to reading. The idea of *Brain Training*, by stimulating the brain little and often will stave off dementia. As already stated by Dr Takao Suzuki, there is very little evidence to confirm such beliefs.

Chapman (2002) suggests the method and development of learning new information, or skills can strengthen memory, and help the brain to grow, delaying the possibility of dementia. Learning new technologies, such as game playing or a new skill can aid older adults to lead a healthier life or even recover from age-related illnesses (BBC News Website, 2008, 2009). Chapman (2002) established that many second/third-age and elderly are not familiar with technology, especially new technology such as gaming, and in some circumstances computing and the Internet. Learning computer skills and the Internet can stimulate and arouse mental strength as well as keeping generations of families connected, it can also help promote independence, something which many want to keep.

Intergenerational relationships are important for keeping in contact with both younger and older members of the family, and the method of using computer games to build and enhance relationships, as well as keeping mentally fit, can be a way of maintaining this. Consoles, like the Nintendo Wii, and games, such as the *Wii Sports*, are suitable for older adults, who have the basic understanding of playing tennis, golf, bowling and boxing, therefore receiving the benefit and experiencing from the pleasures of cognitive wellbeing throughout individual's lifetime, and making it a part of their daily or weekly routine (Chapman, 2002).

Butcher (2008) discusses the use of the game Nintendo's *Brain Age* and other similar games developed by other companies released onto the market. Butcher (2008) opens with the following quote;

> "For millions of people who are approaching old age, developing dementia, particularly if there is a family history of the disease, is a frightening prospect. A government report highlighted that the number of people in England with dementia is set to rise by 30% over the next 15 years" (Butcher, 2008).

Butcher (2008) discusses the effect of what an ageing population, who fear dementia, combined with the notion of *Brain Training*, has had on the market consumer, which – as Nintendo claims – increases player's cognitive functioning, through frequent exercise and has sold millions (Butcher, 2008).

Television advertisements of the DS and the *Brain Training* game have been successful in engaging a wider demographic audience, especially with well-known celebrities such as Nicole Kidman and Chris Tarrant playing the game. *Brain Training*, and similar games developed by Nintendo for the DS, is not the only type of game available. According to Butcher (2008), there are other similar products. The first product from the UK by Susan Greenfield, Professor of Pharmacology at the University of Oxford and Director of the Royal Institution, was a game called *MindFit*, sold by a company called *MindWeavers*. The second game, called *Brain Fitness Program* sold by Posit Science based in America, and cofounded by neuroscientist Michael Merzenich (Butcher, 2008) "claims to be clinically proven to help people think faster, focus better and remember more." With products like these, there are some experts who feel uneasy about companies claiming to ward off dementia through the use of these types of product. One expert in particular, Michael Marsiske, a clinical and health psychologist at the University of Florida suggests there is very little evidence available relating to cognitive training (Butcher, 2008).

Recommendations from a leading dementia researcher and clinician at Dalhousie University, Canada, suggests to patients with mild symptoms of the disease to implement a healthy lifestyle not only in relation to blood pressure and cholesterol, but also to engage in physical and brain exercise in several of ways. Giving patients the ability to feel in control of their memory difficulties, will aid them in feeling that they are in control of their lives, and not the disease (Butcher, 2008).

Research conducted by Ball, *et al.,* (2002) identified through cognitive training (advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) that if older adults are specifically trained for a certain cognitive task such as memory, attention or problem solving, individuals improve on that particular skill for which they have been trained to combat. Previous studies have used First-Person Shooter games and the first generation games such as Pac-Man and Tetris they have indicated that after 35 hours of playing the game showed faster response times, further to this early computer games did show improvements in cognition of older adults but the transfer of full cognitive tasks was not identified (Zelinski, Reyes, 2009, Basak, Boot, Voss *et al.,* 2008). The basis behind using these games in studies relating to cognition have been to assess response time, reaction to time tasks and working memory, (Goldstein *et al.,* 1999, Clark, Lanphear & Riddick, 1987). A study conducted by Basak, Boot, Voss *et al.,* (2008), investigated age-related declines as researchers suggest many tasks relating to executive control processes, for example, processing speed, working memory, reasoning and dual-task processing. The action game *Rise of Nations (RON) Gold Edition,* is a real-time strategy (RTS) game which enables players to combine both speed of gaming in real-time and the complex of turn-based strategy games (Basak, Boot, Voss *et al.,* 2008). Previous studies have used the first-person shooter (FPS) game; *Medal of Honour* which has shown several improvements in visual and attentional abilities with young participants. The researchers suggest it is possible using RON may improve the executive controls of switching between goals, maintaining a variety of items or variables within the strategy game may aid working memory. The investigation by Basak, Boot, Voss *et al.,* (2008), using RON studied performance improvement in "executive control tasks, such as task-switching, inhibition, working memory and short-term memory". Secondly using RON may not identify improvement in visuospatial attentional abilities like the previous studies using *Medal of Honour* where the researchers predicted a broad transfer of skills and cognitive processes experienced in the game for example; executive control and memory processes. In addition the transfer of effects of speeded visuoperceptual processes are lesser emphasized in RTS than in FPS games (Basak, Boot, Voss *et al.,* 2008).

The study was conducted over a 7-8 week period under laboratory conditions, including sessions for the cognitive battery and the training group. The cognitive battery which involved executive control (operation span, task switching, N-Back, Visual Short Term Memory (VSTM), Raven's Advanced Progressive Matrices, Stopping task) and visuospatial attentional tasks (Functional field of view, Attentional Blink, Enumeration, Mental Rotation), lasting between 8-30 minutes to complete, and were conducted three times throughout the study, (pre 1st week, during 4th week, when the study commenced and post, weeks 7/8th). The total number of training hours each participant had was 23.5

hours.

The results discussed by the researchers identified a beneficial effect of video game training, having the ability to switch between two tasks. The *Task switching* tested for accuracy and tasked participants to remember sequences of number, judging a series of numbers – high or low, odd or even. Numbers displayed in front of a blue screen, participants answered high or low (X or Z key) with one hand and on a pink screen odd or even (N or M key) with the other hand, as quickly as possible. In addition to this task, Basak, Boot, Voss *et al.,* (2008) required participants to carry out a "dual-task block in which they switched from one task to the other every five trials over thirty". The objective been to identify switching between blocks; "the difference in performance for trails when the preceding trial involved the same task (non-switch trial) and those when the preceding trial was on the other task (switch trial)" (Basak, Boot, Voss *et al.,* 2008), this was calculated (subtracting) the response time between the non-switch/switch trials. In addition the test for accuracy did increase through repetition, displaying significant effect. Results for the *VSTM* test displayed improvement of performance over time, in particular focusing upon attention. The tests involved participants viewing a series of coloured lines (red, green, blue, pink and black) at different orientations (vertical, horizontal). Viewing of the lines consisted of either 2 or 4 for several seconds, followed by a blank screen and then a test display. In the test displays one item had changed colour or orientation, in comparison to the initial display; participants were required to indicate what had changed on the test display. Sixteen trials were undertaken and primarily measured "accuracy of change detection" over speed. Researchers stated based upon the work of Cowan (1995) capacity of limit on working memory was limited to four items, there for the data set of four was used due to the capacity being limited and most sensitive on training effects, where as two items displayed a high accuracy in change detection.

Raven's Advanced Progressive Matrices was used to identify reasoning ability, and the results identify strategy video gaming significantly improved reasoning ability over time. The test involved participants identifying a missing piece of a complex visual pattern, participants were given a practice and allowed 5 minutes to complete the task. The actual test allowed 20 minutes to complete each 12 item test, the measurement of this study was the proportion of correct items completed in comparison to attempted items.

The researchers concluded from the study, using an RTS game such as RON does influence executive control processes in particular task switching, focus-switching within the N-Back task and VSTM and the results reported from the investigation do support the hypothesis that RTS "based video game may engender transfer to executive control task for older adults" (Basak, Boot, Voss *et al.,* 2008a).

The previous discussions relating to Nintendo *Brain Training* and *Big Brain Academy* software for the DS and Wii, coupled with the work conducted by Basak, Boot, Voss *et al.,* (2008a) implies this type of software may be of beneficial use predominately for short-term memory but not long-term in particular the condition of dementia. Boot, Kramer, Simons, *et al.,* (2008b) discuss the marketing aspects of Nintendo, in particular the *Brain Training* software, which in addition can offer engaging and entertaining training. The authors state clearly and it is re-iterated by Marston who suggests through the previous discussion of recent studies conducted in this investigation that further research is needed "before researchers might recommend a certain game to an individual to improve performance on a task of interest" (Boot, Kramer, Simons *et al.,* 2008b). The Nintendo advertisements, although do not directly state, playing software such as *Brain Training* aides cognitive impairment, they do imply aiding brain stimulation on a short-term basis, Boot, Kramer, Simons *et al.,* (2008b), state *"buying one of these games for the purpose of improving ones cognitive abilities may be premature".*

Figure 4.5.13 displays a group of friends playing the *Wii Sports Tennis* game, there are two players in the image, illustrating players and spectators are able to view the game on one screen, showing both gamers' positions on court. The main player in the image seems to be in mid-flow of hitting the ball, which would then come back to the opponent.

Figure 4.5.14 – Players playing the tennis game with the Wii

With a wide variety of demographic groups, such as second/third-age adults and younger generations conversing about the game, gamers are talking to friends and family about their enjoyment of the Wii, being encouraged and bringing a new form of technology and entertainment to what is called the Baby Boomer era, people who have expendable income and leisure time and are said to be by an American newspaper columnist "the greediest generation"[48] (Diuguid, Lewis, 2006).

4.6 – Conclusions

The consistent data, sourced from 2004 to present as published by the ESA, show there has been a steady increase of older game players and genres across both computer and video game markets in the USA. It is unfortunate that the data obtained outlining the UK statistics, is not as consistent or thorough in comparison, which has proved difficult to form a positive comparison of both countries. There has been a variety of genres on both markets of gaming in the USA which have increased and decreased; this could be due to

[48] http://news.bbc.co.uk/1/hi/magazine/4798825.stm

the nature of content and technology on the market which may have affected the nature of gaming playing habits causing an increase of genres.

At the start of this investigation in 2005, there was very little relevant research, except the study by Copier and CODEMASTERS. To date there is still very little research, although due to the Wii, distributed onto the market, universities and institutes, nationally and internationally have started to explore this area. It is important to clarify that the statistics from the industry have not pre-empted studies into gaming and older adults and in particular this exploration. I believe that this study actually lends itself to both the gaming industry and the field of gerontology, bringing two very different areas together benefiting both the current ageing demographic groups, but also to learn from what has already being sourced to aid the future of ageing groups.

As highlighted in this chapter, the reason why gaming, for many has become important and has brought many incentives, due to the opportunity of experiencing fun and pleasure derived from the content and accessibility of the technology, such as the Wii, easier to interact with peers and family relatives. Different game genres on the market have made this form of entertainment more fun for playing, and have given older players the access to experience a number of genres. The wide variety of game genres available on the market, such as serious, strategy and platform, can enable gamers to interact and play a variety of styles bringing enjoyment and fun.

Chapter Five will discuss, in detail, the CODEWORKS project which was the preliminary study for this investigation.

CHAPTER 5

WORKSHOPS

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5.0 – Overview

This chapter discusses the workshops conducted in Phase One of this investigation, outlining and describing the method, procedure, equipment and qualitative and quantitative results.

5.1 – Introduction

This chapter discusses the workshops that form the basis of this PhD investigation.

The workshops conducted were designed to establish what types of hobby, dream and interest second/third-age adults may have, and to investigate if there are positive results between the collection of computer game ideas and second/third-age adults.

When designing the workshop and commencing this research investigation, it was a thought that one of the concerns as to why second/third-age adults have not taken up computer gaming, was due to the content of computer games. To gain further insight into this, the decision was taken to design a workshop which allowed adults to design their own game idea, relating to a hobby, interest or dream that they may have. It was thought that collecting a variety of ideas, created by this specific demographic group, would give further data as to how to interact and enhance interests into gaming.

5.2 – Outline of Workshop One

5.2.1 – Research Method

The workshop(s) were conducted over several months in 2005, the number of participants who took part in the workshops varied in number, ranging from one to seven. Some participants wished to take part but were unable to attend the full workshop session due to work, study and other commitments. On these occasions, it was decided that participants who were unable to attend a workshop, but were interested in taking part, could still complete the survey. Those who attended a workshop were also asked to complete the survey.

5.2.2 – Survey Design

The survey was administered by Hannah R Marston, who at the time, was employed as a research assistant at the School of Computing, Teesside University. The survey was to be completed by the respondents themselves. There were a number of topics in the survey; these included: computer use and ownership, computer game play, ownership of computer, game equipment and related issues and demographic information. Confidence has been found to be a pivotal factor in computer use in older adults (Barbeite & Weiss, 2004). A recently developed instrument, the (new) Computer Self-Efficacy scale (CSE) (Barbeite & Weiss, 2004), was included in the survey to measure computer confidence (Appendix III). Based on the CSE scale, the Computer Game Confidence scale was developed. Each item used a 7-point response format ranging from, strongly disagree (1), to strongly agree (7). Two versions of each scale were included in the questionnaire: the CSE for computer users and non-users, and the Computer Game Confidence scale for computer game players and non-players. (Appendix III)

5.2.3 – Procedure

E-mail was an effective method of distributing the questionnaire, as these allowed respondents who had seen the advertisement(s) (Appendix IV) and were interested in taking part in the workshop, but unable to attend, to contribute their knowledge to the project.

Some of the questionnaires were distributed to members of staff within the School of Computing by hand from the research assistant. University Certificate Postgraduate Diploma (UCPD) Students, who attend university one a day a week, were also asked to fill in the questionnaire; the age range of this particular group varied; (N=24) mean = 64 years and SD = 6.21. Advertisements about the research project were placed on web sites, such as *50connect.co.uk* and web forums such as *seniornet.com* and *myprime.co.uk*.

Placing advertisements of the workshops on specific age-related web sites, in theory, allowed for a greater scope within the project, allowing for further workshops and surveys to be carried out. This method of recruitment via age-websites was not effective. Within minutes after the advertisement had been placed on a website, members of the forum were making comments on the discussion forum and in general “flaming” the research assistant. It became clear that this method of recruitment was not working.

Teesside University has an intranet site which enables all the schools in the university to upload information regarding their own school and courses. This deemed more feasible for recruitment and advertisements were placed on all the intranet sites.

Using this method of recruitment added further scope for recruitment of participants. Word of mouth was also as a method of recruiting participants, as well as contacting the local Age Concern Branch in Middlesbrough. A presentation to the members of the local branch was carried out to explain the aim and objectives of the research, which allowed the members to choose whether they wanted to take part.

The most effective method of recruitment for the workshops came from the Psychological Aspects of Communication Technologies (PACT) Lab at Northumbria University (Appendix V). The PACT Lab is associated with The School of Psychology and Sports Science; the department has a database of over 200 people over fifty. After contacting the school, via the Dean, the research assistant was able to send the relevant information to the department, who in turn would send out a call for people over fifty. This method proved most fruitful and over a two-day period three workshops were held.

When designing the advertisement (Appendix IV), it was important to present the right information to prospective participants, which involved supplying specific information about the workshop and questionnaire on the poster. It was specified that participants could do either the survey, or the workshop, or both. Contact details of the research assistant were included.

The total number of participants aged fifty or over, who had supplied data either through a workshop or survey, was twenty-eight; four participants had specified information through a survey, due to the fact that they had been unable to attend a workshop for one reason or another.

5.2.4 – Workshop Design

The aim of the workshop was to collect data related to the following issues:

- What participants enjoy doing in their spare time;
- Whether participants play computer games;
- Why participants might want to play computer games;
- What type of computer games participants might like to play;
- What type of computer games participants might enjoy playing; and
- A computer game design idea related to their hobby, interest or dream.

Structure of workshop

It was decided that the workshop should be split into sections so as to not overload the participants with information; a corresponding worksheet was handed out to the participants at the end of each presentation. Jargon was avoided in the presentations as this could cause confusion.

The workshop was split into four sections. Each section involved a presentation given by the workshop leader (Hannah Marston), followed by the participants filling in worksheets corresponding with the presentation. On the worksheets themselves, copies of the presentation slides were also incorporated to assist participants in completing that section (Appendix VI).

Section 1 – Introduction

In this presentation, the participants were told what the research was about, the purpose of the workshop and how the workshop was structured. The first worksheet outlined the type of hobby, interest and dream the participant may/may not have.

Each worksheet was aimed to support participants, building their game idea step-by-step, including ideas of games, imbalances, context, pleasure, rewards, and communication, and finally presenting the game idea in Worksheet 4, collating the information from previous worksheets.

Section 2 – Getting started

The second presentation involved four parts of the game design. Participants had to first create the game ideas, imbalances, verbs and pleasure. Each part was discussed in further detail, explaining what was required to be filled in on the worksheets.

Section 3 – How to play

The third presentation concentrated on what a player of the game was going to see and hear. This included sounds, the look and feel of the game as seen by a player (e.g. in a realistic or cartoon manner), and whether the game was to use, for example, a first-person or third-person view. Participants were also asked to consider how players would communicate with the game. This communication could be carried out with hand gestures or pressing of buttons. Finally, the rewards of the game were included. For example, if the player was to win/lose, would they want gratification or excitement from the game? In this section, participants had to fill in a worksheet. The third worksheet consisted of several sections; including the look and feel of the game, communication (how the player would communicate with the game), the purpose of the game (would the player be able to win or lose, pass their time or achieve a goal at the end).

Section 4 – The finale

The final presentation consisted of a number of questions for participants to answer. The questions were posed to find out where this target audience would want computer games to be advertised, and to identify any other audiences that may want to use/play the computer game, and what cost their computer game should be. It was hoped that posing the following questions would help to determine where an older adult would prefer to buy computer games, and how they should be marketed to reach this target audience.

- Who is the computer game for?
- Why would they want to play it?
- What would they need to play it on?
- Where could they go and buy it?
- How should it be advertised?
- How much should it cost?

The plenary session allowed the participants to discuss each presentation and to give feedback on the workshop, allowing for adjustments to be made either to the workshop, game design, or to add further information to enhance their game idea. The second questionnaire was given out, which gauged whether the participants' views of video games had changed in anyway, as a result of attending the workshop.

5.2.5 – Materials for Workshop

A laptop computer and projector were used to display the presentations. A consent form (Appendix VII), was designed stating participants' rights while taking part in the workshop (for example, they were free to leave at anytime). It was their own decision to take part in the workshop, and participants understood that data collected may be used in research publications, although their personal information would not be revealed.

Worksheets (Appendix VI), used throughout the workshop, were devised to construct a game idea using a step-by-step method. Two questionnaires were designed for the workshop. The first, to gauge participants' usage of computers and computer games and personal details, and the same questionnaire was used in the survey for those who were unable to attend a workshop (Appendix III). The second questionnaire was used to discover what aspects of the workshop participants liked/disliked, to find out whether they enjoyed designing a game related to a hobby/interest, and to identify their views about computer games since taking part in the workshop.

Ethical approval had to be obtained before data collection (Appendix VIII). The ethics committee of the School of Social Sciences and Law at the University of Teesside approved the application.

5.2.6 – Data Analysis

Data from the first questionnaire was analysed using descriptive and inferential statistics. Answers were then coded and entered into SPSS (Statistical Package for the Social Sciences) and descriptive statistics were produced.

Worksheets were used throughout the four sections of the workshop, allowing participants to outline their game design step-by-step. Content analysis was conducted on the game designs produced by workshop participants.

5.3 – Survey Results

The full sample of participants, overall age of fifty and over, was twenty-four (N=24) mean = 64 years and SD = 6.21. The level of education varied amongst participants. Whilst 10 participants had a degree or higher degree, 10 also had 'O' Levels only, or no formal qualifications.

Table 5.3.11a – Education level of workshop sample

	Qualification						
Age	**Higher Degree**	**Percent**	**Degree**	**Percent**	**A Level or Equivalent**	**Percent**	**Total**
50-54 Years	0	0.00	1	14.3	0	0.00	1
55-59 Years	1	33.3	1	14.3	1	50.0	3
60-64 Years	2	66.7	2	28.6	1	50.0	5
65-69 Years	0	0.00	1	14.3	0	0.00	1
70 and Over	0	0.00	2	28.6	0	0.00	2
Total	**3**	**100.0**	**7**	**100.0**	**2**	**100.0**	**12**

	Qualification						
Age	**NVQ or Equivalent**	**Percent**	**GCSE/ O Level or Equivalent**	**Percent**	**No Qualifications**	**Percent**	**Total**
50-54 Years	0	0.00	1	20.0	0	0.00	1
55-59 Years	0	0.00	0	0.00	1	20.0	1
60-64 Years	1	50.0	0	0.00	1	20.0	2
65-69 Years	1	50.0	3	60.0	2	40.0	6
70 and Over	0	0.00	1	20.0	1	20.0	2
Total	**2**	**100.0**	**5**	**100.0**	**5**	**100.0**	**12**

Overall, the education level of workshop participants appears to be higher than that for the North East although it still has to be born in mind the sample of participants was small.

Table 5.3.11b – Education level for the North East of England

	Qualifications - Sex – Male					
Age	**Higher Qualifications**	**Percent**	**Lower Level Qualification**	**Percent**	**No Qualifications**	**Percent**
50-54 Years	14,536	17.0	22,724	19	51,462	11
55-59 Years	9,647	11.0	13,650	11	46,750	10
60-64 Years	7,648	9.0	9,582	8	46,532	10
65-74 Years	10,903	13.0	11,865	10	83,488	18
Total	**42,734**	**100.0**	**57,821**	**100.0**	**228,232**	**100.0**
	Qualification – Sex – Female					
Age	**Higher Qualifications**	**Percent**	**Lower Level Qualification**	**Percent**	**No Qualifications**	**Percent**
50-54 Years	13,612	16	24,822	21	50,626	11
55-59 Years	9,061	11	14,919	12	46,921	10
60-64 Years	7,509	9	10,002	8	50,059	11
65-74 Years	12,042	14	13,004	11	98,243	21
Total	**42,224**	**100.0**	**62,747**	**100.0**	**245,849**	**100.0**

Half of the participants who took part in the workshop were married (see Table 5.3.11c).

Table 5.3.11c – Marital status of workshop sample

Age	Married	Living with 1 or more people	Alone	Other	Total
50-54 Years	2	0	0	0	2
55-59 Years	2	1	1	0	4
60-64 Years	5	0	2	0	7
65-69 Years	2	1	4	0	7
70 and Over	1	0	2	1	4
Total	**12**	**2**	**9**	**1**	**24**

Computer use

Table 5.3.12 presents various characteristics of workshop participants related to computer usage. A majority of respondents had access to a computer, and had used a computer for more than a year and owned a computer, mostly a PC. More than half of respondents were frequent users, using a computer about once a day or more. Time spent using a computer varied widely, but on average amounted to more than 20 hours a week. The most popular types of computer applications used were word processing, e-mail and Internet, followed by spreadsheets and then playing computer games.

Table 5.3.12a – Computer use by workshop participants aged 50 and over

	Do you have access to a computer?			Total
Age	**Yes**	**No**	**No response**	
50-54 Years	2	0	0	2
55-59 Years	4	0	0	4
60-64 Years	7	0	0	7
65-69 Years	3	3	1	7
70 and Over	2	2	0	4
Total	**18**	**5**	**1**	**24**

	Have you used a computer before?			Total
Age	**Yes**	**No**	**No response**	
50-54 Years	2	0	0	2
55-59 Years	4	0	0	4
60-64 Years	7	0	0	7
65-69 Years	3	3	1	7
70 and Over	3	2	0	4
Total	**19**	**5**	**1**	**24**

	Do you own a computer?			Total
Age	**Yes**	**No**	**No response**	
50-54 Years	2	0	0	2
55-59 Years	4	0	0	4
60-64 Years	7	0	0	7
65-69 Years	2	4	1	7
70 and Over	2	2	0	4
Total	**17**	**6**	**1**	**24**

	What type of computer do you own?					Total
Age	**PC**	**MAC**	**Other**	**Not applicable**	**No response**	
50-54 Years	1	0	1	0	0	2
55-59 Years	3	1	0	0	0	4
60-64 Years	4	0	3	0	0	7
65-69 Years	1	0	1	4	1	7
70 and Over	1	0	1	2	0	4
Total	**10**	**1**	**6**	**6**	**1**	**24**

Table 5.3.12b. (continued)

How long have you used a computer for?		
Time of usage	**Frequency**	**Percentage**
More than 1 year	18	75.0
More than 1 month	1	4.2
Month or less	1	4.2
Not applicable	3	12.5
No response	1	4.2
Total	**24**	**100.0**

How frequently do you use a computer?		
Time of usage	**Frequency**	**Percentage**

More than once a day	9	37.5
About once a day	5	20.8
More than once a week	2	8.3
Less than once a month	1	4.2
More than once a month	1	4.2
I normally do not use a computer	2	8.3
Not applicable	3	12.5
No response	1	4.2
Total	24	100.0

What do you use a computer for?

Type of usage	**Frequency**	**Percent**
Word processing	18	75.0
Emails	16	66.7
Internet	15	62.5
Spreadsheets	9	37.5
Playing games	8	33.3
Database	6	25.0
Digital photography	3	12.5
Playing music	2	8.3
Garden design	1	4.2
Programming	1	4.2

Time spent per week using a computer (hours)

Mean		20.12
SD		23.67
95% confidence interval	Lower bound	7.95
	Upper bound	32.29

[a] Responses included of those who reported > 0 hours / week.

A report conducted by CODEWORKS ATL “The Ageing World – Issues for Older People” in association with Age Concern Research Services, reported older adults aged between 50-65 years old, to be “technology-able” due to experience and application in work and wanting to keep in touch with children and grandchildren. The majority of participants in the project had access, used and owned a computer. Although this was a small sample of respondents, it indicates that the results shown in the report conducted by CODEWORKS concludes older adults are able to use technology (CODEWORKS ATL &ACRS, 2006).

5.4 – Computer Game Play

Table 5.4.13 presents various characteristics of workshop participants related to computer game playing. A majority of workshop participants had access to a computer that could be used to play computer games, but a minority had access to a computer game console. Slightly more than half played computer games, but only a very small minority had played computer games on the Internet.

Table 5.4.13a – Computer game playing by workshop participants aged 50 and over

a. Access and play

	Do you have access to a computer that can be used to play computer games?			Total
Age	**Yes**	**No**	**Don't Know**	
50-54 Years	2	0	0	2
55-59 Years	3	0	1	4
60-64 Years	7	0	0	7
65-69 Years	4	3	0	7
70 and Over	1	3	0	4
Total	**17**	**6**	**1**	**24**

	Do you have access to a computer game console?			Total
Age	**Yes**	**No**	**Don't Know**	
50-54 Years	0	2	0	2
55-59 Years	3	1	0	4
60-64 Years	2	5	0	7
65-69 Years	1	6	0	7
70 and Over	0	3	1	4
Total	**6**	**17**	**1**	**24**

Have you played computer games?

	Frequency	Percent
Yes	14	58.3
No	10	41.7
Total	**24**	**100.0**

Have you played computer games on the Internet?

	Frequency	Percent
Yes	3	12.5
No	20	83.3
Not applicable	1	4.2
Total	**24**	**100.0**

Table 5.4.13b – Ownership and purchase

Do you own a game console?

	Frequency	Percent
Yes	11	16.7
No	20	83.3

Total	**31**	**100.0**

What type of game console do you own?

Console	Frequency	Percent
Play station 1	3	12.5
Play station 2	2	8.3
Nintendo game cube	2	8.3
X-box	1	4.2
Dreamcast	1	4.2
Sega master system	1	4.2
Nintendo game boy	1	4.2
No answer/not applicable	13	54.1
Total	**24**	**100.0**

Do you own any of the following?

Technology	Frequency	Percent
Mobile phone	18	75.0
PDA	5	20.8
Other	1	4.2
Total	**24**	**100.0**

Participants owning multiple devices

	Frequency	Percent
Yes	4	16.7
No	20	83.3
Total	**24**	**100.0**

Which devices have you played games on?

Technology	Frequency	Percent
Mobile phone	2	8.3
PDA	2	8.3
No answer/not applicable	20	83.4
Total	**24**	**100.0**

Where did you buy the computer games?

Retail outfit	Frequency	Percent
Supermarket	2	8.3
Computer shop	2	8.3
Not applicable	20	83.4
Total	**24**	**100.0**

A small minority of the participants owned a games console. Although the frequency for type of console is higher, this is probably due to participants owning multiple device consoles. The majority of console owners owned a *Playstation 1*, shortly followed by a *Playstation 2* and a *Nintendo Game Cube*. A majority of participants owned a mobile phone; however, only four participants owned multiple devices, such as mobile phones and PDAs. The number of devices participants had played games on was small, with the majority (20) answering, not applicable or giving no answer. Participants (4) preferred either supermarkets or computer shops to buy computer games.

Table 5.4.14 displays data of participants who have children and/or grand-children. Twenty-one participants reported having children, and eleven reported having grand-children.

Table 5.4.14 – Participants who have children and grand-children

Do you have children?			
Age	**Yes**	**No**	**Total**
50-54	2	0	2
55-59	3	1	4
60-64	5	2	7
65-69	7	0	7
70 and over	4	0	4
Total	**21**	**3**	**24**
Do you have grand-children?			
Age	**Yes**	**No**	**Total**
50-54	0	2	2
55-59	1	3	4
60-64	1	6	7
65-69	6	1	7
70 and over	3	1	4
Total	**11**	**13**	**24**

Table 5.4.15 display the numbers of children and grand-children that participants had.

Table 5.4.15 – Number of children

Number of children participants have							
Age	**0**	**1**	**2**	**3**	**4**	**6**	**Total**
50-54	0	2	2	2	0	0	6
55-59	1	0	2	0	1	1	5
60-64	2	1	2	2	0	0	7
65-69	1	3	1	1	0	0	6
70 and over	0	1	1	0	2	0	4
Total	**4**	**7**	**8**	**5**	**3**	**1**	**20**
Number of grand-children participants have							
Age	**0**	**1**	**2**	**3**	**4**	**6**	**Total**
50-54	6	0	0	0	0	0	6
55-59	4	0	0	0	0	1	5
60-64	6	0	0	1	0	0	7
65-69	2	2	0	1	0	1	6
70 and over	2	0	0	0	2	0	4
Total	**20**	**2**	**0**	**2**	**2**	**2**	**28**

A majority of respondents in Table 5.4.16 reported their children did play computer games and most of those, with grandchildren, reported playing computer games. Participants were asked in the survey if they had children and/or grand-children. Recognising if Phase One participants had children and/or grand-children was to ascertain potential intergenerational relationships between the different generations. Enabling both younger and older generations to learn and play computer games together, as a means of social interaction, this data is illustrated in Table 5.4.16.

Table 5.4.16 – Computer-games played by children and grand-children

Do your children play computer games?				
Age	**Yes**	**No**	**N/A**	**Total**
50-54	2	0	0	2
55-59	2	1	1	4
60-64	5	0	2	7
65-69	4	3	0	7
70 and over	2	2	0	4
Total	**15**	**6**	**3**	**24**
Do your grand-children play computer games?				
Age	**Yes**	**No**	**N/A**	**Total**
50-54	0	0	2	2
55-59	1	0	3	4
60-64	1	0	6	7
65-69	5	1	1	7
70 and over	2	1	1	4
Total	**9**	**2**	**13**	**24**

As already stated, computer gaming has been a form of modern entertainment since the 1960s. With new technologies, such as IPOD, DVD Player, Nintendo Wii or any other game console, individuals may have to read instructions to understand what to do and when. Learning to play computer games is not different. It seems young children are able to understand and pick up more easily what the object and aim of the game(s) is, and what the player is supposed to be doing. For an older adult who has never played, this idea could be quite daunting, especially if they have to press more than one button at a time to do a specific move. Table 5.4.17 illustrates older adults' preferred method or only method of learning how to play games.

Table 5.4.17 shows a majority of those who played games, claimed to have taught themselves to play, rather than through (grand) children or other family members. A majority had played computer games for more than one year. There were more respondents claiming experience in playing computer games than those who considered themselves to be computer game players. This apparent contradiction may have arisen because some who had experience normally, did not play at all, or very little, and therefore may have considered themselves not to be computer-game players. Support for this conjecture came from the findings that in terms of frequency of playing, nine respondents answered no, or were not applicable for playing computer games and a further seven played less than once a month. Less than half played computer games at least several times a week and more.

Table 5.4.17 – How participants learned to play computer games

	How did you learn to play computer games?						
Age	**From grand-child**	**From child**	**Taught in class**	**From family member**	**From a friend**	**Taught myself**	**Total**
50-54	0	0	0	0	0	1	1
55.59	0	1	0	0	0	2	3
60-64	0	0	1	1	1	3	3
65-69	3	0	0	0	0	1	3
70 and over	1	0	0	0	0	1	1
Total	**4**	**1**	**1**	**1**	**1**	**8**	**11**

Table 5.4.18 displays how frequently participants play computer games. Three participants between the age of fifty and fifty-four played once a week, three adults,

two of which are in the fifty-five to fifty-nine years category and sixty-five to sixty-nine year's category, played games either once a day or more than once a day. Three participants between the age of fifty and fifty-four played once a week, three adults, two of which are in the fifty-five to fifty-nine years category and sixty-five to sixty-nine year's category, played games either once a day or more than once a day.

Table 5.4.18 also displays the length of time participants had been playing computer games. Fourteen participants had been playing games for over one year, five of which were between 60 and 64 years of age. Several reasons for this are retirement, money and having knowledge of how to play games.

Five participants from the 65-69 years of age category, and the seventy years and over category, apart from one participant, had being playing games for less than three months, or had never played. Again, there could be a number of reasons why, either they do not have access to a PC or console, or have other interests/ activities in their lives. These reasons, for instance, are ill health, failing eyesight or arthritis, or technology has not been an interest to them.

Table 5.4.18 – Shows length of time participants have been playing computer games

	How frequently do you play computer games?						
Age	**<1day**	**Once a day**	**<1 per week**	**>1 once a month**	**I normally do not play**	**Not applicable/ no response**	**Total**
50-54	0	0	1	0	0	1	2
55-59	1	0	2	0	1	0	4
60-64	0	2	1	2	2	0	7
65-69	1	2	1	1	1	1	7
70 and over	0	2	0	0	2	0	4
Total	**2**	**6**	**5**	**3**	**6**	**2**	**24**

How long have you played computer games?							
Age	**< 1 year**	**< 6 months**	**<3 months**	**< 2 months**	**1 month or less**	**Not applicable/ no response**	**Total**
50-54	1	0	0	0	0	1	2
55-59	3	0	0	0	1	0	4
60-64	5	2	0	0	0	0	7
65-69	1	2	1	1	1	1	7
70 and over	0	2	0	0	2	0	4
Total	**10**	**6**	**1**	**1**	**4**	**2**	**24**

It is understood that younger generations of gamers (predominately males) play games for a vast amount of time, and in some cases do not go to sleep or skip meals to continue playing with their friends or strangers online. Time spent playing computer games varies, as participants in Table 5.4.19. In the sixty to sixty-four age group and sixty-five to sixty-nine age group, seven participants spent time playing in both groups participants recorded playing games between one and two hours. Only one person reported playing games for thirteen hours. This could indicate that they had been a gamer for many years, (this particular participant was in the fifty-five to fifty-nine age group). One reason for spending so much time playing may be, having a considerable amount of time spare.

Table 5.4.19 – Time spent playing games

Time spent playing computer games			
Age	**Mean**	**Frequency**	**Std. Deviation**
50-54	1.00	2	1.414
55.59	4.75	4	5.737
60-64	1.14	7	.900
65-69	1.29	7	2.628
70 and over	.00	4	.000
Total	**1.58**	**24**	**2.948**

[a] Responses included from those who reported > 0 hours / week

Understanding the types of game genre played by participants is important to this investigation. As the main focal point of the study is to understand what type of content second/third-age adults want in computer games. Some may prefer (for one reason or another) to have a simple puzzle game which is easy to pick up and put down. Others may prefer a genre that has more of a story and takes longer to complete and play. This could be an adventure or strategy game.

Table 5.4.20 displays the game genres played by participants. Five participants between the ages of fifty and fifty-four reported playing puzzles, this age group also reported a frequency of three playing strategy games.

Table 5.4.20 – Type of genre participants played

	Types of computer games do you play?					
Age	**Adventure**	**Puzzle**	**Sports**	**Platform**	**Shooter**	**Total**
50-54	0	1	0	0	0	1
55-59	3	3	0	2	2	10
60-64	0	1	0	1	0	2
65-69	0	2	1	0	1	4
70 and over	0	0	1	0	0	1
Total	**3**	**7**	**2**	**3**	**3**	**18**

Hobbies and interests are an important aspect of the workshop and survey for the study of older adults and computer games. Stating the types of hobbies and interests they enjoy doing could form part of their computer game idea.

Table 5.4.21 illustrates the types of hobby participants enjoyed doing in their spare time. Overall, 26 hobbies were reported but were grouped together in 7 ages to make it easier to read and understand. Fourteen participants, of various ages, reported enjoying arts and crafts, 16 respondents ticked walking or reported outdoor activities and nine respondents reported other hobbies. A positive high number such as this indicates there could be an opportunity for modern forms of entertainment, like gaming, to become part of the lives of people over fifty. When interpreting the results from Table 5.4.21, it is important to remember that participants may have ticked more than one box regarding the type of hobby they enjoy doing.

Table 5.4.21 – Hobbies enjoyed by participants

How frequently do you play computer games?								
Age	**Arts & Craft**	**Card Games**	**Dancing**	**Gambling**	**Sport**	**Walking**	**Other**	**Total**
50-54	1	1	0	0	0	1	1	4
55-59	2	0	1	0	2	4	1	10
60-64	6	2	2	0	1	5	2	18
65-69	3	1	3	0	0	4	3	14
70 and over	2	0	1	0	0	2	2	7
Total	**14**	**4**	**7**	**0**	**3**	**16**	**9**	**53**

Table 5.4.22 presents two questions asked on the survey: "Would you consider playing a computer game?" and "Would you consider playing a computer game related to a hobby?" Table 5.4.22 shows that 14 respondents considered playing a computer game and 12 would consider playing a computer game related to a hobby.

Table 5.4.22 – Computer game playing considered by participants

Would you consider playing a computer game					
Age	**Yes**	**No**	**Don't know**	**Not Applicable**	**Total**
50-54	1	0	0	1	2
55-59	4	0	0	0	4
60-64	2	4	1	0	7
65-69	4	1	1	1	7
70 and over	3	1	0	0	4
Total	**14**	**6**	**2**	**22**	**24**
Would you consider playing a computer game related to your hobby					
Age	**Yes**	**No**	**Don't know**	**Not Applicable**	**Total**
50-54	0	0	1	1	2
55-59	2	1	1	0	4
60-64	2	1	4	0	7

65-69	3	2	1	1	7
70 and over	1	2	1	0	4
Total	**8**	**6**	**8**	**2**	**24**

Participants were asked what type of game genre(s) they would consider playing. Table 5.4.23 shows the most popular genres. The genres which were most popular with participants were puzzle, 5 adults between the age of fifty and fifty-four, this age group also ranked strategy (4) as a genre they would consider playing. Four adults aged between sixty-five and sixty-nine also stipulated sport as a genre they would consider playing. These results suggest participants would want something quick and easy to play (puzzle) playing the sport genre, playing football, tennis, or golf. It is easy to understand how these games play and the concept is very straightforward.

Table 5.4.23 – Game genres considered playing

	Game genres considered playing?						
Age	**Adventure**	**Puzzle**	**Sports**	**Platform**	**Strategy**	**Shooter**	**Total**
50-54	0	1	0	0	0	0	1
55-59	3	4	2	1	3	1	14
60-64	0	1	0	0	2	0	3
65-69	0	1	4	0	1	1	7
70 and over	1	3	0	0	1	0	5
Total	**4**	**10**	**6**	**1**	**7**	**2**	**30**

Computer and computer game confidence

Correlations between age, game playing and confidence were calculated for the workshop sub-sample (see Table 5.4.24). There was a statistically significant negative correlation of age with playing computer games; the older respondents were the less likely to play computer games. Sizeable negative correlations (> -0.3) of age with basic and advanced computer confidence in computer users, and basic game confidence in non-computer game players were also found, but these were not statistically significant and suffered from low statistical power because of the small sample size.

The correlation of game playing with confidence measures was not significant. The positive correlation of basic computer confidence, with advanced computer confidence and basic computer game confidence in gamers was significant; the more confident computer users were about basic computer use, the more they were confident about advanced computer use and basic features of computer games. Advanced computer confidence had a significant positive correlation with both basic and advanced computer game confidence in gamers. The positive correlation between the latter two was also significant.

Table 5.4.24 – Correlation of age, computer game playing and confidence measures

(workshop participants aged 50 or over, N = 24)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 Age	**1.00**	*-0.41	-0.37	-0.36	-0.30	-0.07	-0.36	0.10
2 computer game player		**1.00**	-0.12	0.10	a	a	a	a
3basic computer confidence (users)			**1.00**	**0.69	**0.74	0.49	-0.05	0.31
4 Advanced computer confidence (users)				**1.00**	**0.83	**0.63	0.57	0.52
5 Basic computer game confidence (gamers)					**1.00**	**0.89	a	a
6 Advanced computer game confidence (users)						**1.00**	a	a
7 Basic game confidence (non-gamers)							**1.00**	**0.067
8 Advanced game confidence (non-gamers)								**1.00**

Correlation is significant at the 0.05 level (two-tailed)

** Correlation is significant at the 0.01 level (two-tailed).

[a] Correlation cannot be calculated.

5.5 – Conclusions (Survey)

Just over half of workshop participants played computer games, but fewer played computer games than used computers. They were more likely to play games on a PC than on a game console or other devices. Few bought games for their own use. Workshop participants had mostly taught themselves to play games rather than learning from family members. This result differs from those obtained by Copier (2002), who found that older adults learned from family members. Almost half had played computer games for more than one year. They spent on average more than six times less time playing computer games than using computers. Given these findings and the fact that computer games were the fifth most popular type of computer use, there may be scope for changing the balance of computer use in favour of computer games.

Puzzle and strategy were the most popular genre of games played. Although workshop participants engaged in a wide variety of hobbies, only a quarter considered playing a computer game related to their hobby. The reason may be that these results are based on data collected before respondents took part in the workshop and, consequently, at the time of responding it may have been difficult for them to imagine how their hobbies, interest and dreams could be 'translated into' a computer game. However, the results from the workshop demonstrate that hobbies, interest and dreams are a promising vehicle for designing computer games and the wide range of hobbies reported by workshop participants over 50, forms a useful starting point for the design of potential new computer games. Just over half of non-players would consider playing and were willing to learn how to play computer games. Again, puzzles were a popular type of game, and strategy and sports were also reported by several respondents. Lack of time was reported as a reason for not considering playing computer games, rather than negative perceptions of games. This finding indicates that, with the right games and marketing, there may be scope for an increased market for computer games for older adults.

Age was negatively correlated with computer game play and although not significant, age was also negative correlated with various measures of computer and computer game confidence. Several measures of confidence of computer use and computer game play were correlated. These findings make intuitive sense because computers and computer games are both interactive systems that share commonalities in the way users interact with them and skills required. However, without experimental control and relevant theory, these findings cannot be interpreted in terms of cause-effect relationship between computer game play and confidence in using computers and playing computer games.

Future research should investigate which factors influence older adults' confidence in playing or starting to play computer games, and more generally, which factors influence them to start and to continue playing games.

5.5.1 – Reflection

As previously stipulated, participants were required to complete a survey which included demographic questioning, computer usage, computer gaming habits, game genre preference and purchasing habits. In addition to these questions, participants were required to answer questions based on the CSE scale devised by Barbeite and Weiss (2004). By including the CSE scale this made the survey quite lengthy for participants to complete at the end of the workshops. Although the researcher did not experience direct complaints or negativity from the participants during the completion of the survey, the researcher, through observation of body language and hearing the aural sounds of huffing and sighing, did realise some participants found the completion of the survey to be long and arduous. The researcher made a note, stating for future surveys within this investigation to be kept to a minimum, but still be able to collect data necessary to provide and report significant results and findings.

Overall the method of data collection used in Phase One was positive, gathering a group of older adults together to design their game concept and then discuss enabling everyone to gain constructive feedback relating to their concept.

5.6 – Workshop Results

5.6.1 – Hobbies and Dreams

Results from the workshops demonstrated an interesting range of hobbies and dreams from the participants, analysed separately for gamers and non-gamers see (Appendix IX).

The most popular dream for gamers was to travel, and hobbies were walking (6) and cycling (4). When dreams and hobbies were combined, travel (2) and walking (6) were the most popular with gamers, with a frequency of eight.

The most reported dream by non-gamers was travelling by four participants, the two most popular hobbies reported by non-gamers were reading (8) and gardening (6).

The combination of dreams and hobbies reported by non-gamers (with a frequency of four were travel and reading (12), travel and gardening (10).

5.6.2 – Important Times

Participants were asked to write down which times were important to them. Gamers reported spending time with their husband or wife with a frequency of three, and two people reported weekends. Four non-gamers reported their most important time was spent with their grand-children and two participants reported weekend and family times.

Most of the non-gamer participants suggested that they were never bored and they preferred to spend their time with grand-children. Again, this could be another way to introduce computer games to this target audience, two different generations together, interacting with new technology.

5.6.3 – Imbalances and Game Themes

The term “imbalances” originates from the semiotic concept of binary opposition: good/bad, young/old, and order/chaos. Barthes (1984) used this as the underpinning context of narrative development. Imbalances are an implementation of “binary oppositions” and drive game play. Players try to progress in a game by winning points to maintain the imbalance of good against evil, order against chaos, winning against losing, life against death.

Imbalances occur in all types of games, be it sports, board games, or computer games. It is the division of skills, ability and the odds that all should be appropriately balanced that provides a challenge to the player. Participants were asked to write down a concept and the types of imbalances that could be implemented into their game idea.

Seven gamers suggested good/bad and four suggested male/female as an imbalance. Two gamers suggested travel, sport and transport. The results indicate that the majority of gamers would like to implement a number of concepts with the same imbalances. Suggesting some, if not all, of the concepts and imbalances could be implemented together into a game idea if development was considered. Gamers grouped imbalances and concepts equally, with each combination of imbalance and concept being suggested by a single participant, except for the combination of good/bad + travel, which was not selected by any of the participants.

Seven non-gamers reported good/bad imbalance, non-gamers also suggested as imbalances male/female and order/chaos both with frequencies of four. The concepts of travel and history both have a frequency of six. Combining imbalances and concept the results displayed non-gamers, seemingly were able to develop a longer list of both imbalances and concepts and to also develop combinations of the two. Possibly non-gamers are less constrained by game concepts and imbalances that already exist.

5.6.4 – Verbs and Imbalances

Throughout the workshop, participants were asked to write down as many verbs and imbalances as they could think of relating to their game idea. Participants were asked to write down verbs, describing their game or actions within the game, thus generating further ideas within the concept idea. The most popular verb suggested by gamers was walking with a frequency of six, shortly followed by talking with a frequency of four. Seven participants suggested the imbalance of good/bad followed by old/young with a frequency of four. Combining keywords from verbs and imbalances, it revealed walking and the male/female imbalance to be most popular with a frequency of three.

Walking was most popular with non-gamers with a frequency of ten, and six participants suggested good/bad as an imbalance. The combination of verbs and imbalances revealed walking and good/bad to be most popular with a frequency of seven. Again, non-gamers were able to develop more ideas for verbs and combinations of verbs and imbalances than gamers.

5.6.5 – Pleasure and "What is the point (aim)?"

Worksheet 3 asked participants to write down what type of pleasure players would experience from their game. This question was posed to participants to gain an insight into how gamers would experience the game designed by the participants in the workshops. Participants were also asked to write down what the aim of the game idea would be. Gamers reported a frequency of three for both satisfaction and fun when playing, four participants reported winning as the main aim of a game and there was no definitive result in combining both pleasure and aim. The responses suggest that gamers are used to games, resulting in a winner and that they should be fun to play.

Six participants (non-gamers) reported achievement as a pleasure of playing, closely followed was fun from five participants. Eleven participants stated winning as the aim of game playing, closely followed by achievement and losing both with a frequency of six. Learning and education also featured in this section with frequencies of three. There were several combinations of pleasure and aims reported by participants, five participants reported fun and winning and fun and losing. The positive results from non-gamers who suggested a wide range of ideas, indicates non-gamers did not have any preconceived ideas of games and were able to be more adventurous in their ideas.

5.6.6 – Game Space and Communication

Worksheet 3 asked the participants to describe their game idea, and how the game would look. This could include how the player would view the game and how the player could communicate with the game. Both gamers and non-gamers preferred a realistic appearance to a game, with a frequency of five and ten, also a significant proportion of non-gamers also preferred a first-person view with a frequency of seven. Four gamers would prefer to use a mouse as a method of communication and three participants reported speech and a realistic look as a combination of game space and communication method. The method of communication by non-gamers shows no overall result and five participants reported realistic and calm as a method of communicating and viewing games.

5.6.7 – Genres

Analysing the keywords by gamers and non-gamers from the worksheets (Appendix IX) comparisons were made with keywords used by a games industry classification.[63][64]

The results for this section are split into two sections, genre and combined game genre, which were uncovered by analysing keywords throughout the worksheets and linking the genres together. The most popular genre as suggested by gamers was *adventure*. There seemed to be only one combined game genre - '*sport, adventure, strategic*'. There were some game descriptions that did not seem to fit into any of the genres used by the games industry, which suggests that there is scope within the market to create new game genres.

The most popular genre identified from non-gamers was adventure with a frequency of six, suggesting that this would be the most popular genre amongst older adults. There seemed to be several combined game genres, with the most popular being '*adventure, education*' with a frequency of six.

The results from both gamers and non-gamers for this section indicate that the game ideas are broadly similar for gamers and non-gamers. Participants seemed to have combined some genres together. Non-gamers also developed game ideas in two genres, not covered by gamers - *real time strategy* (RTS) and *role playing game* (RPG). Suggesting non-gamers want to play a role within a game or be part of a

[63] http://en.wikipedia.org/wiki/Computer_and_video_game_genres
[64] http://www.ihobo.com/gaming/genres.shtml

community, unlike gamers who know what they prefer in a computer game and would rather stay within that genre through experience of game playing.

5.7 – Conclusions

This chapter reported and discussed the workshops which form Phase One of this investigation. There has been an extensive discussion and breakdown of findings from both, a qualitative and quantitative approach using SPSS, and collating keywords from worksheets completed by the participants from the workshops. This chapter has given the indication that both gamers and non-gamers are able to devise and design a number of game genres, from a variety of areas which form computer games, and having the prior knowledge of gaming does not necessarily aid when trying to design a game idea relating to a hobby, dream or interest.

The results of the workshops suggest non-gamers can be more creative when designing a game idea. The reason could be that they understand very little about gaming in general and therefore have no preconceptions of games and genres. Unlike gamers, who do know about computer games, and their thoughts and views as discussed in Chapter Three, relating to computer game theory.

The work conducted in the design workshops was the basis for this investigation and it was necessary to initially identify through this type of methodology the type(s) of game genre if any, older adults enjoyed and preferred playing. The results from Phase One identified from the survey that participants did play games in the genres of *puzzle (7), platform, adventure and shooter (3) and sport (2).* It needs to be born in mind that participants may have answered more than once to the question. Participants were required to answer the game genre(s) they would consider playing these were *puzzle (10), strategy (7) and sport (6)*. The answers from this question were taken into consideration and brought forward into the second phase of this investigation, during the design and methodology of conducting the controlled experiment discussed in Chapter Six.

Chapter Six will discuss the experiment designed and conducted for Phase Two of the investigation detailing the procedure and data collected.

Chapter 6

Experimental Investigation
The use of Computer Games by Older Adults

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6.0 – Overview

This chapter examines in detail similar investigations to that which has been conducted in this study relating to flow and interaction. This chapter outlines the different stages which formed phase 2 of this investigation, including the methodology, procedure, equipment, qualitative and quantitative results and discussion speculating the pattern of results which would differ using a younger audience.

6.1 – Introduction

Chapter six discusses the experiments aimed at the use of computer games by older adults. This chapter will discuss the design, procedure and results of the experiments conducted. The following general question has formed the basis of this investigation; "Do older adults prefer to play computer games because of the technology used, or whether it is the type of game content and genre of a game?

There are four research questions addressed in the one experiment conducted.

- The first question involves the use of two different gaming platforms (PS-2 and Wii) and the use of two distinctive platforms differs in relation to participant engagement.
- The second question involves the act of interaction between the two platforms and the participant.
- The third question bridges the work conducted under the CODEWORKS ATL project discussed in Chapter Five and the coherence with Phase Two, discussed in Chapter Six.

- The fourth question involves the bridging of data collection from Phase One and Two and recent research conducted, in the design of guidelines of gaming/interactive entertainment from this investigation and that of similar works.
- It is hypothesised that the Wii platform is easier to interact with than the PS-2 during play, and the effect of the game content derived from the games chosen for the experiments and whether content is important to the participant.

The experiment was designed and conducted to discover how easy and straight forward participants find it interacting with the Nintendo Wii and the PS-2 platforms. Choosing two different consoles was imperative for this experiment, the first being classified as a next-generation console, emphasising the intuitiveness of interaction for all demographic groups. The second console chosen was the PS-2, known within the games sector and amongst gamers for playing more complicated games and aimed at hardcore gamers. Games developed for this console appear to concentrate on the graphical interface, in order to ensure that the viewer is exposed to a more realistic feel of the game. The player may be required to use a number of buttons simultaneously to conduct one action.

Enjoyment and flow are central elements within this experiment. Flow can be described by a person being immersed in an activity, or in this instance, computer games. Fencott (2007) discussed in Chapter Three several aesthetics from the text "Game Invaders" and Murray's (1997) theories of aesthetics, which an individual may experience when interacting within a digital environment. Immersion or flow are two of the same feeling when interacting with digital media, this can occur many times during a wide variety of activities and especially during game playing. Fencott (2007) suggests;

> "When we play a computer game, whatever its genre, we will, if it's well designed and coded, get so lost in playing it that we will forget about the rest of the world around us; we will be so absorbed in the game that we will feel immersed; it will provide the only stimuli that we are aware of. More than this we will derive great pleasure in this sense of losing ourselves in this artificial world" (Fencott, 2007).

Jackson and Marsh (1996) have comparable views to Fencott when examining the affects of flow within a sports environment, which has contributed to the vast work conducted by Csikszentmihalyi *et al.,* (1990, 1993) suggesting "flow is an optimal psychological state" (Jackson & Marsh, 1996).

The effects of immersion on players during computer games is very similar to the affects of sports athletes examined by Jackson and Marsh (1996), suggesting individuals who participate in activities encounter many positive characteristics such as free expression and enjoyment from the occurring process. Flow, as suggested by Jackson and Marsh (1996), is an inherent state of pleasure which in turn goes together with orders in consciousness, for example clarification of older adults and objectives, performance, concentration, control and in order to carry out the performance.

Jackson and Marsh (1996) suggest, flow transpires when a person or a performer experiences a "positive experiential state" and becomes affected by their performance within the unique situation where characteristic proficiency equates to the "required challenges" (Jackson, Marsh 1996). Some regard immersion as a prerequisite of flow, immersion as described by Nacke and Lindley (2008) as a sense of loss, an occurrence of flow which is regarded as complete involvement. Csikszentmihalyi (1990, 1993) outlined nine flow facets, thus being a balance of challenge and skills, clear goals, feedback, sense of time, loss of self-consciousness, experience of enjoyment and control in an autotelic activity, for example being self-sufficient. Within this study of flow the characteristics described by Csikszentmihaly (1990, 1993) were analysed using the Flow State Scale (FSS), the challenge of game playing, Nacke and Lindley (2008) describe challenge based immersion as the player balancing gaming abilities against the game challenges, thus game play is related to motor and mental skills.

Flow within games has been studied over the last several years and tested in a number of investigations. The majority of these studies have used young adults, and in some cases predominately males. The studies have focused upon online gaming, using specific genres such as FPS, and analysis of emotion and participants' engagement. The first of these studies used the FSS (Jackson, Marsh, 1996) method, this particular study was by Kivikangas (2006), investigating the correlations between psychophysiology measures and flow experience. The method analysed flow without relying upon participant memory. Kivikangas (2006) investigated the associations between the ratings of the FSS (Jackson & Marsh, 1996) scores and physiological measures involving emotional response continually during game play. The results as suggested by Nacke and Lindley (2008a) of the investigation by Kivikangas (2006) "showed flow did not have a significant relationship with suggested psychophysiological measures of basic emotions" (Nacke, Lindley, 2008a).

Nacke and Lindley (2008a) conducted a pilot study investigating the experiences of game playing using the game *Half Life 2*. A number of levels for stimuli were designed to create a variety of different gaming experiences, for example, boredom, immersion and flow. There were three levels in the investigation; these were secret corridors to test immersion, church walk – boredom and flow check – flow. Experience of playing was measured using the Game Experience Questionnaire (GEQ) devised by researchers based at the Game Experience Lab, Eindhoven University of Technology in the Netherlands and through EU-funded FUGA ("Fun of Gaming") project; a multi-disciplinary group conducts research of games studies. Gajadhar, de Kort and IJsselsteijn (2008) discuss and explain the nature of the GEQ in a recent paper. The GEQ is divided into three sections, the first consisting of seven subscales including positive/negative affect, flow, sensory immersion, tension, challenge and competence; the second scale examines the state aggression, modified from the *trait aggression scale* devised by Buss and Perry (1992), and thirdly the social presence in gaming questionnaire (SPGQ) is included, devised by de Kort, IJsselsteijn and Poels (2007).

The conclusion of this study was that players were able to fire at enemies using a variety of weapons, except for level three which was constricted to using a crossbow, and having enough ammunition (one arrow per enemy). Intensity of emotion increased through the challenge of enemy attack. Nacke and Lindley (2008a) also concluded the final level restricted players. This was due to the amount of ammunition and high death during play but was not the level with highest negative effects. Having low challenges and boredom factors is the one which scored highest negative effects, concluding not having enough or the absence of challenge leaves gamers in a negative emotional state (Nacke and Lindley, 2008a).

A subsequent study from Nacke and Lindley (2008b), as previously discussed, conducted by Nacke and Lindley (2008b) investigated the effect of flow and immersion through FPS games, measuring gamers playing experiences. The nature of this study was to identify and measure game playing experiences and the effect on player valence and arousal, additionally, the goal was also to discover potential correlations connecting valence and arousal features and self-reported subjective experience. This study involved psycho-physiologically different facets of game playing experiences using the game *Half Life 2*. The data analysis of this study was very similar to that of Kivikangas (2006), both using measurements involving electroencephalography, electrocardiography, electromyography, galvanic skin response and eye tracking equipment. This particular study differs from the previous study, relative to the method of survey used during the investigation. Additional aspects of the study also suggest using the GEQ as a means of measuring flow during combat challenges. Spatial presence measurements revealed, the level designed for testing immersion scored high in both self-location and possible actions, and as described by the authors, would be classified as imaginative immersion (Ermi, Mäyrä, 2005), where a particular player is absorbed through narrative or identification with a player (Brown, Cairns, 2004). The term absorbed or absorption derives from the work of Brown and Cairns (2004), who describe this feeling through the "narrative of a game or identification with a character, which is understood to be synonymous with feelings of empathy and atmosphere" (Nacke and Lindley, 2008b, p. 81). The results from the Nacke and Lindley (2008b) study using EMG responses were significant for the muscles indicating a positive valence. Measuring arousal response during the game play also indicated a significant difference under the different conditions and level designs of the investigation. Defining the term arousal, Nacke and Lindley

(2008b, p. 82, 83) state arousal "depicts the activation level linked to an emotionally affective experience, ranging from calmness to extreme excitement". The findings also suggest more challenging levels within the game to be more arousing to the player, encountering positive emotions than the boring levels experienced. According to Nacke and Lindley (2008b), those who play challenging levels experienced more arousal results through the tests, and more positive emotions than those levels classified as boring. Nacke and Lindley (2008b), in concluding their findings, draw upon the results of Kivikangas (2006) stating;

> "The psychophysiological findings contradict the finding of Kivikangas, that EMG activity over zygomaticus major and orbicularis oculi (positive valence), does not have a relationship with flow. If we assume that we can accurately assess flow with the GEQ, then it is found in our study to be related to positive emotion as indexed by physiological responses" (Nacke, Lindley, 2008b).

Wiebel, Wissmath and Groner (2007) studied the relationship of flow and presence within gaming. The investigation was to identify whether both of theses aesthetics, as discussed in Chapter Three of this thesis, are related within the context of computer games. The relationship between flow, presence and enjoyment was analysed. The following measurement instruments were used in the investigation; the presence scale developed by Kim, Biocca, (1997) and a single item *"Did you enjoy the game?"*, 1= not at all; 5= very much to measure enjoyment (Wiebel, Wissmath, Groner 2007). The game chosen for this experiment was *Neverwinter Nights*, which was played for thirty minutes. Flow was assessed during the study by using a short flow scale devised by Rhienberg, Vollmeyer and Engeser (2003), the scale measures two facets, smooth and automatic running and absorption. The study concluded, both presence and flow are two different structures of gaming; through immersion in gaming the effect of flow occurs during play and presence is a sub-dimension of the two. To conclude, the researcher's state being immersed in a VE environment/computer game intercede the relationship or connection between presence and flow, thus the mental state which a person reaches during play being immersed in this environment occurs. Age Invaders is a game developed by Khoo and Cheok (2005), the game encompasses the ability for both older adults and the young to interact simultaneously without much difficulty. The game uses a floor display rather than HMD or supplementary VR clothing, unlike previous equipment which enabled users to perceive the world through a device (Khoo & Cheok, 2005). The nature of interaction with the game is through the whole body using the floor, enabling extensive intuitiveness. The nature of Age Invaders through real-time user interaction, will give the player the concept and perception, from the user themselves and from the game for example; shooting at opponents will be viewed through real time and perceived physically from the user's body, connecting real time with the virtual environment. An added benefit of Age Invaders is the physical nature of the game; all users have to physically move around the floor to interact, rather than sit in-front of a screen. This added advantage promotes intergenerational relationships between grand-parents and grand-children. The game parameters are set enabling ease for older players and difficulty for young players creating a balance.

The researchers concluded the main benefits of this mixed reality environment for older adults were social, physical, cognitive and psychological. Encompassing family and intergenerational relationships, social environment and interaction; moving around the game enables physical activity, cognitive exercise which creates mental stimulation and improves functioning of the participants; the psychological facets involve wellbeing, self-worth and general interaction with family members (Khoo & Cheok, 2005). Age Invaders is very similar to the Wii in the sense of enabling generations of a family to integrate and experience game playing through a social context and interaction, creating mental stimuli for all players and to enhance cognitive skills. Although there is the ability to become physically involved in Age Invaders with little VR augmented equipment, the aspect of a motion sensor remote enables (depending upon the game being played) physical movement by players, giving the players/users the physical traits outlined in the study.

Earlier studies of elderly adults and video games has been conducted by Clark, Lanphear and Riddick (1987), they investigated the effects of response selection using videogames such as *Pacman* and *Donkey Kong*. The nature of the study examined, through demonstration of game playing, information processing primarily response selection could improve. The study decided to use videogames for the investigation, as video games require a quick response during game playing to have some degree of success. During play of *Pacman* players are required to navigate the character using four directions, this is done through joystick movements (up, down, left and right). During play of *Donkey Kong* players were expected to conduct the same movements but also implementing a button press, which conducted the action of jumping to avoid the character being killed by the enemy. Additional reasons why videogames were used are due to perception of being “novel and challenging to elderly people” (Clark, Lanphear, Riddick, 1987). The experiment consisted of two groups of elderly adults, the first group played the two games for seven weeks the second did not. Pre-testing of the participants was carried out on a two-choice reaction time task under two spatial S-R compatible conditions. Participants were also post tested under the same conditions. The performance of videogame performance was monitored, with participants in the experimental group predicting "if videogame playing improved response selection, there would be a differential effect of compatibility on reaction time performance following the intervention" (Clark, Lanphear, Riddick, 1987) and those who were game playing, decrease of response selection time under the incompatible conditions more so than the participants who had not played. The experiment consisted of fourteen participants, six men and eight women; the mean age was seventy years. The participants in the experimental group were given instructions on use of both computer games, including the objectives, rules and a demonstration of the games, during this time participants were also able to practice. The games were played for two hours a week over a seven week period, the time spent and highest score were recorded at the end of each session. The participants were given the choice to choose one or both games to play during the session. The results of the investigation showed improvement relative to performance over the duration. The results from the study did show significant improvement of performance under different spatial compatibility, and those who had played the games showed faster overall performance. There was a significant improvement of "interaction between treatment and compatibility thus indicating a differential effect of compatibility of RT" (Clark, Lanphear, Riddick, 1987). The authors also stated those who had played games showed an improvement of videogames, but also in general processing ability, time is needed to select a response, thus the investigation conducted by the authors indicates declines in such processing can be reversed, although not fully, but improved some what. It was the notion of the authors to demonstrate that interventions, such as videogames, are able to have a positive effect on processing abilities.

A study conducted by McGuire (1984) investigated the improvement of quality of life of residents in care facilities on a long term basis, suggesting the use of computer games as a recreational activity can be effective. The study examined three care homes, observing the morale, and outlined the use of such forms of activity, can benefit and be effective in stimulating and increasing the morale of residents. Previous work by Czikszentimihalyi (1975) supports the benefits of stimulation can improve the quality of life. An investigation conducted by Czikszentimihalyi (1975) indicates depriving young adults of stimulating activity for one day displayed physical and mental effects of deterioration of the participants. There are many benefits to using video games within a care home environment, as outlined by McGuire (1984) illustrating the mobility for those confined to bed, the repetition of the activity enabling individuals with low skill levels, but also giving individuals the choice of advancing skill level and using of videogames does not impinge upon staff time, which is also supported by work conducted by Weisman (1983). As demonstrated by Weisman (1983) videogames do afford stimulation, challenges and the prospect of enhancing self-esteem, confidence through mastering a new skill. The study by McGuire (1984) proposed to examine the effect of videogames on elderly resident's specifically measuring happiness and self-esteem.

The investigation consisted of sixteen participants, four male and twelve females, the average age was seventy-nine years. The games available to play on the Atari 2600 were *Breakout, Space Invaders, Pac Man, Bowling and Football*. The residents were able to play any of the games over an eight week period and often as they wished. The results of the study showed there was an indication of effect relative to quality of life and game playing, indicating over the experimental period the improvement of affect and self-esteem was significant to those who had played. The results also suggested, due to having a new activity this may also have had an effect, outlining game playing may not be truly responsible for the changes but through direct or in-direct alterations the results were positive. The benefits of video games in residential homes can improve the quality of life, and as suggested enabling the challenges built into computer games can aid individuals as their game playing improves.

Bianchi-Berthouze, Kim and Patel (2007) conducted a study entitled “Does body movement engage you more in digital game play? And Why?” which investigated the relationship between body movement and the engagement experience of computer games. The hypothesis of the study was to identify “an increase in body movement imposed, or allowed, by the game controller can result in an increase of the player’s engagement level” (Bianchi-Berthouze, Kim, Patel, 2007). Two separate experiments were conducted during this study; the first experiment involved participants playing the same computer game, using two different controllers, imposing different amounts of task-related movement. This decision was to rule out any imposed factors due to the shape of the controllers. The second experiment involved participants performing game play using the same controller. The difference been the amount of body movement imposed by the controller.

The age of the participants were twenty-five years and over. Fourteen people in experiment one were required to play *Guitar Hero*, a music game for the PS-2. The nature of the game requires gamers/participants to play the song by pressing a series of coloured coded buttons in time with the game/song. Each participant was required to play the game in two conditions, the first using the traditional game pad, the second using the guitar shaped controller. Participants in the second condition were given the guitar shaped controller which features "five colour fret buttons, strut bar and a whammy bar," which enables gamers/participants to feel that they are actually playing a real guitar. Additional features of the controller include moving the guitar in an upwards position, thus increasing the player's "star power" encouraging further body movement. The participants in experiment one were all beginners, with no prior experience of game playing of this genre. Participants were asked to play the game for twenty minutes in each condition (traditional game pad and guitar shaped controller), each condition was played over a two day period.

Results from experiment one using the gaming engagement questionnaire (GEQ), (Chen *et al*., 2005, work in progress) and the "immersive tendency questionnaire (ITQ), proposed by Witmer and Singer (1998) based upon work of Sheridan (1992) who suggests from a theoretical prospective, facets underlining the idea of presence, can be grouped into four categories (control, sensory, distraction and realism). Data collection showed a significant relationship within the guitar condition, a significant relationship with both conditions (traditional game pad and guitar shaped controller) and an insignificant response using the traditional game pad.

Participants using the guitar controller displayed a higher significant response of engagement. This is supported by additional data collection through video analysis – illustrating participants demonstrated a higher incidence of task related movement (keeping the beat through head and body), (Bianchi-Berthouze, Kim, Patel, 2007). Results between the GEQ and GITQ surveys showed significant correlations, thus suggesting the provision of a more natural controller or facilitating more movement.

Experiment two involved eighteen people (M=20), who were beginners and required to play for ten minutes. The authors did not state whether participants from experiment one were used for this experiment. This experiment was conducted to eliminate the novelty factor of using the guitar shaped controller, which in experiment one did increase game player engagement. The controller was primarily used as a dual-pad controller. Participants were informed of the fret buttons, strut and the whammy bar. Participants in the second condition were informed of the “star power” availability.

Results from the second experiment from the second condition, showed participants to experience a higher, significant level of engagement, supporting the results from experiment one. Body movement appears to affect participant engagement level during game play of Guitar Hero. Motion capture was utilised to record data of participant motions during the experiment. In addition to this, six students from the psychology department were asked to observe and record affective expression during the experiment. The observers listed a series of words (22) which best describes the emotions of participants. Some of the words used included excited, happy, content, relaxed, bored, frustrated, annoyed, angry, alarmed, surprised, frightened, calm and joyful. The modal of affect used, is based upon work by Russell (1980), Bowen (2005), Peter and Herbon (2006). The observers were able to document emotions using their own words if one listed was not appropriate or available.

Positive emotions were recorded with high-arousal/high-valence movement and to music-player movements. Negative emotions were expressed by participants most probable through mistakes (Bianchi-Berthouze, Kim, Patel, 2007). The data captured through motion also indicates the participants, in condition one of experiment two, display low-valence levels of arousal, where-as, results in condition two display high-valence/high-arousal levels but will show a positive representation in the low-valence/love arousal segment. The authors state data collection from experiments one and two supported the hypothesis of the study – in that, affective experience is not solely related to game performance but also enjoyment experienced by a player in the role of a music player. Bianchi-Berthouze, Kim, Patel (2007) state "a game controller itself plays a critical role in creating a more complete experience. By inducing body movement, the device results in a higher sense of engagement in the players and mediated a feeling of presence in the digital world".

6.2 – Method

A (2)×2×2 independent measures design was used for conducting and data collection in the experiment. The independent variables were interaction mechanism, the interaction style used by the Wii and PS-2 - and computer-game experience (gamer, non-gamer). The dependent variables were flow of game playing and participants.

It was desirable to have equal number of participants on both consoles. Power analysis demonstrated that in order to detect a large effective size with a power of 0.5, 64 participants were required, 32 per platform. The room used for data collection was an academic office based in the Greig building of the School of Computing, available for the period of time required for Phase Two.

6.3 – Participants

Recruitment of participants was predominately from a list of people who had taken part in a previous investigation at Teesside University. A method of telephoning was carried out explaining to the individual the nature of the research and whether they would be willing to take part in an experiment on campus. A letter outlining the nature of the research was posted to each prospective participant who had expressed an interest during the phone call, and a follow-up call was conducted to arrange a specific time and suitable date. Word of mouth was another means of recruitment, through family members and friends, or through those who had previously taken part in the workshops. Advertisements requesting participants for the experiments were posted on to the Teesside University intranet, although this was not particularly fruitful.

The minimum age of participants taking part in the experiments was forty-five years the maximum age of a participant was seventy-five years. It was intended to include both gamers and non-gamers in the experiment; computer-game experience was established from the survey completed at the end of the experiment.

6.4 – Materials and Apparatus

Several pieces of documentation were used within the experiment, including a consent form (Appendix VII), which participants completed before commencing the experiment. An observation sheet (Appendix IX) was used for each participant playing the games; the nature of the observation sheet was to observe participants' movements, facial features, oral feedback and the researcher's perceptions of their game playing. A 15-inch television was used enabling participants to play and interact with the games console. An observation sheet (Appendix IX) was designed to record additional information from the participants during the experiment. A questionnaire was required for each participant to fill-in after completing the experiment (Appendix X). A consent form was designed stating participants' rights during the experiment (for example, they were free to leave at anytime). It was their own decision to take part in the experiment and participants understood that the results collected might be used in research publications, although their personal information would not be disclosed. The games selected for the experiments were from the sports genre, golf, tennis and boxing; the games differ due to the nature of the platforms been used and it was important to have equal genre of games and number of participants for both platforms.

6.4.1 – Computer Games and Consoles

Two computer gaming platforms were used; a Wii console with numb chuck and remote, and a PS-2 console with game pad. A mobile phone was used as an alarm to set fifteen minutes for each game. As previously stated, the computer games chosen for both console were of the same genre. Three games were chosen for each console. It was necessary to select games that were very similar to one another as this would allow for comparison when analysing the data. The games chosen for the Wii are known as Wii Sports, which has a selection of five games that a particular gamer or user can select, three were used in the experiment, these ranged from golf, boxing, tennis, bowling and baseball. In addition, the choice of game genre chosen for this study (sports), is built upon the results discussed in Chapter Five in relation to participant's answers to the question "what type of game genre would you consider playing?" When the Wii console was released onto market the game which came with the console was Wii Sports and this was also one of the three game genres considered by participants in Phase One to play.

Choosing games for the PS-2 had to be decided, this was a little more difficult as there is not a single game with a multitude of options available on the market as there is for the Wii. Research in a number of high street stores had to be carried out and careful decision-making was required. Three separate games were purchased for the experiments to be conducted on the PS-2 console. These were Tiger Woods PGA Golf 2002, Virtua Tennis 2 and Knockout Kings 2001; these were considered to be equivalent to the three games chosen from the Wii Sports.

6.4.2 – Questionnaire Design

The questionnaire (Appendix X) was administered by the author. On completion of the experiment it was necessary that respondents themselves filled - in the survey. A number of topics were incorporated within the survey to assess ownership of games consoles, digital media, hobbies and interests, length of time playing computer game(s), frequency of purchasing, habits in relation to computer games and how they learnt to play games. Demographic data recorded was age, sex, education and employment history as well as family information, such as children, grand-children and whether they played computer games.

Jackson and Marsh (1996), FSS scale was adopted in the experiment, representing the mind flow dimension as discussed by Csikszentmihalyi (1990, 1993). The subscales of the FSS scale (Jackson and Marsh, 1996) were reliable, reliability test using

Cronbach's α with values of Cronbach's alpha >0.70 (see Table 6.4.2.25). Factor analysis was not conducted during the data analysis due to a low sample size (N=68).

Table 6.4.25 –Reliability grouped with FSS Items

Sub Scale	FSS Questions	Cronbach's Alpha
Challenge – skill balance	1	
	10	0.80
	19	
	28	
Action – awareness merging	2	
	11	0.84
	20	
	29	
Clear goals	3	
	12	0.83
	21	
	30	
Unambiguous feedback	4	
	13	0.81
	22	
	31	
Concentration on task at hand	5	
	14	0.91
	23	
	32	
Paradox of control	6	
	15	0.87
	24	
	33	
Loss of self-concentration	7	
	16	0.80
	25	
	34	
Transformation of time	8	
	17	0.77
	25	
	35	
Autotelic experience	9	
	18	0.91
	26	
	36	

Note: Figures are Cronbach's alpha coefficient for internal consistency reliability.

6.4.3 – Other Materials

Ethics approval had to be obtained before data collection (Appendix XI). The local ethics committee of the School of Social Sciences and Law at Teesside University approved the application.

6.5 – Procedure

A pilot test with two participants was conducted to test the procedure and as a basis for making changes to the development of the main phase of data collection. The consent form (Appendix VII) was handed to each participant to complete before commencing the experiment and participants were informed all data collected would be confidential. Participants were briefed on the nature of the experiment, explaining each game would be timed for 15 minutes and an alarm would sound at the end of each game. Participants were informed that at any time during the experiment they could stop, giving a note of the reason why, and the length of play would be taken.

Demonstrations and explanations were given of how to use the Wii remote and PS-2 pad before each game. Instructions for the games were also delivered where necessary, but not all games had this implemented, additional information was given on the screen during or before the game started. Some participants required additional help with the PS-2 controller when playing the Tiger Woods golf game. This was carried out through demonstration by the researcher.

During the experiment, the researcher recorded movement and oral feedback from participants which were recorded on separate observation sheets (Appendix IX); any additional interaction was also documented. The survey (Appendix X) was given to participants once the experiment had finished playing the games on a particular platform (Wii or PS-2). A de-brief of the aim and objectives of the experiment was explained to the participants once all documentation was complete, allowing the participant the opportunity to ask additional questions if desired. Each participant was given either the PS-2 or the Wii and was required to play the three games chosen for each console. Due to the size of the room used for data collection, some participants ended up banging into office furniture during game playing on the Wii console. This was due to a small space for participants and quite a lot of movement during the tennis and boxing games.

6.6 – Data Analysis

Data from the questionnaire was analysed using descriptive and inferential statistics. Data collected from the observation sheets were coded into SPSS for data analysis. A content analysis was conducted to establish categories of responses. Answers were then coded and entered into SPSS and descriptive statistics were produced.

6.7 Results

6.7.1 Demographic Results

Table 16 shows results collected from the survey. Men and women in the sample were of equal age. Those were married, not married or alone appeared to be younger. In this sample, the lower their qualifications were the older participants were. In terms of occupation retired participants were the oldest.

Table 6.7.26 – Demographic results for participants

	Mean	Standard deviation	N
Age			
	Mean	**Standard deviation**	**N**
Male	57.25	12.16	40
Female	57.71	8.55	28
Overall	**57.44**	**10.75**	**68**
Gender			
	Mean	**Standard deviation**	**N**
Male	4.40	1.50	40
Female	4.11	1.69	28
Overall	**4.28**	**1.57**	**68**
Marital Status			
	Mean	**Standard deviation**	**N**
Married/living with a partner	4.33	1.41	52
Alone	4.54	2.06	13
Other	2.33	0.58	3
Overall	**4.28**	**1.57**	**68**
Education			
	Mean	**Standard deviation**	**N**
Higher Degree	3.76	1.13	25
Degree	3.73	1.75	15
A-Level or Equivalent	4.71	1.80	7
NVQ or Equivalent	4.80	1.79	5
GCSE/O-Level	5.00	1.49	10
No Qualifications	5.67	1.37	6
Overall	**4.28**	**1.57**	**68**
Occupation			
	Mean	**Standard deviation**	**N**
Professional	3.40	1.00	25
White Collar	4.25	0.96	4
Group C Skilled Manual	3.60	1.34	5
Group D Skilled Manual	2.00	.	1
Group E Semi Skilled	4.00	.	1
Student	2.00	1.41	2
Unemployed	3.00	.	1
Retired	5.45	1.35	29
Overall	**4.28**	**1.57**	**68**

Table 6.7.27 shows the results from the survey outlining participants' relationship with computer gaming through ownership, game genres, frequency of play and purchasing habits.

Table 6.7.27 – Ownership results for participants

Would you consider playing a computer game related to your hobby?

Participants	Yes	No	Don't Know	Total
PS-2	12	17	4	33
Wii	18	13	4	35
Total	**30**	**30**	**8**	**68**

Would you consider playing a computer game?

Participants	Yes	No	Don't Know	Total
PS-2	19	11	3	33
Wii	30	5	0	35
Total	**49**	**16**	**3**	**68**

Do own a console?

	Yes	No	Total
PS-2	11	22	33
Wii	7	28	35
Total	**27**	**50**	**68**

Type of game genre considered

Participants	Shooter	Platform	Sports	Adventure	Strategy	Puzzle	Total
PS-2	4	4	9	5	5	10	37
Wii	5	4	12	5	7	14	47
Total	**9**	**8**	**21**	**10**	**12**	**24**	**84**

What type of console do you own?

Participants	PS1	PS-2	Game cube	Wii	Xbox	Xbox 360	DS	Other	Total
PS-2	2	6	0	5	3	3	1	0	20
Wii	2	3	1	3	2	2	0	1	14
Total	**4**	**9**	**1**	**8**	**5**	**5**	**1**	**1**	**34**

Table 6.7.28 – Frequency and time of playing computer games

How long have you played computer games?

Participants	**<1 year**	**6mths <**	**<3mths**	**<2mths**	**>1mth**	**Not Played**	**Total**
PS-2	14	0	1	0	0	18	**33**
Wii	8	1	1	2	3	20	**35**
Total	**22**	**1**	**2**	**2**	**3**	**38**	**68**

How frequently do you play computer games?

Participants	*<1mth*	*>1mth*	*<1 Per wk*	*<Once a day*	*> once a day*	*Never/Do not play*	
PS-2	1	2	8	3	1	18	**33**
Wii	1	4	6	1	2	21	**35**
Total	**2**	**6**	**14**	**4**	**3**	**39**	**68**

Where do you buy computer games from?

Participants	Supermarket	High Street	Computer Shop	Rental	Other	Total
PS-2	3	5	6	1	4	**19**
Wii	2	1	7	2	4	**16**

Total	**5**	**6**	**13**	**3**	**8**	**35**

The results from both surveys handed out to participants in Phases One and Two; and discussed in Chapter Five and Six suggest second/third-age adults do have an interest in gaming and that the game genre preferences of this cohort include *puzzle, sport and strategy.* The genres considered by participants are identical in both Phases, with a higher frequency identified in survey results from Phase Two, with the exception of adventure which was selected by participants in Phase Two and has a frequency of ten.

6.7.2 Flow

Table 6.7.29 – Descriptives for flow

	Challenge Skill balance	Action awareness	Clear goals	Unambiguous feedback	Concentr ation on task at hand	Sense of control	Loss of self-consciousness	Transfor mation of time	Autotelic experience
PS-2	2.43 (1.01)	2.37 (1.01)	3.11 (1.02)	2.88 (1.01)	3.39 (1.19)	2.29 (0.97)	3.75 (0.91)	2.87 (0.92)	2.45 (1.05)
Wii	3.04 (0.79)	2.98 (0.84)	3.68 (0.90)	3.30 (0.90)	3.61 (0.91)	3.13 (1.04)	3.90 (0.93)	3.15 (0.84)	3.60 (0.90)

Note: Figures are means with SD in brackets

The results presented in Table 6.7.29 and Figure 6.7.2.15 appear to show that some aspects of flow were rated higher for those using the Wii than those using the PS-2.

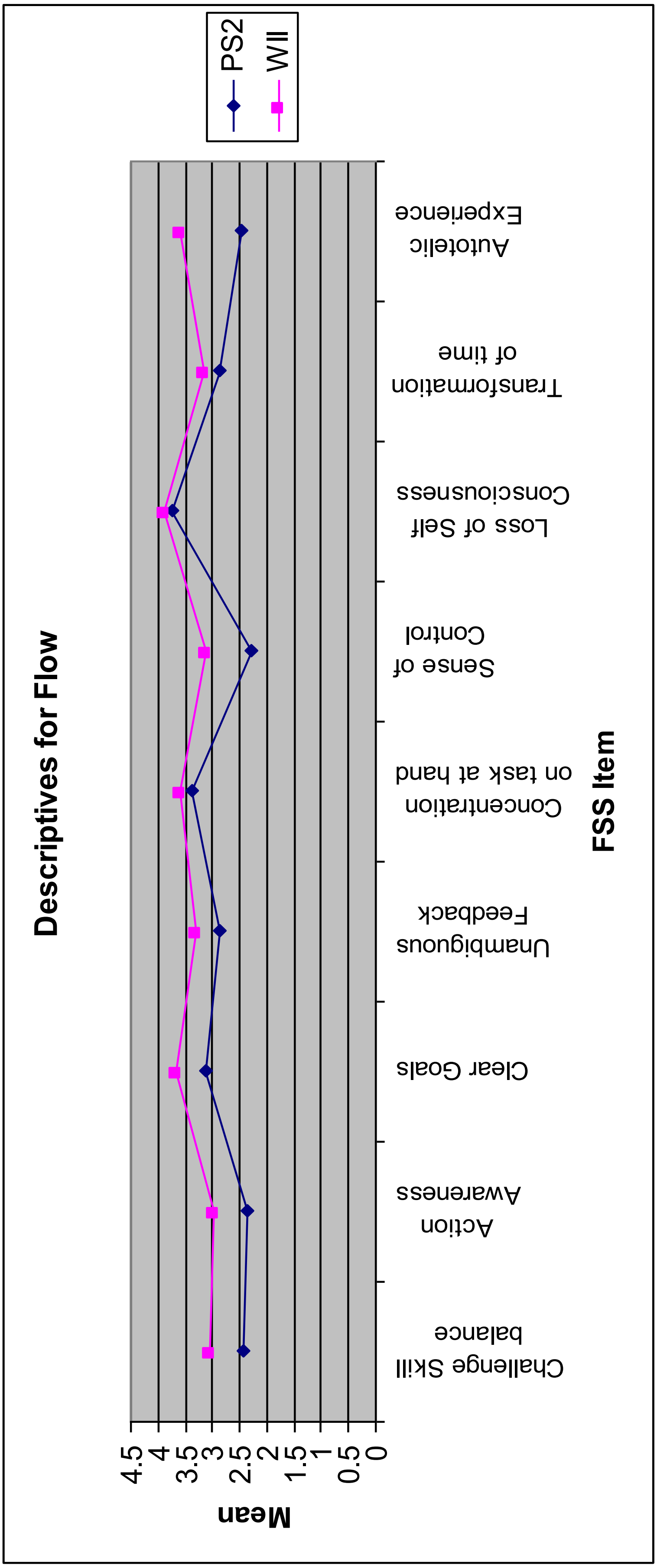

Figure 6.7.2.15 – Flow as a function of platform

A 2 x 9 analysis of variance ANOVA with independent variables platform (game console) and flow scale, demonstrated that the effect of subscale was significant F (5.38, 2.54) = 21.24, $p < 0.00$. The effect of platform was significant F (1, 66) = 10.31, $p = 0.00$. The interaction effect was significant F (5.38, 2.54) = 3.42, $p = 0.00$. Given the significant interaction effect, simple-effect tests were conducted to compare the two platforms per sub-scale. The difference between platforms was significant for challenge of skill balance, t (66) = 2.75, $p = 0.00$, action awareness t (66) = 2.71, $p = 0.00$, clear goals, t (66) = 2.45, $p = 0.02$, sense of control t (66) = 3.43, p 0.00, and autotelic experience t (66) = 4.80, $p = <0.000$.

6.7.3 Observations Per Game

In each session the researcher observed the participant and recorded observations regarding the participants' interaction with the game using a 7-point Likert scale. Table 6.7.30, 31 and 6.7.32 and Figures 30, 31 and 32 present descriptives for both consoles, for the games of golf, tennis and boxing games.

Table 6.7.30 – Descriptives for observation categories for golf

	Ease of Use	Control of Game	Enjoy-ment	Concen-tration	Skill	Aural feed back negative	Aural feed back positive
PS-2	4.73	4.55	3.79	5.91	4.21	2.88	1.36
	(1.51)	(1.44)	(1.22)	(0.81)	(1.32)	(2.00)	(1.82)
Wii	6.20	5.71	5.14	6.14	5.23	2.40	2.71
	(0.72)	(0.89)	(1.22)	(0.65)	(0.77)	(1.56)	(2.23)

Note: Figures are means with SD in brackets.

Table 6.7.30 and Figure 6.7.3.16 show most aspects of interaction were rated higher by those using the Wii than by those using the PS-2.

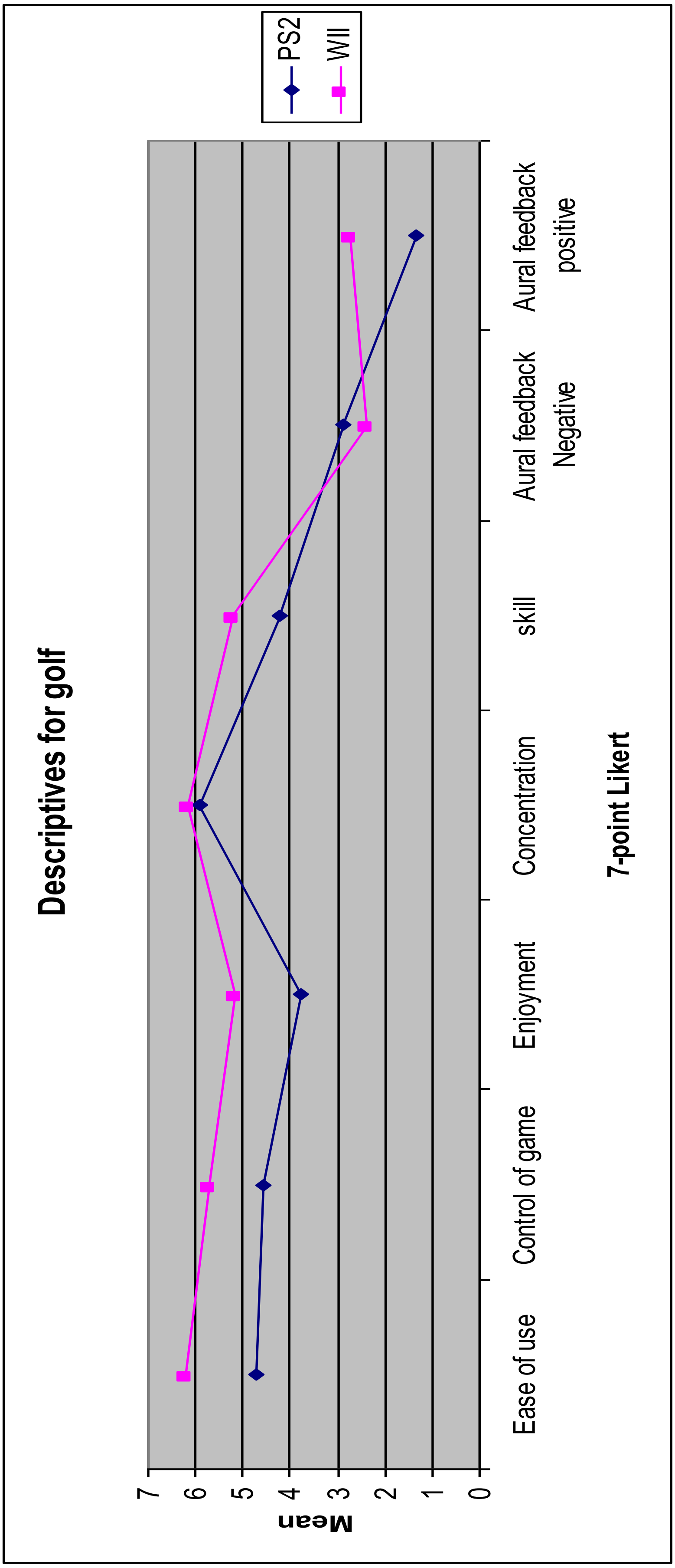

Figure 6.7.3.16 – Interaction as a function of platform for the golf game

A 2 x 7 analysis of variance ANOVA with independent variables platform (game console) and interaction aspect, demonstrated the effect of interaction aspect was *F* (2.85, 18.86) = 96.75, $p < 0.00$. The effect of platform was significant *F* (1, 66) = 22.15, $p < 0.00$. The interaction effect was also significant *F* (53.74, 18.86) = 5.85, $p = 0.00$. Given the significant interaction effect, simple-effect tests were conducted to compare the two platforms per sub-scale. The difference between platforms was significant for perceived ease of use, *t* (66) = 5.19, *p* = <0.00, perceived control of game, *t* (66) = 4.05, *p* = <0.00, enjoyment, *t* (66) = 4.59, *p* = <0.00, skill, *t* (66) = 3.91, *p* = <0.00, and positive aural feedback, *t* (66) = 2.73, $p = 0.00$.

Table 6.7.31 – Descriptives for observation categories for tennis

	Ease of Use	**Control of Game**	**Enjoy-ment**	**Concen-tration**	**Skill**	**Aural feed back negative**	**Aural feed back positive**
PS-2	4.88 (1.32)	4.36 (1.48)	4.18 (1.26)	5.45 (1.00)	4.61 (1.32)	2.55 (1.99)	1.67 (1.87)
Wii	5.66 (1.31)	4.89 (1.11)	4.94 (1.43)	6.00 (0.73)	5.00 (1.11)	1.91 (1.31)	1.69 (1.81)

Note: Figures are means with SD in brackets.

Table 6.7.31 and Figure 6.7.3.17 show most aspects of interaction were rated higher by those using the Wii than by those using the PS-2.

A 2 x 7 analysis of variance ANOVA with independent variables platform (game console) and interaction aspect, demonstrated that effect of platform was significant *F* (3.04, 200.30) = 112.79, $p < 0.00$. The effect of platform was not significant *F* (1, 66) = 2.77, $p < 0.10$. The interaction effect was significant *F* (3.03, 200.30) = 2.93, $p = 0.03$. Given the significant interaction effect, simple-effect tests were conducted to compare the two platforms per sub-scale. The difference between platforms was significant for perceived ease of use, t (66) = 5.19, p = < 0.00, perceived control of game, t (66) = 4.05, p =<0.00, enjoyment, t (66) = 4.59, p = < 0.00, skill, t (66) = 3.91, p = < 0.00 and positive aural feedback t (66) = 2.73, p = < 0.00.

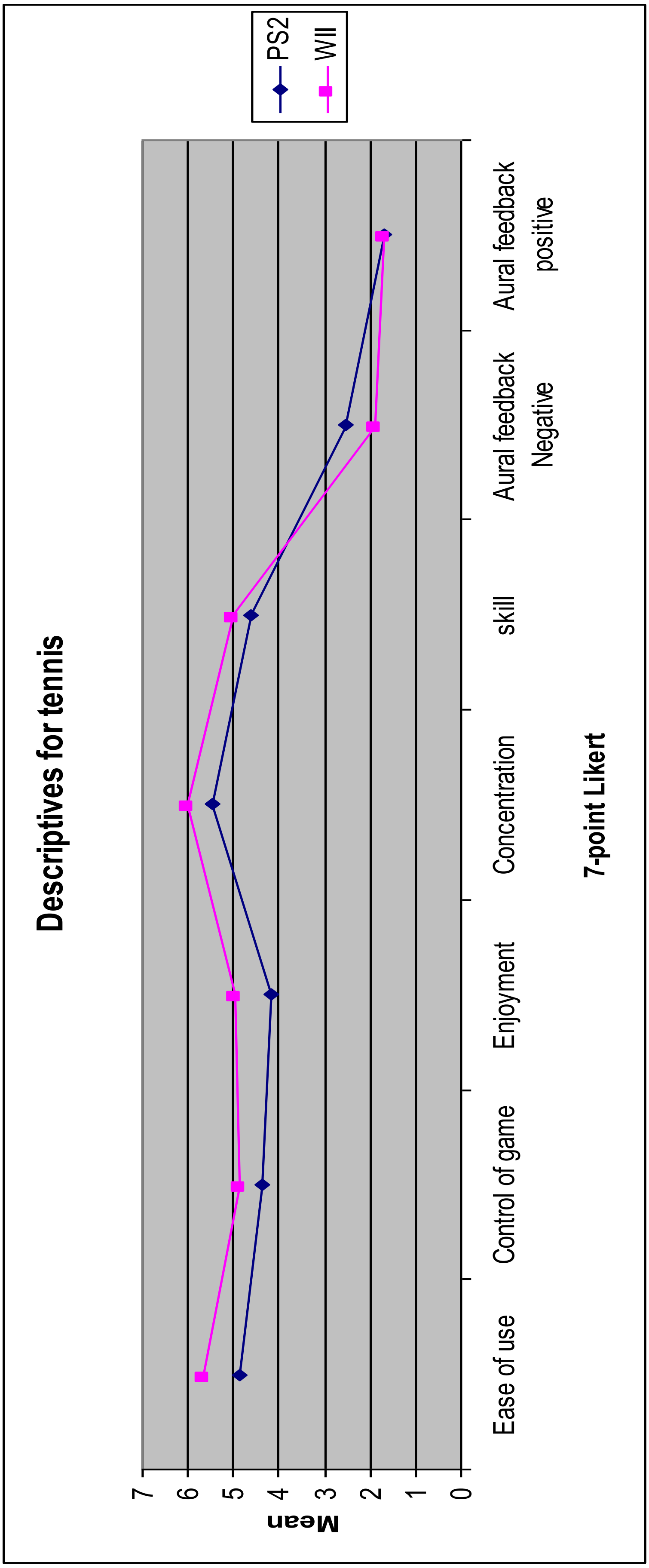

Figure 6.7.3.17 – Interaction as a function of platform for the tennis game

Table 6.7.32 – Descriptives for observation categories for boxing

	Ease of Use	Control of Game	Enjoy-ment	Concen-tration	Skill	Aural feed back negative	Aural feed back positive
PS-2	4.76 (1.35)	4.39 (1.22)	3.73 (1.26)	5.45 (1.23)	4.06 (1.17)	2.18 (2.07)	1.36 (1.58)
Wii	5.77 (0.88)	5.02 (1.11)	4.94 (1.35)	5.83 (0.86)	5.09 (1.04)	2.14 (1.68)	1.83 (2.08)

Note: Figures are means with SD in brackets

Table 6.7.32 and Figure 6.7.3.18 show most aspects of interaction were rated higher by those using the Wii than by those using the PS-2.

A 2 x 7 analysis of variance ANOVA with independent variables platform (game console) and interaction aspect, demonstrated that effect of subscale was significant F (2.82, 186.52) = 102.25, $p < 0.00$. The effect of platform was significant F (1, 66) = 9.00, $p = 0.00$. The interaction effect was not significant F (2.82, 186.52) = 1.53, p = 0.21.

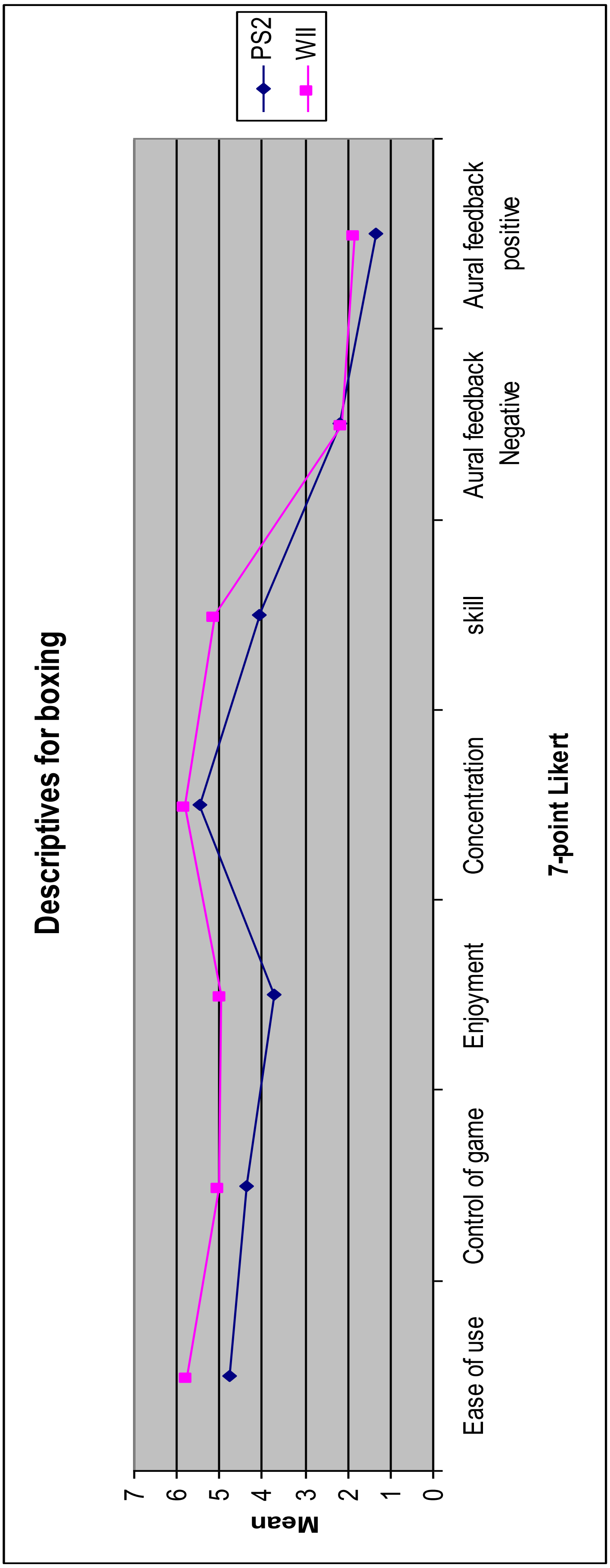

Figure 6.7.3.18 – Interaction as a function of platform for the boxing game

Table 6.7.33 – Descriptives for time spent playing games

Time	Console	Mean	SD	N
Golf	PS-2	0.03	0.174	33
	Wii	0.00	0.000	35
	Overall	0.01	0.121	68
Tennis	PS-2	0.45	1.121	33
	Wii	0.11	0.530	35
	Overall	0.28	0.878	68
Boxing	PS-2	1.27	2.349	33
	Wii	0.94	1.731	35
	Overall	1.10	2.045	68

SD: Standard Deviation
Note: Time in minutes

Table 6.7.33 and Figure 6.7.3.19 shows less time was spent playing games using the Wii than using the PS-2.

A 2x3 analysis of variance ANOVA with independent variables platform (game console) and game, demonstrated that effect of interaction was not significant F (1.29, 0.82) = 15.15. The effect of platform was significant F (1, 66) = 1.34, p = 0.25. The game effect was significant F (1.29, 0.82) = 0.36, p = 0.60.

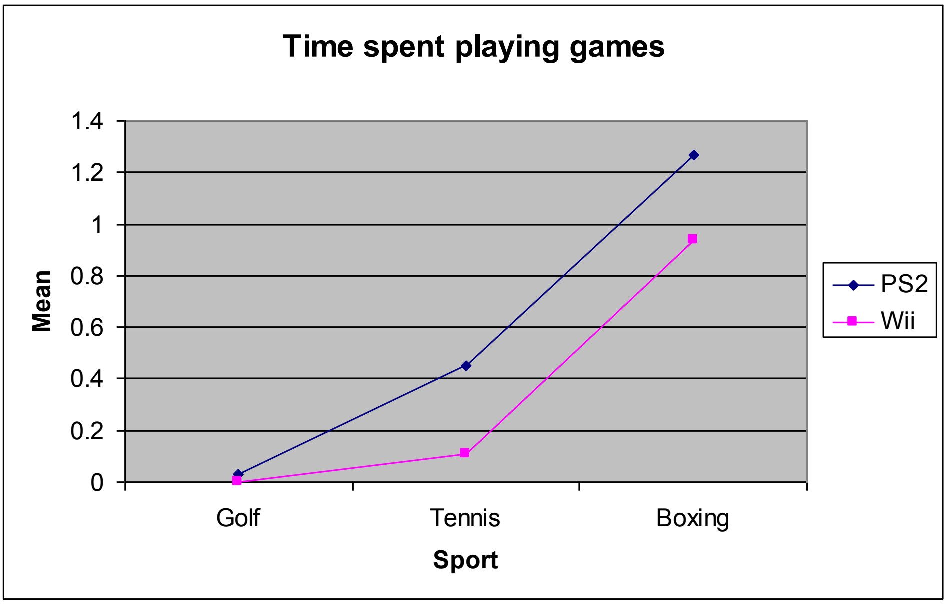

Figure 6.7.3.19 – Time spent playing games during experiment

6.8 – Qualitative Results

The following results were recorded from the observations undertaken by the researcher for each participant during the experiments. It was decided to analyse the data through significant words and actions. The researcher conducted data analysis reviewing each participant for each game, from the participant's transcript. Four categories (emotion, game control, mind and miscellaneous) were chosen to group the words and actions recorded. These categories were chosen due to recordings of observations during each experiment. For ease of analysis, examples are laughter, smiling and body movement, ease of use with game pad and performance for game control. A frequency for each of these categories throughout was tallied and independently checked and re-checked by the researcher. For each game and console positive and negative comments were recorded, and in some aspects participants were recorded in making both positive and negative words and actions during play. The researcher repeated the analysis and an independent person checked the analysis. The frequencies produced by the researcher (twice) and the independent person were analysed for reliability. The frequencies were found to be reliable, Cronbach's alpha = 0.98.

6.8.1 Observation Results for the PS-2

Appendix XI shows the observation results recorded during the experiments. There were many positive results for keywords and actions relating to all categories by participants during the experiments. The positive results for *golf* played on the PS-2 were laughing/smiling (22), concentration (15), experimentation with button (19), good teeing off (11) and practice shots (10) taken before making the final swing. Results for negative experiences on the PS-2 during golf resulted in seven main facets with relatively high frequencies these are, tutting/sucky noises (10), teeing off (8), problems with the stick on the game pad (7), frustration (6), headshaking (6) verbal feedback relating to personal performance (19), and a demonstration of how to use the stick (8).

Positive results from *tennis,* revealed participants to be relaxed (14) with many smiling or laughing (25), facial features (6) and concentration during play (6). Six participants had both good control of the game, and after time got better. Seven participants had rallies during the game, and six were thinking technically about the play. Results show nine participants gave positive verbal feedback relating to personal performance, and five relating to their game playing. It is important to comment that one participant, during play, responded to being immersed and the feeling of agency during the game. The negative results for tennis included court change during the game play (9), (this took a lot of participants by surprise), slow reaction to the game (7), body movement (9) tutting/sucky noises (7) verbal feedback relating to PP (20) and computer game (8). Co-ordination problems and problems hitting the ball or missing the ball were experienced by six participants.

The positive results for *boxing* show many participants laughing at the commentary during the game (23), concentration on their play (11), pressing the X button on the game for actions (7) and positive feedback on personal performance (7). Nine reported positive feedback relating to the game itself; six seemed to be relaxed. It is also important to state that one person reported the effect or immersion/agency during the boxing game in relation to their body movement.

The negative results for boxing, from the observations, showed the combination of buttons (6) to play the game were a problem for some. Nine participants reported feedback relating to personal performance and twelve relating to the game. Five openly admitted to disliking the game. Overall results from all games played on the Wii appear to have higher frequencies than the PS-2 for both positive and negative.

6.8.2 Observation Results for the Wii

The majority of frequencies for *golf* were laughing/smiling (34), relaxed (29), practising the swing before taking the final shot (12), verbal feedback relating to PP (15) and game (12), participants paid attention during the game (17) and concentrated throughout (15). Ten participants asked questions during the game relating to many facets. Nine participants, during the game stood and held the remote like a golfer, three participants were thinking in a technical manner and three had also played or owned a Wii before taking part in the experiment. The experience of absorption was shown by some participants during a game i.e.: golf by the identification of a golfer standing and swinging the remote as you would naturally if playing a game of golf.

The negative results which were recorded from the game included participants tutting and making sucky noises (10), hitting the ball too hard (6), verbal feedback relating to the game (10) and in relation to personal performance (22). In addition to this, five participants had to be reminded about the buttons on the remote or the A button, and seven were recorded as needing suggestions made to them during play, either implementing bigger swings or changing position on the course.

The results for *tennis* are very similar, with several positive outcomes with high frequencies. The emotion of laughing/smiling was most frequent (30), movement

(19), being relaxed during play (17), concentration throughout the game (15) and verbal feedback relating to personal performance (14). Thirteen participants were recorded to have a good serve during the game and eleven participants were recorded in relaying verbal feedback in relation to the game.

The experience of arousal, as defined by Nacke and Lindley (2008b) was experienced by several participants during the tennis game. One participant in particular who experienced arousal from the offset of game play was observed, banging into the office furniture situated within the office, through game play movement. Further observation recorded this particular participant, through movement, was at time, inches away from the television screen. This was through extensive movement and excitement of playing the tennis game. The experience of absorption by participants was predominately through game play of the tennis. Although the game enables four players to play simultaneously, participants played on their own and through the atmosphere portrayed through the game, participants did experience the effect of being absorbed.

There were very few negative results for tennis with high frequencies. The main two were the verbal feedback in relation to personal performance (22), and the game (11). Five participants recorded having problems with the sensor, back-handers or the swing to the ball. Four participants encompassed problems hitting the ball and co-ordination during the game. In addition to this, four participants experienced problems serving the ball. Seven participants were observed to be confused and to have a lack of body movement during the game.

There are several positive results for *boxing*. The two emotions with the highest frequency were laughter/smiling (35) and concentration (22). Eleven participants were recorded to have carried out precise or good punches during the game, and seven participants found the game to be energetic. Verbal feedback relating to personal performance (13), and game (14), both were relatively high. Although, the following results are relatively low in frequency, I feel that it is important to mention the results and observation. Four participants were recorded as having body sweat after playing the boxing game due to being energetic (7) and enthusiastic (3). One participant referred to the image shown during the replay, and commented they actually preferred this style of the game rather than what they had actually being shown during play. Seven were observed as being relaxed, and five participants experimented with the controls and practised their moves before commencing the game. Further experience of arousal, was experienced by participants during the boxing game. The same participant discussed earlier in the tennis section also experienced arousal when playing the boxing game. In addition a further handful of male participants also experienced arousal while playing this game. The experience of absorption was further experienced by some participants through empathy of their character being punched by the opponent during the game.

The negative comments from the boxing game were verbal feedback relating to personal performance (15) and game (17). There were additional observations with low frequencies including, boredom (4), numb chuck not working (3) and demonstrations were required to use the remotes (3). Three participants were observed requiring a suggestion by the researcher in relation to the game. Two participants commented on the game view during play, suggesting it was harder to see exactly what you, as a player, were hitting due to the visual. Haptic feedback from the controls was observed a negative, on both the golf and boxing games, the overall impression to this, from participants, was they didn't like the feeling of the control pad vibrating during play. Arthritis and complaints of thumb, wrist and neck ache were reported by three participants during golf and tennis.

6.8.3 – Reflection

This segment will discuss the effectiveness of the approach to data collection from participants completing the survey at the end of game play. Participants were required to complete the survey, very similar to that used in Phase One but based upon the reflection in Phase One and the response of participants the CSE scale was not included, thus the survey was very much slimed down to the initial version. The amendments conducted to this survey were the implementation of the FSS (Jackson & Marsh, 1996) questionnaire to measure *flow* and the deletion of the CSE scale (Barbeite & Weiss, 2004). Through observation of participants while completing the survey seemed to be a more positive experience than previously observed, as discussed in Chapter Five. The design of the survey enabled participants to tick the relevant boxes. The only criticism that was identified from some of the participants was when completing the FSS survey (Jackson & Marsh, 1996) a couple of participants stated that through the 36 point scale some of the questions posed were the same as previous ones. This had been implemented to test the reliability of the answers completed by participants. Overall the survey used in Phase Two received a more positive response from participants than the survey used in Phase One.

The method of data collection in Phase Two, was again deemed to be a positive means, of including the collection of observational data which enabled the researcher to identify both positive and negative gestures, emotions and aural feedback during game play.

6.9 Discussion

Participants experienced a higher level of flow using the Wii console than using the PS-2 console. The difference from the FSS questionnaire was significant in five of the nine sub-scales in the following: challenge of skill, action awareness, clear goals, sense of control and autolelic experience as the facets of flow during the experiments.

Findings suggest that playing on the Wii was easier due to the nature of the console pad, (the remote), rather than the traditional game pad as used on the PS-2. As previously discussed, the investigation conducted by Khoo and Cheok (2005) involved participants young and old interacting with the environment, Age Invaders, in a physical sense, using their whole body as a means of playing rather than holding a remote and conducting certain physical movements, as required during this set of games such as golf, tennis and boxing; for example, during the golf game most participants held the remote as a golf club, tennis racket or boxing gloves, interacting and playing as you would with a typical game of golf, tennis or boxing. Equally, this experiment and Age Invaders, involved potential physical movement, social interaction and cognition - adding additional well-being benefits for both young and older players. As IJsselsteijn *et al.,* (2006) suggest introducing persuasive gerontechnologies earlier on in life may have a more beneficial impact. As indicated by the results of this experiment, the Wii produced a higher level of flow.

The results for the *golf* game showed a significant effect of both platform and interaction. Five of the seven observation aspects on the Wii scored better: perceived ease of use, perceived enjoyment, perceived control of game, perceived skill and positive feedback during play. The results state the *tennis* game indicated there was a significant effect of both platform and interaction. Three of the seven observation aspects, on the Wii, scored better: perceived ease of use, perceived enjoyment and perceived concentration. The results for *boxing* indicated there was no significant effect for both platform and interaction, but there was a significant effect of platform, with better scores for the Wii. The results for time spent playing the games between the Wii and the PS-2 showed a significant effect between the Wii and game. Results for interaction effect showed there was no significance.

Reflecting upon the results reported from the investigation, it would be expected that the significant response for the three games would be very similar if younger players took part. Previous research has stipulated, for a player to have fun and experience flow and immersion, there is the requirement from a game to offer the player the challenge and goal of attaining a certain level. In the *golf* game this is offered to players in four categories of easy, intermediate and difficult with the fourth level being a nine-hole game, encompassed from the three previous levels. Giving players the ability to play towards varying levels allows them to use skill and ability at a suitable level to their own skill level (Malone, 1980, 1982; Melenhorst, 2002; IJsselsteijn *et al.*, 2006, 2007a, 2007b, 2008; Gajadhar, de Kort & IJsselsteijn, 2008). The *tennis* game does not offer the same challenges and goals as golf, and the skill level is very low with speculation, the researcher feels if younger players were being measured in the same manner as older players, the results would be very similar. The *boxing* game offers three rounds per game to the players. Although this is not similar to the golf, which offered an ability rating scale, it gives little indication to the player, where in the game, they are. Through game play the researcher witnessed one participant for whom the opponent skill level had increased, this was due to the participant having played the game before and was well conversed with the nature of game playing for this particular game.

Feedback should be clear and positive throughout the game, promoting players' self-confidence (Melenhorst, 2002, IJsselsteijn *et al.*, 2007a, 2007b, Gajadhar, de Kort, IJsselsteijn, 2008). Motivation is also important and many of the participants did not see the purpose or benefit of the boxing game. Motivation and purpose is perceived as a great facet of gaming by older adults. Without this, many older adults do not see the purpose or goal (Melenhorst, 2002, IJsselsteijn *et al.*, 2007a, 2007b, Gajadhar, de Kort, IJsselsteijn, 2008). For many, the goal of boxing, which involves hitting someone until they land on the floor, is not a positive activity. As Melenhorst (2002) and IJsselsteijn *et al.,* (2007a, 2007b) have outlined, older adults will only invest their time in such entertainment if they can understand and see the purpose of it.

The results reported in this chapter indicate they are unique to older adults, as previous research suggests. White, McConnell, Clipp *et al.,* (1999) investigated older adults and computer systems, stating many older adults have problems learning to use computers and new technology due to age-related conditions such as cognitive changes, slower processing, decline in working memory and decrease in sustained and divided attention. As the results show from the observations, many of the participants had problems with slower reaction and co-ordination of the remote control, and hitting the ball during the tennis game. Because younger players generally have more experience and find using technology easier than older players, it would be expected that younger players would find the games used in the experiment, easier to play than older adults

The studies discussed earlier in this chapter have investigated several aspects of gaming, for example, flow, presence, interaction and enjoyment, encompassing a variety of psychometric instruments ranging from the FSS scale (Jackson, Marsh, 1996, Kivikangas, 2006), and GEQ, (Gajadhar, de Kort, IJsselsteijn, 2008), to SPGQ (de Kort, IJsselsteijn, Poels, 2007). The GEQ developed by Gajadhar, de Kort, IJsselsteijn (2008) seems to be a superior method of analysing flow and gaming affects with participants, but this was not available at the time of reviewing relevant literature for this particular study. The study conducted by Wiebel, Wissmath and Groner (2007) primarily examined the relationship between presence and flow and the connection of immersion with these two interaction outcomes. In other research, additional analysis was conducted through experiments involving psychophysiology, using electroencephalography, electrocardiography, electromyography, galvanic skin response and eye tracking equipment as reported by Nacke and Lindley (2008b) and Kivikangas (2006) combined with psychometric instruments.

It was not the intention in this study to use such data collection, as the primary focus was to identify the relationships between game content and interaction, and the type of technology used using two different gaming consoles. The main purpose of this study was to establish that two distinctive gaming platforms differed in engagement by participants. As reported earlier, the response was significantly different between gaming platforms, with more favourable outcomes for the Wii than for the PS-2. The hypothesis of this study that the Wii platform is easier to interact with than the PS-2 during play was therefore confirmed.

The experiment demonstrated that the Wii is easier for older players to interact with than the PS-2, due to the technology of the game pad or in this case the remote. Game content on both consoles was very different, and playing the PS-2 was more frantic and technically focused, especially on the golf game, unlike the Wii which was more intuitive and less technically minded, and players did not have to focus primarily on which club to use as this was automatically done during the game. The results imply the effect of game content does, and has had, an effect of game playing on the older adults who participated in this investigation. Whether content is more important to participants can only be measured by assessing the results collected from the observations (see Section 6.7, qualitative results). The most frequent positive experiences with the highest frequencies were from participants playing games on the Wii. Two participants remarked the game view during the *boxing* game was not clear, and during play it was hard to make out exactly what the player was supposed to be hitting, due to the visual perspective. Given the results, it can be concluded that the effect of game content does have a significant impact upon game play and flow.

6.10 Conclusions

This chapter has discussed the wide variety of results, qualitative and quantitative, recorded from the experiment. The quantitative results have shown interaction on the Nintendo Wii to be more positive than the PS-2. The qualitative results recorded through observation during the experiments, also highlight the facets of interaction and content on the Wii, from participants showing positive responses. The three games used in the experiment elicited in participants emotions of laughter/smiling with a high frequency, a majority indicating participant play was fun and enjoyable. Aural feedback for personal performance and game performance were frequent, positive experiences, for both golf and boxing. Feedback relating to the game itself was a positive experience all three games. For all three games, many participants reported concentration throughout game play.

The overall results for both, qualitative and quantitative aspects of the experiments, involving interaction, content and the measure of *flow,* show that playing on the Wii is a more positive experience than playing on the PS-2. The qualitative results indicate interaction, more than content to be significant, in the context of the sports genre from two out of the three games played on the Wii, these two games being golf and tennis. Although the qualitative results do indicate interaction to be more significant than content for the sports genre this can not be said for additional genres such as puzzle, adventure or strategy due to the fact that tests using these genres were not conducted.

Chapter Seven will discuss the relationship between Phase One the workshops and Phase Two the experiment reported in this thesis, bridging the effect of technology in the belief of game content and interaction collectively with the homogenous group – older adults, to ascertain a link between the two subject matters.

CHAPTER 7

GAME CONTENT, INTERACTION AND TECHNOLOGY

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7.0 – Overview

This chapter examines and discusses the relationship between Phase One and Two of this investigation and the connection associated with technology.

7.1 – Introduction

The objective of this chapter is to identify the connection between the two pieces of work, examining current technologies such as the DS, Wii and the Apple IPhone, the variety of games developed and the type of content and genres identified earlier, and establishing links.

Chapter Five reviews the first phase of this investigation ascertaining content, genre and the type of games older adults are, and would be, interested in playing. Outlining older adult's enjoyment of game playing from the sports genre, as outlined in Phase One. The decision to use three sports games from this genre to conduct Phase Two of the study as discussed in Chapter Six.

7.2 – What do We Know Already?

Phase One required participants to design a game idea in a step-by-step approach that they would want to play themselves. It was not the intention of the researcher to ask participants to play any games, as this may have defined knowledge and experience of current gaming technologies and mechanics. Little game jargon was used during the workshops so as to not confuse or prompt participants into misinterpreting what was required. The aim of Phase One was to ascertain the type of genre or genres older adults currently play or would like to play, based on their own game designs relating to a hobby, interest or dream. Through the methods of originality, analysis and concepts there was the possibility of creating new sub-genres, devised through categorisation.

Chapter Five concluded that older adults have the capability to design a game concept that they themselves would want to play, incorporating game features found in games such as imbalances, verbs and communication. Tables IX.12 and IX.13 in Appendix IX outline the game ideas categorised into genres from the workshops. Overall there were two genres with a frequency of 3, these were adventure and other. Game ideas from non-gamers were categorised as adventure, with a frequency of 6 being the most frequent, serious strategy and action shortly followed with a frequency of 3. Sport and other both had a frequency of 2 from non-gamers and gamers alike. The same tables also identify combined game genres. The results for gamers were limited, except from the identification of other with a frequency of 3; non–gamers were more successful with the classification of adventure/education with a frequency of 6, adventure/sport, educational, strategic/simulation/education and other, all with frequencies of 2.

Conclusions of Phase One showed game designs, created by non-gamers, appear more creative than gamers. Crawford (1982), Newman (2005) and Fencott (2007) highlight that gamers identify themselves, within gaming communities, through the discussion of genres, hints and tips to aid game playing with fellow gamers. The ideas created by gamers in Phase One were positive, but their knowledge of computer games may have influenced their designs more so than that of non-gamers.

Phase Two of the investigation, discussed in Chapter Six, combines interaction and content through an experiment examining the effect of both factors on older adults experience and behaviours in game playing. In Phase Two, participants played three types of games from the sports genre on one of two consoles, the Wii and the PS-2.

The observation results, as outlined in Chapter Six, show a multitude of emotions, game aspects, cognitive and other miscellaneous observations. Re-occurring positive emotions were observed for both sets of games and consoles, these were laughter/smiling, relaxation, concentration, paying attention and movement featuring highly during play.

The greatest frequencies of participants being observed were playing games on the Wii console, suggesting participants enjoyed the interactivity of game play on the Wii more so than the PS-2. After taking part in the experiment on the Wii some participants were inquisitive, asking questions such as "where do you buy one from?" and "how much do does it cost?" During these conversations the researcher gave participants the relevant information regarding the console and the overall impression was positive, playing on a console for forty-five minutes, some of the participants could see the ease of use and benefits of playing with such a console, either with family members or on their own for physical/mental exercise.

The results displayed a significant difference in flow between the two consoles, indicating the Wii to be more immersive and intuitive for participants. The relationship between content and platform also identifies a significant effect for interaction, but no effect on the sport genre. During the experiments, participants were observed during play under four categories, as discussed in Chapter Six, section 6.7 – qualitative results.

The observations which were recorded by the researcher, and higher frequencies were identified for the Wii than the PS-2, indicating that participants overall response to console interaction and game content was intuitive. There was one positive point to game content involving the visual perspective of the boxing game on the Wii. Two participants stated they found it difficult to see where they were supposed to be punching during play, as the visual perspective was not clear. Having positive results from Phase Two, combined with positive results from Phase One, identifying originality of game concepts, purpose and potential educational value suggests there is a relationship between game content and interaction for the older adult.

The identification of relationships between older adults and gaming could potentially aid the games industry with a niche market for future development, as stated by IJsselsteijn *et al.,* (2008), suggesting the sixty-five plus demographic group are not catered for by the industry. Khoo and Cheok (2006) outline growth of the global population; 8% of the population in 1950 was aged sixty; fifty-five years later (2005) this has risen to 10% and projected forecast for the next forty-five years see the growth to 22% by 2050 (World Population Prospects, 2005).

Growth on a global scale potentially provides a niche in the market for the games industry, to design and develop for wider audiences, such as Baby Boomers. Encompassing the factors outlined in Chapters Two and Four, physical performance, well being, mental stimulation, intergenerational relationships and social interaction. This, more than ever with the evolution of the Internet, enables individuals to communicate easier than before, although as Charness *et al.,* (1992) identifies, there is little evidence to distinguish the lack of technology take-up by older adults

(Mancini & Orthner, 1982, Goldstein *et al.*, 1997, Melenhorst, 2002, de Kort *et al.,* 2005, Khoo & Cheok, 2006, Fozard & Kearns, 2006, IJsselsteijn *et al.*, 2008, Gajadhar *et al.*, 2008, Gamberini *et al.*, 2008, de Kort & IJsselsteijn, 2008).

White, Connell, Clipp *et al.,* (1999) highlighted many older adults use PCs for personal and recreational activities. The authors suggest their investigation should be taken seriously as it could hinder upon design aspects and programs for the use of older adults.

As many in the field of gerontology, technology and education have stipulated, using and learning new technologies, such as the Internet or computer games, can be time-consuming for anybody, this is especially true for older adults who, with age against them, may start to experience difficulties with age-related circumstances, for example, slower reactions and mental processing. Being able to observe and learn at their own pace and perceive the purpose of learning a new skill or knowledge, can add great benefits to individuals. Motivation is an aspect important to adults who are going to spend time in learning new skills, but in the long term their adoption of new technologies into their lives will bring added benefits, such as enjoyment, as well as communication and social interaction (Mancini & Orthner, 1982, Malone, 1980, White *et al.*, 1999, Melenhorst, 2002, Khoo & Cheok, 2006, Fozard & Kearns, 2006, de Kort *et al.,* 2005, de Kort, 2007, de Kort & IJsselsteijn, 2008, Gajadhar *et al.*, 2008, Gamberini *et al.*, 2008).

7.3 – Correlations between Phase One and Phase Two

As outlined previously in this chapter, the main point is to identify links from this work and to highlight the possibilities of future game design principles in respect to the older audience.

The first identifiable connection and fundamental between the two phases is from the survey conducted with participants during both phases. The participants were required to answer the following question "would you consider playing a computer game related to your hobby?" Tables 7.3.34 and 7.3.35 display results from both Phase One and Two, and as previously stated, participants from Phase One were not required to use any gaming hardware, and gaming jargon was limited. The sole objectives of Phase One involved participants designing a computer game concept individually, relating to a hobby, interest or dream. Participants in Phase Two were required to interact with one of two consoles, playing three games from the sports genre. Table 7.3.34 displays the results from both phases.

Table 7.3.34 – Willingness to play a computer game relating to a hobby

Would you consider playing a computer game related to your hobby?				
	Yes	**No**	**Don't Know**	**Total**
Phase 1	8(33)	6(25)	8(33)	22
Phase 2				
PS-2	12 (36)	17 (52)	4 (12)	33
Wii	18 (51)	13 (37)	4(11)	35
Total	**30**	**30**	**8**	**68**

The second identifiable correlation between the two phases is recognised from participants' answers to the question "Would you consider playing a computer game?" The results for playing a computer game relating to a hobby were more positive than from participants who had played on the Wii, suggesting this mode of interaction maybe a reason for the positive response. The results were not confirmed between the two consoles in Phase Two, a chi-square test of independence was not significant χ^2 (1, *N=68) = 1.95, P = .16.*

Table 7.3.35 displays the results from participants willing to play computer games from both phases.

Table 7.3.35 – Willingness to play a computer game

Would you consider playing a computer game?				
	Yes	**No**	**Don't Know**	**Total**
Phase 1	14(58)	10(42)	0	24
Phase 2				
PS-2	19(24)	11(33)	3(3)	33
Wii	30(25)	5(8)	0(2)	35
Total	**49**	**16**	**3**	**68**

Table 7.3.35 displays a substantial response from participants who had played on the Wii. The positive responses from both phases suggest those participants who had no contact with hardware or software were still enthused at the notion of playing computer games relating to a hobby, and would consider this form of interactive entertainment. The results confirmed between the two consoles in Phase Two by a chi-square test of independence was significant χ^2 (1, N=68) = 4.36, p = .037.

Table 7.3.36 displays results from participants who answered the question "which types of game would you consider playing?"

Table 7.3.36 – Type of genre considered

	Type of Game Genre Considered						
	Shooter	**Platform**	**Sports**	**Adventure**	**Strategy**	**Puzzle**	**Total**
Phase 1	2(8)	0	6(25)	4(17)	7((29)	10(42)	**29**
Phase 2							
Console							
PS-2	4(12)	4(12)	9(27)	5(15)	5(15)	10(30)	**37**
Wii	5(14)	4(11)	12(34)	5(14)	7(20)	14(40)	**47**
Total	**9**	**8**	**21**	**10**	**12**	**24**	**84**

The results in Table 7.3.36 illustrate results from participants in Phase One and Phase Two, the second set of participants that had interacted with the two consoles. The results for the second set of participants suggest, having the opportunity of game playing on the Wii, that the types of genres considered and deemed significantly popular are puzzle and sports. Puzzle also deemed a positive response from participants in Phase One.

Further identification of connection is displayed in Tables 7.3.37 and 7.3.38. This connection relates to participant ownership and type of console owned. The two questions asked to participants in both phases were, if they “owned a console?” and if so “what type of console?” Tables 7.3.37 and 7.3.38 display the results of ownership from both Phases One and Two.

Table 7.3.37 – Console ownership

	Do own a console?		
	Yes	**No**	**Total**
Phase 1	11	20	**21**
Phase 2			
PS-2	11	22	**33**
Wii	7	28	**35**
Total	**18**	**50**	**68**

Table 7.3.38 – Type of console owned

	What type of console do you own?								
	PS1	**PS-2**	**Game cube**	**Wii**	**Xbox**	**Xbox 360**	**DS**	**Other**	**Total**
Phase 1	3(13)	2(8)	2(8)	0	1(4)	0	0	3(13)	**8**
Phase 2									
PS-2	2(6)	6(18)	0	5(15)	3(9)	4(12)	1(3)	0	**21**
Wii	2(6)	3(9)	1(3)	3(4)	1(3)	2(6)	0	2(6)	**14**
Total	**4**	**9**	**1**	**8**	**5**	**5**	**1**	**1**	**34**

The results in Table 7.3.37 display similar results of console ownership by participants from both phases. These results are similar to those of Phase One. The results in Table 7.3.38 display higher frequencies relating to type of console owned. The results show a high positive response from participants owning a PS-2 and a Wii, both of which were lower or non-existent in Phase One participants.

In addition to console ownership further connections were recognised showing the frequency of game play by participants. Table 7.3.39a displays results for the length of time participants had been playing games and how often they played games. The numbers used to calculate the chi-sq test were the total number of participants who had played or not played computer games (15, 9, 30 and 38).

Table 7.3.39a –Frequency of computer game play

	How long have you played computer games?							
	<1 year	**<6 mths**	**<3mths**	**<2 mths**	**<1 mth**	**Played**	**Not Played**	**Total**
Phase 1	9(42)	1(4)	1(4)	1(4)	3(29)	**15**	**9(38)**	**24**
Phase 2								
PS-2	14(11)	0(0.5)	1(1)	0(1)	0(2)		18(18)	**33**
Wii	8(11)	1(0.5)	1(1)	2(1)	3(2)		20(20)	**35**
Total	**22**	**1**	**2**	**2**	**3**	**30**	**38**	**68**

[a] 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.74

The results were not confirmed between the two consoles in Phase Two, a chi-sq test of independence was not significant χ^2 (1, $N=68) = 2.39^a$, $p = .12$. The trend of the result, although not significant, is heading in an expected direction. Table 7.3.39b displays results for the frequency of time participants had been playing games and how often they played games. The numbers used to calculate the chi-sq test were the total number of participants who had played or not played computer games (15, 9, 29 and 39).

Table 7.3.39b – Frequency of computer game play

	How frequently do you play computer games?							
	<1mth	*>1mth*	*<1 Per wk*	*<Once a day*	*> once a day*	*Played*	*Never/Do not play*	*Total*
Phase 1		7(29)	5(21)	2(8)	1(4)	**15**	**9(38)**	**24**
Phase 2								
PS-2	1(1)	2(3)	8(7)	3(2)	1(2)		18(17)	**33**
Wii	1(1)	4(3)	6(7)	1(2)	2(2)		21(23)	**35**
Total	**2**	**6**	**14**	**4**	**3**	**29**	**39**	**68**

[a] 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.48

The results were not confirmed between the two consoles in Phase Two, a chi-sq test of independence was not significant χ^2 (1, N=68) = 2.80^a, p = .094. The trend of the result, although not significant, is heading in an expected direction.

There are slightly more participants from Phase Two who had been playing computer games for a longer period of time than those of Phase One. There is also a small increase of participants who play games, often from Phase Two in comparison to Phase One. This small increase could be due to a three year period between Phase One (2005) experiments and Phase Two (2008) being conducted. The three year gap may have enabled individuals to take-up technology more so than previously recorded due to developments within the market.

Illustrating the connections between the two phases, the survey included the question "Where have you bought computer games from?" Table 7.3.40 displays the results from both phases, illustrating where the participants had bought computer games. The numbers used to calculate the chi-sq test were the total number of participants who had purchased, or not purchased, computer games (20, 4, 33 and 35).

Table 7.3.40 – Place of purchasing computer games

Where did you buy computer games from?								
	Super Market	**High Street**	**Computer Shop**	**Rental**	**Other**	**participant purchased**	**participant not purchased**	**Total**
Phase 1	2(8)	0	2(8)	0	0	**20**	**4**	**24**
Phase 2								
PS-2	3(9)	5(15)	6(19)	1(3)	4(12)		**19**	
Wii	2(6)	1(3)	7(20)	2(6)	4(11)		**16**	
Total	**5**	**6**	**13**	**3**	**8**	**33**	**35**	**68**

[a] 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.17

The results confirmed, between the two consoles in Phase Two by a chi-sq test of independence, were significant χ^2 *(1, N=68) = 8.80*[a], *p = .003.*

Table 7.3.40 shows participants in Phase Two, have bought computer games from a variety of places within the market in comparison to participants in Phase One. The percentages between the two phases suggests, with the recent advertisement of computer games for the DS and the Wii, older adults have more confidence when purchasing or playing computer games, more so than previously seen. The increase in recent years of consoles on the market, may have aided further awareness to Baby Boomers into experiencing new technologies, either through purchasing consoles themselves or through usage of grand-children and children's ownership.

Qualitative data

Building upon the qualitative information collected from participants during Phase One and Two of the investigation. The method of collating this information was in the form of mapping, presented in Figures 133, 134 and 135 (Appendix XIV). Information was taken from participant transcripts collected in Phase One. This information was taken from two sections completed by participants during their game design workshop these were, “communication, view and pleasure”. Under the three headings keywords were identified from the participant’s comments from their computer game ideas. Examples of keywords outlined by participants under the communications table were “touch screen, own responsibility, keyboard, mouse, oral/speech, sound, voice activation, simplicity and variety”. Keywords outlined under the view were “realistic, pictures, 1^{st}, 3^{rd} person, reality, birds-eye, historic/learning environment and role perspective” and keywords outlined under pleasure were “enjoyment, fun, goal, challenge, learning, frustration, anger and less violence” (Figures 129, 130 and 131 Appendix XIV). The same process was taken for participants who had been involved in Phase Two playing the Wii. Keywords were recorded from the observations conducted, for example “experimented, relaxed, smiling, conducting actions as expected, enjoyment, confident, technical thinking, comfortable and improvement” (Figure132 Appendix XIV).

The next process was to identify the connection between the three pieces of keywords connecting older adults, interaction and genre together. After much deliberation, the conclusion of the connection was “technology”. Further mapping was conducted using “older adults, interaction, genre, technology and design guidelines” as titles to identify requirements to outline the prospective design guidelines, this is displayed in

Figure 7.3.19. Figures 133, 134 and 135 in Appendix XIV illustrate the step-by-step approach of the mapping process. Each map outlines the involvement and the technology used, including keywords specifically identified by the participants. As part of the mapping process the identification of "What is a computer genre" and "What is computer game interaction" was carried out, bringing together information obtained from Church (1999), Murray (1997), Crawford (1997), Herman (2001), Rollings and Adams (2003), Newman (2005), de Kort *et al.*, (2005), Apperley (2006), and keywords recorded by participants to outline these two areas.

Figure 7.3.20 illustrates the final map, encompassing information and keywords specified by participants during Phase One and Two of this investigation. The three areas of the map are older adults, technology and content/interaction. This map was the basis in outlining the prospective design guidelines shown in Table 7.6.44 of this chapter.

OLDER ADULTS

OWN RESPONSIBILITY:
- Choice of interaction to use in game
- Choice of viewing – perspective for the game

ROLE PERSPECTIVE:
- Actions to do in game
- Perspective of game
- Add/delete content
- Choice to do…

PURPOSE:
- Using the game
- Learning
- Fun/enjoyment
- Social interaction
- Achievement
- Build confidence
- Experimentation
- Improvement
- Experience positive emotions
- Simplicity

TECHNICAL THINKING:
- How the interaction is working during game play
- Characters react during game play
- Additional information on screen to aid playing

TECHNOLOGY

IPOD/IPHONE
- Intuitive interaction
- User quickness/silliness/fun
- Applications store/user centred/created
- Variety of applications
- On the go/ accessibility
- Original games featured - Tetris

Wii
- Intuitive interaction
- Downloadable content
- Multiplayer capabilities
- Online capabilities
- Varity of games (retro & role perspective)

DS/DSi
- Intuitive interaction
- Quickness/fun
- Variety of applications
- On the go/ accessibility
- Original games featured – Tetris
- User-created content
- Multiplayer capabilities
- Online capabilities
- Download/upload content

CONTENT/ INTERACTION

Genre
- Certain constants
- Obstacles/challenges throughout, to overcome
- Single-or multiplayer
- Variety of hardware
- Variety of content depending upon game genre
- Sound
- Become more realistic in recent years

Interaction
- Choice of interaction mode
- Intuitive
- Physical movements – body
- Hand/eye coordination
- Quick reaction
- Complicated
- Simplistic
- Internet – online gaming, downloading

Figure 7.3.20 – Map of Phase One and Two combined

Comparing the qualitative and empirical results as shown in Table 7.3.35 identifies a significant response to participants considering playing computer games, Table 7.3.34 shows an insignificant response to playing a computer game related to a hobby, suggesting interaction to be more important in game playing (as discussed in Chapter 6.10, conclusions) than content.

The qualitative data and results, shown in Tables 7.3.35 and 7.3.36, further emphasise the importance of interaction and computer game content for the second/third-age, using technologies such as game consoles. Developing content which is easily understandable to a particular audience, and the implementation of daily life interaction, builds upon individual enjoyment, confidence and the experience of immersion, as discussed in Chapter Six and illustrated in Figure 7.3.20.

The chi-sq tests, conducted for Tables 7.3.39a and 7.3.39b, show the frequency of participants playing computer games displays an in-significant response, although the trend is in the direction, as expected, due to the percentages being close together. Purchasing of computer games, shown in Table 7.3.40, has significant results with a fifty percent split and indicating an expected trend. Suggesting second/third-age adults are, in more recent years, becoming more interested and involved in computer games than previous years.

7.4 – Current Trends in the Computer Game Market

The release of consoles, such as the DS and the Wii, has widened the gaming demographic group, encompassing the baby boomer audience, adding to the casual gaming audience. Formerly discussed in this thesis, the game *Dr Kawashima's Brain*

Training released alongside the DS. The emphasis of the game, suggests aiding mental stimulation coupled with the easy interaction of the DS gave way to the success of this console. Marston (2007) emphasises this notion of using technologies, such as computer games, and more so in relation to the DS when conducting earlier work relating to this investigation. Marston (2007) furthermore suggests the design of games, specific to older adults, can give benefits to an ageing population, prolonging memory loss through learning new technologies and through game playing.

The ESA released the 2008 annual report detailing gaming statistics for the previous year. In Chapter Four the discussion relates to the analysis of the video and computer game statistics, predominately related to genres, which have been recorded since 2004 by ESA. The statistics illustrate the highs and lows of the industry and of gaming preferences throughout the years. An increase of the fifty plus gamers, since 2004, has been approximately two percent each year. Due to the publication of data by ESA (March/April 2009) the results in Figure 7.4.21, may not show the full impact of the Wii and additional gaming consoles until several years after the release in 2006. This steady increase of older gamers is displayed in Figure 7.4.21

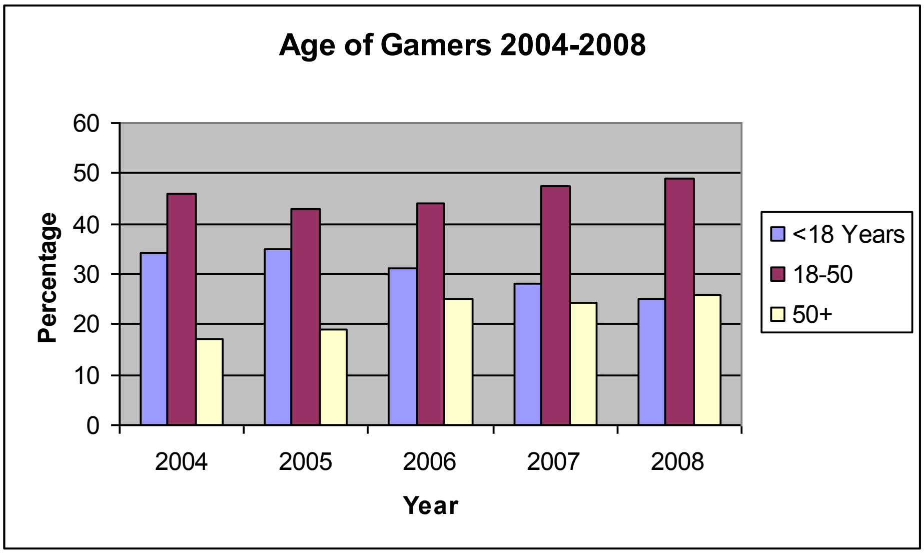

Figure 7.4.21 – Age of game players in the USA

Figures 7.4.22 and 7.4.23 shows evidence of game genres been documented since 2004, illustrating growth within a number of genres in both video and computer games market. In some cases new genres have been introduced at the risk of others increasing or decreasing in percentage. One of the main genres to have increased in growth is the *family entertainment* genre. It is possible the indicative growth within this genre is due to the release of the DS and the Wii. The method of interaction on both consoles has enabled non-traditional gamers and casual audiences to embrace this new form of gaming or interactive entertainment. The development of games for the DS and Wii have cultivated genres to include innovative games, such as the Wii Fit, encompassing additional hardware for the user to interact with what is being classified as *self-improvement* genre/games.

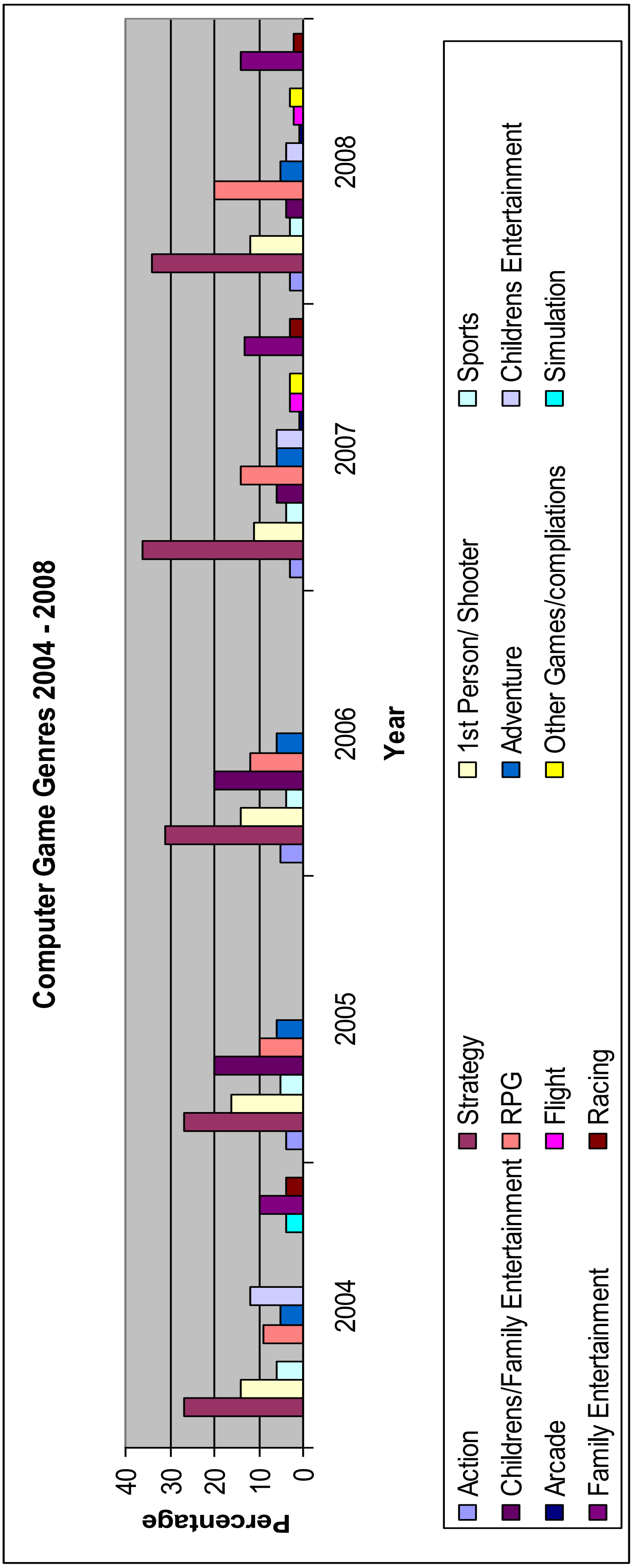

Figure 7.4.22 – Computer game genres 2004-2008 (Source ESA)

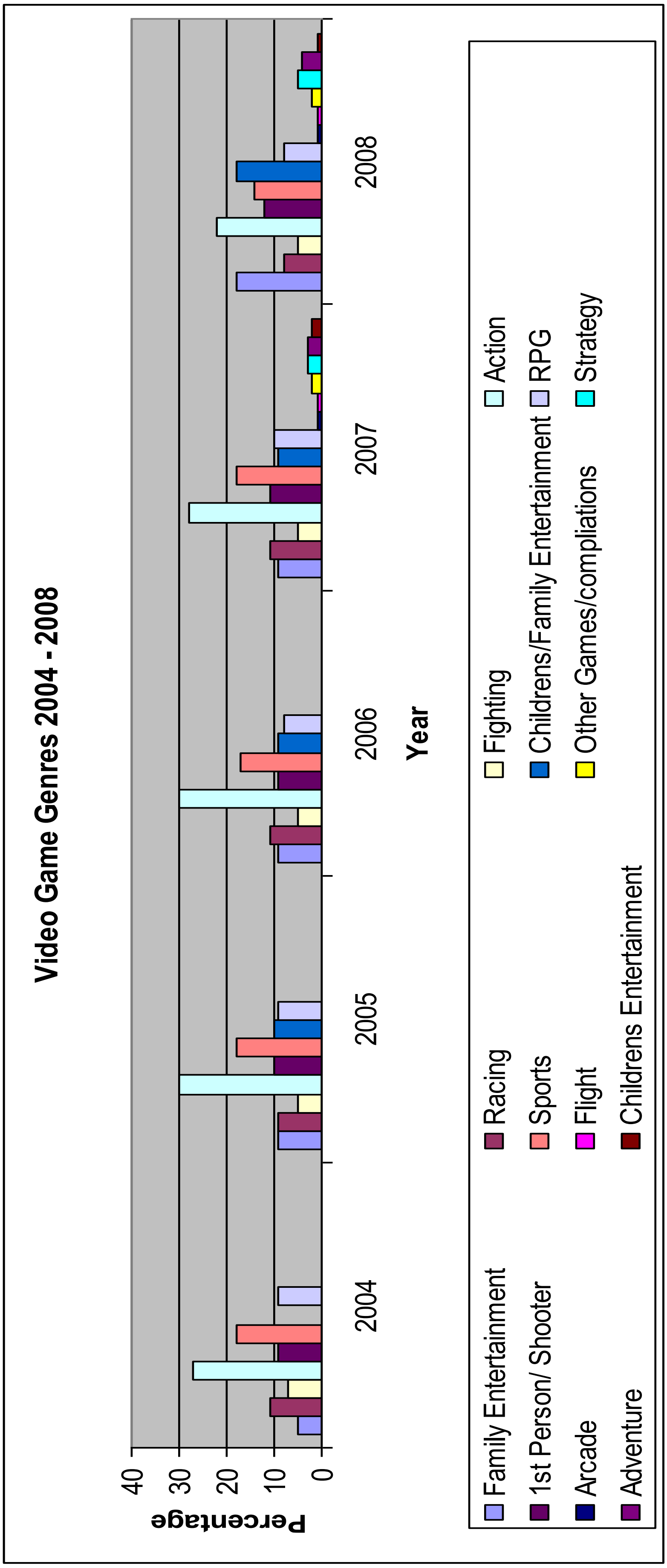

Figure 7.4.23 – Video game genres 2004-2008 (Source ESA)

Further examination of industry gaming magazine MCV, indicates computer-gaming charts for both the DS and the Wii comprise of similar games and genres, as stipulated by participants who have taken part in this investigation, once more adding extra validity to this investigation. Table 7.4.41 and 7.4.42 displays the computer game charts for the DS and Wii.

The top ten games, as shown in Table 7.4.41, are primarily based around the puzzle genre, for example *Professor Layton: Curious Village*, *Brain Training* and *Mario*. It is suggested the success of these games is due to the means of interaction, by which the gamer or user interacts with the game(s) and the concept of the game. These being simple and relative, and at times using concepts which previously have been mapped by the individual, they have the ability to recall the relevant information, enabling pleasure through learning, or enjoyment.

Table 7.4.41 – DS computer game chart

MCV Article Number	**Chart Number**		**Game Title**
	Current Week	Previous Week	
03 April 2009	1	1	Professor Layton:Curious Village
	2	2	GTA:Chinatown Wars
	3	3	Dr Kawashima's Brain Training
	4	4	Club Penguin: Elite Penguin Force
	5	5	Scrabble Interactive: 2009 Edition
	6	6	Mystery Case Files: MillionHeir
	7	9	Mario Kart DS
	8	11	New Super Mario Bros
	9	14	Mario & Sonic at the Olympic Games
	10	10	Big Brain Academy
10 April 2009	1	1	Professor Layton:Curious Village
	2	2	GTA:Chinatown Wars
	3	3	Dr Kawashima's Brain Training
	4	4	Club Penguin: Elite Penguin Force
	5	5	Scrabble Interactive: 2009 Edition
	6	7	Mario Kart DS
	7	8	New Super Mario Bros
	8	9	Mario & Sonic at the Olympic Games
	9	10	Big Brain Academy
	10	11	More Brain Training
17 April 2009	1	1	Professor Layton:Curious Village
	2	3	Dr Kawashima's Brain Training
	3	4	Club Penguin: Elite Penguin Force

4	2	GTA:Chinatown Wars
5	7	New Super Mario Bros
6	6	Mario Kart DS
7	8	Mario & Sonic at the Olympic Games
8	11	Mystery Case Files: MillionHeir
9	5	Scrabble Interactive: 2009 Edition
10	10	More Brain Training

The games displayed in Table 7.4.41 are very similar to that of Table 7.4.42. Consecutively, for three weeks, the *Wii Fit* has been in first position in the charts. Since the release of the *Wii Fit* in Spring 2008, there has been strong take-up of the product. This and other similar types of games, such as *My Fitness Coach, Mind your Language* and most popular of this genre *Brain Training,* have been classified in the genre of *self-improvement*. With the success of *Wii Fit* and the creation of new genres, such as *self-improvement,* the gaming demographic group is widening to include demographics, such as casual, female and family. With the recent success of the console market encompassing wider more enticing games, involving intuitive interaction and content, the future of gaming is set to include a wider demographic base such as Baby Boomers. Dring (2009b,c) discusses the future of Microsoft and Sony entering the *self-improvement* genre, stating, although technology is currently available changes within the industry are necessary to entice and include a wider gaming audience, such as Baby Boomers, women, and casual gamers, enabling interaction with games designed for genres such as *education* and *self-improvement*. Consoles, such as the Xbox, Xbox-360, PS-2 and PS-3, are not perceived as consoles for such audiences, where as the Wii and the DS are because the intuitive interaction and game content are more amenable to a wider audience.

Table 7.4.42 – Wii computer game chart

MCV Article Number	Chart Number		Game Title
	Current Week	Previous Week	
03 April 2009	1	1	Wii Fit
	2	4	Mario Kart Wii
	3	5	Mario & Sonic at the Olympic Games
	4	2	Sonic and the Black Knight
	5	3	Mario Power Tennis
	6	7	The House of the Dead: Overkill
	7	21	Rayman Raving Rabbids TV Party
	8	6	Madworld
	9	New	Pro Evolution Soccer 2009
	10	8	Family Ski & Snowboard
10 April 2009	1	1	Wii Fit
	2	2	Mario Kart Wii
	3	3	Mario & Sonic at the Olympic Games
	4	4	Sonic and the Black Knight
	5	7	Rayman Raving Rabbids TV Party
	6	8	Madworld
	7	6	House of the Dead: Overkill
	8	11	Guitar Heor: World Tour
	9	5	Mario Power Tennis
	10	9	Pro Evolution Soccer 2009
17 April 2009	1	1	Wii Fit
	2	3	Mario & Sonic at the Olympic Games
	3	2	Mario Kart Wii
	4	5	Rayman Raving Rabbids TV Party
	5	4	Sonic and the Black Knight
	6	8	Guitar hero: World Tour
	7	11	Ben 10:Alien Force
	8	7	House of the Dead: Overkill
	9	6	Madworld
	10	12	Animal Crossing: Let's Go to theCity

Dring (2009b,c) implies the future of *self-improvement* games, such as the *Wii Fit* and *Brain Training,* will develop within the gaming sector, to include wider audiences through branding. Following similar successful games as *Cooking with Mama,* audiences will be able to purchase *"What's Cooking with Jamie Oliver"*. Implementing *self-improvement* games with established brands, could transform computer gaming into a different format from what is currently experienced.

Celebrity-endorsed products are not a new phenomenon, as discussed in Chapter Four. Recently there has been another celebrity-endorsed advertisement by the singer, Ronan Keating and his family. The advertisement shows his wife helping their daughter to learn mathematics by playing the game *Professor Kagyama's Maths Training*. The advertisement presents the singer cleaning the kitchen, and his wife and daughter using the DS to aid the daughter's maths skills. The next clip exhibits the mother playing Super Mario Bros with the help of her daughter. Video clips of the advertisement are shown in Figures 7.4.24, 25, 26, 27 and 28.

Figure 7.4.24 – Family in kitchen

Figure 7.4.25 – Mother helping daughter with her maths skills

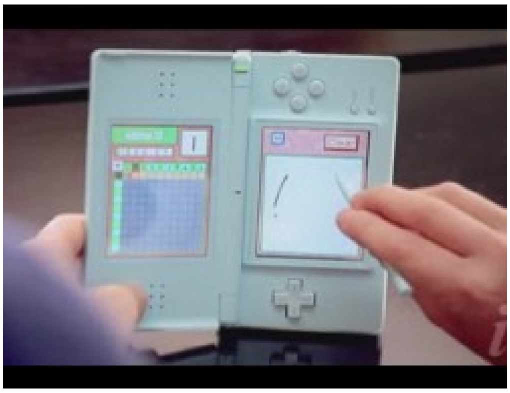

Figure 7.4.26 – Screen shots of Professor Kagyama's Maths Training

Figure 7.4.27 – Screen shots of Mario Bros

Figure 7.4.28 – Daughter helping her mother play Mario Bros on the DS
(http://www.visit4info.com/advert/Nintendo-DS-Maths-Training-and-Super-Mario-Bros-Nintendo-DS/66955)

Demonstrating the use of the DS in this advertisement shows the DS is primarily for one demographic group and genre, but can be used as an inter-generational tool, being an interactive entertainment package through a social context. This particular advertisement indicates educational games do not have to be dull and boring, but learning through game playing can be fun, sociable and a positive means of passing time.

March 2009, The Game Based Learning Conference was held. A number of speakers from the games industry included, Nolan Bushnell the founder of Atari and "father of the video game industry" (http://www.gamebasedlearning2009.com/home), Ian Livingstone of Skillset, Commissioning Editor for Education on Channel 4, Alice Taylor, and the UK Cabinet Office minister and MP for Transformational Government, Tom Watson. The aims and objectives of the conference were to identify practical examples of games and entertainment software being used in educational institutions, from schools to higher education, examining the current market trends and behaviours, including the debate of the classification system of computer games and the Internet within the context of learning and teaching[65].

Graham Brown-Martin the Conference Director was cited in the latest addition of MCV stating;

> "having this dedicated event about video games, social media and learning means that the conference is entirely focused on this rapidly growing phenomenon" (Dring, 2009a).

A conference such as Game Based Learning and celebrity-endorsed advertisements show that gaming/interactive entertainment is not just for children and young adults but for everyone, suggesting games can be a form of family entertainment, enhancing learning and well-being. As previously addressed, computer games developed for technologies such as the DS and the Wii, have exposed supplementary demographic audiences to this medium and in the future it is likely to increase more so with an ageing population. To reiterate the benefits of game playing within an education classroom or context, Brown-Martin added "the games that people are using as part of their everyday enjoyment are far from dumbing them down. They can enhance the educational experience" (Dring, 2009a), encouraging motivation to learners or individuals, such as older adults through interaction (IJsselsteijn *et al.*, 2006, 2007b). Lazzaro, (2004) gives additional reasons why people play games, for example conquering obstacles and achievement of goals, and enjoyment of game playing either console or online. Lazzaro (2004) states gamers will play games they do not like just to spend time with their friends.

[65] http://www.gamebasedlearning2009.com/home

Crawford (1982) discusses the nature of culture within games and game playing associated with children, as 'child's play'. It is expected of children to play games as a tool for education, but as Crawford expresses "children grow up, cultural pressures change and they are encouraged to devote less time to playing of games so that they can devote themselves to more serious activities" (1982). Crawford (1982) suggests the fundamental aspect to game playing is learning. Lazzaro (2004) identifies why non-gamers do not play and gamers may no longer play. Some perceive gaming as a waste of time, gamers grow up and due to work and family commitments do not have the time to play, similar to that of Crawford (1982). Thus the idea of using games as a means of learning and using time productively to build and enhance skills.

Games, such as *Wii Fit, Brain Training* and *Cooking with Mama,* have become popular with wider audiences because new audiences want or require a different gaming experience (Dring, 2009a). The launch of the DSi in Spring 2009 has brought gaming interaction to a different level and perspective for the gamer/user. The central features surrounding the DSi, as described in MCV (Dring, 2009c), incorporate several technologies, for example:-

- Motion detecting cameras
- Enhanced sound
- Game downloads
- In-built memory allowing for user customisation

Motion detection has previously been exposed to the market audience; as illustrated in earlier charts the release of the Wii console has proved to be a vast success since its release in 2006. The concept behind the DSi is to enable users to create and personally customise their DSi to exactly how they wish (Dring, 2009c). Additional features of the console include face recognition, allowing the user(s) to alter, add and morph photographs taken with the camera using the stylus. Game play through the DSi is able to "detect players' facial features and body movements, so action can be controlled by movement alone" (Dring, 2009c). This mode of game playing has formerly proved to be successful with wider audiences through using the Wii console.

One of the many genres that have become popular on consoles, such as the PS-2 in recent years, is *rhythm action*. Games in this genre have previously included *Guitar Hero*, *Rock Band* and *Dance Dance Revolution* encompassing a multitude of audiences. An extra addition to this genre is a game entitled *Rhythm Paradise,* aimed for release on the DSi. Gamers of previous rhythm actions games have used additional equipment, such as dance mats and guitars, following a sequence to a song via the television; thus button pressing and frets are required to correctly interact with the game. The method of interaction using the DSi, as Batchelor (2009a) explains, is far simpler than previously, users are required to "tap and slide the stylus along with the music" (Dring, 2009c) creating, for users, a more rhythmic mode of interactive entertainment rather than physically holding a controller, which is necessary when playing *Guitar Hero* (Dring, 2009c).

The *Rhythm Paradise* game is not just for non-traditional audiences but also entices casual and hardcore gamers, through the creation of challenges and the implementation of difficulty levels within the game, which are important facets within game playing, as outlined by Malone (1980, 1982), IJsselsteijn *et al.,* (2006, 2007a, 2007b), Gajadhar, de Kort, and IJsselsteijn, W.A, (2008), Chapman (2002), Melenhorst (2002), Gamberini, Alcaniz, and Barresi, G, (2008), Clarke and Duimering (2006). Implementing clear challenges, goals and objectives into game designs enables players to reach specific targets or achievement. In the environment of this particular game – *Rhythm Paradise,* completing each track through tapping and sliding to the beat will unlock additional games, giving the user a further sense of pleasure through achievement of completing a specific goal or task.

Gaming is changing rapidly and is on the cusp of many changes of the future for both technology and the computer games industry. To highlight further the changes from gaming to interactive entertainment, a game entitled *100 Classic Book Collection,* comprising a range of literature for the user to choose from, was released in 2008. The selection of literature is through a scrolling and tapping process of the stylus on the touch screen, enabling interaction from the user to the literature. Kollar (2008) outlines the nature of this medium adding that Nintendo promised the ability to download additions to the library, although the frequency of this has not been published. Figures 7.4.29, 30, 31, 32, 33 and 7.4.34 illustrate how the game looks and interacts with a user.

Figure 7.4.29 – The opening screens of the game 100 Classic Book Collection

Figure 7.4.30 – The options available to user on the 100 Classic Book Collection

Figure 7.4.31 – The literature installed on the 100 Classic Book Collection

Figure 7.4.32– Section of the literature - 100 Classic Book Collection

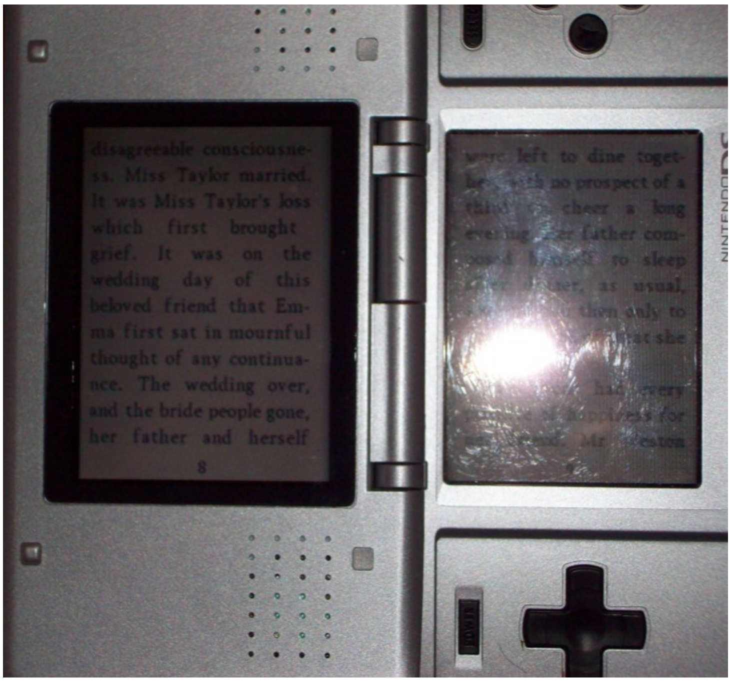

Figure 7.4.33 – Section of reading materials - 100 Classic Book Collection

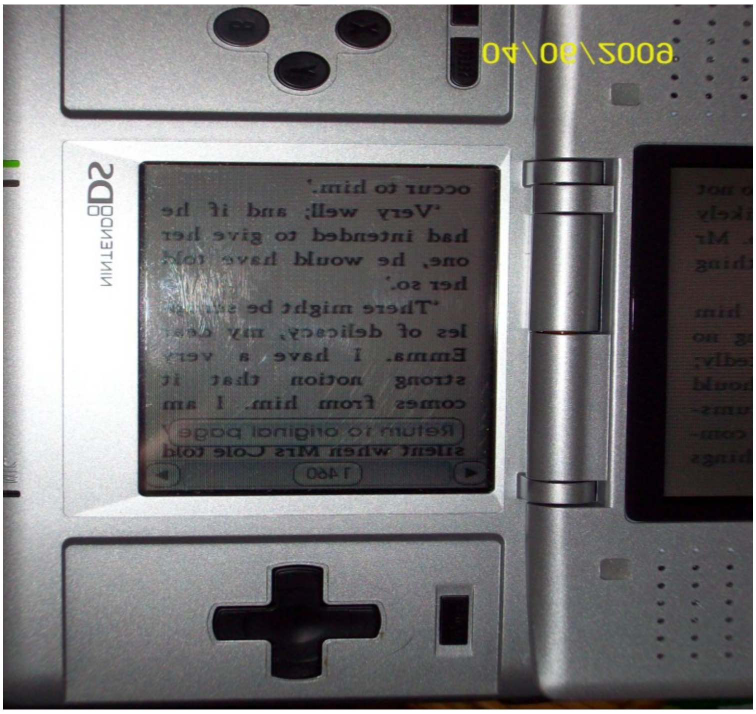

Figure 7.4.34 – Display reading of literature - 100 Classic Book Collection

Gaming and interactive entertainment is not only available on the Wii and the DS. Prior to the release of the DS/DSi and the IPhone, technologies such as Personal Digital Assistant (PDA) and Blackberries were, and still are, available on the market. PDAs and Blackberries are conceived as palm computers enabling the user to conduct a variety of processes while holding the device in the hand. Both devices are able to access E-mail, keyboards (implemented within the hardware), Short Message Service (SMS), web browsing and telephone communication. There have been many models of PDAs and Blackberries, and in recent editions have installed a stylus similar to that found on the DS/DSi, enabling easier interaction for the user. This mode of interaction, encompassing a "virtual keyboard" located on the screen, enables users to input data, construct emails and set appointments (calendar) through tapping the appropriate keys with the stylus (Hermida, 2004).[66]

[66] http://news.bbc.co.uk/go/pr/fr/-/1/hi/technology/3527233.stm

Many PDAs and Blackberries have built in software which enables users to play puzzle games such as Solitaire, Poker and Twenty-One. Users do have the ability to download games either purchasing from a PDA software website or free, for the game to work correctly the user is required to check the type of Operating System (OS) installed on the device, otherwise compatibility of the game and OS may be incorrect. The types of games which are able to be downloaded are traditional arcade games, as discussed in Chapter Three, such as *Pac-Man*. The price for downloading games to the device varies but it is approximately $35.[67]

In recent years, as technology advancements occur, developments such as the Apple IPhone have been created. The IPhone technology is the latest device of PDAs and Blackberries, implementing the "multi-touch" method of interaction allowing the user to conduct and control actions for communication means or graphics by using a finger or several fingers.

The *IPhone* is more than a mobile phone; through default and downloadable applications, starting from 99 pence, users are able to choose precisely what content/applications they wish to have, creating a similar experience to DSi users. Each product being bought and downloaded has been individually created to particular users' needs and requirements. The mode of interaction is very similar to the DSi using the notion of touch. Users of the *IPhone* simply touch and swipe the screen, to interact with the available functions and depending upon the application chosen. This mobile device is more than a mobile phone; for many it is now the main method of communication and a lifestyle decision, due to the availability of applications enhancing and giving valuable information depending upon individual circumstances, through downloaded applications to the hardware. This technology

[67] http://www.pdagamesoft.com/category.php?sort=n&os=5&cat=75&offset=30

has been recently transferred onto the *IPod touch;* the one characteristic where this differs from the *IPhone* is that it cannot be used to make telephone calls. Figure 7.4.35 displays the *IPhone* and *IPod* touch interface.

Figure 7.4.35 – Apple IPhone and IPod touch

Both the *IPhone* and the *IPod* have comparable displays to their users, the only difference is, users are unable to make telephone calls on the *IPod*. There are many downloadable applications available to the user for the *IPhone.* Some are fun and silly, others have a more useful attitude to everyday life, for example the London Tube Map, or suggesting restaurants within the location of the individual, if in a different town or city. Many of the applications, created for the *IPhone/IPod,* are being developed by users themselves. User-created content is slowly becoming one of the main features of the *IPhone* and the *DSi*. Figure 7.4.36 is a picture of the London Tube Map which has recently been created by a user, and uploaded, available for users to download for a price. Through the sliding of a finger on the screen a user can view the whole map.

Figure 7.4.36 – London Tube Map[68]

User-created and user-centred content is becoming a central part of technologies such as the *DSi* and the *IPhone*. Nintendo will be releasing new computer games or interactive entertainment during 2009 for the DSi and the Wii. To give some indication as to the type of user-created interactive entertainment Table 7.4.43 outlines some of the new releases;

Table 7.4.43 – Interactive entertainment for the DSi, new releases

Name	Genre	Description
Art Style: Picopict	Action/Puzzle	Use the stylus and touch screen to move colour pixels in order to construct pictures of classic Nintendo characters
Mixed Message	Not specified	A pass-along-and-play multiplayer game for two-21 players, this sees players taking turns writing sentences and drawing pictures - it's about what you can collectively create, rather than winning or losing.
Real Football 2009	Not specified	Featuring 198 teams and using real players' names, this lets you use the DSi's cameras to take pictures of anything you want anything you want and turn them into your own custom ball, team flag or upload your face to the face of your favourite footy star

(http://www.computerandvideogames.com/article.php?id=212756, accessed April 2009)

68 http://www.mobilemaplets.com/app

Many potential new releases and current applications for the *DSi, Wii* and *IPhone/IPod* touch are being created by users, for users, using user-centred content as identified by Figure 7.4.36. To illustrate the user-centred, user-created developments for the IPhone/IPod, one of the applications available to download is called "*Urbanspoon". This application, through Global Positioning Service (GPS) or Wi-Fi, locates your position and suggests random but prospective restaurants within the vicinity. If the user does not want to eat at the proposed restaurant the *IPhone* is shaken by hand gestures and a new option is found. There are many applications which are reflective to everyday living, ordering a taxi, house hunting and travel. Apple's website[69] demonstrates and explains the variety of applications which users can view and purchase.

Recent technology, devised by Microsoft called 'surface', has been utilised by the company Infusion Development. The product, developed by Infusion Development using surface technology, is called 'Falcon Eye'. A demonstration of *Falcon Eye* at the Active Age Summit (May, 2009)[70] presented the technology implemented using "natural hand gestures, touch and physical objects".[71] The demonstration illustrated the simplicity and ease of using intuitive technology, such as surface computing, to carry out simple actions, such as game playing, writing post cards and visiting the doctor. As stated by Microsoft:-

[69] http://www.apple.com/uk/iphone/
[70] http://www.activeage.org/
[71] http://www.microsoft.com/presspass/presskits/surfacecomputing/default.mspx

> "surface computing breaks down traditional barriers between people and technology, changing the way people interact with all kinds of everyday information — from photos to maps to menus"
> (http://www.microsoft.com/presspass/presskits/surfacecomputing/default.mspx, accessed May 2009).

Infusion Development has designed a variety of applications, implementing the technology to display the capabilities of the software to a wide consumer base. Infusion Development is able to specifically customise applications depending upon the consumer requirements. Interaction and selection of menus is very similar to the *IPhone* technology. Users slide across the main menu to choose an application, and through tapping the icon the application is selected. The following figures were obtained from a video recorded at the CeBIT Trade Fair (March, 2009).[72]

Figure 7.4.37 displays the main menu of *Falcon Eye*, illustrating through hand gestures an application can be selected.

Figure 7.4.37 – Falcon Eye, main menu

[72] http://on10.net/blogs/lorigros/CeBIT-09-Surface-App-Infusion/

Figure 7.4.38 is a health application, built to enable doctors and patients to share and demonstrate information to each other. This application uses object recognition (individual cards) to identify the doctor and patient.

Figure 7.4.38 – Health application

Figure 7.4.39 displays the initial screen after logging into the application. The blue circle represents the patient and the green the doctor. There are icons situated on both circles enabling either individual to select information

Figure 7.4.39 – Main menu
(health application)

Figures 7.4.40 shows the user tapping on an icon of the patient's card which can then check details, which are shown in additional screens, enabling the user to enlarge and view the contents.

Figure 4.7.40 – Selection of specific information from patient card

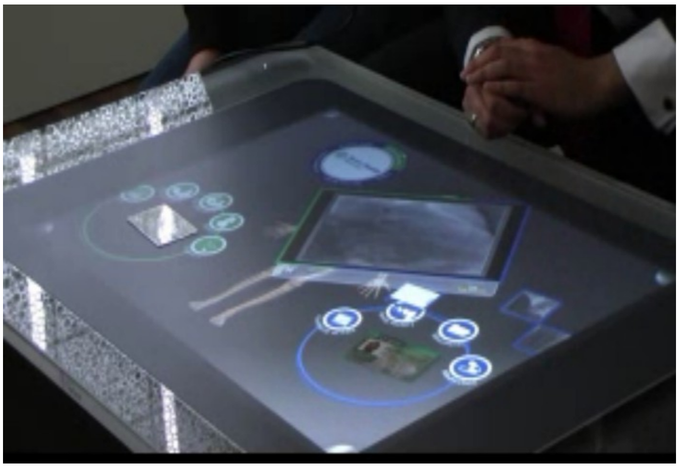

Figure 7.4.41 – Angiogram being shown to both patient and doctor

Figure 7.4.41 shows through selecting a specific piece of information (angiogram video) the patient and doctor are both able to view the angiogram. Through hand gestures it is possible to 'share' this with the patient by moving the document over to card. In Figure 7.4.42 the box shows the angiogram is highlighted both in green and blue. This indicates to both people that the information is being shared.

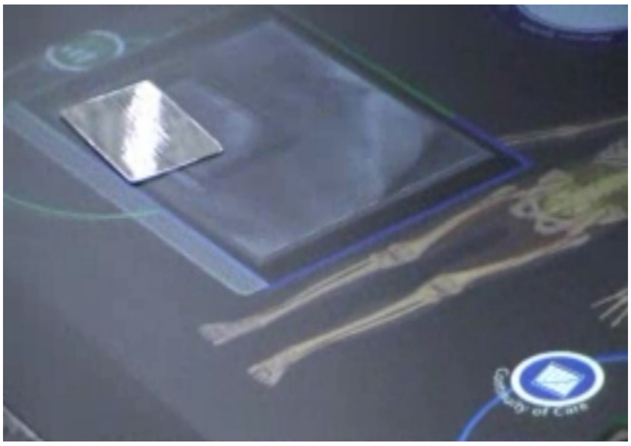

Figure 7.4.42 – Angiogram video situated at the doctors side, illustrating the individual card (object recognition)

Figure 7.4.43 and 7.4.44 demonstrates additional accessibility of patient information, in this case a graph, and with one tap of the document magnification of the document is visible. Using finger movement (outwards) it is possible to enlarge a specific section or a different section of the graph through movement over the document.

Figure 7.4.43 – illustrating additional patient information

Figure 7.4.44 displays the enlargement of a section of the graph[73]

Falcon Eye encompasses many applications for all users and ages. The demonstration at Active Age 2009, illustrated an application called ‘postcards’, which is located in the Emirates business lounge. The application enables users to choose a postcard, and colour the image from the colour pallet built into the application. Once completed, flipping the colour pallet over using hand gestures provides a function to write a message and email address. Sliding the envelope icon emails the postcard to the recipient.

Further demonstrations showed Falcon Eye can be used within an educational environment, and to educate individuals of nutritional advice. An application, using images of familiar objects such as fruit and vehicles, can be multiplayer and has already been tested in Wales, allows users to match similar images within the same subject through dragging the images using hand movements. Nutritional advice was demonstrated through the application called ‘build a pizza’. The user chooses the type of pizza to be built (deep pan, thin crust) and through decision making is able to choose the pizza toppings, which show nutritional value before adding to the pizza.

[73] http://on10.net/blogs/lorigros/CeBIT-09-Surface-App-Infusion/

Concluding the demonstration it was stated this technology and development has the capacity to be used on desktops and televisions, to take advantage of the market and the possible future markets, as technology develops the capabilities will increase. Through a private discussion with the demonstrator the question was posed "Where do Infusion Development and Microsoft envisage this technology", currently this technology is expensive for home users but it is a vision of the future and there is no reason not to implement into the home, for example, within a coffee table. This perception, for the future of this technology, is not un-realistic, and having Falcon Eye situated within a coffee table in the living room would be an ideal place, giving access to family and friends, and has the ability to build learning and enhance upon intergenerational relationships.

7.5 – What is the Future of Gaming and Interactive Entertainment?

Technologies such as the *Wii*, *DSi*, *IPhone* and *IPod touch* have developed due to the nature of technological advancements during the Twenty-First Century. As discussed in Section 7.3, interaction has become more intuitive for users through gaming consoles and communication hardware. Since the release of the *DS* and the *Wii*, communication technology, such as the *IPhone* and *IPod,* has been developed, and is expected to continue to develop for the foreseeable future. The use of motion detection, initially implemented in the Wii and now implemented into communication and music technologies, has facilitated wider audiences, through intuitive interaction and in addition, has opened the environment of gaming to embrace and build upon intergenerational relationships and enjoyment through game playing in a social context.

Game playing, has enabled adults to comprehend different aspects of game playing, unlike previous game pads found on consoles such as the PS-2 or the Xbox-360, which have little intuitive interaction; thus game playing and understanding of player requirements is more difficult to comprehend. Intuitive game interaction implemented by Nintendo and followed by Apple onto communication hardware, using everyday motion, can aid and enhance user's capabilities with technology such as computer games either on a console or mobile phone.

Intuitive interaction, be it through gaming or communication technology, has been incorporated into everyday movements or motions through a specific activity which users will be familiar with. Having knowledge of movement or motion from observation or physical activity will have created mind maps enabling recall during the nature of the activity, enabling users to embrace and interact easier with technology than before.

Ernest Adams, a guest speaker, presented a lecture discussing the "Future of computer entertainment to 2050", on the tenth anniversary of the International Animation and Games Festival in 2009, ANIMEX, held at Teesside University,

Gaming over the next forty years may change comparative to technology, and the nature and future of gamers or users within developing countries, currently categorised as second-and third-world countries such as India, China and the former Soviet states. Delivering and developing games for different cultures, Adams (2009) suggests, users will want games to relate to themselves or their culture, for example the genre of Bollywood films in India. Adams (2009) suggests that if the West is to develop a successful market for these countries, the future will include learning and understanding about consumers and markets. Although this not a new concept to be successful in a different culture/country, it is imperative to fully understand the nature of the target audience.

According to Adams (2009), consoles by 2050 may include certain processors fitting around the needs of the entertainment available, with improvements of screen resolution, thus creating higher and sharper visuals. This technology is currently permeating into entertainment settings within the home, as modern plasma and High Definition (HD) televisions are being purchased by consumers.

Eye-tracking technology or virtual technologies may become a feature of gaming environments, enabling players' movements to be tracked during a game. As previously discussed, the means of user-created content will also be a feature of future gaming, allowing users/gamers to photograph themselves and upload photographs into online environments such as Second Life. This concept is already being implemented into current technologies, such as the DSi, enabling the users to personalise their environments or avatar within online worlds (Adams, 2009, Dring, 2009).

Game content has grown rapidly from abstract images of the sixties and seventies to realistic imagery of the nineties. The development of genres during this short lifespan has, in addition, grown with the advancement of technology and games. Game content by 2050 may incorporate human interactions, for instance, romance or political emotions/actions related to every day lives.

Chapter Three and Appendix II discuss games in 2050 in detail, the classification of game genres, I predict, will still apply in 2050. Adams (2009) suggests there may be in addition complex settings integrated to purposely handicap gamers/users during game play, creating added challenges within the game.

One of the main focal points of The Games Based Learning Conference 2009 was the incorporation of games into education/learning environments. Adams (2009) deliberates, games of 2050 will be a regular component of education, used within classroom settings as a tool to enhance and build upon learning. A facet of Adams' (2009) lecture implied people of varying ages throughout the world will be playing games, not just young hardcore gamers. This is currently being witnessed with the take-up of the DS and the Wii, amongst non-traditional gamers, older adults and wider audiences within the casual gaming environment, embracing technologies as part of their lives to build and augment mental stimulation, social context, inter-generational relationships and effortless interaction (Mancini & Orthner, 1982, Goldstein *et al.*, 1997, Melenhorst, 2002, Khoo & Cheok, 2006, IJsselsteijn *et al.*, 2008, Gajadhar, Kort, IJsselsteijn, 2008, Gamberini, Alcaniz, Barresi *et al.*, 2008).

7.6 – Guideline Principles for Future Interactive Entertainment

The design guidelines, presented in Table 7.6.44, is an amalgamation of keywords from Phase One and Two, from the mapping exercise discussed in Section 7.3 and illustrated in Figure 7.3.20 (including the maps – see Appendix XIV). The points suggested in Table 7.6.44 for the design guidelines, build upon stipulations by Melenhorst (2002), Chapman (2002), Copier (2002), Intille (2004), de Kort *et al.,* (2005), Bianchi-Berthouze, Kim, Patel (2007) and Butler (2008) indicating that older adults want a purpose to game-playing and games which are rule-based, for instance sports. Table 7.6.44 displays the preliminary design guidelines for older adults. It is important to design and implement game content and interaction appropriately for any gaming audiences, and in particular second/third-age adults who are novices to game playing as previously explained, to build and sustain confidence, game play understanding, and enjoyment including continuation of their social circles either with peers or family members. Examining and establishing the design principles is likely to be valuable to those within several areas, for instance the games sector, gerontology, health service, government and second/third-age adults themselves. As stipulated in Chapter Four, embracing gaming into respective disciplines can assist users with multiple treatment and well-being-enhancing quality of life.

This thesis has investigated game interaction and game content, which is more important to the older adult. As discussed in Chapters Five, Six and Section 7.3 – Connections between Phase One and Phase Two of Chapter Seven, results indicate interaction is more important to the older adult than content. Table 7.6.44 identifies preliminary design guidelines for future game/interactive entertainment, combining suggestions for improvement of content and interaction for the older adult. The implications and importance of the preliminary design guidelines is to facilitate second/third age adults with the up-take of technology. Technology has enhanced over the last decade and more so during the last five years. This thesis has specified, older adults do use game technologies such as the Nintendo DS and Wii to keep mentally fit, well-being and for social reasons with friends and family. The use of gaming/communication technologies, such as the Wii/IPhone or forthcoming developments of these tools, will in the future become more popular with an ageing population. The take-up of these technologies by older adults will be greater through understanding the benefits of using such technologies, for example, learning, well-being, social interaction, building and developing intergenerational relationships and having fun and enjoyment.

In 2009 work was conducted by researchers at the University Calgary, Canada, involving the Wii console. The study titled *"Wii All Play: The Console Games as a Computational Meeting Place"*. Researchers aimed to explore game playing collaboration between families, peers and residents of residential homes. The study aimed to establish who makes gaming fun? The age of participants ranged between 3 – 80 years old. Researchers divided the participants into four age groups youth 3-15 years, adult 26-41 years, mature adult 52-59 years and elder 68-84 years. Aural feedback was recorded by participants based upon the sociability of group console gaming. Voida and Greenberg (2009) identified *"the most important part of group console gaming was, very simply, "the sociability of it"*. Additional reports identified by the researchers from the participants were from the mature and older participants stating *"that they only played console games in groups never by themselves"* Voida and Greenberg (2009). Stipulations were outlined from this study and are presented in Table 7.6.44 coupled with the work of Marston (2009) and Voida and Greenberg (2010).

Voida and Greenberg (2010) concluded the study of *"intergenerational interaction in collocated console gaming"* by presenting a set of design guidelines, to support intergenerational gaming/activities. Their guidelines differ in perspective to the ones in this investigation which is presenting a set of guidelines relating to game content and interaction. The suggestive guidelines by Voida and Greenberg (2010) are presented within Table 7.6.44 following on from the guidelines presented based upon the work conducted in this investigation.

The preliminary design guidelines, outlined in Table 7.6.44, have been taken from a variety of sources, through previous work conducted in the areas of technology and gerontology; the second/third-age adults who designed computer game ideas based on their hobbies, dreams and interests (Phase One) and who participated in game playing on the Wii and PS-2 in Phase Two; from computer game information released in 2009, of future games/interactive entertainment for the Wii and DS (Malone, 1980, 1982, Mancini & Orthner, 1982, Melenhorst, 2002, Khoo and Cheok, 2005, Fozard & Kearns, 2006, IJsselsteijn *et al.,* 2006, 2007a, 2007b, 2008, Gamberini *et al.*, 2008, Gajadhar, de Kort *et al.,* 2005, de Kort, 2007, de Kort, IJsselsteijn, 2008, Sweetser & Wyeth, 2005, van Bronswijk, 2006, Bianchi-Berthouze, Kim, Patel (2007), White *et al.*, 1999, Adams, 2009).

The work conducted in both Phase One and Two which formed this investigation has enabled the devise of preliminary design guidelines based upon the empirical data collected from the surveys completed and the observations carried out by Marston during the controlled experiment in Phase Two.

Table 7.6.44 - Preliminary design guidelines

Design Guidelines	
Interaction	Content
Simple interaction	Download/upload content to enhance gaming experience
Intuitive interaction	Enable technical thinking
Enable user to experiment	Build upon learning
Related to real-world/life experiences	Variety of perspectives
Choice of interaction	Entice, enable and support user-created content
Enable multi-player/single play	Enable mini-games
Consider full-body movement through motion	Varying levels of difficulty
A purpose	Sharing of information/data easier
Voice activation/interaction	Own responsibility

Feedback – clear and positive

Design Guidelines to enhance and support intergenerational gaming/activities (Voida & Greenberg, 2009, 2010)

- Allow gamers to rotate in and out of the gameplay easily
- Make use of input devices with intuitive mappings (button-based input devices were less well-liked by the gamers in the study than gestural and physical input devices);
- Provide modes of gameplay that allow players with different skill levels to play with or against each other
- Explore modes of gameplay that alter the game in significant ways for different groups of players so that the owner of the console or the game does not always have an advantage
- Provide modes of play that downplay competition between players
- Appeal to gamers with different gaming preferences within a single game
- Foster audience participation or an otherwise enjoyable audience experience
- Explore ways of extending the social experience of group console gaming into the larger ecology of shared media
- Games designed to support larger number of gamers, to include grand-children, grand-parents and parents simultaneously
- Game space and innovative input devices was identified as a change in design, encompassing larger gaming groups within domestic environment playing games such as Wii tennis;
- Exploration of input devices to be used in smaller spatial footprint within the gaming environment
- Game design which includes intermediary generations would mean games that both children and parents would enjoy playing together;
- Following on from the previous point, designing for intermediary generations could potentially mean designing for three or more generations of game players, therefore designing for a larger number of players would become important;

Content

Download/upload content to enhance gaming experience was implemented into Table 7.6.44, taking on board the current game releases by Nintendo of *Mixed messages, Real Football 2009* and the knowledge of *IPhone applications,* focusing upon user-created content and user-centred content. Implementing the function of users/gamers to download/upload content such as photographs, music and art into a game environment may enhance the users pleasure during game play, enabling *own responsibility* for actions during the game/interactive entertainment. *Own responsibility* was specified by participants in Phase One of this investigation shown in Figure XIV.129.

Games which are currently on the market vary in perspectives depending upon genre. It is common within a shooter genre that gamers will have a perspective of 1st or 3rd person perspective, or in some cases have the ability to switch between the two. Participants from Phase One specified game content to be viewed in a *variety of perspectives*, although there was no specific information relating to genre when this information was recorded. Participants in some cases listed birds-eye view, 1st/3rd person view, words and images and as the game progress the imagery would become more realistic.

As discussed in Chapter Two, Malone (1980, 1982) and IJsselsteijn *et al.,* (2007a, 2007b) both suggested the implementation of *varying levels of difficulty* into game design, coupled with challenges, goals and rewards, suggests over a period of time, giving players/users the choice of difficulty enabling the success of attaining the game objectives and goals. Offering players the opportunity to play towards varying levels, will enable players to build upon the skills and knowledge acquired during play, and to build upon self-confidence as discussed in Chapter Six (Malone, 1980, 1982, Melenhorst, 2002, IJsselsteijn *et al.,* 2006, 2007a, 2007b, 2008, Gajadhar, de Kort, IJsselsteijn, 2008).

As discussed previously in Table 7.6.44, the development of applications for users by users, entice, enable and support user-created content and through consultation with specific companies such as Infusion Development, who developed Falcon Eye, allows users the choice to download or to develop an application for a specific purpose. This has been experienced with the *IPhone/IPod,* as discussed in Section 7.4, using the London Tube Map as an example of user-created content. Implementing this into the design guidelines enables users to take responsibility for their decisions in game playing. The implications for content and application development will become more user-centred. This is currently being experienced by the *IPhone/IPod* users; having some understanding of programming languages has enabled individuals to create applications such as the London Tube Map. The next level would allow individuals with no programming experience or language skills to develop applications for their own use and for fellow users to access.

Email communication has become popular within many environments in society. The technology enabling individuals to *share information* in a variety of formats, has enabled society to grow with technology developments, but as Fozard and Kearns (2006) state "enhancing communication by e-mail is the most popular use of the internet by persons of all ages, yet today's elderly still lag behind". As illustrated with Falcon Eye, the mode of sharing pieces of information between doctor and patient can be simple through the use of a card. Implementing this type of technology into gaming may enhance interaction and content within a game or environment, thus enabling gamers/users to bring content on their own card, which is then shared with fellow gamers/users within the game.

Figures XIV.129, 130 and 131 show keywords highlighted from transcripts of Phase One and observations of Phase Two participants. Culminating this information with the keynote presentation by Adams (2009) specifically looks at game content of the design guidelines. Enabling gamers to add/delete content to an environment will add a wider experience and perspectives to the overall game.

Technical thinking was observed during Phase Two from some of the participants while playing both Wii Sports and Tiger Woods PGA Golf. Implementing this kind of guideline to create and enhance challenges could improve participants, gaming experience and confidence during a game. Understanding the technical thinking of a certain element will enable gamers to understand the purpose and aim of the next action.

Participants in Phase One specified game content should encourage learning or be of an educational substance. *Implementing specific* content into a game or a series of games may possibly *build upon a user's learning*, and as discussed earlier in this chapter would be incorporated into the *self-improvement* genre enabling gamers to enhance skills, knowledge and personal learning.

Implementing *mini games* into the main game environment facilitates gamers at varying levels and experience of playing that game. This specific game aspect has been implemented into the *Rhythm Paradise* game, reported by Dring (2009) in an edition of the MCV magazine and discussed in Section 7.3. Implementing this feature into computer games or applications enables gamers of all gaming abilities to be challenged while completing a mini game.

Interaction

The preliminary guidelines for *interaction* were derived from the comments of participants during the mapping process and Phase One. It also considers the work by Khoo and Cheok (2005), "Age Invaders". This work involved both young and older adults interacting in real time within a VE, using their full body as a means of interaction rather than a controller. As demonstrated by the *IPhone* and *Falcon Eye,* intuitive interaction using hand gestures, enables individuals to understand how to interact with the interface or environment through natural movement.

The first preliminary guideline which is stipulated in Table 7.6.44, is *simple interaction* identified from the results of Phase Two. As previously discussed, participants were required to play games on two different consoles, the Wii and the PS-2. The results indicate that the Wii was more intuitive and easier to interact with than the PS-2, which used a traditional game pad. As reported, users can develop applications for the *IPhone/IPod*, enabling users to choose applications which have been developed specifically for the user. The study conducted by Bianchi-Berthouze, Kim and Patel (2007) as discussed in Chapter Six, support the idea of implementing simple interaction to engage players' game playing activities. As reported in Chapter

Six some participants, during game playing on the Wii, moved around more so than on the PS-2, engaging into the environment of playing golf, tennis and boxing. Implementing *simple interaction* with body movement will entice and engage the player into the gaming environment. As stipulated by Bianchi-Berthouze, Kim and Patel (2007) “body movements also appeared to play a role in determining the players’ affective state and hence in increasing the players’ level of engagement.”

Incorporating *clear and positive feedback* into game content can boost self-confidence of players during play, boosting individual self-confidence (Melenhorst, 2002, IJsselsteijn *et al.*, 2007a, 2007b, Gajadhar, de Kort, IJsselsteijn, 2008). Many participants in Phase Two experienced self-confidence during play, and was observed by the researcher from many of the participants predominately playing the Wii console.

Enabling users to experiment and have a *choice of interaction* during game playing/interactive entertainment was suggested by participants from Phase One and Two of this investigation. Participants from Phase One suggested enabling users the choice of interaction from typing of words, buttons, joystick and touch screen, this is illustrated on Figure XIV.129 of Appendix XIV. Participants during Phase Two experimented during game play, predominately during play of the golf game on the Wii.

Voice activation/interaction is very similar to that of hand/facial gestures. Gamers/users would be able to interact/play with a game/interactive entertainment through speech/voice. This could be implemented alongside full body movement, very similar to that of Khoo and Cheok (2005) and Bianchi-Berthouze, Kim and Patel (2007), which suggests in the Age Invaders study (Khoo and Cheok, 2005) gamers/users would become the game pad or remote themselves, rather than holding a pad or remote. Further emphasis of implementing body movements into gaming environments is also supported by the “does body movement engage you more in digital game play? And Why?” investigation, which Bianchi-Berthouze, Kim and Patel (2007) concluded through the increase of “non-verbal response of the player, we are providing the game designer with a huge amount of information that could allow the creation of more social and entertaining games”.

Keywords from both Phase One and Two, shown in Figures XIV.129, 130, Appendix XIV, illustrate the type of interaction participants from Phase One stated during their design ideas. Giving gamers the choice of interaction (mouse, speech, hand gestures, game pad, or keyboard) enables individuals to interact with a game environment using familiar technologies. Adams (2009), and participants in this research, suggested that the nature of interaction should *relate to the real world or life experiences;* this could be in the form of hand gestures as witnessed by the mode of interaction with the *Wii*, and the work carried out by Khoo and Cheok (2005), interacting with a game or environment which is familiar to a particular individual.

Implementing multi-or single-player options within a game environment allows participants to play against friends and family, encouraging intergenerational and social friendships. Technologies such as *Wi-Fi* built into the *Wii, DS/DSi* and *PS-3* have single/multi-player options embedded into the hardware, facilitating gamers to play with fellow gamers across the world on the same game.

The effect of the design guidelines, if implemented, for future users, gamers and technology, implies that interaction with a game or device will involve further *intuitive interaction* using the body, as discussed by the work of Khoo and Cheok (2005) and Bianchi-Berthouze, Kim and Patel (2007), *Falcon Eye* and *IPhone/IPod*. Using facial expressions (smiling, un-happy/happy and angry) as a means of interaction, coupled with *full-body movement* may be used to interact with the software, controlling the character(s) within the game through bodily and facial expression, but also to give gamers/users additional pleasures during engagement of the environment.

Games such as *Mixed message* are being released onto the *DS/DSi,* enabling gamers to create their own content while giving gamers a different perspective to the traditional methods of gaming. The reward from this genre of games is that users are able to be creative with fellow gamers, rather than winning and embracing a multitude of creativity. The game, *Real Football 2009,* enables users to use the technology situated within the *DS/DSi,* to take photographs and upload within the game itself, for instance, a user is able to upload a photograph of themselves, onto a football. User-created content may be implemented into technology devices, like the *IPhone/IPod* and *Falcon Eye,* enabling users who have no programming knowledge to create content and be creative.

Figure XIV.131 illustrates the pleasures that second/third-age adults listed from Phase One of this investigation. Keywords, from Phase One, listed second/third-age adults wanting to experience a variety of pleasures including goals, rewards, learning, success, satisfaction, enjoyment, anger, frustration, gratification and fun. In the interaction section of Table 7.6.44 *a purpose* was listed as one of the preliminary design guidelines. This was listed due to the combination of pleasures stated by participants, as an umbrella for game playing/interactive entertainment. The pleasures, listed by participants in Figure XIV.131, are supported by previous work conducted in this area (Mancini & Orthner, 1982, Malone, 1980, White *et al.*, 1999, Melenhorst, 2002, Khoo &Cheok, 2006, Fozard & Kearns, 2006, de Kort *et al.,* 2005, de Kort, 2007, Bianchi-Berthouze, Kim and Patel (2007), de Kort & IJsselsteijn, 2008, Gajadhar *et al.*, 2008, Gamberini *et al.*, 2008). The use of keywords in Phase One and Two of this investigation, and the work carried out by Bianchi-Berthouze, Kim and Patel (2007), highlights the importance of emotions during game playing activities, something which should be considered during the game design process. This idea of consultation with older users is supported by van Bronswijk (2006) who stipulates;

> "Active participation of older persons in the design process appears to be a key factor in effective persuasion, probably since it bridges the technology-generation gap between older users and younger designers" (van Bronswijk, 2006).

7.7 – Conclusion

This chapter has identified results from both Phase One and Phase Two, incorporating technology developments, such as the Wii, DSi and IPhone, including the nature of content and interaction accomplished by users. The objective was to identify possible connections within this investigation. In relation to technological enhancement, the developments of the DS and the Wii have unlocked the gaming industry to be more amenable towards a wider audience. Interactive entertainment as described in Section 7.4, relates to software such as the *100 Classic Book Collection*, and has facilitated non-traditional gamers to enjoy and interact with technologies, such as the DS more than before. Through the method of a stylus, or in the case of Professor Kayama Maths Training, the wife of a celebrity pop singer is helping her daughter with her maths problems; in turn the daughter then shows her mother how to play Super Mario Bros. This method of gaming/interactive entertainment enables users to learn and bridge the divide between generations, bringing together inter-generational relationships, positive pleasure – enjoyment and fun. Later editions of the *DS*, such as the *DSi*, and communication technologies like the *IPhone*, have allowed users to create their own content/applications which are downloadable for fellow users (e.g. the *London Tube Map*.

Because of technology enhancements as discussed in Section 7.4, computer games are moving towards a different medium of entertainment, opening the gaming demographics to suit wider audiences, such as second/third-age adults. Incorporating intuitive interfaces and interaction has enticed users to use this technology either for entertainment, functional tasks in everyday life, learning or for fun. Facilitating users and technology to create simple, useful and fun content, be it on the *DSi* or the *IPhone/IPod*. These gaming technologies have taken gaming/interactive entertainment into a different dimension, enabling wider audiences to play games and interactive entertainment through intuitive interaction.

Collating participant results from Phase One and Two has assisted in the design of preliminary design guidelines and coupled with the guidelines identified through the studies conducted by Voida and Greenberg (2009, 2010), should they be taken into consideration during the design and development process for future interactive entertainment. With recent technological advancements, the design of content has become more user-focused, enabling users/gamers to create content that they themselves would enjoy creating.

It is important to bear in mind, when designing content for audiences, such as second/third-age adults, their opinions need to be taken into account. Consultation of target audiences during the design and development process is important to the success. Consultation of a specific audience would not hinder the process and, as shown in this investigation (in particular Phase One), and stated by van Bronswijk, (2006) second/third-age adults can and have the potential to design entertaining, educational and positive game ideas. In addition to the design process, incorporating second/third-age adults during development would facilitate design issues and interaction method, taking into consideration age-related impairments which may occur during play.

If the preliminary guidelines are taken into account during the design and development process, by computer games companies, the up-take of games/interactive entertainment by second/third-age adults may be increased, together with the understanding of the purpose within the game/interactive entertainment, this may increase the use of new technologies into second/third-age adults' daily lives. Understanding the purpose behind a certain game concept, and identifying the benefits from spending time with a particular piece of technology or game, would also benefit users as previously stated.

Implementing natural movements or facial expression into technology is probable for successful technological developments and advancements. With an ageing society, and second/third-age adults living longer, using natural movements as a means of interaction, coupled with understanding of purpose and use, seems to be the future for technology developments. To enhance well-being and intergenerational relationships as well as player engagement, as indicated by Bianchi-Berthouze, Kim and Patel (2007) through studying players' engagement and emotional affects during game playing on the music game *Guitar Hero* using an intuitive controller (guitar shaped) and a traditional game pad.

Chapter Eight will present the conclusions of this thesis and will examine overall the work that has been conducted through this investigation. Considerations of potential future work will also be discussed, exploring avenues related to Baby Boomers and technological innovation.

CHAPTER 8

CONCLUSIONS

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8.0 – Overview

This chapter concludes the overall investigation outlining particular areas within the study and modifications, if the opportunity arose. Discussion and considerations of future work that potentially could be investigated as a derivative from this study is reviewed.

8.1 – Introduction

This chapter discusses the work in full which forms this thesis, encompassing research questions which combine the study of computer games and gerontology, forming an investigation which has not being explored and is new to both fields.

Chapter One introduced the area of study and research, including research questions which were formed from the initial Grey Gamers' project (Marston, Fencott, & van Schaik, 2006). Chapter Two discusses the nature and classification of ageing out-lining several gerontologists' perspectives of ageing and relying upon the social context to define how ageing is categorised. Chapter Three investigates game theory (Murray, 1997, Church, 1999, Newman, 2005 and Fencott, 2007) and the course of gaming from the 1960s to present day (Herman, 2001 and Hind 2006), examining the varied hardware and software developments which have evolved, also discussing gerontechnology and persuasive technologies, exploring previous and current research within these domains (Malone, 1980, 1982, Chapman, 2002, Fogg, 2003, Intille, 2004, de Kort *et al*., 2005, Hindmarch, Cockton, Young *et al.,* 2006, Van Bronswijk, 2006, IJsselsteijn *et al.,* 2006, 2007a, 2007b, Lesnoff-Caravaglia, Pennathur, 2007, BBC News, 2008, 2009. Chapter Four examines current statistics in relation to the games industry from both American and British sources supported by the work of

Dodson, 2004, ESA, 2004, 2005, 2006, 2007, 2008, Pratchett, 2005, Tiwari, Astheimer, File 2004, BBC News, 2003, and the IDSA, 2001, highlighting the upward trend of older adults embracing gaming as part of their lives (Copier,2002), especially the American market, and illustrating the genres of game which are popular with this audience. Chapter Four also examines products similar to that of *Brain Training* which have been explored and marketed to the general public (Butcher, 2008). Chapters Five and Six outline the workshops and experiment conducted during this study. Analysis of both qualitative and quantitative results was discussed in each chapter. Using a set of methods enables participants to design their own game idea, creating possible marketing factors and facets to be included in computer games. Further discussion and analysis of work conducted in this by researchers and academics in the fields of virtual reality and gerontology (Weisman, 1983, McGuire, 1984, Clark, Lanphear and Riddick, 1987, Csikszentmihaly, 1990, 1993, Jackson and Marsh, 1996, Ermi, Mäyrä, 2005, Khoo and Cheok, 2005, Kivikangas, 2006, de Kort, IJsselsteijn and Poels, 2007, Bianchi-Berthouze, Kim and Patel, 2007, Wiebel, Wissmath and Groner, 2007, Nacke and Lindley, 2008a, 2008b). Chapter Six reports the findings from Phase Two of the investigation indicating participants did experience *flow,* while playing on the Wii, more so than the PS-2. Also the results indicate interaction to be more significant than content from two out of the three games played on the Wii, these two games being golf and tennis.

Chapter Seven embraces the identification of possible links between game genre, interaction and older adults, establishing gaming as a form of interactive entertainment with recent releases onto the market, such as, *100 Classic Book Collections.* Recent months have revealed that additional game genres have entered the market as a consequence of content, for instance, the creation of the *self-*

improvement genre (Dring, 2009) which includes the game Wii Fit. In connection with identifying links between Chapters Five and Six, recent technology which encompasses the DS, now the DSi, Wii and communication hardware such as the IPhone/IPod has facilitated the use of motion to entice and increase usage amongst wider audiences. In recent months, users have started using the IPhone/IPod to create specific applications for fellow IPhone/IPod users. The content of applications varies widely. For example, as discussed in Chapter Seven, one of the applications created consists of the London Tube Map. The consideration of future gaming technologies in 2050, as presented by Adams (2009) at the Annual ANIMEX festival held at the University of Teesside, incorporating results of this investigation from Phase One and Two, have evolved into potential design principles brought together through the association and collaboration of former work conducted by Malone (1980, 1982), Melenhorst (2002), Sweetser and Wyeth (2005), van Bronswijk, (2006), IJsselsteijn *et al.*, (2007a, 2007b).

8.2 – Summary of Main Findings

8.2.1 – Research Question One

What is important to older adults, computer game content or game interaction?

This research question was the initial basis and focus for this study. The contribution to knowledge that this thesis made, explored the nature of two distinctive consoles with a specific group such as second/third-age adults, has ascertained through research methods, that second/third-age participants playing on the Nintendo Wii, experienced the measure of *flow,* identifying that game play on the Wii console is a more positive experience than those participants who were assigned to playing on the

PS-2. The qualitative results, as discussed in Chapter Six, Section 10, indicate that interaction is more important than content, in the form of the sports genre, from two out of the three games played on the Wii, these two games being *golf* and *tennis*. As discussed in Chapter Six, Section 10, this conclusion does not apply to additional genres such as puzzle, adventure and strategy, as classified by the games industry. Further experimentation and data analysis would be required to determine whether this conclusion is the same for these additional genres.

Combining Phase One and Two of this investigation, verified whether content or interaction is important, specifically to second/third-age adults, gave added support and affirmation to the contribution to knowledge. Close scrutiny of positive keywords recorded by participants from Phase One and Two, and discussed in greater detail in Chapters Six, Seven, Appendixes IX and XII, identified second/third-age adults required a variety of choice for both interaction and content, suggesting content should be related to the real world. Analysis of this work has established a common theme covering the three main facets of this investigation (older adults, genre and interaction) identifying technology to be the common thread. Technology is the main component in the delivery of advancements and up-take of wider audiences. Before 2005, computer game hardware/software had advanced considerably since its creation in the 1960s, through development improvements and game content developing which lead to consoles and controllers in the 1990s being virtually the same; game interfaces were very realistic, with technological hardware improvement content and interfaces becoming very life like. Gaming was perceived by many, as a form of entertainment for young people, predominately boys and men. The release of the DS and Wii changed perceptions of gaming, showing computer games/interactive entertainment was accessible to wider audiences than boys/men.

The release of the DS in 2005 and the Wii in 2006 highlighted the need of bringing wider audiences and game entertainment to the market, demonstrating to the industry and consumers that current audiences require innovative adjustments to entice new players. This thesis has discussed thoroughly the positive consequences of the DS and the Wii upon a wider audience. The development of new and fresh game concepts enabling users to be the central focus within games or, in some cases, create content, has been a successful aspect of the Nintendo brand. User-centred and user-created content is possibly one characteristic of future gaming, giving users the responsibility to create their own interactive entertainment and combine their play with fellow gamers/users.

As discussed in Chapter Seven, recent studies have identified, the idea of implementing body movements, hand and facial gestures into a game environment has proved to be a significant factor for player's engagement, coinciding with game player interaction of a specific controller (Bianchi-Berthouze, Kim, Patel, 2007). Implementing body movements, hand and facial gestures as part of the game interaction would enable second/third-age adults to interact easier with the game, as the mode of interaction would be perceived as second nature.

8.2.2 – Research Question Two

What is the effect of the interaction design of gaming platforms on older adults' experience and behaviours of playing computer games?

Chapter Six discusses in detail Phase Two of this investigation, outlining similar work and methods conducted in this investigation. Qualitative and quantitative data collected from Phase Two, showed participants did experience higher levels of *flow* using the Wii console than the PS-2 console. Analysis of the FSS questionnaire (Jackson & Marsh, 1996) identified five significant sub-scales out of the nine. These were challenge of skill, action awareness, clear goals, sense of control and autolelic experience, as these were the aspect of *flow* during the experiments. The results from the FSS questionnaire indicate participants did find the Wii console easier to interact with due to the pad (remote), and the ability to move in a natural way aid interaction more than the PS-2 game pad where participants were required to sit at the desk and press a series of buttons to interact with the game.

This is supported by the work conducted by Khoo and Cheok (2005, 2008), which involved young and old participants physically interacting with an environment using their bodies as a remote rather than holding a remote. Participants who were playing on the Wii console (golf, tennis, boxing) did hold the remote as if they were actually playing the sport in real life. The results, from this investigation, have identified the effects of interaction design on gaming platforms to be positive, measuring the experience and behaviours of *flow.*

As stipulated in Chapters Two, Four and Seven, the motives for older adult engagement with computer games are primarily to enhance a multiplicity of well-being during their lives, be it second, third or fourth-age as classified by some gerontologists. The classification of this demographic group participating in Phase Two was second and third-age adults, who had retired but had decided to continue working, be it voluntary or paid, or who were still working and had not entered the third age.

Chapters Four and Seven affirm the potential benefits of using computer games within health-care environments for rehabilitation purposes. For example, the Wii is being used by health care professionals aiding military personnel in rehabilitation, who arrive home from Iraq (BBC News, 2008). The Wii fit board is being used in a health-care environment at the University of Aberdeen and Grampian NHS assisting elderly adults with balance, and studying the prevention of falls using this form of technology (BBC News, 2009). Residential homes have initiated engagement and physical-fitness programmes to increase and encourage participation through social and physical interaction. Second/third-age adults interact with the Wii, promoting physical exercise in a fun and relaxed environment. As a consequence, second/third-age adults obtain additional benefits, including an increase of social activity with friends or relatives, building upon their intergenerational relationships and furthermore enhancing their quality of life (BBC News 2002a, 2002b, 2003a, 2003b and 2008). Physical movement is fairly sedimentary for players on the PS-2. Participants during Phase Two were seated in front of a television screen and were required to hold a controller in their hands during play. Thus, little body movement was experienced and the measure of *flow* was not significant. Chapters Three and

Four outlined the physical benefits of the Wii over the PS-2 during play, enabling physical engagement, intergenerational relationships, mental stimulation, socialising amongst peers and family, which can aid overall health while enjoying game play. Highlighting further with the release of the Apple IPhone/IPod, suggesting communication technologies are implementing the use of motion detection, as found with the Nintendo Wii. The IPhone, as described in Chapter Seven, has the original capabilities of any communication medium, but has additional features such as applications and intuitive interaction mechanics. Users of the IPhone can operate through touching and swiping of the screen to select the necessary applications. Applications available to IPhone/IPod users are being created for the general public, for example, Chapter Seven illustrated the user-created, user-centred application of the London Tube Map is available to download to all users.

The successes of the DS/DSi, Wii and IPhone/IPod have purely been through technological advancements, creating a means of interaction which is freely accessible to all users, young and old. Using motion to communicate, play and interact with technology enables individuals with age-related impairments to connect with friends and family within a social context.

As described earlier, the mode of interaction of the PS-2 is very different from that of the Wii. The PS-2 has not experienced the similar attention to that of the Wii since its release in 2006, this is probably due to the mode of interaction being far simpler and easier to understand. Individuals or homogenous groups who have problems pressing and remembering the sequence of buttons to conduct one movement, will find the PS-

2 difficult to use and play, unlike the Wii, which-has established and proved successful with many audiences due to motion detection in a short space of time.

8.2.3 – Research Question Three

What gaming facets and requirements do older adults require from computer games?

This research question was the basis of the CODEWORKS ATL project conducted in 2005. Data collected through workshops enabled both qualitative and quantitative results to be analysed and identify possible trends, facets and requirements of gaming by second/third-age adults. Respondents were split into two categories gamers and non-gamers, the criteria for this was whether they had played computer games or not. Quantitative results identified scope for future research within this area in relation to the results collected and analysed. The ownership of consoles identified second/third-age adults did play computer games, and owned a variety of consoles ranging from a PS-2/1, Nintendo Game Cube, Sega Master System and Xbox. Learning to play games was identified by participants through self-learning and from a grand-child. The length and frequency of game playing was answered and illustrated participants; played games at more than once a day, about once a day and more than once a week. In addition, the length of game playing was identified to be one year or more. The type of game genres played; identified by participants were puzzle, shortly followed by adventure, platform and shooter.

The nature of Phase One, in designing game concepts was based around participant's hobbies, interest and dreams. Positive results were displayed by the participants when answering the question - would they consider playing a game and would that game be relating to a hobby, interest or dream. Consideration of game genre by participants to be played was identified to be puzzle, strategy and sports.

The second element of Phase One involved the design of game concepts, incorporating aspects such as communication, verbs, imbalances, important times for participants, pleasure experienced through potential game playing. The game designs created were transcribed and keywords were identified and coupled together. The results are displayed in Appendix 9 of this thesis which outlines the different combinations of keywords, from imbalances, communication, important times, dreams, hobbies, interest, concepts, verbs, aims and pleasure.

From the keywords it was possible to identify and couple together game genres. As discussed in Chapter Five the most popular genre to be suggested by gamers' was adventure, in addition coupling genres together identified one potential genre, which was sport, adventure, strategic. Some game concepts did not fit into any category and therefore implies this could be an opening or future enhancement of game genres. The most popular genre identified by non-gamers was adventure. It was evident when discussing the workshop aims and objectives with participants at the end of the workshop, and from the transcripts they completed they wanted games to include an educational element to them. The most popular game genre combined was adventure, education.

The design concepts displayed interesting and creative ideas for future game ideas. The results suggest non-gamers can be more creative than gamers when designing game concepts. As stipulated in Chapter Five, reasons for this creativity are, having little knowledge and understanding of gaming and there fore have no preconceptions of games and genres.

8.2.4 – Research Question Four

What are the implications for the design of computer games/interactive entertainment based upon the data collection in this investigation stated as preliminary design guidelines?

Chapter Seven discussed in great detail the connections between Phase One and Two of this investigation, outlining the significant responses from participants during the phases, and although the results displayed in Table 7.3.34 (willingness to play a computer game relating to hobby) was not significant, participants in Table 7.3.35 showed a significant response to playing computer games. Further results highlighted in Table 7.3.36 showed participants who had played on the Wii, preferred puzzle and sports game genres. Similarly, participants from Phase One also preferred the puzzle genre. As discussed also in great detail in Chapter Seven, the computer games, released for the DS and Wii, involved a variety of games predominately from the puzzle genre, for example, *Professor Layton: Curious Village*, *Brain Training* and *Mario*. The discussion of future games to be released as listed in Table 7.4.37, suggest gaming/interactive entertainment will be moving into user-centred and user-created content, enabling players to take responsibility for content. With this in mind it is probable to speculate future computer games/interactive entertainment will encompass the genre of puzzle/sports, with the facility to allow users to create content during game play.

Communication technologies, such as, the Apple IPhone/IPod currently enable users to download a multitude of applications, including traditional/retro games, such as *Pac-Man,* but also applications which can aid individuals during holidays or visiting cities, for instance the London Tube Map and Urbanspoon. The development of Falcon Eye has shown future content and more specifically interaction to be similar to that of the IPhone/IPod. Currently, Falcon Eye has the ability to demonstrate and share information to a wide variety of audiences, using one to two individual user cards which hold specific information relating to a particular application, for example, a health application. As discussed in Chapter Seven, Falcon Eye has the ability to offer applications to a wide variety of users, including schools, businesses, individual clients and potentially the NHS. Figures 7.4.40, 41, 42, 43, 44 and 45 illustrated the interaction and content of specific data held by future users' cards and being shared between two people, for example, a doctor and a patient.

Future gaming/interactive entertainment will involve a number of preliminary design guidelines built upon both participants comments from Phase One and Two, and previous work and stipulations by Melenhorst (2002), Chapman (2002), Copier (2002), Intille (2004), de Kort *et al.* (2005) and Butler (2008). The preliminary design guidelines would be outlined under the two sections (interaction and content). In addition the work which was conducted by researchers in Canada, Voida and Greenberg (2009, 2010) has presented a different perspective of guidelines which coupled together with the design guidelines identified from the data collected from this investigation display a positive set of guidelines which if implemented by the games sector could increase gaming participation by older adults, both for enjoyment and the possibility of increased intergenerational relationships.

Understanding the design requirements required by older adults is one of the fundamental areas the game sector needs to address, and supported by van Bronswijk (2006), active engagement of older adults in the design process is imperative to successful take-up of the technologies, bridging the generation-gap of young creative's and older users. Involving target audiences, such as older adults from the initial concept stage, continuing through to testing and marketing and release of the game/interactive entertainment, would enable both game sectors and potential target audiences to learn and understand both parties' concerns, and potentially for the game sector to learn from an ageing demographic group, in preparation for future users and technology developments. Implementing and enabling gamers/users to create user-centred and user-created content for gaming/interactive entertainment on technologies, such as, the IPhone/IPod, DSi and potentially Falcon Eye will bring wider audiences. Allowing gamers/users to create their own content will generate innovative concepts in the market.

Bringing together the preliminary design guidelines and the results from Phase Two of this investigation, gaming/interactive entertainment will entail simpler and more intuitive interaction, enabling older adults and wider demographic audiences to play and interact together (intergenerational relationships), as well as bringing non-traditional users into gaming/interactive entertainment. Encompassing body movement, as one of the design guidelines, would engage users/players into the gaming environment, this particular aspect of gaming/interactive entertainment from the investigation conducted by Bianchi-Berthouze, Kim, Patel, (2007) and discussed in detail in Chapter Six and Seven, would potentially enhance the gaming experience and engagement of second/third-age adults by conducting game play mechanics through natural body movements.

Learning and educational aspects were specified by participants in Phase One, and this has been implemented into the design guidelines. As discussed in Chapter Seven, the implementation of gaming/interactive entertainment into the national curriculum at the Game Based Learning Conference (March, 2009) will create a learning emphasis, brining challenges and goals to students in a fun approach through interaction with peers and family members. Adding clear positive feedback to students would enable them to build upon self-confidence and knowledge, understanding there is a purpose of playing the game/interactive to achieve the end goal. Incorporating varying levels of difficulty will also aid in the learning process and self-confidence of gamers/users.

The guidelines identified by Voida and Greenberg (2009, 2010) which have been put within the guidelines identified from this investigation suggest similar guidelines to that from Phase One and Two, for example implementation of gestures, through input devices. The guidelines suggested by Voida and Greenberg (2009, 2010) are additional outlines and can only build-upon the stipulations from this investigation.

8.3 – Contribution to Knowledge

By means of qualitative and quantitative data collection and data analysis investigating game content and interaction. My contribution to knowledge can be stated as follows.

I have established that older adults of the second-and third-age do experience flow while interacting with a game console with an intuitive interface, more so than with a game console with a restrictive interface. Thus, indicating the Nintendo Wii to be easier to interact with than the PS-2. Analysis of the results denotes game interaction to be more important to second-and third-age adults than content during game play within the sports genre (golf, tennis and boxing), implying the method of interaction is essential to future technologies and take-up by second-and third-age adults.

8.4 – Limitations of the Study

The study was conducted with, and depended on, the availability of participants. Without second-and third-age adults participating in the study, this investigation could not have been completed. Whilst undertaking the workshops, the possibility of videoing was considered. Several participants were not comfortable with this therefore, video recordings were not made. Future work would involve using video to record movements, which may be missed by the researcher, and to follow up on data relating to the emotion of game playing.

8.4.1 – Use of Equipment

A 15-inch television screen was used during Phase Two of the investigation. To give participants a full gaming experience a larger television screen would have been suitable to facilitate inclusive engagement. The PS-2 was appropriately selected for the success of the console and for future work; the use of the PS-3 would be considered due to significant graphical developments enhancing engagement of the participant.

A small room was used for the investigations which was an academic office situated in the School of Computing, vacant over the experimentation period. The size of the room, being too small, became problematic while participants played on the Wii console; some participants found it constraining during play, as some would have preferred a larger space to move around when hitting the tennis ball or boxing; in some cases participants ended up banging into office furniture. The ideal room would have enabled participants to move freely during play and experience full engagement with immersive environment of games.

8.4.2 – Questionnaire Design

Future work would contemplate using the questionnaire devised by researchers at the Eindhoven University of Technology called Game Experience Questionnaire (GEQ). The use of the FSS questionnaire, devised by Jackson and Marsh (1996) in this investigation enabled data to be collected relevant to the study. It would be honest to suggest that due to this new questionnaire, designed specifically towards computer games, future work conducted in this area would have to consider the use of the GEQ. Using the GEQ questionnaire over the FSS questionnaire includes seven areas of measurement (Sensory and Imaginative Immersion, Tension, Competence, Flow, Negative Affect, Positive Affect, and Challenge), unlike the FSS which initially was designed to test flow in physical activity.

8.5 – Future Research

The importance and affect of technology on an ageing society, both on a national and global scale, incorporates many aspects for example health, well-being and potential technology assistance in the form of gaming and persuasive technologies. Conducting gaming/technology research pertinent to an ageing society, allows individuals in a number of private and public-sector settings to understand and learn the effects of ageing and the potential benefits of using technology to enhance well-being, health and quality of life within a social context. Very little research has been conducted in the area of computer games and gerontology. In recent years, my research has shown that the concept of an ageing society, in relation to the potential benefits of gaming, is slowly starting to be recognised within the private and public sectors, more so after the release of the Nintendo DS and Wii. Due to the phenomenal interest and the advancement of technologies, gaming has assisted individuals within society to communicate and enjoy this medium, with great success in a limited space of time.

Further research would involve an in-depth study of the effects of age, incorporating older and younger adults and whether gender of adults has an effect on game play in terms of experience, enjoyment, quality of life and well-being. Including gender into future studies would be an interesting concept and comparison, certainly when technology is at the helm of the study. I have an interest in gender and computer games/technology and would want to continue this further on in my research/academic career.

Within this potential further research, it is possible to address gender in second-and third-age adults, and to carry out a comparison with younger adults. The technology used would incorporate the Nintendo Wii and the DSi, and include additional consoles such as the PS-3 and the PSP. Because these consoles are relatively new to the market and audiences, little or no research in relation to this type of gaming technology has been conducted. It would also be interesting to compare the handhelds and consoles ideally using the same participants.

The game genres puzzle, casual, sports and driving (Mario Kart) in particular, would be considered as charted by the MCV magazine and in Tables 7.4.23 and 7.4.24 (Chapter Seven), which identify the purchasing habits of gamers/users on the DS and Wii, together with the results from participants in Phase One and Two. Using new consoles and handhelds such as the DSi, PSP, Wii, Xbox-360 and the PS-3, users/players have the ability to play and interact with other gamers over the Internet; games such as Mario Kart, which is available on both Nintendo formats, could be controlled within an environment with friends and family, investigating the social interaction amongst different generations (intergenerational relationships) and friends of varying ages.

Consoles such as the DS/DSi and Wii have been popularised by British media, promoting intergenerational engagement and widening gaming audiences. Further exploration would entail conducting empirical research analysing potential benefits and effects of consoles and genres amongst demographic groups. Alongside intergenerational relationships, furthermore social-interaction, residential-care environments and educational environments could be explored. Education is starting to consider how gaming in the future may be used within the National Curriculum, in British schools, to enhance learning within the classroom. This was discussed at the Game Based Learning Conference (March 2009), the potential to use console/gaming as a medium for learning. This, I believe, is an untouched area of research which could have potential benefits on a national and international level, investigating the potential usage of computer games within a classroom environment to aid learning at all levels of education.

This investigation has primarily focused upon the sports genre and future work would consider studying the effects of *flow* and continuing the identification of importance of interaction and content with additional classified genres by the games industry such as puzzle, adventure and strategy. This would be a positive follow on from this study and enable the researcher to build-upon the work that has been conducted within this thesis.

8.6 – Conclusions

This thesis has discussed and reported evidence and findings of two distinctive academic field's together, forging a unique but relevant connection in contemporary ageing and technological society. One important contribution of this investigation was the difference in *flow* experience between the PS-2 and Wii consoles. As outlined previously participants experienced a higher level of *flow* during play on the Wii, than on the PS-2. This result suggests that the technological concepts of integrating motion detection into a console can assist second/third-age adults into engaging in experiences and embrace health and well-being. The focus was the nature of technology within society and the affects technology can have on users. This has been identified with recent developments of the *DSi* and of the *IPhone/IPod;* both products have had a positive effect on users/gamers due to the intuitive mode of interaction, and the ability for users to create applications and/or content they want, by means of entertaining themselves and fellow users. These contributions, in turn, led to the design of preliminary design guidelines, which predominately focus upon two main facets, users and technology. It is important to focus upon the target audience when developing new technologies or software; consultation and advice are imperative, as demonstrated by participants in Phase One of this research. The future of gaming/interactive entertainment is going to be exciting, witnessing and playing new technologies developed for wider audiences, and how current trends and future trends of game software will unfold based primarily around user-centred and user-created content, as discussed in Chapter Seven and illustrated by games, such as *Art Style: Picopict, Mixed Message* and *Real Football 2009*. This investigation has established that older adults have the capability to design a game concept and to experience *flow* during game playing using an intuitive piece of hardware.

I conclude this thesis by stating that older adults, classified as second/third-age adults, have the ability to comprehend the nature of gaming, if the aims and objectives of the game/interactive entertainment are outlined clearly, including the nature of interaction through motion, as identified in this research.

Bibliography

50Connect Website., *"Calling All Computer Game Fans"* http://www.50connect.co.uk/index.asp?main=http://www.50connect.co.uk/50c/gamers.asp, [Accessed February 2005]

Adams, E. W., (2009). *"The future of computer entertainment to 2050"* Guest speaker, Animex 2009, University of Teesside, Middlesbrough, United Kingdom

Alleyne, R., (2008). *"Playing computer games improves brain power of older adults, claim scientist"* Telegraph The, http://www.telegraph.co.uk/scienceandtechnology/technology/technologyreviews/videogamereviewsandpreviews/3708754/Playing-computer-games-improves-brain-power-of-older-adults-claim-scientists.html, [accessed 2009]

American Psychological Association., (2006). *"Memory Changes in Older Adults"* http://www.psychologymatters.org/memchanges.html, [Accessed September 2006]

Arnseth, H. C., (2006). *"Learning to Play or Playing to Learn – A critical Account of the models of communication informing educational research on computer gameplay"* The international Journal of Computer game research, Vol 6, (1), ISSN:1604-7982

Barbeite, F. G., Weiss, E. M., (2004). Computer self-efficacy and anxiety scales for an Internet sample: testing measurement equivalence of existing measures and development of new scales, *Computers in Human Behaviour, 20*, 1–15.

Basak, C. Boot, W. R, Voss, M. W, Kramer, A. F., (2008). Can Training in a Real-Time Strategy Video Game Attenuate Cognitive Decline in Older Adults? Psychology and Aging, Vol 21, No 4, pp. 765 – 777, DOI: 10.1037/a0013494.

BBC Online Network (Science/Technology)., (1999). *"Old brains can learn new tricks"* http://news.bbc.co.uk/1/hi/sci/tech/482305.stm [accessed January 2009]

BBC News Website (Education)., (2000) *"Award for oldest learner, 107"*, http://news.bbc.co.uk/1/hi/education/759364.stm [accessed January 2009]

BBC News Website (Science/Nature)., (2002a) *"Computer games lure older players"* http://news.bbc.co.uk/1/sci/tech/1918554.stm [accessed May 2007]

BBC News Website., (2002b) *"Elderly could learn to improve memory"* http://news.bbc.co.uk/1/hi/health/1821076.stm [accessed 2008]

BBC News Website., (2003a), *"Gaming is not just for grandchildren"* http://news.bbc.co.uk/1/hi/technology/3321631.stm [accessed April 2007]

BBC News Website., (2003b). *"Pensioners catch the gaming bug"* http://news.bbc.co.uk/1/hi/technology/3287891.stm [accessed April 2007

BBC News Website., (2004a). *"Games: Future of entertainment?"* http://news.bbc.co.uk/1/hi/talking_point/3616436.stm [accessed October 2007]

BBC News Website., (2004b). *"Humans' will live to age of 150'"* http://news.bbc.co.uk/1/hi/sci/tech/3761310.stm [accessed January 2009]

BBC News Website., (2004c). *"Nintendo DS beats sales targets*" http://news.bbc.co.uk/1/hi/business/4081001.stm, [accessed February 2009]

BBC News Website., (2004d). *"The secrets of long life revealed?"* http://news.bbc.co.uk/1/hi/health/3783543.stm [accessed February 2009]

BBC News Website., (2004e). *"Nintendo plans two-screen gaming"* http://news.bbc.co.uk/1/hi/technology/3416011.stm [accessed February 2009]

BBC News Website., (2005). *"Old age 'is no bar to sharp mind'"* http://news.bbc.co.uk/1/hi/health/4427704.stm [accessed February 2009]

BBC News Website., (2007a). *"How the Wii won over the world's gamers"* http://news.bbc.co.uk/1/hi/technology/6960575.stm [accessed October 2007]

BBC News Website., (2007b). *"Normal ageing 'can addle brain'"* http://news.bbc.co.uk/1/hi/health/7127463.stm [accessed February 2009]

BBC News Website., (2003). *"Gaming is not just for grandchildren"* http://news.bbc.co.uk/1/hi/technology/3321631.stm [accessed February 2009]

BBC News Website., (2008). *"Internet use 'good for the brain'"* http://news.bbc.co.uk/1/hi/health/7667610.stm [accessed February 2009]

BBC News Website., (2008a). *"Could the Wii be good for you"* http://news.bbc.co.uk/1/hi/health/7262770.stm [accessed February 2009]

BBC News Website., (2009). *"Elderly wanted for Wii experiment"* http://news.bbc.co.uk/1/hi/scotland/north_east/7869445.stm [accessed February 2009]

Batchelor, J., (2009a). *"Rhythm Heaven – Retail Biz"* MCV, Issue 532, http://issuu.com/intentmedia/docs/mcv_issue532 [accessed April 2009]

Batchelor, J., (2009b). *"Getting better and better"* MCV, Issue 533, http://issuu.com/intentmedia/docs/mcv_issue533 [accessed April 2009]

Bennallack, O., (2006). *"Brain games aim to boost your IQ"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/4930996.stm [accessed August 2006]

Beaumont, C., (2008), *"E3: Is the future of video gaming all in the family?"* The Telegraph http://www.telegraph.co.uk/scienceandtechnology/3357946/E3-Is-the-future-of-video-gaming-all-in-the-family.html [accessed April 2009]

Bianchi-Berthouze, N., Kim. W. W., Patel. D., (2007). *"Does body movement engage you more in digital game play? And Why?"* Springer Link Berlin Heidelberg, Doi: 10.1007/978-3-540-74889-2, Vol 4738/2007, Book title: *"Affective computing and intelligent interaction"*, pp 102-113, ISBN: 978-3-540-748885, Doi: 10.1007/978-3-540-74889-2-10, ISSN 0301-9743 (Print), 1611-3349 (Online)

Bond, J., Peace, S., Dittmann-Kohi., Burdick, D.C., Kwon, S., (2004). *"Gerontechnology, Research and Practice in Technology and Aging"* Springer Publishing Company, Inc, New York

Bond, J., S, Peace., F, Dittmann-Kohli., Westerhof, G., (2007). *"Ageing in Society"*, Third Edition, London, SAGE Publications Ltd, ISBN 978-1-4129-0020-1

Bowen, H., (2005). *"Can video games make you cry?"*, GameInformer Magazine

Brown, E., Cairns, P., (2004). *"A grounded investigation of game immersion"*, CHI 2004, ACM Conference on Human Factors in Computing, ACM Press, PP 1297-1300

Butcher, J., (2008). *"MIND GAMES: DO THEY WORK?"* British Medical Journal, (2008;336:246-8; doi: 10.1136/bmj.39462.534630.AD), http://archive.student.bmj.com/search/pdf/08/03/sbmj103.pdf [accessed February 2009]

Callois, R., (1961). "*Man, play and games"* New York: Free Press of Glenco

Campbell, A., (2008). *"Seniors home receives some Wiihabilitation"* http://www.canada.com/technology/gaming/Seniors+home+recieves+some+Wiihabilitation/1105421/story.html [accessed February 2009]

Canada.com., (2008). *"Videogames may do the aging brain good"*, http://www.canada.com/technology/gaming/Videogames+aging+brain+good/1105410/story.html [accessed February 2009]

Casey, K.P., (2006). *"Nintendo hopes Wii spells winner"*, http://www.usatoday.com/tech/gaming/2006-08-14-nintendo-qa_x.htm [accessed February 2009]

Cassmassina, M., (2007). *"Big Brain Academy: Wii Degree Review"* http://uk.wii.ign.com/articles/795/795126p1.html [accessed January 2008]

Chapman, S., (2002). *"Strategies for maintaining cognitive health"*, The Journal on Active Aging, September, October 2002 (learning memory)
Census., *"The Elderly of Today and Tomorrow"* Chapter 7, http://www.census.gov/prod/1/pop/p23-190/p23190-k.pdf [accessed November 2006]

Chen , M., Kolko, B., Cuddihy, E., Medina, E., (2005). "Modelling and measuring engagement in computer games." Paper presented at the annual conference for the Digital Games Research Association (DIGRA), Vancouver, Canada

Chisnell, D., Reddish J.C., (2005) *"Who Is the "Older Adult" in your Audience?"* http://www.stc.org/intercom/PDFs/2005/200501_10.pdf [accessed February 2007]

Charness, N., Schumann, C.E., Boritz, G.M., (1992). *"Training Older Adults in Word Processing: Effects of Age, Training Technique and Computer Anxiety"* International Journal of Technology and Aging, Vol 5, Number 1, 1992, Human Sciences Press, Inc.

Clark, J.E., Lanphear, A.K., Riddick, C.C., (1987). *"The Effects of Videogame Playing on the Response Selection Processing of Elderly Adults"* Journal of Gerontology, Vol 42, No 1 pp 82-83

Clarke, D., Duimering, P.R., (2006). *"How Computer Gamers Experience the Game Situation: A Behavioural Study"* ACM Computers in Entertainment, Vol 4, No 3

CODEWORKS ATL & Age Concern Research Service., (2005). *"The Ageing World, Issues for Older People: 2005 - 2025"*

Copier, M., (2002). *"Is gaming just for kids? Elderly people do play games"* http://les1.man.ac.uk/cric/gamerz/abstracts/copier.htm [accessed March 2005]

Crawford, C., (1982). *"The Art of Computer Game Design"* http://www.vancouver.wsu.edu/fac/peabody/game-book/Chapter8.html [accessed February 2009]

Csikszentmihalyi, M., (1975). *"Beyond boredom and anxiety: experiencing flow in work and play"* San Francisco, ISBN 0787951404

Csikszentmihalyi, M., (1990). *"Flow: the psychology of optimal experience"* New York: HarperPerennial, ISBN 0060920432

Csikszentmihalyi, M., (1993). *"The Evolving Self: A Psychology for the Third Millennium"* New York: HarperCollins, ISBN 0060921927

Czaja, S.J., Fisk, A.D., Hertzog, C, Rogers., W.A, Charness., N, Nair., S.N, Sharit, J., (2006). *"Factors predicting the use of Technology: Findings from the Center for Research and Education on Aging and Technology enhancement (CREATE)"* Psychology and Aging, 2006, Vol 21, Number 2, Pages 333-352, The American Psychological Association, DOI: 10.1037/0882-7974.21.2.333
Davies, O., (2005). "*State of the Industry"* version 1, Strange Agency

De Grey, A., (2004). *"We will be able to live to 1,000"* BBC News Website http://news.bbc.co.uk/1/hi/uk/4003063.stm [accessed February 2009]

De Kort, Y.A.W., IJsselsteijn, W.A., Midden, C.J.H., Eggen, J.H., van den Hoven, E.A.W.H., (2005). *"Persuasive Gerontechnology"* Gerontechjournal, Vol 4, Number 3, www.gerontechjournal.net, [accessed March 2009]

De Kort, Y.A.W., IJsselsteijn, W.A., Poels, K., (2007). *"Digital Games as Social Presence Technology: Development of the Social Presence in Gaming Questionnaire (SPGQ)"* Presence 2007 Conference, October 25-27, Barcelona

De Kort, Y.A.W., IJsselsteijn, W.A., (2008). *"People, Places, and Play: Player Experience in a Socio-Spatial Context"* ACM Computer in Entertainment, Vol 6, Number 2, Article 18

Derbyshire, D., (2006). *"Video game aiming to keep those little grey cells moving"* The Telegraph, http://www.telegraph.co.uk/news/worldnews/asia/japan/1513333/Video-game-aiming-to-keep-*those*-little-grey-cells-moving.html [accessed February 2009]

Dodson, S., (2004). *"Play time for Grown Ups"* The Guardian Newspaper, http://www.guardian.co.uk/computergames/story/0,,1150678,00.html [accessed January/February 2005]

Dickinson, A., Eisma, R., Syme, A., Gregor, P., (2002). *"Usable Technology for Older People: Inclusive and Appropriate"* Proceedings Vol 2 of the 16th British HCI Conference

Dovey, J., Kennedy, H.W., (2006). *"Game Cultures Computer games as New Media"* Berkshire, Open University Press, ISBN-13: 978-0-335-21357

Dring, C., (2009). *"Game Based Learning 2009 backed by industry heavyweights"* MCV, Issue 524, http://issuu.com/intentmedia/docs/mcv_issue524 [accessed February 2009]

Dring, C., (2009). *"The I-Generation"* MCV, Issue 530, http://issuu.com/intentmedia/docs/mcv_issue530 [accessed March 2009]

Dring, C., (2009). *"Nintendo DS – Retail Biz"* MCV, Issue 531, http://issuu.com/intentmedia/docs/mcv_issue531 [accessed April 2009]

Economist, The., The World in 2006, 20th Edition, (2006). *"The Aging World, Issues for Older People 2005 – 2025"*

Entertainment Software Association., (2004). *"Essential Facts about the Computer and Video Game Industry 2004"* http://www.theesa.com/files/EFrochure.pdf [accessed February 2005]

Entertainment Software Association., (2005). *"Essential Facts about the Computer and Video Game Industry 2005"* http://www.theesa.com/files/2005EssentialFacts.pdf, [accessed June 2005]

Entertainment Software Association., (2006). *“Essential Facts about the Computer and Video Game Industry 2006”* http://www.theesa.com/facts/pdfs/ESA_EF_2006.pdf [accessed March 2006]

Entertainment Software Association., (2007), *“Essential Facts about the Computer and Video Game Industry 2007”*, http://www.theesa.com/facts/pdfs/ESA_EF_2007.pdf, Accessed March 2007

Entertainment Software Association., (2008). *“Essential Facts about the Computer and Video Game Industry 2008”* http://www.theesa.com/facts/pdfs/ESA_EF_2008.pdf [accessed March 2008]

Ermi, L., Mäyrä, F., (2005). *“Fundamental Components of the Gameplay Experience: Analysing Immersion”* http://www.uta.fi/~tlilma/gameplay_experience.pdf [accessed March 2009]

Fencott, P.C., (2007). *“Game Invaders”* Teesside University, Middlesbrough, UK, https://outranet.scm.tees.ac.uk/users/u0000692/Analyst/StrangeInvaders.htm

Fernandez, A., (2007). *“Fun experience with digital Games: a Model Proposition”* http://www.fun-of-use.org/interact2007/papers/FunExperienceWithDigitalGames.pdf, [accessed February 2009]

Finchum, T., Weber, J.A., (2000). *“Applying Continuity Theory to Older Adult Friendships”* Journal of Aging and Identity, Vol 5 Issue 3, 2000 (social networks)

Fozard., J.L., Kearns, W.D., (2006). *“Persuasive GERONtechnology: Reaping Technology’s Coaching Benefits at Older Age”* pp 199-202, Springer-Verlag Berlin Heidelberg

Gajadhar, B.J., de Kort., Y.A.W., Ijsselsteijn., W.A., (2008). *“Influence of social setting on player experience of digital games”* CHI 2008 Proceedings, ACM 978-1-60558-012-8/08/04

Gamberini, L., Alcaniz, M., Barresi, G., Fabregat, M., Prontu, L., Seraglia, B., (2008). *"Playing for a real bonus: videogames to empower elderly people"* Journal of Cyber Therapy & Rehabilitation, 2008, Vol 1, Issue 1, Pages 37-47

Goodman, J., Syme, A., Eisma, R., *"Older adults' use of computer: A survey"* http://www.computing.dundee.ac.uk/projects/utopia/publications/bcs_hci03.pdf#search=%22older%20adults%20and%20computer%20games%22 [accessed September 2006]

Goldstein, J., Cajko, L., Oosterbroek, M., Michielsen, M., van Houten, O., Salverda, F., (1997). *"Video Games and the Elderly"* Social Behaviour and Personality, Vol 25, Number 4, Pages 345-352

Graetz, JM, August 1981, The origin of Spacewar, Creative Computing, http://www.wheels.org/spacewar/creative/SpacewarOrigin.html [Accessed 10 August 2008]

Greengross, S., (2004). *"Why ageism must be eradicated"*, BBC News Website, http://news.bbc.co.uk/1/hi/uk/4041713.stm [accessed February 2009]

Gregor. P., Newell, A.F., Zajicek, M., *"Designing for Dynamic Diversity interfaces for older people"* http://www.computing.dundee.ac.uk/projects/UTOPIA/publications/Designing%20for%20Dynamic%20Diversity%20(with%20Mary%20Z).pdf [accessed April 2007]

Hein, K., (2006). *"Category Wars: Game Plans for Xbox 360, Wii, PS3 to Target Families"* http://www.allbusiness.com/marketing-advertising/branding-brand-development/4698036-1.html [accessed February 2009]

Herald, The., (2003). "*Pensioners plug into computer game generation"*

Herman, L, Phoenix, The fall and rise of Videogames 3rd Edition

Hermida, A., (2003). *"Game graphics hit their limits"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/3189537.stm [accessed February 2009]

Hermida, A., (2004a). *"New handheld consoles fight it out"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/3663594.stm [accessed February 2009]

Hermida, A., (2004b), *"Blackberry device is out of season"*, BBC News Website, http://news.bbc.co.uk/go/pr/fr/-/1hi/technology/3527233.stm, Accessed 2009

Hermida. A., (2004c). *"UK turning into nation of gamers"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/3613916.stm [accessed 2008]

Hermida, A., (2006). *"Rosy outlook for gadgets for elderly"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/4608920.stm [accessed 2007]

Herz, J.C., (1997). *"Joystick Nation: How Computer games Ate our Quarter, Won our Hearts and Rewired Our Minds"* http://www.wheels.org/spacewar/joystick_nation.html [accessed 2008]

Highfield, R., (2008a). *"'Brain Training game do work study finds"* The Telegraph, http://www.telegraph.co.uk/scienceandtechnology/science/sciencenews/3340967/Brain-training-games-do-work-study-finds.html [accessed February 2009]

Highfield, R., (2008b). *"Brain training games boost IQ study shows"* The Telegraph, http://www.telegraph.co.uk/news/1906452/Brain-training-games-boost-IQ-study-shows.html [accessed February 2009]

Highfield, R., (2008c). *"Elderly are more open-minded than young people"*, The Telegraph http://www.telegraph.co.uk/scienceandtechnology/science/sciencenews/3350732/Elderly-are-more-open-minded-than-young-people.html [accessed February 2009]

Hill, A., (2006). *"£20m to help baby boomers grow older gracefully"* The Guardian http://www.guardian.co.uk/society/2006/oct/29/longtermcare.uknews [accessed 2008]

Hindmarch, M., Cockton, G., Young, M., McDonald, S., Chau, P., Woolrych, A.,(2006). *"Digital Gerontechnology: Opportunities, Approaches and State of the Art, Rethinking Digital Gerontechnology: Pointers from Exploratory Fieldwork"* School of Computing and Technology, University of Sunderland

Hitti, M., (2006). *"Computer Game May Screen for Dementia"* http://www.webmd.com/alzheimers/news/20060719/computer-game-screen-dementia [accessed September 2006

Hogg, C., (2006). *"Grey gamers flex brain muscles"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/5041690.stm [accessed April 2007]

Hooyman, N.R., Kiyak, H.A., (2007). *"Social Gerontology: A multidisciplinary Perspective"* 8th Edition, ISBN: 0-205-27772-1

Hughes, M., (2003). *"Why over-60s are happy to become mouse bound"* The Guardian, http://www.guardian.co.uk/money/2003/dec/13/savingforretirement.jobsandmoney [accessed April 2007]

Huppert, F.A., (2003). *"Designing for Older Users"* In: J Clarkson, R Coleman, S Keates & C Lebbon (Eds) Inclusive Design: Design for the whole population, Springer Verlag, London, http://www.circa.cam.ac.uk/pages/chapter1.pdf [accessed 2007]

Interactive Digital Software Association, (2001). *"State of the Industry 2000 - 2001"* http://banners.noticiasdot.com/termometro/boletines/docs/consultoras/idsa/2001/idsa_SOTI2001.pdf [Accessed 2005]

IJsselsteijn, W., de Kort, Y. K., Midden, C., Eggen, B., van den Hoven, E., (2006). *"Persuasive Technology for Human Well-Being: Setting the Scene"* Springer-Verlag Berlin Heidelberg, Pages 1-5

IJsselsteijn, W., de Kort, Y., K, Poels., Jurgelionis, A., Bellotti, F., (2007a). *"Characterising and Measuring user Experiences in Digital Games"* ACM: 1-58113-000-0/00/0004
http://alexandria.tue.nl/openaccess/Metis215134.pdf [accessed March 2009]

IJsselsteijn, W., Nap, H. H., de Kort, Y., Poels, K., (2007b). *"Digital Game Design for Elderly Users"* http://alexandria.tue.nl/openaccess/Metis215142.pdf [accessed February 2009]

IJsselsteijn, W., van den Hoogen, W., Klimmt, C., de Kort, Y., Lindley, C., Mathiak, K., Poels, K., Ravaja, N., Turpeinen, M., Vorderer, P., (2008). *"Measuring the Experience of Digital Game Enjoyment"*
http://www.noldus.com/mb2008/individual_papers/Symposium%20vanderHeijden/Symposium_vanderHeijden_IJsselsteijn.pdf [accessed February 2009]

Intille, S. S., (2004). *"A New Research Challenge: Persuasive Technology to Motivate Healthy Aging"* IEEE Transaction on Information Technology in Biomedicine, Vol 8, Number 3

Jarvis, H., (2008). *"Wii solution to an age old problem"* BBC News Website, http://news.bbc.co.uk/1/hi/scotland/glasgow_and_west/7637801.stm [accessed November 2008]

Jeavans, C., (2004). *"Welcome to the ageing future"* BBC News Website, http://news.bbc.co.uk/1/hi/uk/4012797.stm [accessed 2008]

Jenkins., A. (2006, March). Codeworks ATL Overview. Paper presented at the meeting of the National Council on Aging & American Society of Aging. Anaheim, CA

Jennings, L., (2007). *"Mason Professor Lists Top 'Brain Games' for Older Adults"* Mason Gazette, The, http://gazette.gmu.edu/articles/10400/print [accessed December 2008]

Jimison, H., (2006). *"Computer Card Game Detects Cognitive Changes"* Oregon Health and Science University, http://www.ohsu.edu/ohsuedu/newspub/releases/071706dementia.cfm [accessed 2006]

Johnson, B., (2008). *"Hand-waving computer control brings Minority Report to life"* The Guardian, http://www.guardian.co.uk/technology/2008/jan/11/games.computing/print [accessed February 2009]

Juul, J., (2003). *"The Game, The Player, The World: Looking for a Heart of Gameness"*, in Copier, M. and Raessen, J., (eds) Level Up: Digital Games Research Conference Proceedings, University of Utrecht, pp.30-47

Kent, S.L., (2001). *"The Ultimate History of Video Games"* California, Prima Publishing

Kerr, A., (2006) *"The Business and Culture of Digital Games Gamework/Gameplay"* London, SAGE Publications LTD, ISBN-10 1-4129-0047-6

Khoo, E.T., Cheok, A.D., (2006). *"Age Invaders: Social and Physical inter-generational mixed reality family entertainment"* The International Journal of Virtual Reality, Vol 5, No 2, pp 45-50

Khoo, E.T., Cheok, A.D., (2008). *"Age Invaders: Social and Physical inter-generational mixed reality family entertainment"* Virtual Reality, 2008, Vol 12 Number 1, pp. 3-16, ISSN: 1359-4338 Springer-Verlag, London Limited, DOI: 10.1007/s10055-008-0083-0

Kimiecik, J.C., Harris, A.T., (1996). *"What is Enjoyment? A Conceptual/Definitional Analysis with Implications for Sport and Exercise Psychology"* Journal of Sport & Exercise Psychology, Vol 18, pp. 247-263

Kivikangas, M.J., (2006). *"Psychophysiology of flow experience: an explorative study"* Master Thesis, Department of Psychology, University of Helsinki, Helsinki, Finland, http://ethesis.helsinki.fi/julkaisut/psyko/pg/kivikanga/psychoph.pdf [accessed 2008]

Knapton, S., (2008). *"Pensioners feel 13 years younger than they are"* The Telegraph, http://www.telegraph.co.uk/health/elderhealth/3709559/Pensioners-feel-13-years-younger-than-they-are.html [accessed January 2009]

Kollar, P., (2008). *"Nintendo promoting literacy with 100 classic book collection for DS"* 1up website, http://www.1up.com/do/newsStory?cId=3171578 [accessed February 2009]

Larson, C., (2008). *"Games to Keep Your Brain Agile"* US News, http://health.usnews.com/articles/health/brain-and-behaviour/2008/01/28/games-to-keep-your-brain-agile [accessed March 2009]

Lazzaro, N., (2004). *"Why we play games: Four keys to more emotion without story"* Technical report, XEO Design Inc

Lenhart. A., Sydney. J., Macgill. A.R., (2008). *"PEW Internet Project Data Memo"* Pew Internet & American Life Project, http://www.pewinternet.org/pdfs/PIP_Adult_gaming_memo.pdf [accessed 2008]

Lesnoff-Caravaglia, G., (2007). *"Gerontechnology, Growing old in a Technological Society"* Springfield, Illinois, USA, Charles C Thomas Publisher LTD

Lillington, K., (2003). *"Grown-up players push computer games into the mainstream – The computer games market is growing in sophistication"* Irish Times Dublin Ireland, http://www.ireland.com/cgi-bin/dialogserver [accessed January/February 2005]

Lindley, C. A., (2004). *"Trans-Reality Gaming"* Conference Proceedings, 2nd Annual International Workshop in Computer Game Design & Technology [accessed January 2009]

Lindley, C. A., Nacke, L., Sennersten, C., (2007). *"What does it mean to understand gameplay?"* [accessed January 2009]

Lindley, C. A., Nacke, L., Sennersten, C., (2008). *"Dissecting Play – Investigating the Cognitive and Emotional Motivations and Affects of Computer Gameplay"* CGAMES08 [accessed January 2009]

Long, N., (2007). *"Industry follows Nintendo as gaming goes casual"* MCV, http://www.mcvuk.com/news/28432/Industry-follows-Nintendo-as-gaming-goes-casual [accessed February 2009]

Long, N., (2008). *"Euro Charts: Brain Training cleans up"* MCV, http://www.mcvuk.com/news/29462/EURO-CHARTS-Brain-Training-cleans-up, [accessed February 2009]

Lost Garden., (2005). *"Game Design Review: DS Training for Adults"* http://lostgarden.com/2005/10/game-design-review-ds-training-for.html [accessed 2005]

Mancini, J. A., Orthner, D. K., (1982). *"Leisure Time, Activities, Preferences, and Competence: Implication for the Morale of Older Adults"* Journal of Applied Gerontology, 1982, Vol 1, Issue 1, pp. 95-103

Mandryk, R., L, Inkpen., K. M., Calvert, T. W., (2005). *"Using psychophysiological techniques to measure experience with entertainment technologies"* Behaviour and Information Technology, Vol 25, Issue 2, March April 2006, pp. 141-158 (18), Taylor and Francis Ltd

Malone, T. W., (1980). *"What Makes Things Fun to Learn? Heuristics for Designing Instructional Computer Games"* ACM 0-89791-024-9/80/0900-0162

Malone, T. W., (1982). *"Heuristics for Designing Enjoyable User Interfaces: Lessons from Computer Games"* Conference Proceedings on Human Factors in Computing Systems, Maryland, USA, pp. 63-68

Malone, T. W., Lepper, M. R., (1987). *"Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning"* Aptitude Learning and Instruction, Vol 3

Marston, H. R., Fencott. P. C., Van Schaik. P., (2006). "*Grey Gamers Project"* CODEWORKS ATL Project, Teesside University

Marston, H. R., (2007). *"Computer games and older adults Why???"* Legacy of Learning conference, University of Strathclyde, Scotland

Melenhorst, A. S., (2002). *"Adopting communication technology in later life: The decisive role of benefits"* Technology University of Eindhoven, ISBN 90-386-1867-0

McCurry, J., (2006). *"'Grey Gamers' boost Nintendo Sales"* The Guardian http://www.guardian.co.uk/technology/2006/jul/24/nintendowii.nintendo/print, [accessed February 2009]

McGuire, F., (1984). *"Improving the quality of life for residents of long term care facilities through videogames"* Activities, Adaptation and Aging, Vol 6. 1-7

Mellor, M. J., Rehr, H., (2005). *"Baby Boomers, can my eighties be like my fifties?"* New York, Springer Publishing Company, Inc

Morgan, L., Kunkel, S., (1998). *"Aging the Social Context"* London, SAGE Publications Ltd

Minkley, J., (2006). *"Nintendo toasts global DS success"* MCV, http://www.mcvuk.com/news/682/Nintendo-toasts-global-DS-success [accessed February 2009]

Mossman, K., (2006). *"Circuit Training, computer games for mental workouts"* Scientific American Mind, http://www.sciammind.com/article.cfm?articleID=00016C9D-2761-1477-D3383414B7F0000 [accessed September 2006]

Nacke, L., Lindley, C., (2008a). *"Boredom, Immersion, Flow – Pilot Study Investigating Player Experience"* In proceedings of the IADIS Gaming 2008: Design for Engaging Experience and Social Interaction (Amsterdam, the Netherland, July 25-27). IADIS Press, pp. 103-107

Nacke, L., Lindley. C., (2008b). *"Flow and Immersion in First-Person Shooter: Measuring the Player's gameplay experience"* In proceeding of the 2008 Conference on Future Play: Research, Play, Share, Canada, pp. 87-88, ISBN: 978-1-60558-218-4

National Post, The., (2008). *"Video games my slow ageing in older brains"* http://www.nationalpost.com/story.html?id=1106696 [accessed February 2009]

Nauert, R., (2008). *"Video games improve cognitive skill in Older Adults"* Psychcentral, http://psychcentral.com/news/2008/12/12/video-games-improve-cognitive-skills-in-older-adults/3497.html [accessed February 2009]

Newell, A. F., Clackson, J., Coleman, R., Keates, S., Lebbon, C., (2003). *"Inclusive Design or Assistive Technology"* Chapter 10 from the book "Inclusive Design – Design for the whole population" Springer, pp. 172-181, http://www.computing.dundee.ac.uk/projects/UTOPIA/publications/Asst%20&%20%20Mainstream%20tech%20book%20chapter%20revision.pdf [accessed April 2007]

Newman, J., (2005). *"Videogames"* Oxon, Routeledge, Taylor & Francis Group, ISBN 0-415-28192-X

Nugent, K., (2008). *"In Clinton, Seniors say Oui! To Wii"* Local News, Worcester/ Wachusett, http://www.telegram.com/article/20080210/NEWS/802100403/1008/NEWS02 [accessed January 2009]

Nyren, C., "*Why Advertisers will stop ignoring aging boomers",* Bimonthly The, Newspaper of the American Society on Aging, Vol XXVII, No 1, ISSN 1043-1284, www.agingtoday.org [accessed January/February 2006]

Novak, T. P., Hoffman, D. L., Yung, Y. F., (1999). *"Measuring the Flow construct in Online Environments: A structural Modelling Approach"* Working Paper

Onaf, A., (2008). *"Nintendo Wii the Game controller that Controls the Future"* http://www.articlebase.com/print/450103 [accessed April 2009]

O'Neill, B., (2006). *"Baby boom…and bust"* BBC News Website*,* http://news.bbc.co.uk/1/hi/magazine/4798825.stm [accessed 2008]

Office of National Statistics, (2007). National Projections, http://www.statistics.gov.uk/cci/nugget.asp?id=1352 [accessed 2008]

Parfitt, B., (2005). *"New DS bundle for Mario fans"* MCV, http://www.mcvuk.com/news/580/New-DS-bundle-for-Mario-fans [accessed February 2009]

Parfitt, B., (2009). *"NPD: Nintendo continues to expand the market"* MCV, http://www.mcvuk.com/news/33246/NPD-Nintendo-continues-to-expand-the-market [accessed February 2009]

Park, D. C., Schwarz, N., (2000). *"Cognitive Aging: A Primer"* Sussex, Psychology Press, Taylor & Francis Group, ISBN 0-86377-692-2

Parkinson, J., (2004a). *"Learning in retirement"* BBC News Website, http://news.bbc.co.uk/1/hi/education/4054259.stm [accessed 2008]

Parkinson, J., (2004b). *"What about adult learners?"* BBC News Website, http://news.bbc.co.uk/1/hi/education/4017059.stm [accessed 2008]

Peter, C., Herbon, A., (2006). *"Emotion representation and physiology assignments in digital systems"*, Interacting with Computers, Vol 18, pp.139-170, DOI: 10.1016/j.intcom.2005.10.006

Phillips H., Douglas K., (2006). "*Live to 100"* New Scientist, number 2554, pp. 36 – 42

Polivka, L., (2000). "*Postmodern Aging and the Loss of Meaning*" Journal of Aging and Identity, Vol 5, Issue 4, pp. 225-235

Powers, K., (2007). *"New 3D camera eyes Wii-style gameplay"* Reuters UK, http://uk.reuters.com/article/idUKLAU35808420071213 [accessed February 2009]

Pratchett, R., (2005). *"Digital play, Digital Lifestyles"*, Commissioned by the BBC Creative Research and Development department.

Proudfoot, S., (2008). *"Grey-haired generation got game"* Canwest News Service, http://www.canada.com/technology/gaming/Grey+haired+generation+game/1080612/story.html [accessed February 2009]

Province, The., (2008). *"Video games for Grandpa*" http://www.canada.com/technology/gaming/Video+games+Grandpa/1076985/story.html [accessed February 2009]

Rhienberg, F., Vollmeyer, R., (2003). *"Flow experience in a computer game under experimentally varied conditions"* Journal of Psychology, issue 4, pp. 161-170

Rosmarin, R., (2007). *"Making the Virtual World Real"* Forbes.com, http://www.forbes.com/2007/12/09/videogames-wii-camera-tech-cx_rr_1210games.html [accessed February 2009]

Ross, P. E., (2007). *"Benedetto Vigna: The Man Behind the Chip Behind the Wii"* http://www.spectrum.ieee.org/mar07/4956 [accessed 2008]

Russell, J.A., (1980). *"A circumplex model of affect"*, Journal of personality and social psychology, volume 39, pp. 1161-1178

Salem, K., Zimmerman, E., (2004). *"Rules of Play: Game Design Fundamentals"*, Cambridge, MA and London:MIT

Schott, G., Thomas, S., (2008). *"The impact of Nintendo's 'For Men' Advertising campaign on a potential female market"* Eludamos. Journal of Computer Game Culture, 2(1), pp. 41-52, http://www.eludamos.org/index.php/eludamos/issue/view/4/showToc [accessed 2009]

Science Centric., (2008). *"Strategic video game improves critical cognitive skills in older adults"* http://www.sciencecentric.com/news/print.php?q=08121125-strategic-video-game-improves-critical-cognitive-skills-older-adults [accessed 2009]

Science Daily., (2008). *"Strategic video game improves critical cognitive skills in older adults"*, https://www.sciencedaily.com/releases/2008/12/081211081442.htm [accessed February 2009]

Sheridan, T.B., (1992). *"Musings on telepresence and virtual presence. Presences: Teleoperators and Virtual Environments",*

Shim, R., Borland, J., (2005). *"Can games grow beyond the hard-core set?"* cnet news.com, http://news.com.com/Can+games+grow+beyond+the+hard-core+set/2100-1043_3-5713868.html [accessed December 2008]

Shirinian, A., Dickelman, E., (2002). *"Applying Video Game Interaction Design to Business Performance"* Performance Improvement, Vol 41, No 10, http://www.ispi.org [accessed January 2009]

Sicart, M., (2008). *"Defining Game Mechanics"* The international Journal of Computer game research, Vol 8, (2), ISSN:1604-7982

Smith, A., (2005). *"Course beats the generation gap"* BBC News Website, http://news.bbc.co.uk/1/hi/education/4576557.stm [accessed 2008]

Stuart, K., (2006). *"Can the games industry address an ageing population?"* Guardian Unlimited Games Blog, http://blogs.guardian.co.uk/games/archives/2006/01/17/can_the_games_industry_address_an_ageing_population.html [accessed April 2007]

Stuart-Hamilton, I., (2006). *"The Psychology of Ageing, An Introduction"* Fourth Edition, London, Jessica Kingsley Publishers, ISBN 10:1-84310-426-1

Sweetser, P., Wyeth, P., (2005). *"GameFlow: A Model for Evaluating Player Enjoyment in Games"* Computer in Entertainment, Vol 3, Issue 3, July 2005, ISSN: 1544-3574, ACM, USA

Tabuchi, H., (2006). *"Nintendo Brain-Training Game a Hit"* CBS News Website, http://www.cbsnews.com/stories/2006/03/09/tech/main1387633.shtml [accessed December 2008]

Tapscott, D., (1998). *"Growing Up Digital: The Rise of the Net Generation"* Meridian, http://www.ncsu.edu/meridian/jan98/feat_6/digital.html [accessed September 2006]

Taub, E. A., (2007). *"With Wii and DS, Nintendo Has 2 Hit Game Devices"* New York Times http://www.nytimes.com/2007/12/31/technology/31nintendo.html?_r=1 [accessed January 2008]

Telegraph, The., (2008). *"Computer games that train your brain make it sharper"* http://www.telegraph.co.uk/scienceandtechnology/technology/3709474/Computer-games-that-train-your-brain-to-make-it-sharper.html [accessed February 2009]

Thompson, B., (2004). *"New technologies, old problems"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/3735931.stm [accessed 2007]

Tiwari, L. D., Astheimer, P., File, P., (2004). *"Considerations in Designing Games for Older People"* http://www.dcs.gla.ac.uk/utopia/workshop/tiwari2.pdf#search=%22older%20adults%20and%20computer%20games%22 [accessed September 2006]

Toynbee, P., (2008). *"Despite the baby boomers ageing, we can afford to care"* The Guardian Newspaper, http://www.guardian.co.uk/commentisfree/2008/may/13/longtermcare.socialcare, [accessed 2008]

Triggle, N., (2004). *"Are we destined for a frail old age?"* BBC News Website, http://news.bbc.co.uk/1/hi/health/3958495.stm [accessed 2008]

Tsai, W. C., Lee, Y. H., Chang, T. H., Ho, C. J., Hsu, J. Y., (2008). *"Designing Human-Computer Multi-agent Collaboration in Productive Multi-Player Games"* International conference on autonomous agents, Conference Proceedings of the 7th International joint conference on Autonomous agents and multi agent systems - Volume 3, pp. 1441-1444, ISBN: 978-0-9817381-2-X

Twist, J., (2004). *"Decade of dominance for PlayStation",* BBC News Website, http://news.bbc.co.uk/1/hi/technology/4054797.stm [accessed February 2009]

Van Bronswijk, J. E. M. H., (2006) *"Persuasive GERONtechnology: An Introduction"* Springer-Verlag Berlin Heidelberg, pp. 183-186

Van Eck, R., (2006) *"Digital Game based Learning"* http://net.educause.edu/ir/library/pdf/ERM0620.pdf [accessed February 2009]
Vincent, J., (2003). *"Old Age"* London, Routledge, Taylor & Francis Group, ISBN 0-415-26823-0

Walker, A., Barnes, M., Cox, K., Lessof, C., (2006). *"New Horizons Research Programme. Social Exclusion of Older People: Future Trends and Polices, Think Piece"* Department for Communities and Local Government: London, http://www.communities.gov.uk/pub/129/TheSocialExclusionofOlderPeopleFutureTrendsandPoliciesThinkPiece_id1501129.pdf [accessed November 2006]

Walker, A., Maltby T., (1997). *"Rethinking Ageing, Ageing Europe"* Buckingham, Open University Press, ISBN 0-335-19746-9

Walker, D., (2004). *"Live fast, die old"* BBC News Website, http://news.bbc.co.uk/1/hi/magazine/3659996.stm [accessed 2008]

Ward, M., (2007). *"Video games need 'realism boost'"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/6934462.stm [accessed February 2009]

Water, D., (2004). *"Nintendo DS aims to touch gamers"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/4042431.stm [accessed February 2009]

Waters, D., (2007). *"What exactly is a next generation game"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/6937058.stm [accessed February 2009]

Waters, D., (2008). *"Taking the Wii to the next level"* BBC News Website, http://news.bbc.co.uk/1/hi/technology/7511215.stm [accessed August 2008]

Weisman, S., (1983). *"Computer games and the frail elderly"* Gerontologist, Vol 23 (4), pp. 361-363

Western Daily Press., (2003). *"Grey gamers' Sonic tonic"*

Woelfel, J., (2007). *"Nintendo Wii: A video game that's good for you no matter what your age"* http://www.gilbertguide.com/2007/10/16/a-video-game-thats-good-for-you-no-matter-what-your-age/ [accessed February 2009]

White, H., McConnell, E., Clipp, E., Bynum, L., Teague, C., Navas, L., Craven, S., Halbrecht, H., (1999). *"Surfing the net in late life: A review of the literature and pilot study of computer use and quality of life"* The Journal of Applied Gerontology, Volume 18, Issue 3, pp. 358-378

Whitcomb, G. R., (1990) *"Computer games for the elderly"* Symposium on computers and the quality of life, proceedings of the conference on computers and the quality of life, ISBN 0897914031

Witmer, B.G., Singer, M.J., (1994). *"Measuring immersion in virtual environments",* (ARI Technical Report 1014), Alexandria, VA:U.S. army Research Institute for the Behavioural and Social Sciences,
https://mitpress.mit.edu/journals/PRES/PS00734.pdf, [accessed June 2009]

World Population Prospects: The 2004 Revision. United Nation Department of Economic and Social Affairs' Population division, 2005.
Zajicek, M., (2006).*"Special Interface Requirements for Older Adults"*
http://virtual.inesc.pt/wuauc01/procs/pdfs/zajicek_final.pdf [accessed November 2006]

APPENDICES

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APPENDIX I

COMPUTER GAMES AND OLDER ADULTS WHY?

LEGACY OF LEARNING CONFERENCE

UNIVERSITY OF STRATHCLYDE

MAY 2007

Computer Games & Older Adults Why???

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Abstract:

There has been a tremendous development of computer games since they first appeared in the sixties. Since the invention of computer games many young people have engaged with this form of entertainment as part of their growing up. Many baby boomers may remember the first computer game been released or even playing it, but what about now in the 21st Century? Would the over-fifties consider playing games with their children/grandchildren using the latest technology available? Playing and Interacting with this form of entertainment for people of all ages is a learning curve, learning in the sense of what buttons to press, the nature of the game itself and what is expected of the player when playing the game.

The baby boomer generation has been part of and experienced many exciting developments, in recent years and decades such as the invention of youth culture and the reinvention of middle age, since this generation was born during the two decades after World War Two. The year 2006 has seen the first of this generation turn 60 years old. Workshops conducted to gain both qualitative and quantitative data revealed interesting results from participants who were both gamers and non-gamers. The method used to collect data was in the form of workshops, consisting of a survey which gauged computer use, confidence of using a computer, computer game usage, confidence of computer games and personal details. Four presentations and four worksheets were used as part of the workshop, where each presentation and worksheet corresponded with each other. Participants in the workshop were given a step-by-step approach into designing their own game idea, relating to a hobby, interest or dream. Of the participants 25% had taught themselves to play computer games shortly followed by 17% learning from a grand-child. Twenty-nine percent of players preferred playing puzzle games, shortly followed by 21% enjoying strategy.

Introduction:

Baby boomers are a population of people who have been part of many phenomenons, since this generation were born during the two decades after the war the invention of youth culture and the reinvention of middle age. 2006 will see the generation start to turn 60. With the technology enhancements that have occurred during the late 20th Century some of the baby boomers will have become familiar with and others not as familiar through employment, social network and family life. Computer games have come a long way since they were first developed in the sixties. The knowledge and skills that have derived over the years have seen many young people taking this form of entertainment as part of their growing up. Many baby boomers may remember the first computer game been released or even playing it, but what about now in the 21st Century?

Over the last forty years there have been many developments and implementations that have brought computer games to where they are today. Computer games companies have developed games for the younger audience rather than older adults and seniors.

There has been a number of articles in recent years reporting on older adults and computer gaming. One particular article reported on the BBC web site "Pensioners catch the gaming bug" stating: "Increasing numbers of over 60s are picking up joysticks to play videogames." A games company based in the Midlands called CODEMASTERS, has nicknamed this particular audience "grey gamers," which has seen an increase in people over sixty "buying the more diverse games such as strategy and historical titles." The report also discusses "the type of games that get grannies and grandpas going are the ones that require lateral thinking and problem solving rather than shoot em ups." *(Pensioners Catch the Gaming Bug, BBC News, 03 December 2003, http://news.bbc.co.uk/go/pr/fr/-/1/hi/technology/3287891.stm)*

Since the Nintendo DS was released in 2005 one of the best selling games which have been developed for the handheld has been Dr Kawashima's Brain Training game. The game itself involves a number of "brain-enhancing exercises" *(Bennallack, 2006)* allowing gamers and non-gamers to play "a variety of mini-games designed to give brains a workout." *(Bennallack, 2006)* The type of mini games implemented range from "solving simple maths problems, counting people going in and out of a house, drawing pictures on the Nintendo DS touch screen, and reading classic literature aloud into the device's microphone." *(Bennallack, 2006)* Gamers are able to see how their brain is performing and improving with time as they are given a brain age reflected from their performances through the games, the better scores you gain the younger your brain should get. The game itself has "sold some 1.8 million copies and it is still in the Japanese top 10 a year after release" *(Bennallack, 2006)*

The Wii, which was released 8th December 2006, is another Nintendo success story. The Wii allows players to actively interact with games rather than just push buttons. Introducing motion sensors to gamers and a console allow everyone to interact with the technology even more so older adults and the elderly who may find pressing buttons awkward. An example of this is the golf game, "the device becomes the club and the force of a drive is determined by how far back you swing the controller." (Hermida, 2006)

Previous Research:

A small study was carried out in the Netherlands *(Copier, 2002)* which focused on elderly people playing computer games. The main research outlined in the project investigated the following: what kind of digital games do they play, what motivates the elderly to play digital games and does the playing of digital games lead to a wider social network? This study interviewed twelve people ranging from 50-76 years old.

From the investigation the study reported that "the elderly play games out of every game-genre: action, adventure, fighting, puzzle, role-playing, simulations, sports and strategy (Herz, 1997). But most of them played cards, chess, puzzle and adventure games." One of the main conclusions from the study was the only people who the elderly speak to about games was other family members, who in turn provided them with new games.

A similar investigation to that was carried out in the Netherlands was conducted by the University of Abertay, Dundee, Scotland, called the UTOPIA project. The aim of the project was to assess and determine older adults and user interfaces in relation to computer games. The article itself has some interesting points but there are also areas within the project where it raises a number of questions, for example how did the computer games used be chosen?, what further research has been conducted to gain further qualitative and quantitative data off the back of this project?

Why should older adults and seniors learn to play computer games?

Keeping the mind and brain active throughout life is imperative to the human mind allowing the individual to learn, enhance skills and knowledge and to interact with others. A younger person learning to play computer games can be fairly easy to understand and pick up either from family members or friends. When learning to play young people may find this easy to do by watching what happens on the screen and the hand movements conducted on the console pad. For an older adult to learn how to play could be more taxing especially when not use to this new form of entertainment and as technology is enhancing hardware may become fiddly to comprehend and to use which an older adult may find more difficult to learn and operate.

A report in the Journal Active Aging September/October 2002 reports; "As adults live longer and have more experiences, their brains has more information to sort through to retrieve those memories. The activities someone has done for a lifetime have established connections in the brain, making them easier to recall. But people need to use newer information frequently to form that direct connection to memory. Keeping the brain agile in its ability to find and use information will help reduce the memory loss associated with aging." *(Chapmen, 2002)* to combat memory loss associated with aging and enhance mental stimulation the report details the strategies to overcome this; "learn new things, read books and periodicals and do word games." *(Chapmen, 2002)*

Method:

The method developed for this investigation included a survey to be completed by respondents themselves. The following topics were included: computer use and ownership; computer game play, ownership of computer game equipment and related issues; as well as demographic details. Confidence has been found to be a pivotal factor in computer use in older adults (Barbeite & Weiss, 2004). A recently developed instrument, the (new) Computer Self-Efficacy scale (CSE) (Barbeite & Weiss), was included in the survey to measure computer confidence. Based on the CSE scale, the Computer Game Confidence scale was developed. Each item used a 7-point response format ranging from strongly disagree (1) to strongly agree (7). Two versions of each scale were included in the questionnaire: the CSE for computer users and non-users, and the Computer Game Confidence scale for computer game players and non-players. The method also included a series of workshops.

Participants are talked through four presentations. The first presentations discuss aspects of computer games such as context, communication, game play, imbalances and verbs. The final presentation asks participants to write down where their computer game could be advertised and how much the game should cost, as well as other target audiences. As part of the final presentation participants are asked to outline their game idea using the information from the previous presentations. For each presentation participants were handed a corresponding worksheet allowing a step-by-step approach. Not all participants who wanted to take part in the investigation were able to attend a workshop. It was decided that participants who were unable to attend a workshop but still interested in taking part in the project could still complete the survey.

In the workshops participants were asked a series of questions relating to hobbies, interests, dreams and what are their most important times. The rationale behind these questions was to discover whether participants wanted computer games designed and developed relating to their hobbies, interests and dreams. The initial results indicated that a number of participants enjoyed gardening, walking, sewing, sport, reading, photography, music and puzzles. The majority of participant's dreams were to travel, learn a language and to take part in adult education. Their most important times were spent with grandchildren, husband or wife, family members and at weekends.

As part of the survey handed out in the workshops, participants who had been playing computer games how they had learnt to play. There were a number of options for the participant to choose from these were; learned from a grand-child, learned from a child, learned from other family member, learned from a friend, taught myself, taught in class or other. There was no stipulation to the participant(s) as to how many in this section they could tick. In some of the cases the participants could have answered more than once. For participants who did not already play computer games they were asked whether they would consider playing a computer game, a further question which followed a negative response to this was "If not, why not?."

Participants who were not game players and who had not answered previous section of the survey relating to type of game genre(s) played where asked to specify the type of game genre they would considered playing; this included shooter, platform, sports, puzzle, adventure, strategy and other. Participants were not constricted to ticking one option; therefore participants may have answered more than one question. The next question that participants were asked relating to learning was "would you be willing to learn how to play computer games?" Participants were required to answer yes, no or don't know. The final question in this particular section asked participants whether they "consider playing a computer game related to their hobby?" Participants were required to answer yes, no or don't know.

Results:

The full sample of participants overall aged fifty and over was twenty-eight. Five of those participants had not been able to take part in the workshops and therefore had just filled in a survey. The gender split between the participants was sixteen women and twelve men. When participants were asked from the survey how they had learnt how to play computer games five had responded with the answer learned from a grandchild, two from a child, ten had taught themselves, one from a friend, one had reported other means of learning (not reported from participant) and nine had reported to do not play. Participants were asked whether they had access to a games consoles, eight had reported yes, nineteen had reported no and one had reported don't know. Participants were asked whether they owned a computer for playing computer games. Twenty reported yes, seven reported no and one reported don't know. When asked what type of computer they owned for playing games fifteen reported owning a PC, two reported owning a Macintosh, five answered not sure and six reported of not owning a computer. Participants were then asked whether they had access to a computer to play games, twenty-one had reported yes to have access to a computer, six reported no and one reported don't know.

The twenty-eight participants were then asked whether they had played games on the Internet. Six reported yes to playing games on the Internet and twenty-two had reported no. Participants were asked whether they would be willing to learn how to play computer games? Nineteen reported yes they would, five reported no and four reported don't know. Of those participants who were classed as gamers they were asked what type of genre they enjoyed playing. Three ticked shooter, two platforms, two sports, nine puzzle, six adventures, seven strategy and six other. Participants may have answered more than once to the game genres. Of those who are not gamers, they were asked as to what type of genre they would consider playing? Four answered yes to shooter, one to platform, eight to sports, thirteen to puzzle, eight to adventure, ten to strategy and two to other. As the same with gamers, non-gamers may have ticked more than once.

Conclusions:

This paper has discussed a number of issues relating to older adults, computer games, new technology and learning. The areas discussed have included why older adults should learn to play computer games in relation to mental stimulation, playing games allows the gamer to keep their brain active, learn a new form of entertainment and technology as well as enhancing skills and knowledge if playing games on the PC or Internet, enhancing techniques already learnt from using the computer for word processing or communicating with friends and family. From the results of the workshops conducted the response to learning how to play computer games and the type of genre(s) considered playing by non-gamers was positive, giving a wide variety of genres that would be considered playing. Prior knowledge of computer games was not required by participants for the workshops and having little knowledge gave the participants the chance to understand where what was required.

Having no knowledge allowed participants to be free with their ideas. Gamers who had been playing games all their life or just for a short period also gave positive responses to the survey and workshops as much as the non-gamers. Game technology has been discussed and one thing to think about is; is it the game content or the type of technology that older players want? Looking at the effect of the Wii has had on this audience maybe it is the type of technology interaction that is required to entice more players into playing and learning how to play computer games. With the technology that the Wii has brought to the market allowing older adults to immerse themselves in a game with friends and family maybe the future for games and having not only other demographic groups but also easier on learning in the sense playing golf or tennis it is easier to understand what is expected of them as a player when using the device of the Wii as you would a racket or golf club. What does the future hold in respect to further research? It is intended to look further into the notion that the type of technology used in a variety of game consoles is more important than the game content and genre used to entice and aide older people into playing and learning computer games.

References:

Barbeite, F. G. & Weiss, E. M. (2004). Computer self-efficacy and anxiety scales for an Internet sample: testing measurement equivalence of existing measures and development of new scales, *Computers in Human Behaviour, 20*, 1–15.

BBC News Website, "*Pensioners Catch the Gaming Bug"* http://news.bbc.co.uk/1/hi/technology/3287891.stm Accessed January/February 2005

Bennallack, O, *"Brain games aim to boost your IQ"* 24 April 2006, BBC News Website, http://news.bbc.co.uk/1/hi/technology/4930996.stm, Accessed 28 March 2007

Chapman, S, *"Strategies for maintaining cognitive health"* The Journal on Active Aging, September /October 2002

Computer Card Game Detects Cognitive Changes, July 17 2006, http://www.ohsu.edu/ohsuedu/newspub/releases/071706dementia.cfm Accessed October 2006

Copier.M, April 2002, *"Is gaming just for kids? Elderly people do play games"* http://les1.man.ac.uk/cric/gamerz/abstracts/copier.htm

Dickinson, A, Eisma, R, Syme, A, Gregor, P *"UTOPIA, Usable Technology for Older People: Inclusive and Appropriate"* http://www.computing.dundee.ac.uk/projects/UTOPIA/

Dodson, S, *"Play time for Grown Ups"*, Guardian the, Newspaper, Thursday February 19, 2004 http://www.guardian.co.uk/computergames/story/0,,1150678,00.html accessed January/February 2005

Game Design Review: *"DS Training for Adults"*, 02 October 2005, http://lostgarden.com/2005/10/game-design-review-ds-training-for.html, accessed May/June 2005

Hermida, A, *"Having a Wii good time"* BBC News Website, 11 May 2006, http://news.bbc.co.uk/1/hi/technology/4760473.stm Accessed 28 March 2007

Hitti, M, *"Computer Game May Screen for Dementia"*, July 2006, http://www.webmd.com/content/article/125/115925.htm Accessed October 2006

Huppert, F, *"Designing for older user"* Chapter 1, University of Cambridge, http://www.circa.cam.ac.uk/pages/chapter1.pdf Accessed September 2006

Lillington, K, "*Grown-up players push computer games into the mainstream – The computer games market is growing in sophistication*", Irish Times Dublin Ireland, 17 January 2003, http://www.ireland.com/cgi-bin/dialogserver, accessed January/February 2005

Marston, H,R, Fencott, PC, & van Schaik, P March 2006, "*Grey Gamers Project*", CODEWORKS ATL Project, Middlesbrough

Mossman, K, *"Circuit Training, Computer games for mental workouts"*, Scientific American Mind, June 2006, http://www.sciammind.com/article.cfm?articleID=00016C9D-2761-1477-9D3383414B7F0000 Accessed September 2006

Phillips, H, Douglas, K, "*Live to 100*", New Scientist, number 2554, June 2006, Page 36 – 42

Shim, R, Borland, J, *"Can games grow beyond the hard-core set?",* C-Net News.com, 19 May 2005, http://news.com.com/Can+games+grow+beyond+the+hard-core+set/2100-1043_3-5713868.html Accessed September 2006

Tabuchi, H, *"Nintendo Brain-Training Game A Hit"*, March 2006, http://www.cbsnews.com/stories/2006/03/09/tech/main1387633.shtml Accessed September 2006

Tapscott, D, *"Growing Up Digital: The Rise of the Net Generation"*, http://www.ncsu.edu/meridian/jan98/feat_6/digital.html Accessed September 2006

The Aging World, Issues for Older People 2005 – 2025, CODEWORKS ATL, in association with Age Concern Research Services, June 2005

The Herald (United Kingdom): "*Pensioners plug into computer game generation*", December 3, 2003

APPENDIX II:

HISTORY OF GAMES

II.0 – Introduction

Appendix II will discuss a variety of fundamentals in relation to computer games, this will involve the retrospective of computer gaming and handhelds, to the existing technology available to gamers and non-gamers. Within the discussion of gaming the investigation of interaction of a game, how the player or players interact within the game itself. The second aspect of this chapter will focus upon genre, content and interaction in relation to gaming.

II.1 – The start of a new medium

Computer games have been around for some years dominating the latter half of the twentieth century "depending on where you take the starting point, between 35 and 50 years a rich and often subjective history has accumulated" (Kirriemuir, 2006).

It is said, amongst the gaming world, that the creation and release of *Spacewar* in the early 1960s was the start of a new media format, although some critics would state that the game *Tennis for Two,* created in 1958, was the first game (Newman, 2004). Willy Higinbotham based at Brookhaven National Laboratories in New York, created *Tennis for Two* which was shown to the public on open days.

The interface of the game was very simple, two blue lines, one representing the net and the other placed along the bottom of the screen, which as the ball moved on the screen when it hit the horizontal line, would bounce. The game was intended as a two player format, where the controllers were very straightforward to use. There were only two buttons which formed the game controller, the first being to shoot the ball to the opposite side, and the second knob controlled the angle of the ball.

Due to the essence of the controller being simple to use and the interface being simple, the method of interaction between the player and game is relatively straight forward. Figures II.1 and II.2 show the interface of the game and the controller used to interact, looking at the images it is extremely easily to understand how to control the game and interact with the interface as the graphics and buttons are limited.

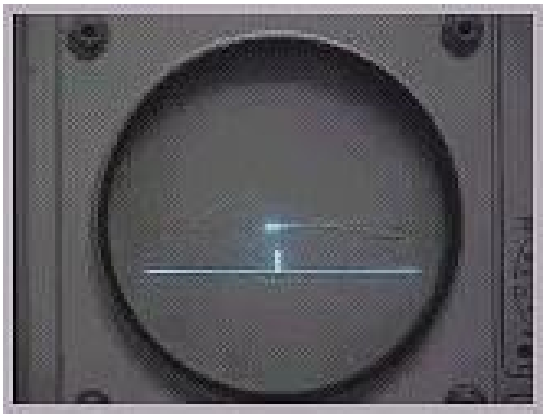

Figure II.1 – Interface of the game; Tennis for two[45]

Figure II.2 – The controller used to play Tennis for Two[46]

Following on from the creation of *Tennis for* Two, what is now known and debated by many within the gaming industry and academia as the first ever computer game to be developed, was Spacewar (1962). Newman states "when Steve Russell created Spacewar in the computer labs of the Massachusetts Institute of Technology, he started a chain of events that would change not only computing, but also entertainment and popular culture – not immediately, and certainly not knowingly, but decisively and permanently." (2004) Russell had created Spacewar which was executed on the PDP-1, this machine was not the size of what many gamers of the Twenty-First Century are used to playing on, such as the PlayStation 2 (PS-2), but large metal cabinets which ran the programme. Figure II.3 shows what the PDP-1 looked like and how much space the machine used within a room.

[45] http://www.emuunlim.com/doteaters/HiginPong2.gif
[46] http://www.emuunlim.com/doteaters/HiginPong2.gif

Figure II.3 – PDP-1 machine[47]

Figure 11.3 shows a monitor on top of the desk which is where the players would sit and play the game. With this game both the interface and interaction for the individuals was very simple and easy to understand. The interaction between the user and the interface derived from the PDP game controllers, these consisted of four controls "rotate counter clockwise, rotate clockwise, turn on your rocket thrust and torpedo" *(Herz, JC, 1997, Chapter 1, Joystick Nation: How computer games ate our quarters, won our hearts and rewired our minds).* There were problems with using this method of playing the screen was slightly off centred, and "with two excitable space warriors jammed into a space meant for one reasonably calm operator, damage to the equipment was a constant threat. At the very least, a jittery player could miss the torpedo switch and hit the start lever, obliterating the universe in one big anti-bang" (Graetz, JM, August 1981, The origin of Spacewar, Creative Computing, http://www.wheels.org/spacewar/creative/SpacewarOrigin.html).

The interaction between the player, controllers and the graphical interface was limited with the use of two switches and one button, further development of the controller was required to enhance the game play experience. Figure II.4 illustrates the original method of playing and Figure II.5 shows how the controller was enhanced for better game play.

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[47] http://www.stibbe.net/History/Games_Speech/Spacewar!.htm

Figure II.4 – Spacewar Interface[48]

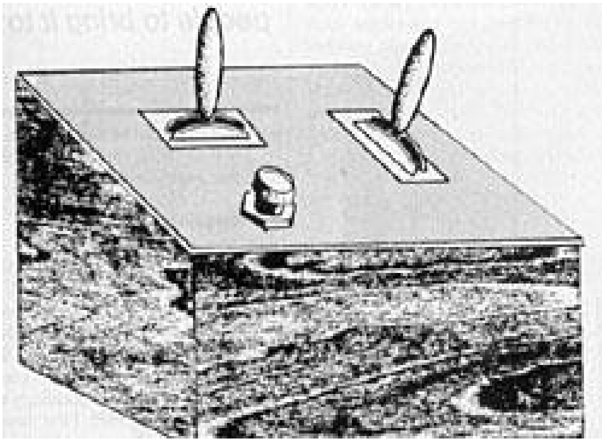


Figure II.5 – shows the original controllers used for Spacewar[49]

Graetz (1981) discussed how the improvement of the controller expanded game playing suggesting "players could sit comfortably apart, each with a clear view of the screen. That, plus the carefully designed layout of the controls, improved one's playing skills considerably, making the game even more fun."

The graphical interface of *Spacewar* is very simple there are two aircraft and a black hole. The purpose of the game is for players to shoot at one another, gravitate around the hole with-out being sucked into the middle. With the basic controllers and interface the game play for users would be intuitive and easy to understand. Figure II.6 illustrates the simplicity of *Spacewar*.

[48] rossignol.cream.org/new/spacewar.jpg
[49] http://www.wheels.org/spacewar/creative/SpacewarOrigin.html

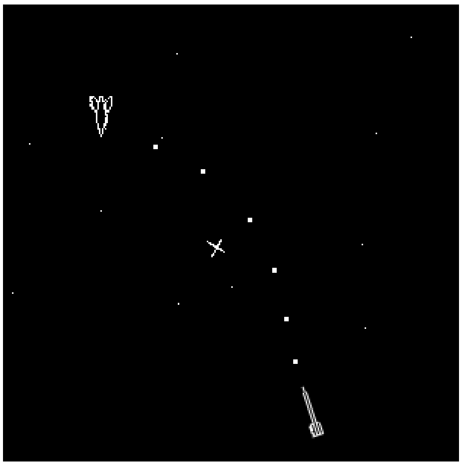


Figure II.6 – Spacewar interface[50]

In many educational institutions across America the notion of *Spacewar* was replicated, or as Kirriemuir (2006) states "modified, throughout a number of US academic institutions over the next few years making it the first game to be available outside a single research institute." One particular student called Nolan Bushnell, who in later years would become a prominent figure of the games industry, had played *Spacewar*. Bushnell had the idea of developing coin operated videogames, as Herman discusses, to conduct this type of operation and the size of the machinery required this was not possible for the time being (Herman, 2001).

The text Game Invaders, used by Fencott (2007) in the module of Games Futures at the Teesside University, discusses in chapter four – pleasure, the aesthetics of *Spacewar* as discussed by Steven Poole (2002) in Trigger Happy. The structure the game takes aesthetically, as Poole describes, is essential to many games today as listed below:

- simple rules with innumerable combinatory possibilities;
- the competitive urge to destroy your opponent's spaceship;
- the pleasure of mastery of a well-defined, consistent system;
- the challenge of reacting instantly to craft governed by inertial physics;
- and the sensual buzz of playing with animated patterns of light."

There are many more aesthetics which need to be considered when discussing and designing games which will be further discussed throughout this chapter. Figure II.6

[50] http://www.stibbe.net/History/Games_Speech/Spacewar!.htm

shows how simple the interface of *Spacewar* was at that time, and for many gamers who played the pleasure derived from the game came in several formats, for example; "destruction of mastering a simple interface, that demands we develop skills to use effectively. We also see the pleasure of action – as defined requiring rapid responses coupled with good hand-eye co-ordination" (Fencott, 2007).

Gaming in the 1970s

The seventies saw the dawn of a new era for video gaming, Bushnell and Nutting Associates devised and released the first coin operated video game arcade, over a thousand units were built and released onto the market known as *Computer Space*, not only was this viewed as the first coin operated video game but also the first failure. Figure II.7 illustrates the coin-operated machine (Herman, 2001).

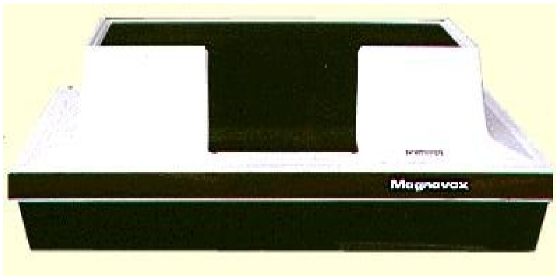
Figure II.7 – First coin operated video game machine[51]

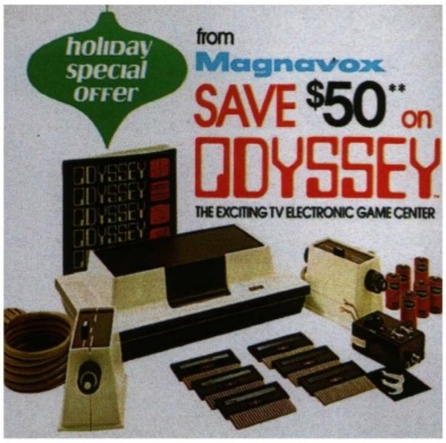
Figure II.7 displays the screen where the game would be played, the four buttons which the player would press to interact are situated below, which for some may find it difficult to use the number of buttons implemented for the game may have caused players further irritation during the game play. As stated previously this was not a success, the cause which Herman talked about was "the game was just too complicated for the general public. People raised on pinball weren't willing to spend

[51] http://www.vintagecomputing.com/index.php/archives/404

time reading instructions and learn what the variety of button labelled thrust, fire and rotate did.” (Herman, 2001)

The commercial release of the home video game console released by Magnavox was called Odyssey. Magnavox had licensed the Tennis for Two from Ralph Baer, the manager employed to overlook consumer product development for a military electronics company (Hind, 2007). Figures II.8 and II.9 illustrate the overall look of the console.





Figures II.8 – Magnavox Odyssey console

Figures II.9 – Advertisement of the Magnavox Odyssey

One of the first games developed by Atari was an arcade version of Pong. Pong was viewed as a simple game of tennis; Kirriemuir (2006) states “dozens of companies created clones of the game for use in either arcades or the home. Pong also marked the start of the long relationship between the gaming and legal industries, as companies such as Atari and Magnavox disputed the origins and ownership of Pong and other games.” The specifications came from Bushnell, although Alcorn was the engineer behind Pong, and during development implemented a single sound which was a “Pong” when the ball hit the side; deriving the name for the game Pong. Figure II.10 displays the simple two player interface of the game showing the simple line down the centre illustrating the net.

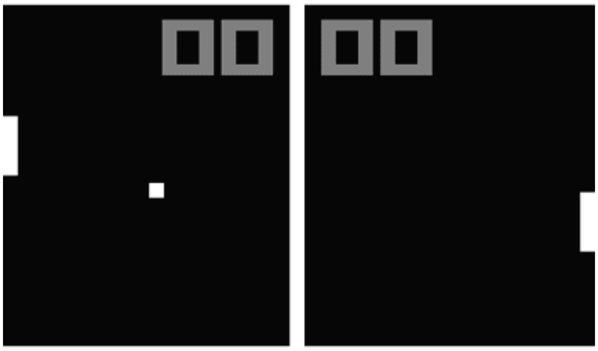


Figure II.10– Pong interface[52]

Figure II.11 shows the arcade machine with the display screen and the two buttons used for playing the game. The idea formerly derived from Higinbotham with the *Tennis for Two* games; *Pong* had additional features, such as, a score for each player and minimal sound of the ball bouncing from side to side giving the players the added gaming experience.

Figure II.11 – Pong Arcade machine[53]

Atari did not patent the idea of Pong which entailed many companies to copy the original idea of the game. Figure II.12 displays a similar looking machine, that of Figure II.11, the machine was very much the same as the Atari brand, although the controllers are different, where knobs were used for Pong, joysticks were utilized in the Bally Playtime version. For some people, this may have been easier to use within

52 http://www.aifactory.co.uk/newsletter/images/pong.gif
53 http://www.pong-story.com/arcade.htm

the game play experience than the Atari version, controlling the bat within the interface may be easier with a joystick than a paddle.

Figure II.12 – Pong Arcade machine[54]

The home console market was created in the mid-seventies, although for many of the management team within the company the idea of this was not positive due to lack of knowledge of the consumer market. Development of Pong for the home was completed January 1975. This new console was known as the Atari 2600, the company were cautious not to make similar errors which Magnavox had done when the Odyssey was released onto the market. Many games were developed for the Odyssey, unlike Atari which only had the one game Pong, this did not faze the company and as Herman states "Pong's resolution was superior; its controls were more responsive; it displayed colour graphics, on colour televisions. The best part was the price. Thanks to the declining cost of microchips, Pong cost less than the Odyssey". Figure II.13 demonstrates the Atari 2600 (VCS) home console, the player would use the joystick situated on top of the console to play Pong and other developed games. Figure II.14 shows the Atari 2600 VCS with joysticks and paddles, which for some of the games was a requirement by the player to play the game.

[54] http://www.pong-story.com/arcade.htm

Figure II.13 – Atari 2600 VCS[55]

Figure II.14 – Atari 2600, Joysticks, Paddles and Cartridge Game[56]

The first game to use joysticks, as a means of game play, had been developed by Atari for the arcade machines – this was known as Tank. The nature of the game was to move through a maze, the two players would shoot at one another and also had to avoid the mines, which were marked with an X. The player gained points through shooting at the opponent or when the tank moved over a mine, the player with the highest score at the end of the time limit would win the game. As Figure II.15 illustrates the interface of Tank was very simple and easy to follow, even more so when the player was controlling the tank through a joystick controller, giving the impression to the player that they were actually in control.

[55] http://media.photobucket.com/image/atari/ryanmediocre/800px-Atari2600a.jpg
[56] http://www.atari7800.com/2600/2600ad3.jpg

Figure II.15 – Tank Interface[57]

The mid-seventies saw Coleco release a similar version of Pong onto the market called Telstar; this was received by many families in a positive manner especially retailing at fifty dollars. Coleco also developed a multi arcade controller, which allowed for a number of controllers, for a number of games implemented onto a triangular set. Figure II.16 illustrates the multi game controller; this particular side of the controller is for playing on Pong as there are the paddles. Placed around the controller were several means of interaction, which allowed the gamer to play one of three games on each cartridge. The cartridge would be placed into the triangular insert at the top.

Figure II.16 – Coleco Telstar Arcade Controller[58]

The company Mattel released the first handheld game in late seventies. The console looked rather chunky in comparison of today's handhelds; a number of games were

[57] http://www.gamecareerguide.com/features/327/on_game_design_a_history_of_video_.php?page=3
[58] http://gamingmuseum.classicgaming.gamespy.com/arcadegun.jpg

released, for example football, Missile Attack, Armor Battle and Sub Chase. A year later after Mattel, Milton Bradley Microvision released what probably is the first known handheld which used interchangeable cartridges. There were several problems with this, the first only having a number of games, also the LCD screen had a tendency to rot, and with a small amount of static this could damage the games/cartridges. Figure II.17 and Figure II.18display the two handheld consoles.

Figure II.17 – Mattel handheld

Figure II.18 - Milton Bradley Microvision[59]

Between 1978 and 1980 saw a number of advancements which "for historians of entertainment a golden period of gaming development" (Kirriemuir, 2006). The video games company Taito released the game Space Invaders, and as Hind (2007) suggests, was the first to have "animated characters, and could conceivably last forever and had a Hi-Score that was continually displayed" (2007). Herman (2001) discusses the nature of the interface which showed forty-eight characters or space creatures which moved across in unity, for the gamer, the aim was to fire at the invaders situated at the top of the screen and the advancing creatures which were moving towards the player. Once all of the invaders and creatures were killed another set would appear for the player to aim at. The character is symbolised by a tank, which shoots bullets at the creatures symbolising aliens and the enemy. The three tanks signify to the player the number of lives left in the game, and once all three have been used the game is over. *Space Invaders* was a vast success with gamers, due to the nature of giving the player the sense of realism, implying that aliens were

[59] http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/

attacking and by killing them “they were actually saving the earth by destroying these creatures” (Herman, 2001). The appealing nature of the game was as seen in previous games, the essence of not finishing due to timing out or because the player had reached the highest score. Figure II.19 shows the graphics of *Space Invaders*, showing the simplicity of the characters and score.

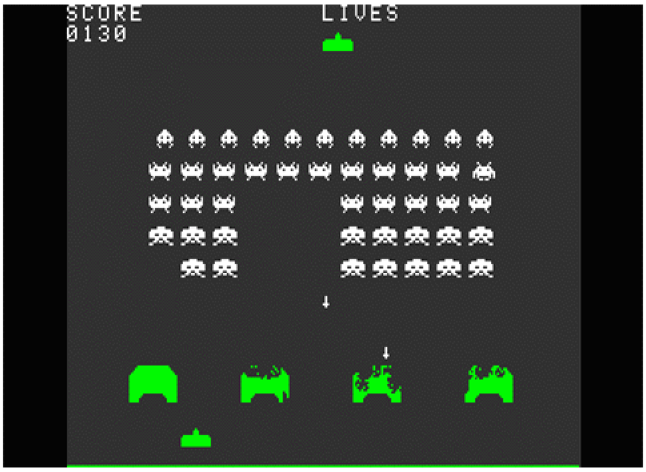


Figure II.19 – Space Invaders interface game[60]

Breakout had similar success with gamers as *Space Invaders* did, due to giving the player the impression that it was never ending. The main difference between the two games were; *Breakout* never increasingly became harder as the player progressed through the levels, where as *Space Invaders,* as the gamer advanced, throughout the screens the player was faced with an increase of speed from the aliens. During play, gamers want to be able to have a goal to aim for, and in an arcade environment, playing amongst friends, this would be through competition and trying to beat the previous player. Taito added an additional feature to the game which allowed the previous high score to be shown on the screen, thus allowing gamers to see what score they had to beat, Herman (2001) states, “players trying to set records in high scores and in time spent playing the game.” Due to the success of the game in Japan, Midway licensed the game from Taito, and Space Invaders was launched on to the American market.

[60] http://www.petesqbsite.com/sections/express/issue9/anarky.jpg

Atari released a keyboard for the VCS version, which connected by being plugged into the controller ports. A number of games were released by Atari which involved using the controllers, this included Hunt & Score, Concentration and Codebreaker, and all were very similar releases to those of Magnavox for the Odyssey². A set of memory games were released called Brain Games, this was the third cartridge to be released for the VCS using the controller keyboard. The VCS version by Atari had several games developed, all of which had been released on the Odyssey² being able to connect the keyboard into the ports of the VCS gave the player the ability to play games, such as memory games, one in particular called Brain Games.
Sports games were still been developed by both companies and one in particular called *Basketball* designed by Alan Miller, this had been designed for the VCS, although very similar to the Odyssey² the difference was "Basketball was the first example of a videogame with a 3D perspective." Miller had designed the game interface showing the court with depth rather than the version for the Odyssey², the VCS version showed a horizontal court with a net on each side, which gave it the depth.

Space War was re-released into the arcade machines by Atari which had used a different type of graphic, this was known as the vector graphic, games which used rastor graphics meaning, "the electron gun scanned the screen horizontally 30-60 times per second and created an image that consisted of two-dimensional pixels" (Herman, 2001). The difference between Space Wars and previous games were, although the graphics had less detail, their look was sharper.

Lunar Lander was developed and released by Atari in 1979 into the arcade environment; the aim of the game was to land the space ship on the surface of the moon while fighting with the gravity pull. The game itself was the first for using vector graphics, which had initially been used in the *Space War* game a year earlier. Figure II.20 shows the graphical interface of *Lunar Lander*. Fencott (2007) has dedicated a chapter of the text Game Invaders to the subject of genre, this discusses in depth the classification of genre and how others such as Rollings and Adams classify games into genres.

At the time of *Lunar Lander* being released, the industry and gamers themselves would have classified this game as a vehicle-simulation, or as Rollings and Adams suggest, a Meta-Genre such as vehicle-simulation. The gamer was, in essence, driving or controlling the vehicle, which would initially put this game in this particular genre. As games progressed throughout the decades, since *Lunar Lander* and others, this would now be classified in the retro or classics genre.

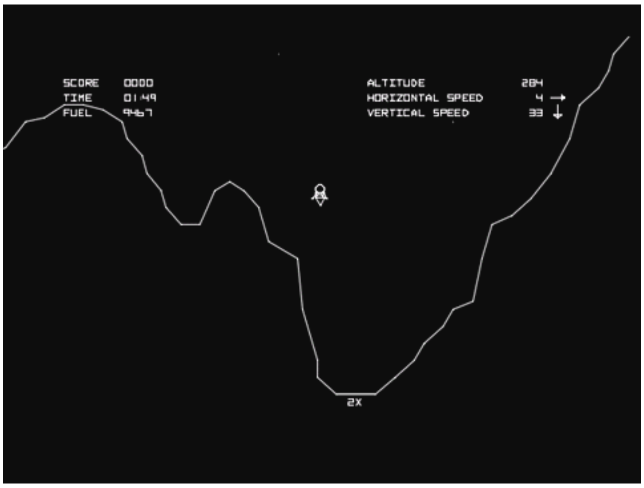


Figure II.20 – Lunar Lander game interface

Figure II.21 shows the graphical interface of *Asteroids*. The nature of Asteroids for the gamer(s) was to destroy all of the asteroids, but the problem when shooting at the asteroids was they broke up into smaller pieces. The gamer gained points when hitting an asteroid. Once all of the asteroids had been cleared on the screen another set would appear allowing the player to start again. Figure II.21 shows the interface of Asteroids which players became accustomed to.

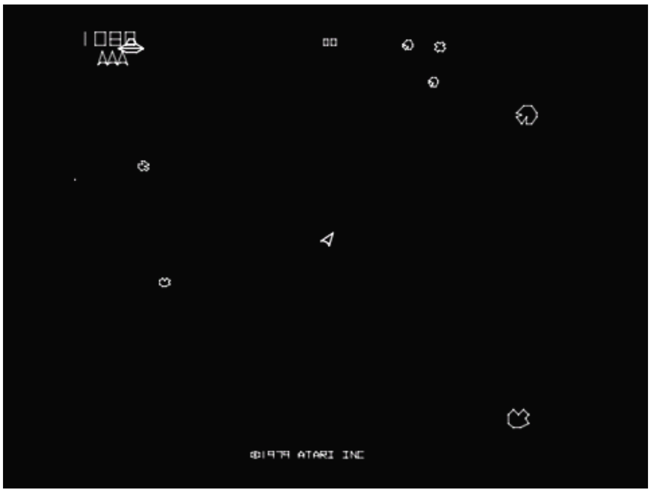


Figure II.21 – Asteroids game interface

Gaming in the 1980s

The nineteen-eighties saw the release of more popular games and the release of a home version of *Space Invaders*, which was as successful as the arcade version. Atari released a game called *Adventure* or *ADVENT* for short, this did not gain the excitement or attention as *Space Invaders* had previously, but as Herman (2001) states, "it proved that Atari's designers could still come out with new and interesting games."

There has been little discussion in relation to the broad field of aesthetics and video games. Fencott (2007) continues to examine the nature of this topic in relation to MUDs and Virtual Reality (VR). Sherry Turkle spoke to many gamers in relation to gaming, and one of the main aspects she found during this was gamers found the pleasure of gaming with fellow gamers. Fencott (2007) brings to mind this need for pleasure, aesthetically known in VR terms as co-presence, a gamer is able to be absorbed in the environment with others during play. The opposite of this is presence as defined by Fencott (2007) as, "a state of mind being absorbed" (2007). Continuing on from Fencott (2007), who reminisces about MUDs and text-based adventure games such as ADVENT, the pleasure gamers received from these was co-presence, an important aesthetic pleasure "way before 3D graphics was even thought of."

The game was first seen as a quest game or what would now be classified by Fencott *et al*., (2007) within the adventure genre, this was a single player game, the image which represented the player on screen was a square cursor, the aim of the player was to search and return a golden chalice to the castle. The game was operated over a number of screens and both the chalice and keys to the castle were hidden, enemies within the castle were also hidden, known as dragons, which could end the game at any point by eating the cursor signifying the player. Weapons were available to the player but had to be located within the game and as a, "final obstacle, a player could only carry one object at a time" (Herman, 2001). Figure II.22 shows the interface of the Adventure game showing a hidden key.

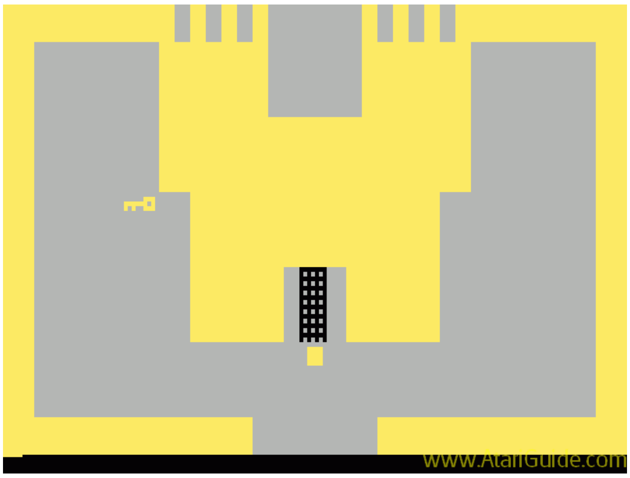


Figure II.22 – Adventure Interface[61]

A new company entered the market called Activision. The VCS was in many homes and the company decided to develop games purely for the VCS. Activision released four games within 1980, which for consumers proved that the VCS, stated by Herman (2001) were a, "versatile machine more powerful than anybody had imagined." The use of vector graphics within game design gave one game in particular a more realistic interface and impression to the gamer, this was known as *Battlezone* so much so that the "US Army ordered a modified version of the game for real combat tank training." (Herman, page 50) As previously discussed *Lunar Lander* been classified as a meta genre under vehicle-simulation, *Battlezone* could also be placed in this genre, due to the nature of how the game is played. It could also be suggested and documented that the game could first and foremost be classified under the first person genre, as Figure II.23 illustrates, the gamers perspective of the environment viewing

[61] http://uk.gamespot.com/pages/forums/show_msgs.php?topic_id=25995488&page=1

the surrounding area through the gamers eyes. The object of the game was to move the tank and to avoid enemy fire, which surrounded, not just in-front but also behind. Figure II.24 illustrates another aspect of the game, through the eyes of the gamer.

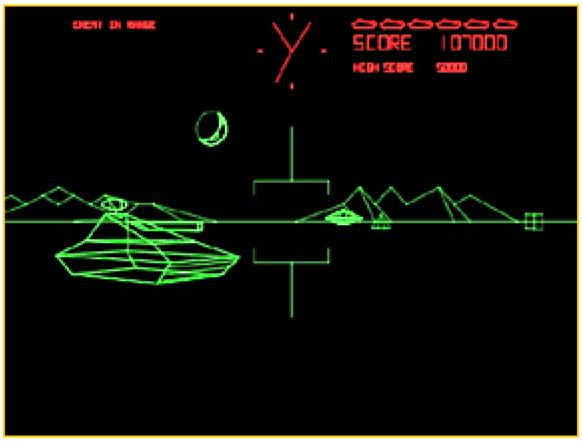


Figure II.23 – Battlezone interface[62]

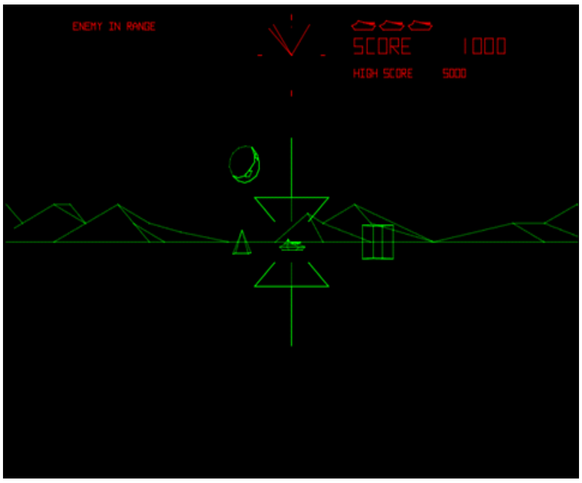


Figure II.24 – Battlezone interface[63]

A pinball manufacturer, based in Chicago by the name of Williams, released a game called Defender. The interface of this game scrolled horizontally, a method which would be used later on in games developed by Nintendo. The object of Defender was to "pilot a spaceship while avoiding and shooting down the enemy ships. The player also had to save the inhabitants of the planet from being kidnapped by the enemies" (Herman, 2001). The method of game play for the user was through seven buttons, although this did not put off players from enjoying the game. Herman (2001)

[62] http://uk.gamespot.com/pages/unions/read_article.php?topic_id=20000750&union_id=729&print=1
[63] http://uk.gamespot.com/pages/unions/read_article.php?topic_id=20000750&union_id=729&print=1

describes the mechanisms for playing Defender, previous games on the market showed action on the screen unlike Defender, a lot of the game playing was conducted away from the player, alerts were sent to the gamer through sound effects when an inhabitant had been kidnapped by the enemy. The cost of running a playfield in the game was expensive and therefore a scanner was introduced to show the full perspective. Figure II.25 shows the interface of Defender, the white dot in the perspective view is the gamer; the yellow dots are the enemy.

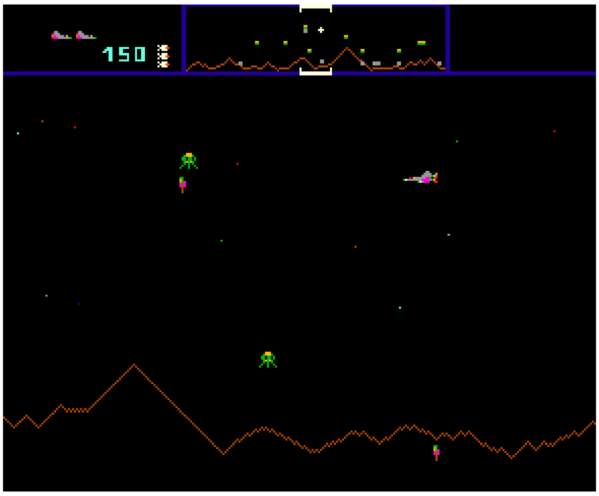


Figure II.25 – Defender interface

Nintendo entered the handheld gaming market in 1980 and for the following ten years were making an impact as previously discussed in this chapter. The handheld released by Nintendo at this time was called "Nintendo's Game and Watch Series" the games would famously become the brand for Nintendo such as Mario Bros and Donkey Kong further integration of hardware installed was an alarm and a watch, Figures II.26 and II.27 displays Nintendo's first release on to the handheld market. In 1984 Milton Bradley's Microvision released their second handheld called the Epoch Game Pocket Computer, which was only released onto the market of Japan, but as with the previous release this too was not successful. Figures II.26 and II.27 show both handhelds released by the companies.

Figure II.26 Nintendo Game & Watch Series Handheld

Figure II.27 – Epoch Game Pocket Computer[64]

A different type of game was on the horizon in 1980 developed by a company called Namco, it was initially named Puck-Man, as the main image representing the player looked like a puck. The new name of the game was Pac-Man. Figure II.28 shows the original interface of Pac-Man, which from level to level, very rarely changes.

The premise of Pac-Man was to collect or eat the yellow dots around the maze which would give points to the player. Once the player had travelled around the maze collecting the dots a new maze would appear. Fruit or cherries were scattered throughout the mazes, which would in turn give additional health points. There were enemies within the game who would try and stop Pac-Man from collecting the necessary points, these enemies were under the disguise of ghosts; if Pac-Mac collided with the ghosts he would die. Midway released further Pac-Man games, 1981 saw the release of Ms Pac-Man, the interface was similar to the first game and still had the same premise. Figure II.29 shows the interface of Ms Pac-Man which is very similar to the original version of the game.

[64] http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/

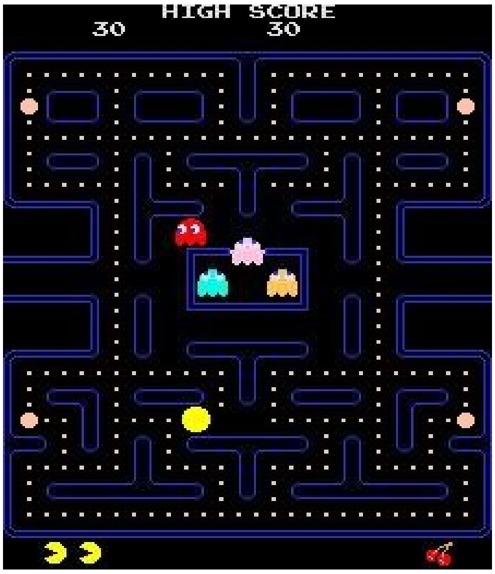


Figure II.28 – Pac-Man

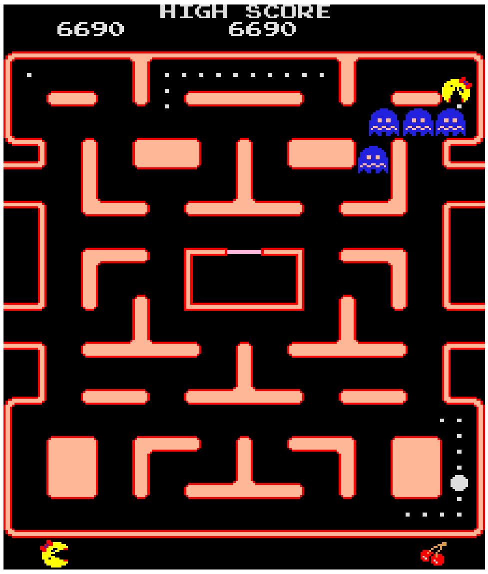


Figure II.29 – Ms Pac-Man

The success of Pac-Man superseded Asteroids and as Herman (2001) states would "eventually it would become one of the top-selling arcade games of all time". The primary reason for the success was due to the non violent content of the game, the game also opened up to the female audience. Girls started to play the game realising that it was not just the boys who where good at playing games, and a vast amount of merchandising was created on the back of the game (Herman, 2001).

Many people viewed Pac-Man as the first character within a game, throughout this chapter there has been several discussions relating to a variety of games created prior to this, all of which allowed the gamer to interact by driving tanks or landing space ships. Pac-Man gave the player the opportunity to play someone or something. Fencott (2007) discusses the game in great detail, a quote used in Game Invaders from the creator Toru Iwatani explains the characteristic nature of the Pac-Man "I designed Pac-Man to be the simplest character possible, without any features such as eyes or limbs. Rather than defining the image of Pac-Man for the player, I wanted to leave that to each player's imagination". Further discussion of aesthetics and Pac-Man will follow in the next section of this chapter.

1981 saw the creation of what was to be one of the most successful game companies of the twentieth century and continuing into the Twenty-First Century, the company was called Nintendo. It was formed because the Japanese market wanted to develop and release their own arcade games, setting up American divisions where operations could be handled. Shigeru Miyamoto at the time was a young developer who was creating a game called "Stubborn Gorilla," the name changed to what is now known as Donkey Kong, the nature of the game for the player, who as a carpenter, has to rescue his girlfriend from the gorilla. The interface of the game involves scaffolding which the player can climb using ladders, as the player is moving between the ladders the gorilla is throwing barrels. Figure II.31 shows the game interface with the main characters, which the player has to rescue and avoid.

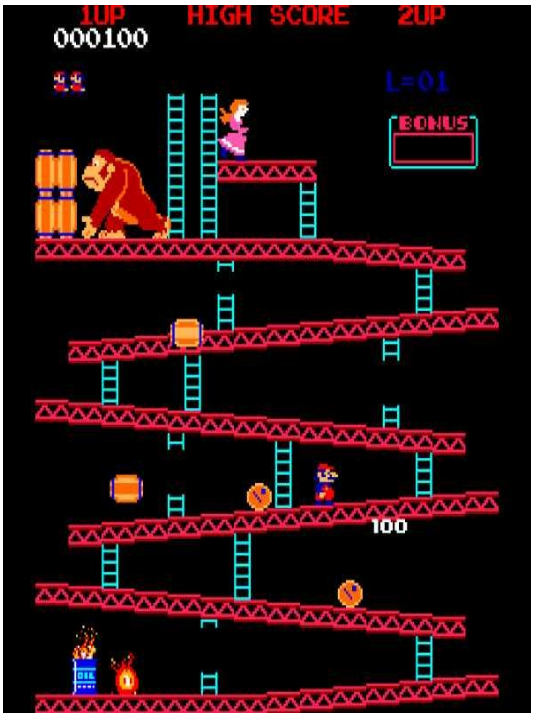


Figure II.31 – Donkey Kong[65]

Aside from this the eighties saw additional growth in the industry; consoles were still being enhanced by a number of companies, one in particular from Coleco, they released their version of the console named Colecovision. The company also released add-ons to the console named Colecovision, expansion module 1 and module 2. The expansion module 1 of the console allowed VCS games to be played, this addition allowed all the "features of the switches that were on the VCS and accepted the VCS joysticks," the company explained to consumers that by plugging the extension in the graphics would still be the same as they would if being played on the original

[65] http://onemansblog.com/wp-content/uploads/2007/09/Donkey_Kong.jpg

Colecovision. Expansion module 2 involved a large steering wheel with the game Turbo, classified in the genre of a first-person driving game; this had been licensed by Sega. Using the steering wheel gave the player the feeling that they were driving the car themselves. Examples of these add-ons are shown in Figures II.32, II.33 and II.34.

Figure II.32 – Colecovision console[66]

Figure II.33 – Colecovision module 1[67]

[66] http://www.maniacworld.com/game_console_history/
[67] http://www.geocities.com/djslacker1/colecovision_controllers.html

Figure 34 – Colecovision module 2[68]

Coleco decided to release titles which had already been released on the arcade machines, one in particular was Sega's Zaxxon; the game, as Herman (2001) suggests "was truly amazing especially since Zaxxon, which Sega had just introduced to arcades the same year, brought a new perspective to videogame graphics." The nature of the game was for the player to pilot a spaceship over land, during this the game they would scroll from top right to bottom left, the player, during flight, had to destroy everything and to avoid objects by either turning the aircraft left, right, up or down, the graphics on the game gave the gamer the impression that the graphics were 3D, a first for videogames at this time. Figure II.35 illustrates the Zaxxon interface.

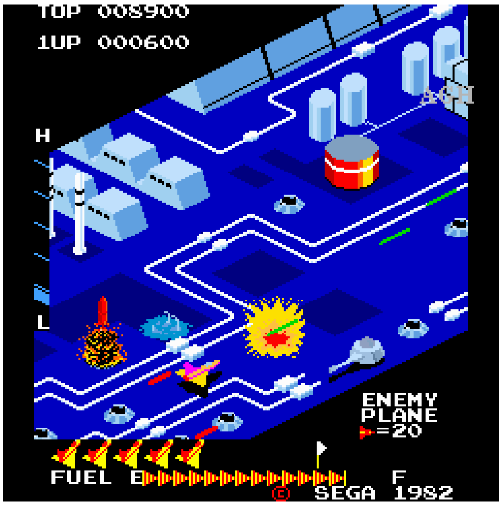


Figure II.35 – Zaxxon Interface[69]

[68] http://www.geocities.com/djslacker1/colecovision_controllers.html
[69] http://www.comefunziona.net/articolo.asp?Ogg=VideoGames&Pro=0

For many years the movie and games industry have been in parallel with one another, and for movies to have games developed using the same if not similar plot line to the movie and vice versa. This started in 1982 when the movie The Empire Strikes Back had a game designed based around the plot, this continued for many companies and the movie industry, which included Twentieth Century Fox, decided to sell VCS cartridges. The movie E.T was a hit with the audience and Atari thought by producing a game it would have the same success; gamers bought the game expecting to know how to play as the game had previously been released on the arcades and gamers were expecting the same game play, but the cartridge version wasn't, therefore for players, the pleasure of playing the game wasn't the same and the game was not a success.
Several more games were developed and released in relation to the movie industry, some were a success, for example the arcade game Tron, although the movie was not such a success initially as the game, further releases of the game from Mattel Electronics did involve movie characters and scenes.

The eighties witnessed Atari introducing products to the market, one in particular although was never released but tested by engineers, was called *Mindlink*, this specific controller used a headband which detected electrical pulses in the head, and then transmitted these signals to a receiver through to a number of Atari hardware products. The game which occupied *Mindlink* was called Bionic Breakthrough, which was a similar version to the previous Breakout game; the player would control the movement on screen through head muscles. Atari announced that there would be further cartridges for *Mindlink* involving stress, relaxation and interactive games. Figure II.36 demonstrates how a player would wear *Mindlink* and interact with the interface.

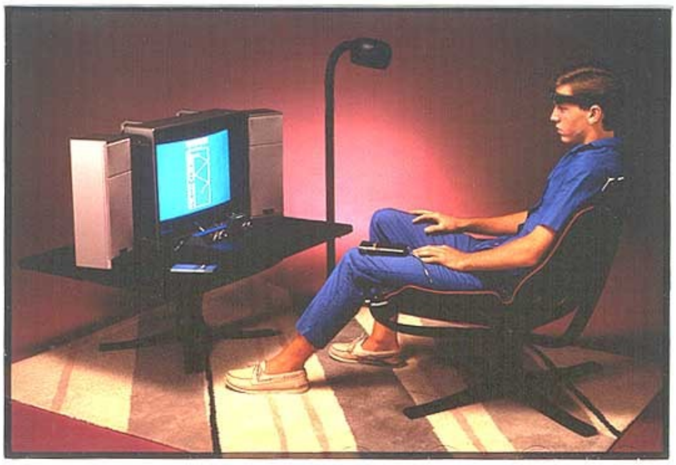


Figure II.36 – Mindlink controller[70]

The method, which this technology worked with the gamer, was using both an infrared transmitter and receiver via the headband placed on the gamers head. The software was written specifically which controlled the actions seen on the screen, muscle resistance from the gamers forehead would be passed through the headband and interpreted into commands, which would then be carried out on to the interface. This innovative technology was not released onto the market, feedback from the engineers and testers made comment that at times, because of extensive movement of the forehead, it gave individuals headaches from concentrating too much on movements (http://www.atarimuseum.com/videogames/consoles/2600/mindlink.html, August 2008).

A designer by the name of Dave Theurer had designed the game *I Robot*, this game was graphically ahead of its time due to Theurer using 3D polygon graphics. Elements of the game had been used in earlier arcade games such as Galaga and Pac-Man; the game gave the gamer the opportunity to draw their own "abstract polygon generated art." The success of *I Robot* in the arcade environment, "never caught on" Herman (2001) suggests the lack of enthusiasm for the game derived from the unusual graphics and game play. To show how much graphics within games had progressed, although for some years this would not be too common within games, Figure II.37 is a screen shot of the interface for *I, Robot*.

[70] http://www.atarimuseum.com/videogames/consoles/2600/mindlink.html

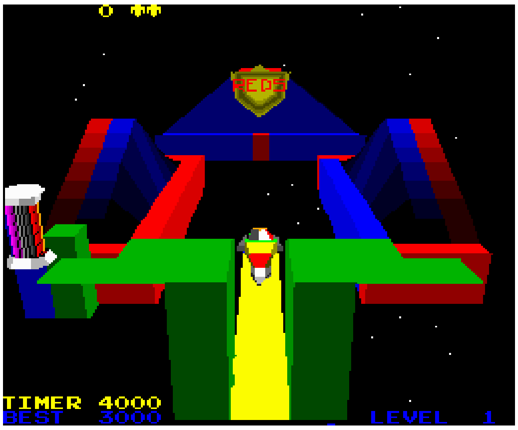


Figure II.37 – I, Robot interface[71]

The Japanese company Nintendo, released the first realistic home console known as the Famicom (Family Computer) in Japan, a version for both the American and European markets was released called Nintendo Entertainment System (NES) both featuring Mario, the now famous character which is associated with Nintendo.

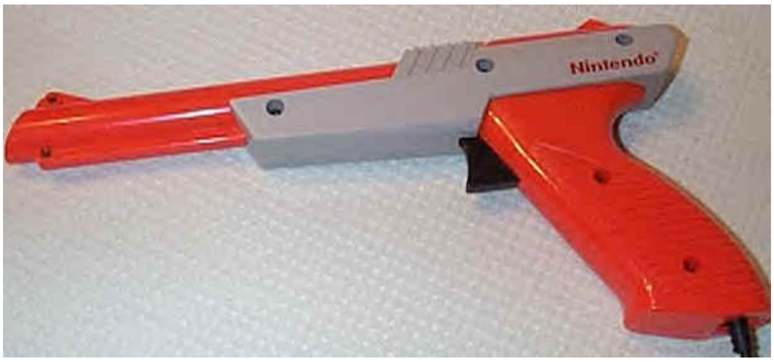
The success of the NES came from the game, which was released with the console, featuring a character that had made an earlier appearance in the game *Donkey Kong*, the name of the character was Jumpman, now known as Mario. The basis behind what would be *Mario Bros* was a scrolling game, or as Fencott *et al.,* (2007) would classify as a platform genre, due to the characters moving through the game from platform to platform as the screen moved along with the gamer. The home cartridge version of the game played the same as the arcade, enabling gamers to transfer their knowledge from one system to another. The object of the game was to travel through each level without being caught by an enemy, or falling down any holes in the ground. Enemies took on many appearances from cannon balls, venus fly traps which appeared in pipes to ducks and small creatures. At the end of each level Mario would gain points, depending on how high he jumped onto the flag pole, the gamer could gain additional points and life lines by collecting coins and catching mushrooms.

The control pads plugged into the front of the console, the buttons were very simple to use, these were up, down, left and right; there was a start button and an A and B

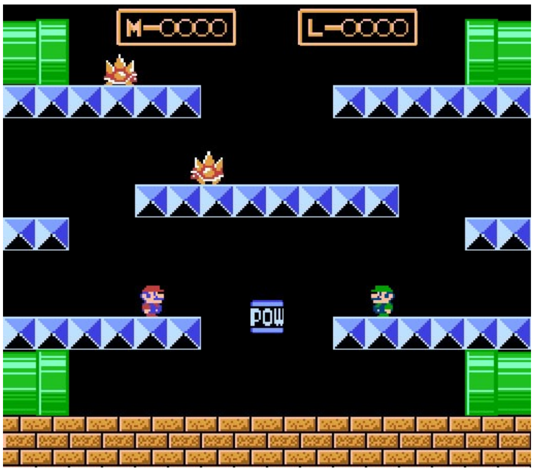
[71] http://www.atarihq.com/danb/irobot.shtml

button used for firing. *Duck Hunt,* a game which was also released on the NES, used a controller in the shape of a gun, and used infrared to send signals. Figures II.38 to II.41 show the hardware and game imagery for both *Mario Bros* and *Duck Hunt*.

Figures II.38 – NES Home Console, with control pads[72]



Figures II.39 – NES light gun[73]



Figures II.40 – Mario Bros game Interface[74]

[72] http://cybernetnews.com/2007/09/21/myfive-best-nes-accessories-and-features/
[73] http://www.tomheroes.com/Video%20Games%20FS/video%20games/nintendo/zapper_gun.htm
[74] http://uk.gamespot.com/pages/unions/forums/show_msgs.php?topic_id=25764836&union_id=7420&page=24

Figures II.41 – Duck Hunt interface[75]

The graphical interfaces for both of these games are clean and crisp, using a 2D interface. The development of game interfaces, from the seventies up to the release of these games, had changed dramatically from the initial method of vector graphics. Nintendo was very much aware of what the consumer required from the market, which was a large selection of games, this was achieved by 3rd party developers.

An additional peripheral, bought by Nintendo known as the power pad, came as part of a package called Family Fun Fitness. The pad would be connected to the NES through one of the ports and the accompanying game was titled *Athletic World*. Figure II.42 is an example of the power pad, when a player stood on one of the circles the character in the game would do an action; these actions would change depending on which circle the player would touch. This type of game, although not necessarily classified at the time of release, would now be viewed by the industry and consumer as the rhythm action genre. Fencott (2007) talks about this genre as one of the newest in the industry and has "enabled, in some cases, by peripheral technology" this type of genre would become more prevalent throughout gaming.

[75] http://www.racketboy.com/retro/2006/04/best-light-gun-games-for-re-revolution.html

Figure II.42 – Power Pad Peripheral for the NES[76]

Sega had been in the games industry for some years, and like Nintendo decided to produce and enter the home console market. Their version of the home console was known as the Sega Master System, very similar to the NES in the sense of game pads, a light gun and game cartridges. Herman (2001) discusses that on release of the Master System, Sega announced that by the Christmas period additional console peripherals would be available, including "a track-ball sports pad controller, a graphic board for drawing pictures on the screen and a 3½ inch disk drive." To demonstrate how similar both the NES and the Master System were in hardware, Figure II.43 displays the Sega Master System.

Figure II.43– Sega Master System, home console[77]

[76] http://kezins.com/2008/05/7-greatest-nes-accessories/919

[77] http://www.gameconsoles.com/mastersystemhome.htm

The distribution of peripherals did not just stay with Nintendo but Sega also disseminated glasses, when worn with specific games, the graphics would appear to be 3D on the screen. The technology used was called LCD, the look of the glasses was very realistic, and connection to the console was through one of the ports. 3D glasses had been around for many years, these were cardboard, and one side of the lens was red and the other green, simulating a 3D effect. Figure II.44 shows how the Sega 3D glasses looked.

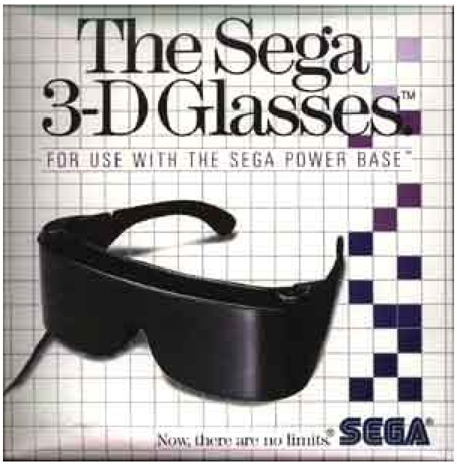


Figure II.44 – Sega 3D glasses[78]

Further developments of controllers were released onto the market in 1989, the Roll and Rocker, which worked with the NES controller, was similar to the Amiga Joyboard, allowing players to simulate either skateboarding or surfing depending upon the cartridge. Depending upon the game, two Roll and Rockers could be connected, allowing for two gamers to compete with one another.

A motion detector controller was also released at a similar time called the U-Force; the controller also detected velocity and direction of gamers hand movements, which gave the user control of the actions seen on the screen without having a controller in their hands, this was conducted through signals transmitted through the NES and then shown on the screen in-front of the gamer. Herman (2001) states that motion detection was more prominent in "boxing games, such as Mike Tyson's Punchout, where an on-screen boxer instantly imitated the punches that a gamer had made in the air." Additional controllers were created to enhance the gaming experience for players during driving and flying games, this was a T-bar which fitted onto the board,

[78] http://uk.gamespot.com/pages/forums/show_msgs.php?topic_id=25570558

allowing the player to simulate the experience. Figures II.45 display these pieces of technology used alongside the NES.

Figure II.45 – LJN Roll and Rocker controller board[79]

Figure II.46 – Broderbund U-Force Controller[80]

Shortly after the release of the U-Force Mattel released the Power Glove, interaction with a game using the glove was very similar to the U-Force, for the glove to work the gamer had to connect a sensor device to the top of the television and the NES, once this was complete the sensor was able to detect motion from within the glove, which would then determine what action would take place. For the glove to work correctly with the game and the gamer, the gamer had to "in-put instructions into the glove that told the sensor device what every movement meant" (Herman, 2001). Figure II.47

[79] http://thewarpzone.classicgaming.gamespy.com/hardware/rollnrocker.jpg)
[80] http://www.retrojunk.com/details_articles/2261/

illustrates the power glove, on the arm of the glove is a keyboard which was applied for the purpose of the gamer inputting the instructions. A similar controller to that of the NES was also built into the keypad. Templates were programmed into the instructions of the glove to aid the gamer when inputting information for a specific game. Mattel released games which were specifically used for the power glove one in particular was called Glove Ball, "a three-dimensional cross between Handball and Breakout" (Herman, 2001). The game play, which occurred between the game and the gamer, suggested that the gamer was punching into the air which would then show the ball hitting the tiles on the screen. Image 45 shows the interface of Glove Ball, looking at the interface you can see the hand which would hit the tiles when simulated by the gamer through motion.

Figure II.47 – Mattel Power Glove[81]

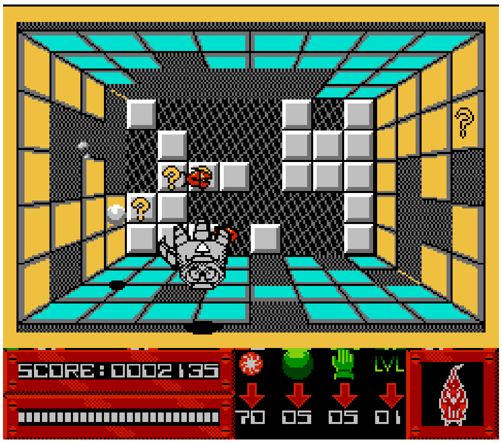


Figure II.48 – Glove Ball interface[82]

[81] http://www.crg.cs.nott.ac.uk/events/hci93vr/desktopvr/
[82] http://www.consoleclassix.com/nes/super_glove_ball.html

The eighties saw the introduction of the 16-bit video game systems, although the 32-bit systems were starting to be introduced. A British company called Konix had developed a controller, previously distributed on the market as a steering wheel, the ethos of the companies designers were controllers, these were the most important aspect in a console. This particular controller was different to the previous steering wheels, although very similar to the Colecovision Module 2 peripheral. The difference being, gamers were able to add additional elements to the steering wheel, such as Herman (2001) states, “a stick shift and a foot pad to really simulate a car ride. The wheel itself was detachable so handlebars for motorcycle games could replace it.”

Sega released the Genesis, the software between the master system and the Genesis was not interchangeable, preventing a grey area from arising within the market. A number of peripherals were to be released with the console, one in particular known as the Power Base Converter; this allowed the 8-bit Master System games to be played on the Genesis. This did not improve the quality of graphics or game play, but it did allow the gamers to play the software on the upgraded console. The Telegenesis Modem released by Sega, allowed gamers to participate between one another using the telephone line. Nintendo were still selling the 8-bit console, which in comparison to the 16-bit consoles, were a vast improvement. The importance for gamers, at this time in the industry, was the quality of games being released rather than the quantity.

Gaming in the 1990s

Nintendo released another style of handheld in 1989 called the “Gameboy.” The handheld was successful as Melanson (2006) suggests, “games, and in particular, the drop dead brilliant move of bundling Tetris” (http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/). The graphical interface of the games was not overly impressive on the green screen, but with successful games like Tetris and the further release of games for the future, developments would continue into the nineties. Figure II.49 illustrates the Gameboy handheld, and Figure II.50 is a screen shot of the popular game Tetris.

Figure II.49 – Nintendo Gameboy[83] *Figure II.50 – Tetris screen shot*

There has already been discussion of gaming aesthetics in the previous section, further will be discussed in the proceeding section. To discuss the nature of aesthetics within Tetris, for many gamers and myself included, would be agency as stated by Murray (1997), but as Church (1990) states in, what he calls FADTs or Formal Abstract Design Tools, perceivable consequences is listed as one of these. As a gamer is playing, trying to slot the bricks into the gaps, the intention is to not allow the screen to fill up and to end the game, but in some cases as progression through levels, and anticipating what the next action will be, gives the pleasure to the gamer, this type of pleasure experienced by the gamer is surely one of the reasons why Tetris was such a success, trying to reach the next level and achieve that while being challenged with the speed of the bricks dropping.

Atari had also entered the handheld market releasing in the late eighties early nineties the Lynx/Lynx ii, NEC Turbo Express and most importantly the Sega Game Gear. As previously, Sega and Nintendo had created a battle with the release of home consoles, this was also true within this market. The Game Gear was competition for the Gameboy and was doing well with a variety of games, although this did not make much difference within the market due to the dominance of Nintendo. Figure II.51 shows the Sega Game Gear.

[83] http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/

Figure II.51 – Sega Game Gear[84]

Sega had released their 16-bit console, Nintendo were to release their version of the 16-bit known as the Super Famicom, also known as the SNES. Figure II.52 shows the console with the controllers, very similar to the NES, although slight differences with the shape, seeming to fit comfortably in the gamers hands. Two ports were implemented allowing for two players. Sega had decided to make their two consoles compatible with each other as the software developed; this was not the same case for Nintendo at their initial announcement of the SNES, but in 1991 when released onto the market at an additional cost to the consumer, an adapter would be available.

Figure II.52 – Nintendo SNES game console (1991)

A further peripheral was developed by Konami, called the LaserScope, which was a controller situated on the gamers head covering the ears, a microphone would be in front of the mouth, a further extension of the headgear was implemented resting in front of the gamers eye(s), the "eyepiece was a plastic shield with a set of crosshairs painted on" (Herman, 2001). Herman (2001) discusses the interaction of the

[84] http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/

LaserScope, suggesting it was very similar to the light gun; for the gamer to shoot at a specific target the cross hairs were lined up, and with the mouth piece spoke ‘fire’, which would then fire the shot within the game. Figure II.53 displays the LaserScope situated on a gamer.

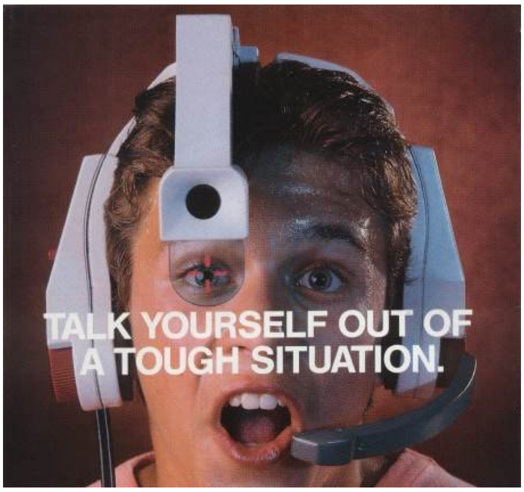


Figure II.53 – Konami Laser Scope[85]

As Nintendo released the infamous character of Mario, Sega also created a character to be associated within the brand of Sega and the Genesis/ Megadrive known as *Sonic the Hedgehog*, which aided sales of the console in 1991/1992 with the release of Sonic, “it pushed Sega into the lead of the video gaming race” (Herman, 2001). Figure II.54 shows the game interface of Sonic the Hedgehog.

Figure II.54 – Sonic the Hedgehog game interface[86]

Sega were still enhancing technology with further releases of consoles, reaching into the mid-nineties firstly with what was called the Genesis Super 32-X, this would

[85] http://www.solidoxygen.com/collectibles/laserscope.php
[86] http://www.stevechamberlin.com/cpu/sonic_the_hedgehog.gif

connect into the existing Genesis slot. This new development gave the Genesis "faster processing speed, high-colour definition, texture-mapping, enhanced scaling and rotation, improved polygon graphics and an ever-changing 3-D perspective" (Herman, 2001). During the expansion of the Genesis, Sega had also been preparing for the debut of the 32-bit Saturn, like the Dreamcast, enabled small capabilities of basic Internet access. Sega held back the release of the Saturn for a couple of reasons, the expense of the console retailing at $500 and wanting to promote the Sega-CD/Mega-CD, which was available for the Gensis/Megdrive (Hind, 2008).

Further news circulated within the media industry regarding future developments from Sony, with the intention of releasing the PS-X. The name PlayStation was announced at a press conference, demonstrating the abilities of the new console, one specific feature was "a serial port that allowed players to hook up to two PlayStations to each other" (Herman, 2001). Incorporating this feature gave the gamer the ability to view the game on a separate monitor, further speculation surrounded the console with a parallel I/O port, which would allow the gamer to connect a modem. Enhancement of graphics, using 3D geometric and producing full-motion video, was achievable due to the hardware improvements using high-end chips and circuit boards. Kirriemuir (2006) suggests that the materialization of the PlayStation "would limit the lifespan of SEGA's penultimate hardware platform." Figure II.55 illustrates what the Sony PlayStation looked like on release.

Figure II.55 – Sony PlayStation console[87]

Many of the consoles being released were not using cartridges to hold the games but CDs. With the advancement of technology, in relation to computer/video games,

[87] http://upload.wikimedia.org/wikipedia/commons/b/bf/PlayStationConsole.jpg

graphical interfaces were becoming more realistic, and with the added content and narrative of violence and gore, parents were becoming concerned and started to complain to video games companies. On the back of this, Sega made the announcement that future games released would be rated in a similar manner to how movies were rated for the cinema.

Throughout the eighties there had been many peripheral developments and releases onto the market, allowing the gamer to feel more of the gaming experience of presence and co-presence. 1994 saw the release of the Aura Interactor which was the first virtual reality product, a vest was worn by the gamer to feel more intuitive with the interface during play. The vest allowed the gamer to feel the sounds during the game. The PDS Gamer headset, Herman (2001) suggests games were closer to experiencing virtual reality. The headset featured two LCD television panels situated in front of the gamers eyes, covering the ears was a pair of headphones. During the play, the gamer would, "be away from the real world in the effect that all he could see was the screen in front of him and all he could hear were the game sounds" (Herman, 2001).

Although technology was expanding at a rapid rate, experiencing the full virtual reality experience discussed by Fencott *et al* (2007) in Game Invaders, it was still in the distance of the late Twentieth Century and Twenty-First Centuries. As previously discussed in this section, the eighties saw the development of the Power Glove, which was available on one console, 1994 saw The Glove introduced onto the market by Anaphase Unlimited, this was available for both the SNES and the Genesis. An additional peripheral was released called Batter Up. This was able to allow the gamer, during play of baseball, to swing the bat toward the television set, once the game had calculated whether the player had hit the ball it would decide the kind of hit which had been swung.

The turn of the mid-nineties saw the release of three consoles from three different companies, Sega released the Saturn, Sony, the PlayStation and Nintendo released the Ultra which is now known as the N64. Although there was a videogame race between Sega and Sony, Nintendo had not released the N64, but did announce due to the delay developers were concentrating on delivering the finest games feasible. The company did announce that the controller for the N64 “would be revolutionary, as it had been specifically designed for 3-D games” (Herman, 2001). Herman (2001) discusses the speculation surrounding the controller, although it did feature some of the previous buttons used on the NES controller, it also had an analogue joystick. The majority of all controllers which had been brought out onto the market were digital, the problem with this Herman (2001) suggests, is the gamer does not have full control over the interaction on the screen, for example;

> “Although a player could move an onscreen character by pressing a joypad in a certain direction, the computer always decided exactly how far that character would move. With an analogue controller the on-screen character could move with precision, exactly as far as the player wanted him to move” (Herman, 2001).

Previous consoles had two ports which enabled two gamers to play at the same time, the N64 had four, potentially allowing for four people at one time playing, this had been a first since the release of the Atari 5200. Additional controllers were also to be sold in different colours.

Figure II.56 – Nintendo 64, with controllers in different colours[88]

[88] http://www.nintendo.com.au/n64/system/index.php

The games developed for the N64 were still in a cartridge format and the development times and costs were large, which hindered the take-up of purchasing this particular console. There is an upside to this, a number of classic titles derived from this period, such as "Super Mario 64 (a 3D platform game), Golden Eye (a first person shooter) and Zelda: Ocarina of Time (a multi-genre game)" (Kirriemuir, 2006) all of which aided the console to gain a considerable amount of consumer support. The following images show the graphical interface of the Super Mario 64 game and the Legend of Zelda: Ocarina of Time.

Figure II.57 – Super Mario 64[89]

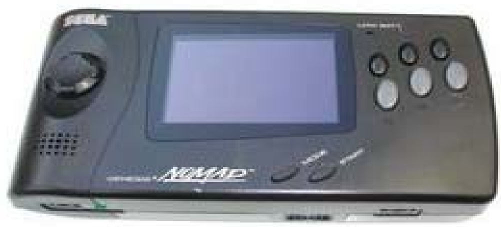
Figure II.58 – Legend of Zelda: Ocarina of Time[90]

[89] http://www.vgretro.com/wp-content/uploads/2008/08/n64_super_mario_64_start.jpg
[90] http://wiiconsumer.wordpress.com/2009/01/04/the-complete-guide-to-the-legend-of-zelda-games/

Many companies were using CDs to deliver the games to the gamer rather than cartridges, one particular reason was due to how quick and cheap it was to manufacturer, Sega and Sony were both using this method, as Herman (2001) states, "knowing that if the games became hits they could quickly produce more copies. That wasn't the case with cartridges. If Nintendo produced too few of a given title, it would take weeks for that supply to be replenished." An additional benefit of using a CD was that it could store eighty times more information than the cartridges used by Nintendo.

The success of the N64, within the first month of it being released, showed sales of the system reporting 51% of consoles, this is staggering as Herman (2001) states that the release of the console was in the last week of the month. At the annual Japanese trade show – Shoshinkai, Nintendo displayed what was called a Jolt Pack, this was plugged into the console through the memory slot, this gave the controller vibrations throughout games; predominately action move.

Sega and Nintendo dominated the handheld market throughout the nineties as they did with the console market. In 1995 Sega released the Nomad handheld, this was very much the Genesis but portable, and having access to a back catalogue of games created for the Genesis this seemed ideal. The Nomad was not particularly successful due to the lack of battery life. The Game Boy Colour was a further development onto the market by Nintendo, very similar to the previous Game Boy but also having backwards compatibility, a colour screen, and the improvement of graphics aided the success of this version. Figures II.59 and II.60 display both the Nomad and Game Boy Colour.



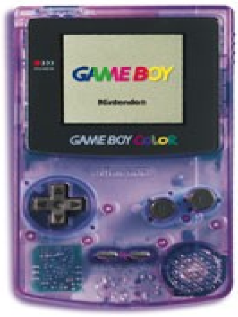


Figure II.59 – Sega Nomad

Figure II.60 – Nintendo Game Boy Colour[91]

Companies throughout the nineties and into the Twenty-First Century were releasing handhelds, this included Nintendo and Sony, with the most exciting and spectacular releases during the early and mid twenty-first century where Nintendo released the Game Boy Advance/ Advance SP and Micro. Melanson (2006) suggests that the GBA was very much similar to the Super Nintendo console; games from the console were also transferable onto the handheld as were original games developed. The Game Boy Micro released in 2005 was small in comparison to previous handhelds, but still held the same style of button and "with a small and sleek design aimed in large part at an older, IPod-totting, audience" (Melanson, 2006 http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/). Figures II.61 and II.62 illustrate the GBA and the Micro

Figure II.61 – Game Boy Advance

Figure II.63 – Game Boy Micro[92]

Further developments with virtual reality (VR) were still being created, one in particular by Namco developed a virtual headset, Namco signed a deal with the

[91] http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/
[92] http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/

company Virtuality, which would create a VR arcade game from the classic game of Pac-Man. With this creation the user would actually be Pac-Man in the virtual world, the player would take on the basis of the character in a first person stance, and would carry out the nature of the game as previously done in 1980 when the game was in the arcades. There was opportunity for up to four players to play with the game, which enabled the gamers to talk to each other. Figure II.64 shows the VR headset created by Virtuality.

Figure II.64 – Atari Jaguar VR headset[93]

The Sega Dreamcast was marketed between 1998 and 2002, Herman (2001) states alongside the release Sega had announced a number of peripherals would be available ranging from an "arcade stick, racing controller, steering wheel, fishing rod and a keyboard." The Dreamcast did not do particularly well for one reason or another. One of the first problems encountered was the marketing and advertising strategies used, which for many gamers left them confused, this as Kirriemuir (2006) states, "referring to play in an abstract sense, but not to digital games." The chief executive of Sega, Bernie Stolar, referred to the Dreamcast as "a living organism that could grow as the player grows" (Herman, 2001). Stolar suggested that for the Dreamcast to grow "the system would change and evolve with the gamer's needs, demands and wants" (Herman, 2001). Herman (2001) suggests the method of evolving a console is through the development of peripherals giving the gamer a variety to choose from. Further announcements were made suggesting, along with the console, a camera and microphone would be available allowing gamers to see and talk to each other while playing and competing online. Sega saw the Dreamcast as "videogame's next

[93] http://www.planet-atari.de/?article=6392&name=Special_Jaguar_VR_Hands_On

frontier," (Herman, 2001) creating a home console which enabled the gamer to connect to the Internet.

Gaming from the 20th Century into the New Millennium

Games, which had been developed for the Dreamcast, were viewed in comparison to consoles on the market as being "graphically superior," developers either avoided or decided to have nothing to do with the development of games for the console, which in the end left Sega struggling to gain investment. One aspect of the Dreamcast marketing tool was having online capabilities, but this is was the "critical failure," the Dreamcast had very few games throughout the duration of its lifespan until the end, Phantasy Star Online was highly commended, although this did seem to enable gamers from around the world to play online, it was decided that the Dreamcast would be dropped in 2002. From this point onwards Sega started developing games for other platforms. Figure II.65 shows the Dreamcast console.

Figure II.65 – The Sega Dreamcast console[94]

Throughout the late nineties Sony referred to the console as the "future PlayStation" (Herman, 2001) whereas the press called it the PlayStation 2. The marketing behind the console was nothing like the original PlayStation, this was a gaming console which also brought together various forms of entertainment, from playing DVDs and CDs to computer USB ports, enabling the user to connect a modem or Ethernet. In addition to the PS-2, Sony had decided to release or offer to the consumer broadband

[94] http://i.testfreaks.co.uk/images/products/600x400/18/sega-dreamcast.439314.jpg

technology, either through the Ethernet or modem. The option of an extra disk drive would give the gamer the ability to download game information and demonstrations, when the launch of the PS-2 came there was the chance to have a dual shock analogue controller, and a memory card holding eight megabytes of memory. (Herman, 2001) The style of the PS-2 was very different to its predecessor; Figure II.66 shows how the PS-2 looked.

Figure II.66 – Sony PlayStation 2 console[95]

Games for the PS-2 would be released on both CD and DVD format, both formats running slightly different from one another, including backwards compatibility with the original PS. The success of this console derives from a variety of angles, such as, the gamer being able to play PlayStation titles, franchise of popular and key games such as *Grand Theft Auto (GTA)* and *Gran Turismo*, both very successful titles amongst hardcore gamers. The Twenty-First Century saw further releases of consoles, such as the Xbox, created by Microsoft (2001). American sales of the Xbox proved to be very successful although European figures have been increasing, the Xbox is different to previous consoles as it has a hard-drive installed, allowing the gamer to save soundtracks and game components which can then be used within games. Another element of both of these consoles was allowing the gamer to play CDs and DVDs. The Xbox was more powerful than the PS-2 and the Dreamcast, Herman (2001) states the “graphics on the X-box would blow away its competitors.” The graphics chip, which Microsoft used for the graphics, was more than double that used for the PS-2 and the Dreamcast.

[95] http://www.openrussia.ru/catalogitems/7187/Ps2-Console.htm

The third console to be released in the early part of the Twenty-First Century was the successor to the Nintendo 64 known as the Nintendo Game Cube. This unlike the previous two consoles did not play CDs or DVDs. As previously mentioned in relation to the Nintendo brand, creating the Mario character(s) also followed through onto the Game Cube, which proved successful, as well as game titles such as the Resident Evil titles, developing games, not solely for the hardcore gamer but also for the adult market, showed that the console was not just aimed at school children. Over the last four years since 2004, the development and release of the Next Generation consoles has been exciting, Microsoft released the Xbox-360 (2005), Nintendo released the Wii (2006) and the handheld DS (2005) and Sony released the Play Station 3 (2007) and PSP (2006).

The development of the Sony PlayStation 3 (PS-3) is advancement in technology from its predecessors as well as the Xbox 360 and the Nintendo Wii. Sony, since the creation of the PlayStation, has been primarily targeting hardcore gamers. A news report of the PlayStation 3 stated "it is a graphical powerhouse, with a cutting-edge Cell processor and a customized Nvidia graphics chip that could melt most gaming PCs. But the console goes beyond gaming, doubling as a Blu-ray and DVD movie player. " (http://www.cnet.com/PS-3.html, accessed May 2008) The PS-3 has other capabilities, such as, Wi-Fi networking and free online head-to-head gaming allowing gamers to play one another over the Internet.

The Nintendo Wii, which is not as expensive as the PlayStation 3, has been very successful out of all of the Next Gen consoles, and since the release of the DS in 2005, which primarily launched the take- up of gaming to a wider demographic audience. The difference with the Wii, in comparison to other consoles, is the method of interaction between the gamer and the game, this is through motion sensor. The user has the remote in their hands and, for example they are playing golf on the Wii sports, the user will hold the remote like a golf club, which will hit the sensor placed on top of the television. The type of controller used for the Wii has been developed differently to the ones used for the PS-3 and the Xbox-360 which use a typical game controller. Figure II.72 shows an older adult playing the boxing game on the Wii, in their hands is the remote and the nunchuk, which are connected to each other and are used by the player to box the opponent in this case it is the computer game. Figure

II.67 shows the Wii remote, and the different aspects it can do. The black part of the remote, shown in the top left corner, is where the motion is sent to the sensor placed on top of gamers' television. Figure II.68 shows the remote and the nunchuk connected, which in some cases like the boxing is required. This method of interaction within a game is necessary, as the nunchuk represents the gamers' left hand.

Figure II.67 – Wii Remote

Figure II.68 – Wii remote and nunchuk[96]

When Nintendo released the Wii the game this accompanied the console and was called Wii Sports. This was a CD which held five different sports, Golf, Boxing, Tennis, Baseball and Bowling. All of which are available to play from one disk and by the gamer selecting the individual game from a menu and the number of people to play. For some games, such as tennis, four individual players are able to play at the same time. Figures II.69, II.70 and II.71 show three screen shots of the games used for the PhD investigation.

Figure II.69 – Wii Golf

Figure II.70 – Wii Boxing

[96] http://www.videogameaction.com/niwiisy2plbu2.html

Figure II.71 – Wii Tennis[97]

The games available for the Wii range from the classics of Sega and predecessors of the Wii, such as *Mario Kart*. Nintendo also developed games relating to the movie industry creating Harry Potter and the Order of the Phoenix. The development of the DS enables users to interact with games through voice or touch interaction with a stylus. The advantage, which the Wii seems to have had over other consoles on the market, is the way the gamer or user interacts with the game itself, allowing not only young people to pick up and play but variant generations within the family, accessibility of the controller using the motion sensor detection within the game play allows a grand-parent to play even though they may have slight arthritis. (http://reviews.cnet.com/4321-10109_7-6551960-1.html?tag=feat, accessed may 2008) The image below shows Benedetto Vigna playing the boxing game on the Wii Sports, Vigna is the creator of the motion sensor used within the Wii

Figure II.72, Vigna Playing on the Wii Sports[98]

So far, in this section of the chapter, there has been an in-depth discussion into the history of gaming since starting in the 1960s, through to the present day. To

[97] http://www.videogameaction.com/niwiisy2plbu2.html
[98] http://www.spectrum.ieee.org/images/mar07/images/vigna01.jpg

understand how the games industry has formed throughout the decades there has been much examination of peripherals, which had been developed and released onto the market, in some cases like the *Mindlink* peripheral this did not, but it still focused the developers and industry into how interaction could be enhanced for the gamer. As shown so far specialist peripherals were bought by the consumer if wanting to play a particular game, for example a steering wheel for a driving game, although controllers seemed to improve this actually made the game play more difficult to conduct having to press a sequence of buttons together, and also remembering the exact buttons for carrying out specific activities in the game. Discussion of the interface from the initial *Spacewar* to that of the *Wii Sports*, has dramatically improved as technology has enhanced, the graphics have improved in clarity and depth.

The real developments and competition between the companies commenced during 2004/2005 with the release of the Nintendo DS and the Sony PlayStation Portable (PSP). The DS was a turning point, for what many would say, the whole of the games industry in relation to the demographic audience. The DS changed many peoples perspectives of gaming, and computer games were not just for young hardcore gamers in their twenties, but also for older adults and for some much older than those that were witness to the first video game being released in arcades, known as the Baby Boomers.

The DS has a number of features, such as the stylus allowing the user/gamer to play games without having to press a number of buttons simultaneously, which is expected on the Sony PSP, a built in Wi-Fi allows players to connect and play games such as Mario Kart world-wide, games designed for the GBA are also able to be interjected giving the player a further range and availability to games. Tetris has already been discussed and was released on the original Game Boy, an updated version of the game, using a similar style to its predecessor the main difference is the nature of interaction and the coloured graphics. Figure II.73 illustrate the DS version of Tetris

Figure II.73 – Tetris on from the DS[99]

The idea behind the PSP was to create a handheld bringing a number of media entertainments together, very much like the PS-2 and the PS-3, this entailed incorporating DVD format, photo viewing as well as gaming. Playing on the PSP gave the gamer the opportunity to connect to other PSP handhelds which also included Sony's newest console release the PS-3 and the Internet. Figure II.74 and Figure II.75 illustrate the DS and the PSP, both of which have become popular within their market audiences, as the Playstation in the console market targeted young hardcore gamers this has followed through to the PSP, and Nintendo have always tried to create a new experience, and with the DS this was the start of delivering an entertainment format alongside the release of the Brain Training Game to a wider demographic group, from young children through to adults in their seventies and onwards.

Figure II.74 – Nintendo DS

Figure II.75 – Sony PSP[100]

Both consoles are a success within their own rights, but when it comes to interaction and game playing there is one main feature which distinctly stands out, playing a

[99] http://uk.ds.ign.com/dor/objects/726069/tetris-ds/images/tetris-ds-20060127000102298.html;jsessionid=xykd7cjx5dzm
[100] http://www.engadget.com/2006/03/03/a-brief-history-of-handheld-video-games/

game on the DS, the user has a number of intuitive methods, the bottom screen allows the player to touch the game with the stylus, which for some people this method of gaming is easier to understand. For some games, such as Wario Ware or Brain Training, the player is required to speak into the built-in microphone. This has been demonstrated over the last couple of years through commercial advertisement, with many endorsements from movie celebrities, such as Nicole Kidman, who is shown to speak into the handheld.

As games commenced in the early days there were very little or no statistics collected but for many people, who played games in the arcades, this young generation at the time is now viewed by society as the baby boomer generation, and for many who played throughout the years of early gaming, the skill required to press a number of buttons within a specific time limit was very skilful. The following section will discuss a brief history of the handheld, with discussion relating to the Nintendo DS which has made a breakthrough in the gaming industry by opening up the target audience. To give an insight into how the gaming demographics have increased in the early part of the Twenty-First Century, data from the Entertainment Software Association (ESA) from 2004 to 2008 shows the increase by age that now play videogames. Figure II.76 displays this increase.

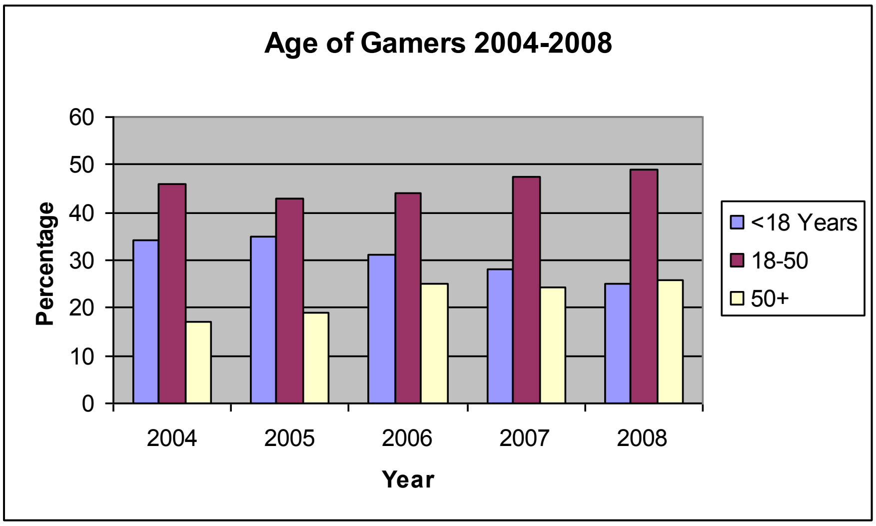


Figure II.76 – Increase of gamers by age from 2004 – 2008

The chart above illustrates that during the last four years gaming has not just been resigned to the younger generation, but for older adults too, and as illustrated the over fifties. Between 2004 and 2008 the increase of over fifties raised from seventeen percent to twenty-six percent, this it seems, has come from the development of the Nintendo DS, due to the ease of interaction has given older adults the ability to interact and take-up this entertainment medium.

APPENDIX III:

WORKSHOP QUESTIONNAIRE 1

Computer game questionnaire

Introduction

We are interested in finding out older people's views on and experiences of playing computer games. We would like you complete this questionnaire whether you are playing computer games or not. Thank you in advance for your help.

Please answer the following questions.

Section A: Computers

A1 Do you own a computer?

☐ Yes ☐ No

A2 If so, what type of computer do you own? (Please tick all that apply.)

☐ Macintosh ☐ Personal computer (PC) ☐ Other, please specify ……….

A3 Do you have access to a computer?

☐ Yes ☐ No

A4 Have you used a computer? (Please tick one answer.)

☐ Yes ☐ No

If yes, then please answer the following questions.
If no, then please go to turn to page3.

A5 How long have you used a computer? (Please tick one answer.)

☐ more than 1 year	☐ more than 2 months
☐ more than 6 months	☐ more than 1 month
☐ more than 3 months	☐ month or less

A6 How frequently do you use a computer? (Please tick one answer.)

☐ more than once a day	☐ more than once a month
☐ about once a day	☐ less than once a month
☐ more than once a week	☐ I normally do not use a computer

A7 How many hours a week do you use a computer? ____ hours

A8 What do you use a computer for? (Please tick all answers that apply.)

☐ Word processing	☐ Drawing	☐ Programming
☐ Database	☐ Email	☐ Playing games
☐ Spreadsheet	☐ Internet	☐ Other, please specify ………..

Please go to page 3.

Section B: Confidence (computers)

Please read the following example first.

Working with a computer would make me happy.

Strong disagree	1	2	3	4	5	6	7	Strongly agree

If you fairly strongly agree that working with a computer would make you happy then you would circle your answer as indicated above.

Please turn to page 4 if you use computers.
Please turn to page 6 if you do not use computers.

For computer users

Please circle one answer per statement.

B1 I feel confident making selections from an on screen menu

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B2 I feel confident using a computer to write a letter or essay

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B3 I feel confident escaping or exiting from a program or software

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B4 I feel confident calling up a data file to view on the monitor screen

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B5 I feel confident troubleshooting computer problems

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B6 I feel confident understanding terms/words relating to computer hardware

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B7 I feel confident explaining why a program (software) will or will not run on a given computer

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B8 I feel confident writing simple programs for a computer

Strong disagree	1	2	3	4	5	6	7	Strongly agree

Please turn to page 8.

For people who do not use computers
Please circle one answer per statement.

B9 I would feel confident making selections from an on screen menu

Strong								Strongly
disagree	1	2	3	4	5	6	7	agree

B10 I would feel confident using a computer to write a letter or essay

Strong								Strongly
disagree	1	2	3	4	5	6	7	agree

B11 I would feel confident escaping or exiting from a program or software

Strong								Strongly
disagree	1	2	3	4	5	6	7	agree

B12 I would feel confident calling up a data file to view on the monitor screen

Strong								Strongly
disagree	1	2	3	4	5	6	7	agree

B13 I would feel confident troubleshooting computer problems

Strong								Strongly
disagree	1	2	3	4	5	6	7	agree

B14 I would feel confident understanding terms/words relating to computer hardware

Strong								Strongly
disagree	1	2	3	4	5	6	7	agree

B15 I would feel confident explaining why a program (software) will or will not run on a given computer

Strong disagree	1	2	3	4	5	6	7	Strongly agree

B16 I would feel confident writing simple programs for a computer

Strong disagree	1	2	3	4	5	6	7	Strongly agree

please turn to page 8.

Section C: Computer games

C1 Do you own a game console?

☐ Yes ☐ No

C1.1 If so, what type of game console do you own? (Please tick all that apply.)

☐ Play Station 1	☐ X-Box	☐ Dreamcast
☐ Play Station 2	☐ Other, please specify …………	
☐ Nintendo Game Cube	☐	

C2 Do you own a computer that can be used to play computer games?

☐ Yes ☐ No

C2.1 If so, what type of computer do you own? (Please tick all that apply.)

☐ Macintosh ☐ Personal computer (PC) ☐ Not Sure

C3 Do you own any of the following?

☐ Mobile Phone	☐ PDA (Personal Digital Assistant)	☐ Other, please specify………
☐ Black Berry		

C3.1 If so which have you played games on?

☐ Mobile Phone	☐ PDA (Personal Digital Assistant)	☐ Other, please specify………
☐ Black Berry		

C4 Do you have access to a computer game console?

☐ Yes ☐ No ☐ Do not Know

C5 Do you have access to a computer that can be used to play computer games?

☐ Yes ☐ No ☐ Do not Know

C6 Have you played computer games? (Please tick one answer.)

☐ Yes ☐ No

If yes, then please answer the following questions.
If no, then please go to Section D, page 13.

C7 Have you played computer games on the Internet?

☐ Yes ☐ No ☐ Do not Know

C8 How long have you played computer games? (Please tick one answer.)

☐ more than 1 year
☐ more than 6 months
☐ more than 3 months
☐ more than 2 months
☐ more than 1 month
☐ month or less

C9 How frequently do you play computer games? (Please tick one answer.)

☐ more than once a day
☐ about once a day
☐ more than once a week
☐ more than once a month
☐ less than once a month
☐ I normally do not play computer games

C10 How many hours a week do you play games?

____ hours

C11 What types of computer games do you play? (Please tick all answers that apply.)

☐ Shooter
☐ Platform
☐ Sports
☐ Puzzle
☐ Adventure
☐ Other, please specify …………
☐ Strategy

C12 Have you ever bought a game that you would play yourself?

☐ Yes ☐ No ☐ Not sure

C13 If so, how many have you bought? _____ games

C14 If so, where did you buy? (Please tick all that apply.)

☐ Supermarket ☐ Computer shop ☐ Rental Shop
☐ High street ☐ Other, please specify …………

C15 how did you learn to play computer games?

☐ Learned from grandchild
☐ Learned from child
☐ Learned from other family member
☐ Learned from friend
☐ Taught myself
☐ Taught in class
☐ Other, please specify …………

C16 Would you consider playing a computer game? (Please tick one answer.)

☐ Yes ☐ No ☐ Do not Know

C16.1 If not, why not?

C17 If so, which types of game would you consider playing?

☐ Shooter ☐ Puzzle ☐ Other, please specify …………

☐ Platform ☐ Adventure

☐ Sports ☐ Strategy

C18 Would you be willing to learn playing a computer game? (Please tick one answer.)

☐ Yes ☐ No ☐ Do not Know

C19 What kind of hobbies do you do in your spare time? (Please tick all that apply and specify exactly what kind of sport(s) or other hobby(ies) you enjoy in each category.)

☐	Arts and Crafts………………………………………………………………………………
☐	Card games………………………………………………………………………………
☐	Dancing…………………………………………………………………………………………………
☐	Gambling……………………………………………………………………………………………
☐	Sport……………………………………………………………………………………
☐	Walking………………………………………………………………………………
☐	Other, please specify ……………………………………………………………………………

C20 Would you consider playing a computer game related to your hobby? (Please tick one answer.)

☐ Yes ☐ No ☐ Do not Know

Please turn to Section D, page 13.

Section D: Confidence (computer games)

Please read the following example first.

Working with a computer would make me happy.

Strong disagree	1	2	3	4	5	6	7	Strongly agree

If you fairly strongly agree that working with a computer would make you happy then you would circle your answer as indicated above.

Please turn to page 14 if you play computer game.
Please turn to page 16 if you do not play computer games.

For computer game players
Please circle one answer per statement.

D1 I feel confident playing a simple computer game

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D2 I feel confident escaping or exiting from a computer game

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D3 I feel confident calling up a computer game to play on the monitor screen

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D4 I feel confident making character selections from an on screen menu of game levels

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D5 I feel confident resolving challenges in a computer game problems

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D6 I feel confident understanding terms/words relating to computer games

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D7 I feel confident explaining how to play games

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D8 I feel confident logging & playing online games

Strong disagree	1	2	3	4	5	6	7	Strongly agree

Please turn to page 18.

For people who do not play computer games

Please circle one answer per statement.

D9 I would feel confident playing a simple computer game

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D10 I would feel confident escaping or exiting from a computer game

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D11 I would feel confident calling up a computer game to play on the monitor screen

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D12 I would feel confident making character selections from an on screen menu of game levels

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D13 I would feel confident resolving challenges in a computer game problems

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D14 I would feel confident understanding terms/words relating to computer games

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D15 I would feel confident explaining how to play games

Strong disagree	1	2	3	4	5	6	7	Strongly agree

D16 I would feel confident logging on to & playing online games

Strong disagree	1	2	3	4	5	6	7	Strongly agree

Please turn to page 18.

Section E: Personal details

E1 What is your age? _____ years

E2 Are you male or female?

☐ Male ☐ Female

E3 What is the highest level of education that you have achieved?

(Please tick one answer.)

☐ Higher degree	☐ NVQ or equivalent
☐ Degree	☐ GCSE/O level or equivalent
☐ A Level or equivalent	☐ No qualification

E4 What is your Occupation? (Please tick one answer.)

☐ Professional worker (lawyer, doctor, scientist, manager of large scale organisation)	☐ Semi-skilled manual, for example bus driver, lorry driver, fitter
☐ Shopkeeper, farmer, teacher, white-collar worker	☐ Unskilled manual, for example general labourer, barman, porter
☐ Skilled manual ('hand') worker - high grade, for example master builder, carpenter, shop assistant, nurse	☐ Retired
☐ Skilled manual - low grade, for example electrician, plumber	☐ Unemployed

E5 What are your living arrangements? (Please tick one answer.)

☐ Married or living with a partner ☐ Alone ☐ Other

☐ Living with 1 or more people

E6 Do you have any children? (Please tick one answer.)

☐ Yes ☐ No

If yes, then please answer the following questions.
If no, then please go to Page 21.

E6.1 How many children do you have?
______Children

E6.2 Do they play computer games?
☐ Yes ☐ No

CONTINUED OVERLEAF

E7 Do you have any Grandchildren?

☐ Yes ☐ No

If yes, then please answer the following questions.
If no, then please go to Page 21.

E7.1 How many Grandchildren do you have?

______Children

E7.2 Do they play computer games?

☐ Yes ☐ No

Please go to Page 21.

Final question

Please write down below anything else about computer games that you would like to tell us.

Thank you for completing this questionnaire!

APPENDIX IV:

ADVERTISEMENT POSTER

Women & Men Participants Needed

Over 50s Playing Computer Games

One of the UK's top manufacturers of video games has found an increasing number of seniors are playing computer games.

One of the nation's fastest growing youth markets that usually attract younger people seems to be attracting a sector of older people. The booming video games business has a £2 billion core market among 25 to 34 year olds but one of the top companies in the industry believes that computer-playing pensioners may be expanding the age limits well into the 60's.

University of Teesside is requesting the help of Older Adults in the Tees Valley.

You are invited to take part in a research project into what makes a **Good Game** for **Older Adults**. You can take part in a research questionnaire, workshop or both. If you are an older adult who does not play computer games then we would still like to hear from you.

If you are interested in taking part in this research project please contact:

Hannah Marston
Research Assistant
School of Computing
University of Teesside
h.r.marston@tees.ac.uk

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APPENDIX V:

PACT LAB LETTER

Hannah Marston
Research Assistant
University of Teesside
School of Computing
Middlesbrough, TS1 3BN
h.r.martston@tees.ac.uk
01642 384540
July 2005

Computer Games and Older Adults

My name is Hannah Marston; I am a research assistant at the University Of Teesside School Of Computing I am currently studying an MPhil/PhD relating to computer games. As part of the MPhil I am researching into a project relating to Computer Games and Older Adults.

The overall aim of the project is to identify the current game playing habits and preferences for older adults and possible future trends. The team are interested in: What type of games do people enjoy playing? Why do people want to play games? What do people enjoy doing in their spare time?

I would like to invite you to take part in one of the workshops whether you play computer games or not. At the workshop you will be shown four presentations outlining how you can design your own computer game, and a step by step worksheet will be completed. The worksheet will build upon your own idea for a computer game. The workshop in non-technical and you won't be playing games just discussing and planning ideas. You are free to leave the workshop at any time. A workshop will take between 2½ to 3 hours to complete.

There have been approximately thirty-two people who have taken part in the workshop aging from 23 years to 65 years old. All participants who have taken part in the workshop have enjoyed themselves while designing a game relating to their hobby or interest.

Depending upon how many participants there are for the workshop I am able to carry out workshops at the University of Teesside or if you live in Newcastle or anywhere else I may be able to travel to you. Car parking at the University is limited but I am sure I could give suggestions of where to park.

I am able to run a workshop at a time that is convenient to you, although there does need to be a minimum of two people. If you are interested please do not hesitate to get in touch.

Thank you for your time and interest in our and related research

Yours truly,

PACT Team--

Older Adults and Computer Games

I would like to take part in the above research project and attend one of the workshop sessions.

Name:…………………………………………………………………………………
…………

Address:………………………………………………………………………………
………
…………………………………………………………………………………………
………..
…………………………………………………………………………………………
………..
Telephone No:…………………………………………
Mobile Telephone No:…………………………………………………..
Email:…………………………………………………………………
Age:…………………   Male/Female

The workshops will take place on the following dates and times.
Please tick the one you would like to attend:

Thursday 21st July, 10.00am ☐

Thursday 21st July, 1.00pm ☐

Friday 22nd July, 10.00am ☐

Friday 22nd July, 1.00pm ☐

APPENDIX VI:

CONSENT FORM

CONSENT FORM ID Number

Title of Project: Computer Games and Older Adults

The aim of this research is to identify whether game content/genre is important to the gamer/non-gamer or is it how the gamer/non-gamer interact with the console (controller/game pad). You can participate in this research through a questionnaire and experiment. Your responses will help us to find out whether it is the content/genre that is important or whether it is actually the hardware?

Yes *No*

► I understand that it is completely my decision to take part or not ☐ ☐

► I understand that I do not have to take part and don't have to give a reason why not ☐ ☐

► I understand that I am free to stop taking part at any time without giving a reason ☐ ☐

► I understand that if I stop taking part at any time this will not affect any help I am getting now or will get in the future ☐ ☐

► I understand that results may appear in research publications and that my name or other personal information will not be mentioned. ☐ ☐

► I understand that if I agree to take part in a telephone interview what I say will be recorded on audio tapes by the researchers (for the purpose of analysis), and will not be looked at by anyone other than the researchers without my written permission. ☐ ☐

► I agree to take part in Project: **Computer Games and Older Adults** ☐ ☐

Name of Participant -------------------------------- Date --------------

Signature(s)---

copy for research team (please return this section in the envelope provided)

✂_✂_✂_✂_✂_✂_✂_✂_✂_✂_✂_✂_✂_✂_✂_✂__✂_✂_✂_✂__✂_✂_✂_

Yes **No**

ID Number

► I agree to take part in Project: **Computer Games and Older Adults** ☐ ☐

Name of Participant ----------------- Date ---------------------

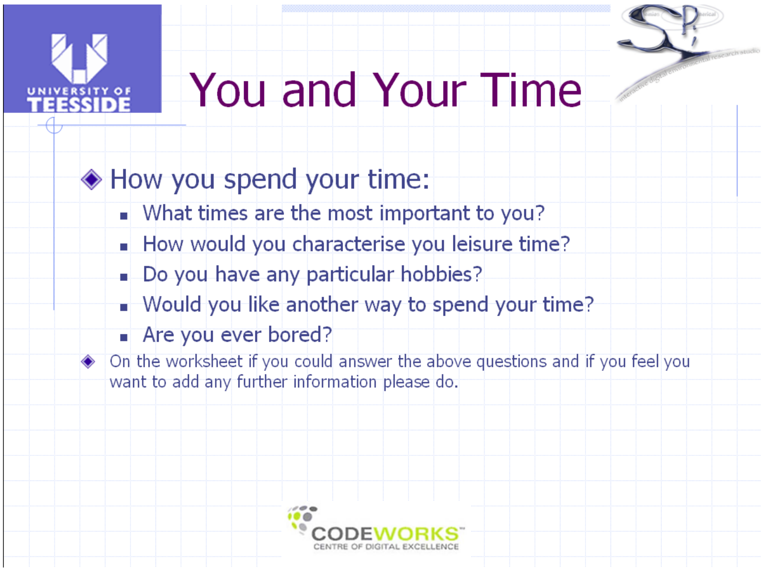
Signature(s)--

APPENDIX VII:

WORKSHOP WORKSHEET

ID Number:

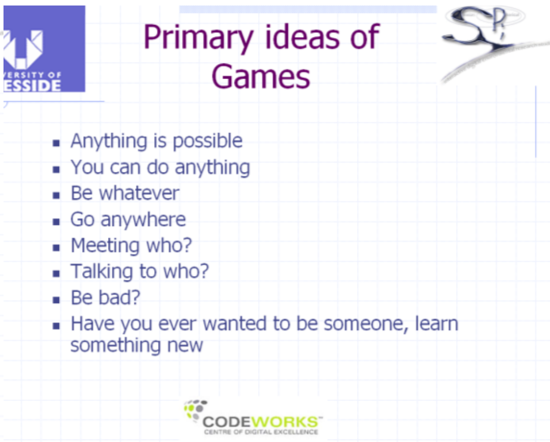
Session 1 – Hobbies, Interests, Dreams Anything you Want!!



You're Hobbies, Interests, Dreams …

ID Number:

Session 2 – The Big Picture, Imbalances, Verbs, Pleasure & Reward



My game idea is….Please relate to hobby, interest etc

ID Number:

The Good, The Bad, The Imbalance

- Imbalance
  - is created by oppositions, within the context.
- The player/character needs to achieve an imbalance EG:
  - Good/Bad
  - Male/Female
  - Old/Young
  - Human/Alien
  - Order/Chaos
- You can have as many imbalances as you like *(you don't have to use the ones above)*

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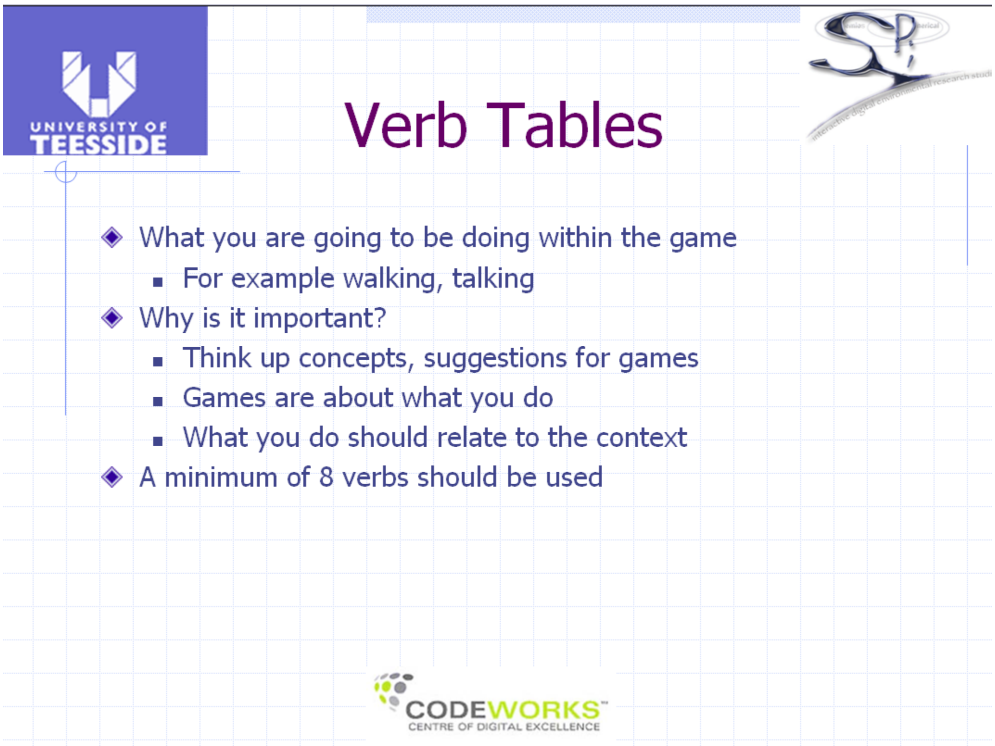
Imbalances; EG good/bad, pretty/ugly

ID Number:



Verb Table; EG Fishing, walking, talking, knitting

ID Number:

The Pleasure in Games

- Types of pleasure in games?
- What kinds of pleasure's) would you like people to experience in your game?
  - You can include emotion, feeling, experience etc

The pleasures; EG, fun, gratification, laughter

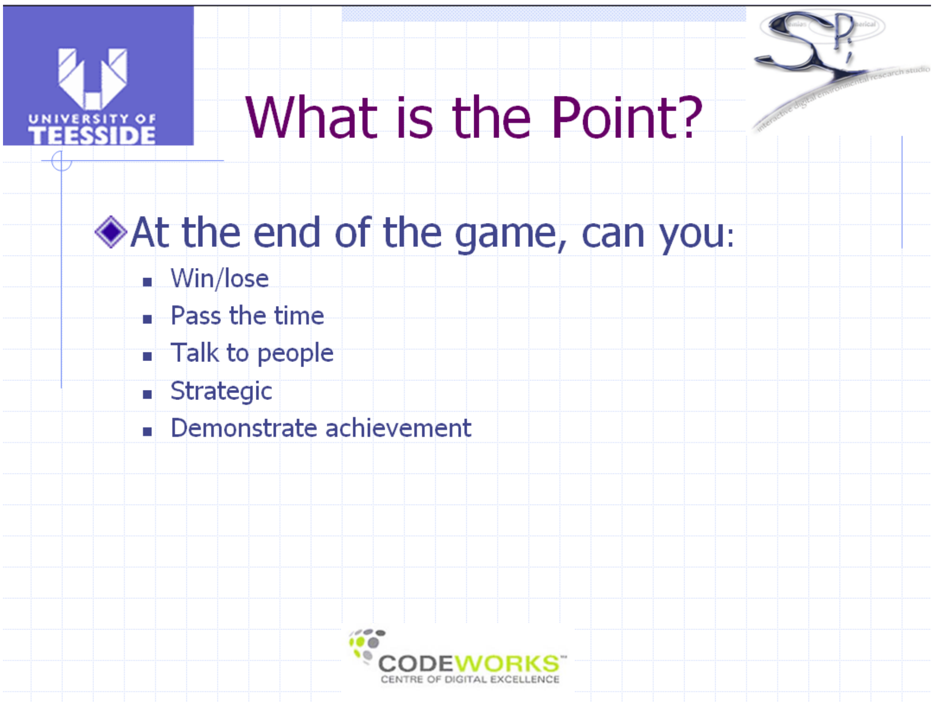
ID Number:

Session 3 – Game Space, Intervention, What's the Point?

Game Space EG, What will you see, hear, how the game will be represented, what type of view will the player see?

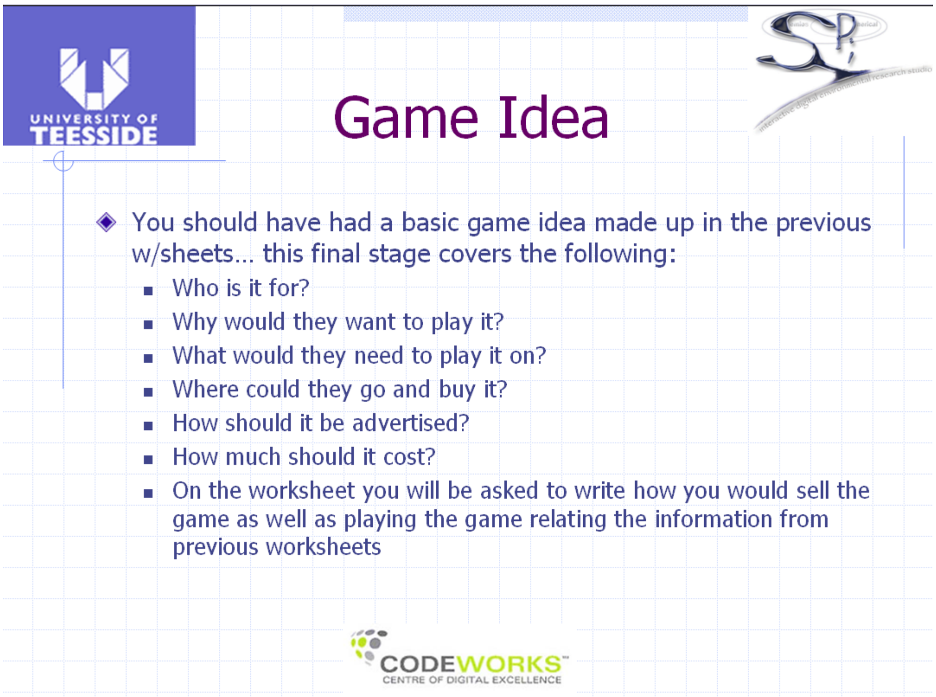
Communicating with the game; push buttons, speak, frantic, calm relaxed

ID Number:



What's the Point; win/loose, demonstrate achievement

ID Number:



Explain how you would sell the game on the market

ID Number:

PTO

Session 4 – Description of Game

Please explain how you would play the game using the verbs from the verb table and the other information you have wrote down in the previous worksheets.

ID Number:

My ideas, thoughts….

APPENDIX VIII

ETHICS FORM

UNIVERSITY OF TEESSIDE **CONFIDENTIAL** **REQUEST FOR ETHICAL APPROVAL**	**Please return form with Section A completed to: The Secretary, Research Ethics Committee School of ……………….**

Section A: To be completed by the appropriate Project Supervisor or Director of Studies

***1. School**:* School of Social Sciences and Law

2. Project Title: Computer Games and Older Adults

***3a): Name, position and address of Project Supervisor/Director of Studies**:*
Paul van Schaik

3b): Name(s) and position of other Supervisor(s):

3c): Names of other collaborators on project:

4. Name(s) of Researcher(s)/Students working on this project:
Hannah Marston, Paul van Schaik, Clive Fencott

Please tick type of Researcher:

Taught Postgraduate		*PG Research Student*		*Staff - higher degree*		*Staff - other research*	√	*FinalYearUnder-grad. Student*	

5. Expected duration of project from: March 2005 ***to:*** on-going

6. Aim(s) of Project:
The overall aim of the project is to identify the current game playing habits and preferences for older adults in the UK and possible future trends.

7. Briefly describe the design of the project:
1 Survey of game playing (see project application to CODEWORKS)
2 Game design workshops (see project application to CODEWORKS)

In addition: A copy of the Protocol (no more than 2 sides of A4) ***must be attached.***

8. Will the participants be: (please tick as appropriate)	*University of Teesside Students?*		*University of Teesside Staff?*	

Other: (Please specify):
Older adults from outside the university

9. How many participants will be involved?
A sample of 1000 will take part in the survey. Five groups of 15 participants will take part in game design workshops

10. State how participants will be selected:
Participants will be selected through organisations of and for older people and press outlets.

11. Has statistical/methodological advice been sought on the size and design of the project? YES / NO
(If YES, please state name of adviser and qualifications)
The research team has the necessary statistical and methodological expertise required.

***12. What procedure(s) will be carried out on the participants**? (Explain in terms*

appropriate to a layperson)
A survey of computer game player by older adults and game design workshops will be conducted.

13a): What potential risks to the interests of participants to you foresee?
No particular risks to participants are apparent.

13b); What potential risks to the Researchers do you foresee?
No particular risks to researchers are apparent.

14 a): Will informed consent be obtained from all participants? YES
(If written, attach a copy of the consent form)

14b): If NO, why not? *(Provide rationale.)*

15: If there is doubt as to a subject's ability to give consent, what steps will be taken to ensure that the subject is willing to participate *(e.g. assistance of independent colleague/ next of kin or other means.)*
Not applicable

16: What information will be given to subject(s)?: *(Attach copies of letters or information sheets to be given to participants.)*
See consent form.

17: Where will consent be recorded?
Yes, see 15.

18a): Will participants be informed of their right to withdraw? YES

18b): If not, why not? *(provide rationale)*

19: Does the project involve any other disciplines and/or Ethics Committees? YES / NO
(If YES, please state which and what approval has already been obtained - attach documentation.)
No other Ethics committees are involved.

20: Will payments to participants be made? YES / NO
(If YES, state amount and whether payment is for out-of-pocket expenses, or a fee.)
Fees at a fixed rate will be paid to participants in the game design workshops.

21a): Will the project receive financial support from outside the University Teesside? NO

21b): If YES, specify the nature and source of the support:

21c) If YES, have any restrictions been imposed upon the conduct of the research? YES / NO *(If YES, specify the nature of the restrictions)*

22: Will any restrictions be placed on the publication of results? NO
(If YES, please state the nature of the restrictions)
Approval from the external funder is required. However, no problems are expected with publication of results.

23: Are there any other points you wish to make in justification of the proposed study?
With an increasingly ageing population, the potential market for computer games for older adults is expanding phenomenally. However, there is a lack of research and a validated knowledge to realise this potential and this research project addresses this issue.

***24*: I have read the University's guidelines on ethics related to research, and to the best of my knowledge and ability confirm that the ethical considerations overleaf have been assessed. I am aware of and understand University procedures on Research Ethics and Health & Safety. I understand that the ethical propriety of this project may be monitored by the School's Research Ethics Sub-Committee.** *(Please complete the following as appropriate)*	*Please Tick*
▪ **I have appropriate experience of the general research area.**	
▪ **I confirm that I have Research Ethics Training required by my School.**	
▪ **I confirm that as Supervisor that I will monitor progress of the project.**	
• **I confirm that the project complies with the Code of Practice of the following Professional Body:**	
25: *Signature of Staff Researcher:* ________________________________ *Date:* _________ ***OR**: Signature of* *Project Supervisor/Director of Studies* __________________________ *Date:* _________	
SECTIONS B/C: SCHOOL APPROVAL or REFERRAL and UNIVERSITY RESEARCH ETHICS COMMITTEE APPROVAL/REJECTION	

Ethical Consideration *The following points have been assessed:*

1. *The merit and feasibility of the proposal*
2. *Possible discomfort, distress or inconvenience to participants and/or Researchers*
3. *Procedures for respecting confidentiality and operating with data protection legislation.*
4. *The implications of monetary or other inducements to University of Teesside, its staff, student or researchers, to participants or anyone else involved.*
5. *Potential conflicts of interest arising between the researcher's employment and the research project, or other collaborative research.*
6. *All safety risks have been assessed in accordance with the University's Risk Assessment Procedure and measures taken where appropriate to make them as low as reasonably practicable.*

7 If the research involves human subjects, the following points have also been assessed: Procedures for:

- *providing explanation to participants including the preparation of an appropriate information sheet.*
- *obtaining informed consent from participants or where necessary from their parents or guardians, including the preparation of a written consent form.*

8. If the work may involve participants from vulnerable groups, the nature of recruitment and participation of these people.

SECTION B: SCHOOL APPROVAL or REFERRAL
To be completed by Chair of the School Research Ethics Committee

EITHER:

a) Following consideration by the School Research Ethics Committee, I now authorise the above project.

Signature of Chair of School Research Ethics Committee: _____________ *Date:* _________

OR:

b) The School Research Ethics Committee is unable to reach a conclusion, and the case is referred to the University Research Ethics Committee.

Signature of Chair of School Research Ethics Committee: _____________ *Date:* __________

The Chair of the School Research Ethics Committee must send a copy of an APPROVED Request for Ethical Approval Form to: The Secretary, University Research Ethics Committee, Research & Development Office, University of Teesside. The original of the form should be kept in the School. The ORIGINAL of a REFERRED Request must be sent to the above address for action and the

Director of the School notified.
SECTION C: APPROVAL / REJECTION by University Research Ethics Committee
EITHER: **a) On behalf of the University Research Ethics Committee, I now authorise the above project:** *Signature of Chair of University Research Ethics Committee:* ____________ *Date:* _________ ***OR:*** ***b)*** **The University Research Ethics Committee is UNABLE TO APPROVE the project for the following reasons:**   *Signature of Chair of University Research Ethics Committee:* _____________ *Date:* ________

APPENDIX IX:

WORKSHOP RESULTS

The following tables show the results collected from both gamers and non-gamers who took part in Phase One.

Table IX.1a – Dreams Reported by Gamers

Dream	Number of respondents
Travel	2
Learn Pottery	1
Learn to paint	1
Learn a foreign language	1
Flying	1
Learn to play a musical instrument	1
Be a Detective	1
Be a Film Director	1
Be a Forensic Scientist	1

Table IX.1b – Hobbies Reported by Gamers

Hobby	Number of respondents
Walking	6
Cycling	4
Music	3
Sport	3
Gardening	2

Table IX.1c – Combinations of Dreams and Hobbies Reported by Gamers

Dream and Hobby	Number of Respondents
Travel + Gardening	2
Travel + Walking	1
Travel + Cycling	1
Travel + Music	1
Learn Pottery + Walking	1
Learn to Paint + Walking	1
Learn a language + Walking	1
Flying + Cycling	1
Flying + Music	1
Playing an instrument + Cycling	1
Playing an instrument + Music	1
Be a Detective + Cycling	1
Be a Detective + Music	1
Be a Film Director + Cycling	1
Be a Film Director + Music	1
Be a Forensic Scientist + Cycling	1
Be a Forensic Scientist + Music	1

Table IX.2a – Dreams Reported by Non-Gamers

Dream	Number of respondents
Travel	4
Learn a foreign language	1
Adult Education	1
Win the Lottery	1
A Safe Environment	1

Table IX.2b – Hobbies Reported by Non-Gamers

Hobby	Number of respondents
Reading	8
Gardening	6
Making Objects	3
Walking	3
Photography	3
Puzzles	3
Sewing	2

Table IX.2c – Combinations of Dreams and Hobbies Reported by Non-Gamers

Dream and Hobby	Number of Respondents
Travel + Reading	2
Travel + Puzzles	2
Travel + Gardening	1
Travel + Walking	1
Travel + Photography	1
Learn a language + Reading	1
Adult Education + Gardening	1
Adult Education + Photography	1
Win Lottery + Gardening	1
Safe Environment + Reading	1
Safe Environment + Sewing	1
Safe Environment + Gardening	1

Table IX.3a. Important Times: Gamers

Important times	Frequency
With husband/wife	3
Sometimes I get bored	2
Never bored	2
Weekends	2
All my time is important	1
Do what I want when I want	1
Going abroad	1
With grandchildren	1
Going away at weekends	1
Having family and friends to stay	1

Table IX.3b. Important Times: Non-Gamers

Important times	Frequency
Never bored	6
With grandchildren	4
Having family around	2
Weekends	2
Early mornings	1
Time alone	1
Afternoons/evenings	1
All 24 hours is important	1
Sometimes I get bored	1

Table IX.4a – Imbalances Reported by Gamers

Imbalances	Number of Respondents
Good/bad	7
Male/female	4
Young/old	3
Illness/healing	2

Table IX.4b – Concepts Reported by Gamers

Concepts	Number of Respondents
Travel	2
Sport	2
Transport	2

Table IX.5a – Imbalances Reported by Non-Gamers

Imbalances	Number of Respondents
Good/bad	7
Male/female	4
Order/chaos	4
Young/old	3
Government/public	3
Town/city	2
Old/new	1

Table IX.5b – Concepts Reported by Non-Gamers

Concepts	Number of Respondents
Travel	6
History	6
Environment	5
Social stimulation	3
Transport	2
Education	2
Sport	2
Invaders/defenders	2

Table IX.5c – Combinations of Imbalances and Concepts Reported by Non-Gamers

Imbalances and Concepts	Number of Respondents
Good/bad + History	3
Order/chaos + History	3
Good/bad + Travel	2
Good/bad + Invaders/defenders	2
Male/female + Social stimulation	2
Order/chaos + Travel	2
Young/old + Travel	2
Good/bad + Transport	1
Male/female + History	1
Male/female + Environment	1
Male/female + Education	1
Order/chaos + Transport	1
Young/old + History	1
Young/old + Social stimulation	1
Young/old + Transport	1
Government/public + Social stimulation	1
Town/city + History	1
Town/city + Social stimulation	1
Town/city + Invaders/defenders	1
Old/new + Travel	1
Old/new + History	1
Old/new + Education	1

Table IX.6a – Verbs Reported by Gamers

Verbs	Number of Respondents
Walking	6
Talking	4
Driving	2
Shooting	2

Table IX.6b – Imbalances Reported by Gamers

Imbalance	Number of Respondents
Good/Bad	7
Old/Young	4
Male/Female	3
Order/Chaos	2

Table IX.6c – combinations of Verbs and Imbalances Reported by Gamers

Verbs and Imbalances	Number of Respondents
Walking + Male/female	3
Walking + Good/bad	2
Walking + Young/old	2
Talking + Good/bad	2
Talking + Young/old	2

Driving + Good/bad	2
Driving + Young/old	2
Shooting + Good/bad	2
Shooting + Young/old	2
Walking + Order/chaos	1
Talking + Order/chaos	1
Driving + Order/chaos	1
Shooting + Order/chaos	1
Talking + Male/female	1
Driving + Male/female	1
Shooting + Male/female	1

Table IX.7a – Verbs Reported by Non-Gamers

Verbs	Number of Respondents
Walking	10
Speaking	3
Riding	3
Cycling	2
Planning	2
Swimming	2
Flying	2
Sailing	2

Table IX.7b – Imbalances Reported by Non-Gamers

Imbalances	Number of Respondents
Good/Bad	6
Order/Chaos	4
Male/Female	4
Old/Young	3

Table IX.7c – combinations of Verbs and Imbalances Reported by Non-Gamers

Verbs and Imbalances	Number of Respondents
Walking + Good/bad	7
Speaking + Good/bad	5
Walking + Order/chaos	3
Walking + Young/old	3
Walking + Male/female	2
Speaking + Order/chaos	2
Riding + Good/bad	2
Swimming + Good/bad	2
Sailing + Good/bad	2
Speaking + Young/old	1
Speaking + Male/female	1
Cycling + Good/bad	1
Cycling + Order/chaos	1
Riding + Young/old	1
Riding + Male/female	1

Swimming + Young/old	1
Swimming + Male/female	1
Flying + Good/bad	1
Flying + Young/old	1
Sailing + Young/old	1

Table IX.8a – Pleasure Requirements Reported by Gamers

Pleasure	Number of Respondents
Satisfaction	3
Fun	3
Success	2

Table IX.8b – Aims Reported by Gamers

Aim	Number of Respondents
Win	4
Loose	2
Educate	2

Table IX.8c – Combinations of Pleasure and Aims Reported by Gamers

Pleasure + Aim	Number of Respondents
Satisfaction + Win	1
Satisfaction + Educate	1
Success + Educate	1

Table IX.9a – Pleasure Requirements Reported by Non-Gamers

Pleasure	Number of Respondents
Achievement	6
Fun	5
Satisfaction	4
Learning	3
Experience	3

Table IX.9b – Aims Reported by Non-Gamers

Aim	Number of Respondents
Win	11
Achieve	6
Lose	6
Learn	3
Pastime	3
Educate	3

Table IX.9c – Combinations of Pleasure and Aims Reported by Non-Gamers

Pleasure + Aim	Number of Respondents
Fun + Win	5
Fun + Lose	5
Achievement + Win	4
Achievement + Achieve	3
Fun + Achieve	3
Satisfaction + Win	3
Satisfaction + Lose	3
Achievement + Learn	2
Achievement + Educate	2
Learning + Win	2
Learning + Achieve	2
Experience + Achieve	2
Achievement + Pastime	1
Fun + Learn	1
Fun + Pastime	1
Satisfaction + Achieve	1
Satisfaction + Educate	1
Learning + Lose	1
Learning + Educate	1
Experience + Win	1
Experience + Lose	1
Experience + Pastime	1

Table IX.10a – Game Space Ideas Reported by Gamers

Game Space	Number of Respondents
Realistic	5
Sound	3
First Person	2
Outside	2
Cartoon	2
Frantic	2

Table IX.10b – Communication Methods Reported by Gamers

Communication Methods	Number of Respondents
Mouse	4
Speech	3
Keyboard	2
Buttons	2

Table IX.10c – Combinations of Game Space and Communication Methods Reported by Gamers

Game Space + Communication Method	Number of Respondents
Realistic + Speech	3
Realistic + Mouse	2
Outside + Keyboard	2
Realistic + Frantic	1
Realistic + Keyboard	1
Realistic + Buttons	1
Outside + Mouse	1
Outside + Frantic	1
Outside + Buttons	1
Cartoon + Mouse	1
Cartoon + Speech	1

Table IX.11a – Game Space Ideas Reported by Non-Gamers

Game Space	Number of Respondents
Realistic	10
First Person	7
Cartoon	6
Sound	4
Different Views	2
Calm	9
Relaxed	4
Frantic	4

Table IX.11b – Communication Methods Reported by Non-Gamers

Communication Methods	Number of Respondents
Picture	3
Keyboard	3
Speak	3
Buttons	3

Table IX.11c – Combinations of Game Space and Communication Methods Reported by Non-Gamers

Game Space + Communication Method	Number of Respondents
Realistic + Calm	5
First Person + Calm	3
Cartoon + Calm	3
Cartoon + Frantic	3
Realistic + Relaxed	2
Realistic + Keyboard	2
Realistic + Buttons	2
Realistic + Frantic	1

Realistic + Picture	1
Realistic + Speak	1
First Person + Relaxed	1
First Person + Picture	1
First Person + Keyboard	1
First Person + Speak	1
First Person + Buttons	1
Cartoon + Keyboard	1
Cartoon + Speak	1
Cartoon + Buttons	1
Different Views + Calm	1
Different Views + Frantic	1
Different Views + Picture	1

Table IX.12 Genres for Game Designs Produced by Gamers

Game Genre	Frequency	Combined game genre	Frequency
Adventure	3	Sport, Adventure, Strategic	1
Sport	2	Other	3
Casual	2	Adventure, sports, education	0
Puzzle	2	Adventure, sports	0
Strategy	2	Adventure, education	0
Other	3		

Table IX.13 Game Designs Produced by Non-Gamers

Game Genre	Frequency	Combined game genre	Frequency
Adventure	6	Adventure, education	6
Serious	3	Adventure, sports	2
Strategy	3		
Action	3	Educational	2
Casual	2	Strategic, sim, education	2
Real time strategy	2	Other	2
Role Playing Game	1	Adventure, sports, education	1
Sport	1		
Other	2		

APPENDIX X

EXPERIMENT OBSERVATION SHEET

Observation sheet for experiment

Participant number

Type of console

Game being played

Observation	**1 disagree**	**2**	**3**	**4**	**5**	**6**	**7 Agree**
Perceived ease of use							
Perceived control of game							
Enjoyment							
Concentration							
Skilled							
Aural feedback negative							
Aural feedback postive							

Further Comments

Game being played

Observation	1 disagree	2	3	4	5	6	7 Agree
Perceived ease of use							
Perceived control of game							
Enjoyment							
Concentration							
Skilled							
Aural feedback negative							
Aural feedback positive							

Further Comments

Game being played

Observation	1 disagree	2	3	4	5	6	7 Agree
Perceived ease of use							
Perceived control of game							
Enjoyment							
Concentration							
Skilled							
Aural feedback							

Further Comments

APPENDIX XI:

EXPERIMENT QUESTIONNAIRE 2

Computer Game Questionnaire

ID Number

Introduction

We are interested in finding out people's views and experiences of playing computer games and console games.

Thank you in advance for your help

There are 3 parts to this questionnaire:

***Section A** of the Questionnaire – Game Playing Habits*
***Section B** – Demographic Details*
***Section C** – Game Interaction (workshop)*

A1 Do you own a game console? (If NO go to Question A2)

☐ Yes ☐ No

A1.1 If so, what type of game console do you own? (Please tick all that apply.)

☐	Play Station 1	☐	X-Box	☐	Dreamcast
☐	Play Station 2	☐	Other, please specify …………		
☐	Nintendo Game Cube	☐			
☐	Play Station 3				
☐	Nintendo Wii				

A2 Do you own a computer that can be used to play computer games?

☐ Yes ☐ No

A2.1 If so, what type of computer do you own? (Please tick all that apply.)

☐ Macintosh ☐ Personal computer (PC) ☐ Not Sure

A3 Do you have access to a computer game console?

☐ Yes ☐ No ☐ Don't Know

A4 Do you have access to a computer that can be used to play computer games?

☐ Yes ☐ No ☐ Don't Know

A5 What kinds of hobby do you do in your spare time? (Please tick all that apply and specify exactly what kind(s) of sport or other hobby you enjoy in each category.)

☐	Arts & Crafts…………………………………………………………………………
☐	Card games………………………………………………………………………… ………………

☐	Dancing……………………………………………………………………………………
☐	Gambling……………………………………………………………………………………
☐	Sport……………………………………………………………………………………
☐	Walking……………………………………………………………………………………
☐	Other, please specify ……………………………………………………………………………………

A6 Would you consider playing a computer game related to your hobby? (Please tick one answer.)

☐ Yes ☐ No ☐ Don't Know

A7 Would you consider playing a computer game? (Please tick one answer.)

*(If YES **got to Question** A8, If NO **go to next question**)*

☐ Yes ☐ No ☐ Don't Know

A7.1 If not, why not?

If you Do Not play games on a regular basis please go to Page 6

A8 If so, which types of game would you consider playing?

- ☐ Shooter
- ☐ Puzzle
- ☐ Other, please specify …………
- ☐ Platform
- ☐ Adventure
- ☐ Sports
- ☐ Strategy

A9 Have you played computer games on the Internet?

☐ Yes ☐ No ☐ Don't Know

A10 If you DO PLAY Games, how long have you played computer games?

(Please tick one answer.)

- ☐ more than 1 year
- ☐ more than 2 months
- ☐ more than 6 months
- ☐ more than 1 month
- ☐ more than 3 months
- ☐ month or less

A11 How frequently do you play computer games? (Please tick one answer.)

- ☐ more than once a day
- ☐ more than once a month
- ☐ about once a day
- ☐ less than once a month
- ☐ more than once a week
- ☐ I normally do not play computer games

A12 How many hours a week do you play games?

____ hours

A13 What types of computer game do you play? (Please tick all answers that apply)

- ☐ Shooter
- ☐ Puzzle
- ☐ Strategy
- ☐ Platform
- ☐ Adventure
- ☐ Sports
- ☐ Other, please specify …………

A14 Have you ever bought a game that you would play yourself?

☐ Yes ☐ No ☐ Not sure

A15 If so, how many have you bought? _____ games

A16 If so, where did you buy? (Please tick all that apply.)

☐ Supermarket	☐ Computer shop	☐ Rental Shop
☐ High street	☐ Other, please specify …………	

A17 how did you learn to play computer games?

☐ Learned from grandchild	☐ Taught myself
☐ Learned from child	☐ Taught in class
☐ Learned from other family member	☐ Other, please specify …………
☐ Learned from friend	

Section B – Demographic Details

B1 What is your age? _____ years

B2 Are you male or female?

☐ Male ☐ Female

B3 What is the highest level of education that you have achieved? (Please tick one answer.)

☐	Higher degree	☐	NVQ or equivalent
☐	Degree	☐	GCSE/O level or equivalent
☐	A Level or equivalent	☐	No qualification

B4 What is your Occupation? (Please tick one answer.)

☐	(group A) Professional worker (lawyer, doctor, scientist, manager of large scale organisation)	☐	(group E) Semi-skilled manual, for example bus driver, lorry driver, fitter
☐	(group B) Shopkeeper, farmer, teacher, white-collar worker	☐	(group F) Unskilled manual, for example general labourer, barman, porter
☐	(group C) Skilled manual ('hand') worker - high grade, for example master builder, carpenter, shop assistant, nurse	☐	Student
☐	(group D) Skilled manual - low grade, for example electrician, plumber	☐	Unemployed

☐ Retired

☐ If you work Part time please state your occupation

☐If you are retired please state your occupation prior to retiring

B5 What are your living arrangements? (Please tick one answer.)

☐ Married or living with a partner ☐ Alone ☐ Other

B6 Do you have any children? (Please tick one answer.)

□ Yes □ No

<u>If YES then please answer the following questions.</u>
<u>If NO, then please go to PAGE 9 – FINAL QUESTION.</u>

B6.1 How many children do you have?

______Children

B6.2 Do they play computer games?

□ Yes □ No

B7 Do you have any Grandchildren? (If NO, Do not answer questions D7.1/2.)

□ Yes □ No

B7.1 How many Grandchildren do you have?

______Children

B8 Do they play computer games?

□ Yes □ No

Section C of the Questionnaire – Game Interaction (Experiment)

Continued overleaf

Flow State Scale

Please answer the following questions in relation to your experience in the event you have just completed. These questions relate to the thoughts and feelings you may have experienced during the event. There are no right or wrong answers. Think about how you felt during the event and answer the questions using the rating scale below. Circle the number that best matches your experience from the options to the right of each question.

Rating Scale

Strongly disagree **1**	Disagree **2**	Neither agree nor disagree **3**	Agree **4**		Strongly agree **5**

	Strongly Disagree				Strongly agree
1.I was challenged, but I believed my skills would allow me to meet the challenge.	1	2	3	4	5
2.I made the correct movements without thinking about trying to do so.	1	2	3	4	5
3.I knew clearly what I wanted to do.	1	2	3	4	5
4. It was really clear to me that I was doing well.	1	2	3	4	5
5. My attention was focused entirely on what I was doing.	1	2	3	4	5
6. I felt in total control of what I was doing.	1	2	3	4	5
7. I was not concerned with what others may have been thinking of me.	1	2	3	4	5
8. Time seemed to alter (either slowed down or speeded up).	1	2	3	4	5
9. I really enjoyed the experience.	1	2	3	4	5
10. My abilities matched the high challenge of the situation.	1	2	3	4	5
11. Things just seemed to be happening automatically.	1	2	3	4	5
12. I had a strong sense of what I wanted to do.	1	2	3	4	5
13. I was aware of how well I was performing.	1	2	3	4	5
14. It was no effort to keep my mind on what was happening.	1	2	3	4	5
15. I felt like I could control what I was doing.	1	2	3	4	5

16. I was not worried about my performance during the event.	1	2	3	4	5
17. The way time passed seemed to be different from normal.	1	2	3	4	5
18. I loved the feeling of that performance and want to capture it again.	1	2	3	4	5
19. I felt I was competent enough to meet the high demands of the situation.	1	2	3	4	5
20. I performed automatically.	1	2	3	4	5
21. I knew what I wanted to achieve.	1	2	3	4	5
22. I had a good idea while I was performing about how well I was doing.	1	2	3	4	5
23. I had total concentration.	1	2	3	4	5
24. I had a feeling of total control.	1	2	3	4	5
25. I was not concerned with how I was presenting myself.	1	2	3	4	5
26. It felt like time stopped while I was performing.	1	2	3	4	5
27. The experience left me feeling great.	1	2	3	4	5
28. The challenge and my skills were at an equally high level.	1	2	3	4	5
29. I did things spontaneously and automatically without having to think.	1	2	3	4	5
30. My goals were clearly defined.	1	2	3	4	5
31. I could tell by the way I was performing how well I was doing.	1	2	3	4	5
32. 1 was completely focused on the task at hand.	1	2	3	4	5
33. I felt in total control of my body.	1	2	3	4	5
34. I was not worried about what others may have been thinking of me.	1	2	3	4	5
35. At times, it almost seemed like things were happening in slow motion.	1	2	3	4	5
36. I found the experience extremely rewarding.	1	2	3	4	5

Final question

Please write down below anything else about computer games that you would like to tell us.

Thank you for completing the questionnaire

APPENDIX XII:

OBSERVATION RESULTS

The following tables display the observation results recorded in the experiments from participants playing on both the Wii and the PS2 consoles.

Table XII.14 – Positive results for golf game on the PS-2

Golf – Positive PS2

Emotion	Frequency	Game control	Frequency
Confidence	2	Experimented with buttons	19
Relaxed	9	Good teeing off	11
Laughing/smile	22	Game pad easy to use	1
Hands in air	2		
Conscioucentous	1	Fingers hovered over buttons during instructions	7
Concentration	15	Comments on commentary	3
Improved	1	At times/ease got hang of it	1
Ease	1	Good shots	4
Attention	9	Changed club auto	2
Keenness	1	Practice shots	10
Facial features	6	Pressed buttons during instructions	1
Comfortable	1	Inquisitive about screen info	1
		Pad & screen/instructions	6
Mind	**Frequency**	**Misc**	**Frequency**
Talking to self	3	Asking questions	5
Double checking	1	Verbal PP	12
Thinking technical	2	Verbal game	2
Thumb in air	1		
Stick – pin ball	1		

Table XII.15 –Negative results for golf game on the PS-2

Golf – Negative PS2			
Emotion	**Frequency**	**Game control**	**Frequency**
Sucky/tutting noises	10	Teeing off	8
Boredom	1	Stick	7
Frustration	6	Remembering buttons	1
Facial features	4	Commenting on comments	1
Nervous	1	Loosing missing ball	1
De-motivated	2	Combo of buttons	1
Headshaking	6	Instructions	1
Confused	2	Stroke limit	4
Restless	1		
Enjoyment	1		
Relaxed	1		
Hitting feet on floor	1		
Body movement	1		
Puzzled	2		
Mind	**Frequency**	**Misc**	**Frequency**
Haptic feedback	2	Verbal PP	19
Arthritis	1	Asked questions	1
Mis-judging	1	Demo	8
		Explaining % bar	2
		Verbal game	5

Table XII.16 – Positive results for tennis game on the PS-2

Tennis – Positive PS2			
Emotion	**Frequency**	**Game control**	**Frequency**
Relaxed	14	Body movement	2
Lol/ smile	25	Game control	6
Improved	4	Easier to play	2
Facial features	6	Court change (Bottom) to play	3
Confidence	1	Court change (Top) to play	1
Surprised	2	General playing	4
Concentration	6	Better when serving	2

Attention	2	Better after time	6
		Rallies	7
		Technical	6
		Self learning	3
Mind	**Frequency**	**Misc**	**Frequency**
Immersion	1	Verbal (PP)	9
Agency	1	Asking Question	2
		Testing the Game	1
		Verbal Game	5

Table XII.17 – Negative results for tennis game on the PS-2

Tennis – Negative PS2			
Emotion	**Frequency**	**Game control**	**Frequency**
Confusion	5	Court Change	9
Body Movement	9	Demonstration	1
Frustration	6	Slow Reaction	7
Understanding	1	Action Replay	1
Facial Features (Puzzled, missed ball)	6	Unrealistic	2
Stressful	1	Co-ordination	6
Boredom	5	Buttons not Registering	2
Concentration	1	Frantic	1
Not relaxed	1	Game Itself	4
		Problems with Controls/ ball hitting	6
Mind	**Frequency**	**Misc**	**Frequency**
Sucky noises/ tutting	7	Verbal PP	20
		Verbal Game	8
		I suggested….	1
		Verbal General	5

Table XII.18 – Positive results for boxing game on the PS-2

Boxing – Positive PS2			
Emotion	**Frequency**	**Game control**	**Frequency**
Relaxed	6	Frantic	5
Laughing & at commentary	23	Got into the game	2
Chuckled	1	Testing – combo	1
Mimicking	1	Correlating buttons	1

		& info	
Concentration	11	Precise punches	3
Easier understand	1	X button pressed for actions	7
Understanding	1	Blocking buttons	2
Attention	1	Good at play	2
Body moves	1	got hang of buttons	3
Laughing at KO	2	Pressing buttons	4
Surprised	1	Experimented	1
Fun	1		
Mind	**Frequency**	**Misc**	**Frequency**
Immersion/agency, body movement	1	Verbal PP	7
Facial features*	5	Asked questions**	5
Talking to self	1	Verbal Game	9
Mouth movement	3		
Commenting back	1		
Continued to press buttons after game ended	1	* - Mouth, tongue ** - Cut Scenes, blocking, stick for game, OA play? Proper boxers	

Table XII.19 – Negative results for boxing game on the PS-2

Boxing – Negative PS2

Emotion	Frequency	Game control	Frequency
Fed up	1	Frantic button	2
Frustration	2	Combo of buttons	6
Remember	2	Buttons not quick	2
Didn't like it	5	Blocking	3
Confused	2	Player not quick enough with buttons	3
Unsure	1	Attempted combo	1
Complicated	1	No punches	1
Relaxed	1	Wrong buttons	1
Be-wildered	2	Not too frantic	4
		Pot luck with buttons	1
Mind	**Frequency**	**Misc**	**Frequency**
Prefer this to golf	1	Verbal PP	9
Neck & wrist aching	1	No demo on the game	1
Thumb Ache	2	Verbal Game	12
Haptic Feedback	2	I suggested…	2
Head shaking	1	Game	3

Facial features	1	Froze/crashed I explained X Button	2

Table XII.20 – Positive results for golf game on the Wii

Golf – Positive Wii			
Emotion	**Frequency**	**Game control**	**Frequency**
Relaxed	26	Putting as you would	2
Lol/smile	35	Experimented with buttons	8
Body movements*	5	Commenting on their play	1
Concentration	15	Being technical	1
Confident	3	Humour/commenting on commentary	3
Animated movements – missed hole	1	Good swing	1
Comfortable	2	Practice before hand	11
At ease	4	Easily picked up	1
Enjoyment	1		
Attention	15		
Dancing	2		
Improved	1		
Energetic	1		
Enthusiastic	1		
Mind	**Frequency**	**Misc**	**Frequency**
Technical thinking	2	Asked question	10
Talking to self	3	Is a golfer	2
Simulating	1	Stands/holds like a golfer	9
		Course design	1
		Verbal PP	15
		Verbal Game	8
		Played/owned Wii before	3
		Scottish music	1

Table XII.21 – Negative results for golf game on the Wii

Golf – Negative Wii			
Emotion	**Frequency**	**Game control**	**Frequency**
Speech – tutting	10	Stroke limit	2
Headshaking	2	Clipping hole/not putting	5
Eye rolling	1	Hitting too hard	7
Facial features	3	Swinging remote wrong way	1
Nervous	1	I explained/reminded A button	2
		Remote not like a club	1
		Letting go of A button before swinging	3
		Small swing	2
Mind	**Frequency**	**Misc**	**Frequency**
Not standing like a golfer	1	Verbal PP	20
		Verbal Game	8
		Demonstration	4
		I suggested…**	7

* - Hand, fist, thumb, feet in the air etc
** - Position change (5), bigger swings (2)

Table XII.22 – Positive results for tennis game on the Wii

Tennis – Positive Wii			
Emotion	**Frequency**	**Game control**	**Frequency**
Relaxed	17	Got hang of it	6
Lol/smile	33	Served properly	2
Dancing	2	Good serving	19
Confident	2	Practiced	1
Movement	22	Right hand easier to hit ball	1
Enjoyment	2	Rallies	7
Serious	2	Control	2
Concentration	16	Backhanders	4
Conscious	1	Pressed A – replays	3
Energetic	2	Play	3
Comfortable	3	Controlled 2nd player in game	2
Competitive	1	Game thinking	1

		forehand when playing BH	
Attention	1		
Enthusiastic	1		
Improved	6	Got a lot more into the game	1
Mind	**Frequency**	**Misc**	**Frequency**
Technical thinking	2	Verbal PP	16
Facial Features	4	Verbal Game	9
Learning	1	Commenting to game	1
Testing game	1	Played before	1
Banging into furniture	2	Plays badminton	1
Thumb in air	3	Replays	3
		I explained button for replay	1
Talking to self	1	Stand/hitting properly	1

Table XII.23 – Negative results for golf game on the Wii

Tennis – Negative Wii			
Emotion	**Frequency**	**Game control**	**Frequency**
Child like	1	Sensor/swing/BH	4
Facial feature **	2	Problem serving	6
Confidence	1	Hitting ball from opponent	5
Relaxed	2	More time for serving	1
Frustration	1	Swing to quickly	1
Boredom	1	Problem missing ball	1
Enjoyment	1	Pot luck	1
Aggression	2	Mis-judge	1
Confused	2		
Puzzled	1		
Mind	**Frequency**	**Misc**	**Frequency**
Reaction delay	5	Verbal PP	19
Sucky noises	2	Verbal Game	6
Headshaking	1	Demo	6
Co-ordination	3	Not so good hitting left hand	1
Hand at mouth	1	Wrist strap	1

Sighing	1	I suggested…	1

** - Straining in face, mouth open at missing ball

Table XII.23 – Positive results for boxing game on the Wii

Boxing - Positive			
Emotion	**Frequency**	**Game control**	**Frequency**
Laughter	33	Precise/good punches	11
Body movement	5	Good with remotes	5
Dancing	2	Got hang of game as time went on	3
Confident	2	Played before	1
Competitive	1	Skill level increased during play	1
Concentration	22	Experimented	5
Energetic	7	Practice	5
Heading nodding (hitting opponnent)	1	Got moves in	1
Proud (opponnent knocked out)	1	Got into the game	2
Dancing (opponnent knocked out)	1	Left remote good	1
Improved	1	Standing properly	1
Enthusiastic	3	Moving around	2
Easier	1	Imagery - arms	1
Comfortable	3	Several KO	1
Relaxed	7		
Mind	**Frequency**	**Misc**	**Frequency**
At ease	1	Verbal PP	13
Mouth open	1	Verbal Game	14
Technical thinking	3	Asked questions*	2
Better than tennis	2	Used to box	2
Facial features**	4	Sweating	4
Preferred replay imagery	1	*- how to block and game control ** - smile, concentration, tongue, mouth	

Table XII.24 – Negative results for boxing game on the Wii

Boxing - Negative

Emotion	Frequency	Game control	Frequency
Doesn't like it	1	Numchuck not working	4
Aggression	3	Not too good at times	1
Boredom	3	Remote like a remote	1
Energetic	1	No real hitting	1
Understand	2	Imagery	1
Confused	1	Random control	1
Puzzled	2	Pressing A & stick to play	1
Engagement	1	Remote better Frantic	1
Mind	**Frequency**	**Misc**	**Frequency**
Body aching	1	Verbal PP	16
Sucky noises	1	Verbal Game	16
Couldn't hit properly – visual	1	I explained blocking	1
Haptic feedback	1	Wire getting in the way	1
		I suggested, blocking and pointing remote to sensor	2
		Demonstration	2
		Asked question	1

APPENDIX XIII:

EXPERIMENT PHOTOGRAPHS

During the experiments photographs were taken at the permission of the participants playing the Wii and the PS-2 consoles. The photographs illustrate how participants interacted and played with both consoles.

Photographs of participants playing on the Wii

Figures XIII.75, 76, 77 and 78 show a participant playing the tennis game on the Wii

Figure XIII.75

Figure XIII.76

Figure XIII.77

Figure XIII.78

Figures XIII.79, 80, 81, 82, 83 and 84 show participants playing the tennis and boxing games on the Wii console.

Figure XIII.79

Figure XIII.80

Figure XIII.81

Figure XIII.82

Figure XIII.83

Figure XIII.84

Figures XIII.85, 86, 87, 88, 89 and 90 show participants playing boxing, tennis and golf on the Wii console.

Figure XIII.85

Figure XIII.86

Figure XIII.87

Figure XIII.88

Figure XIII.89

Figure XIII.90

Figures XIII.91, 92, 93 and 94 shows how one of the participants played golf on the Wii console. The participant interacted with the game very similar to that of an amateur golfer.

Figure XIII.91

Figure XIII.92

Figure XIII.93

Figure XIII.94

Figures XIII.95 and 96 show the same participant in Figures XIII.91, 92, 93 and 94 playing the boxing game on the Wii

Figure XIII.95

Figure XIII.96

Figures XIII.97 and 98 show another participant playing the boxing game on the Wii.

Figure XIII.97

Figure XIII.98

Figures XIII.99 and 100 shows a participant playing the tennis game in the academic office, illustrating space was minimal but still able to interact with the game competently.

Figure XIII.99

Figure XIII.100

Figures XIII.101, 102, 103, 104 and 105 shows the participant playing the boxing game on the Wii console.

Figure XIII.101

Figure XIII.102

Figure XIII.103

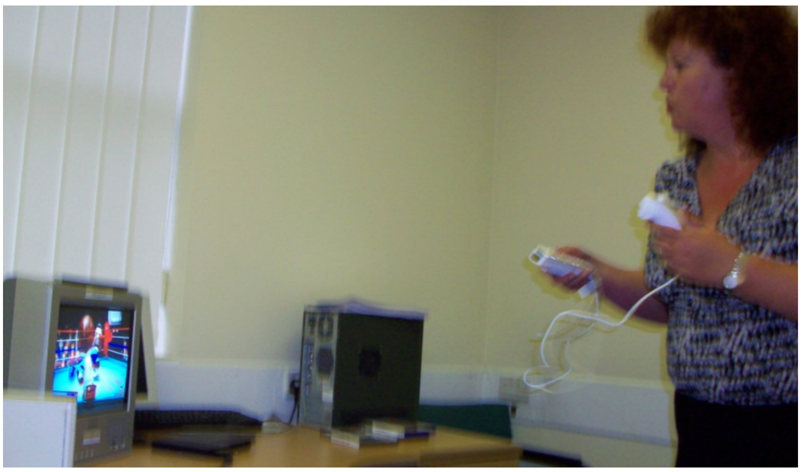


Figure XIII.104

Figure XIII.105

The following photographs illustrated how participants played and interacted with the PS2 during the experiments. Figures XIII.106 and 107 show a participant playing the tennis and boxing games on the PS-2 console in the academic office.

Figure XIII.106

Figure XIII.107

Figures XIII.108, 109 and 110 shows in close detail a participant playing the boxing game using the PS-2 console pad. The figures illustrate the complexity of using the PS-2 game pad for game playing, pressing a multiple of buttons.

Figure XIII.108

Figure XIII.109

Figure XIII.110

Figures XIII.111, 112 and 113 show a participant playing the golf game on the PS-2. The figures demonstrate the multiple buttons pressing for this game.

Figure XIII.111

Figure XIII.112

Figure XIII.113

Figures XIII.114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131 show a close detail of different participants using the PS-2 game pad during the three games. Close detail of the multiple buttons been pressed is also shown, to demonstrate the awkwardness of multiple button pressing.

Figure XIII.114

Figure XIII.115

Figure XIII.116

Figure XIII.117

Figure XIII.118

Figure XIII.119

Figure XIII.120

Figure XIII.121

Figure XIII.122

Figure XIII.123

Figure XIII.124

Figure XIII.125

Figure XIII.126

Figure XIII.127

Figure XIII.128

APPENDIX XIV:

MAPPING OF QUALITATIVE DATA

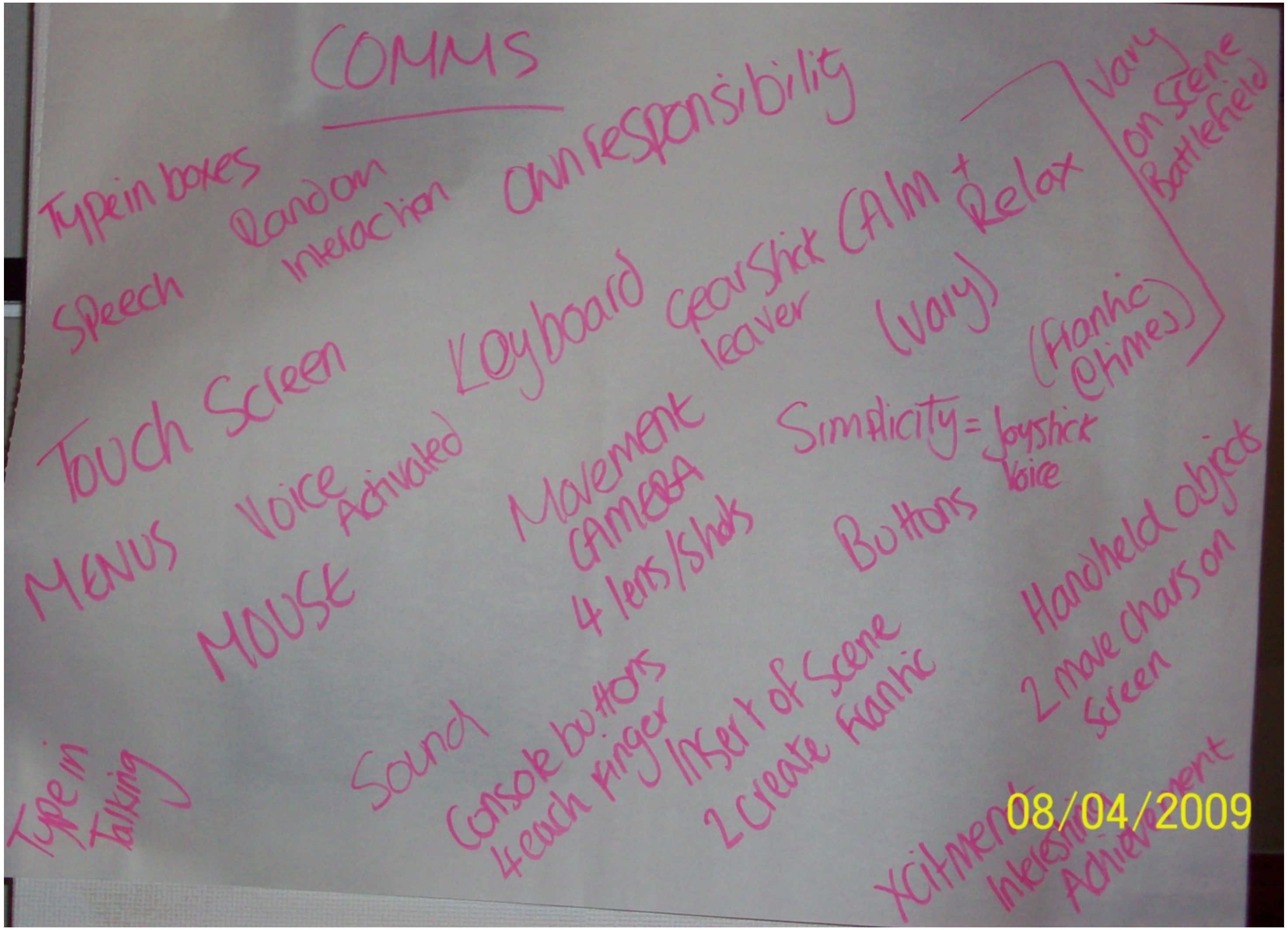


Figure XIV.129

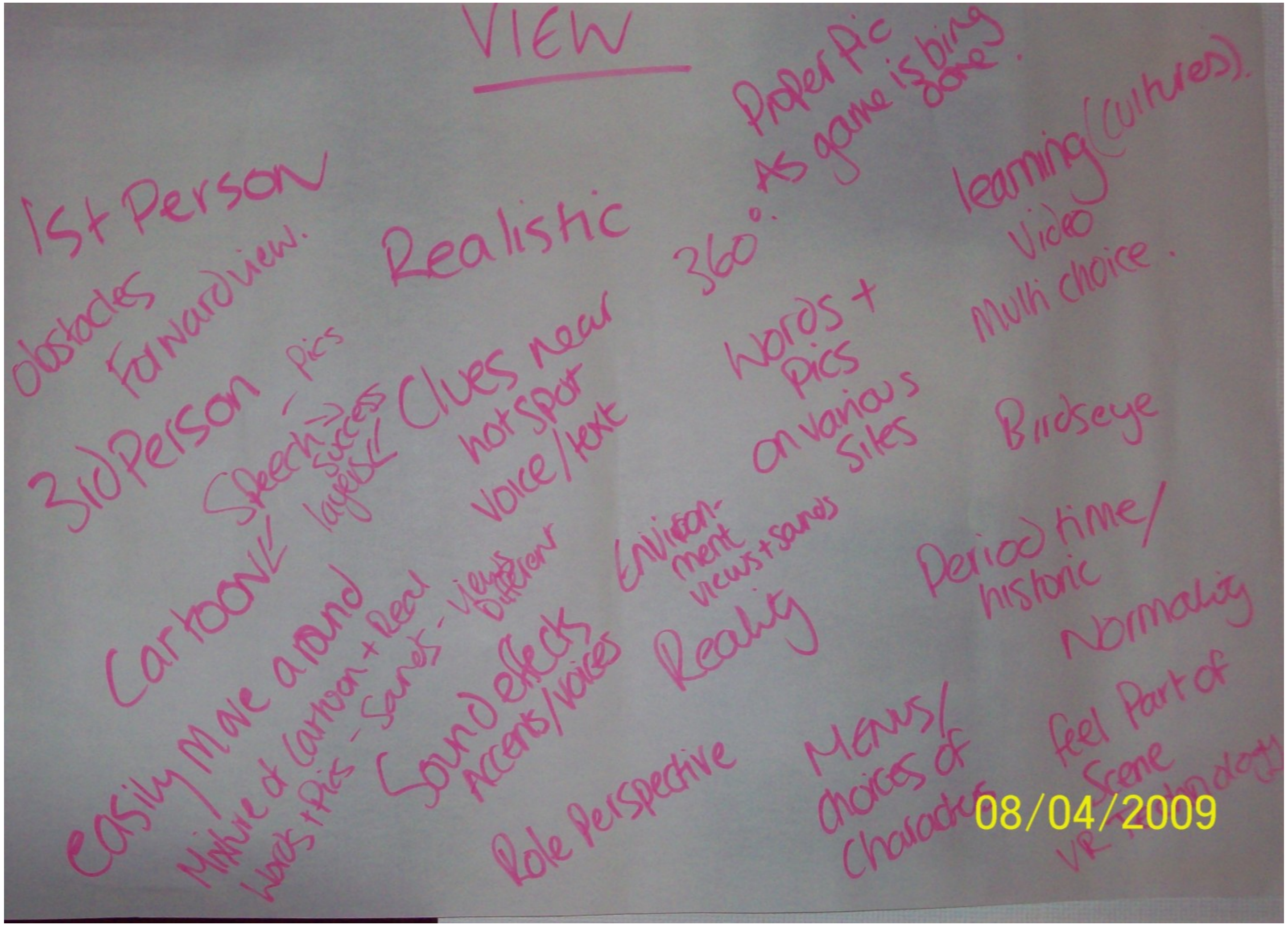


Figure XIV.130

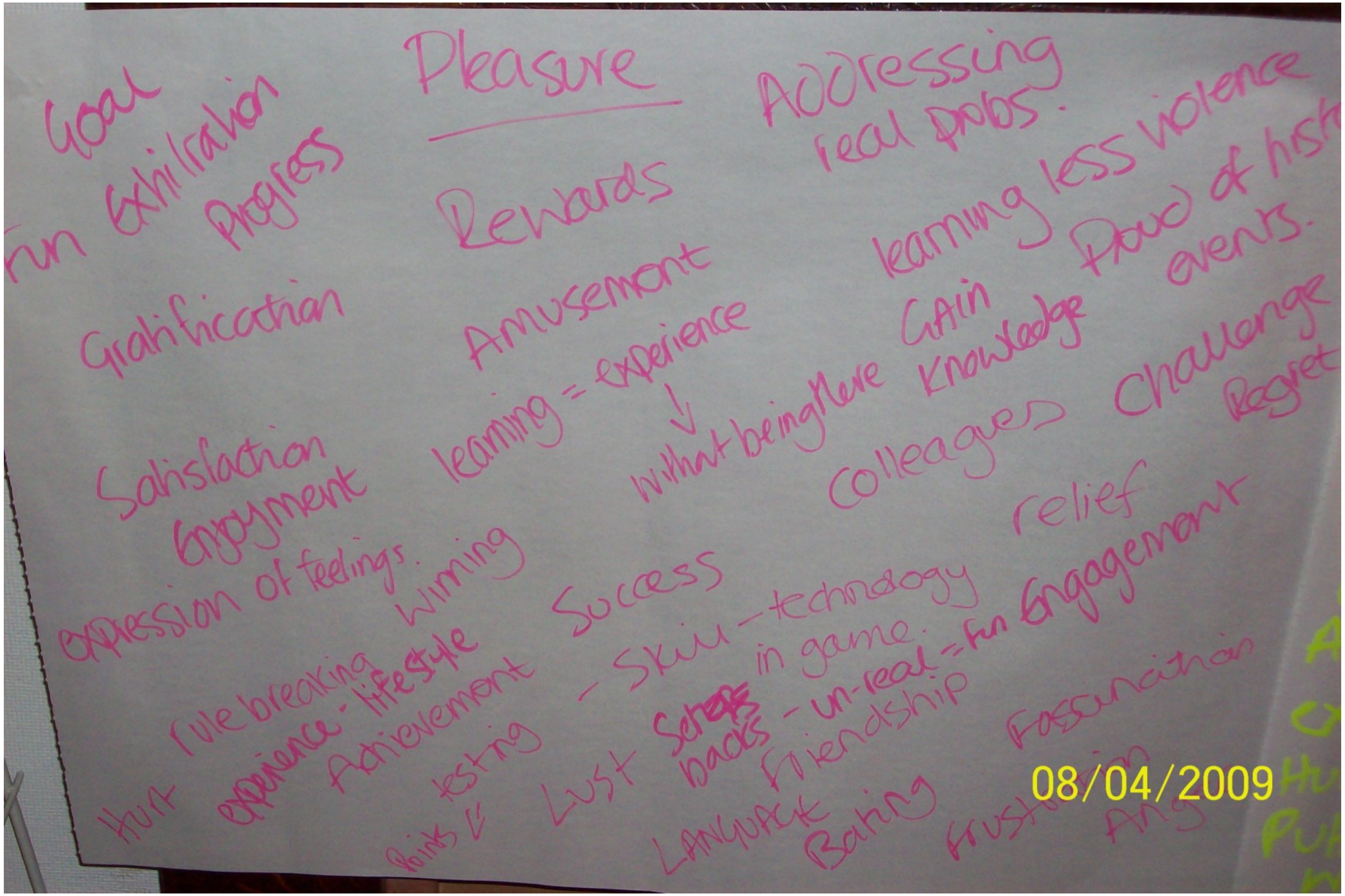


Figure XIV.131

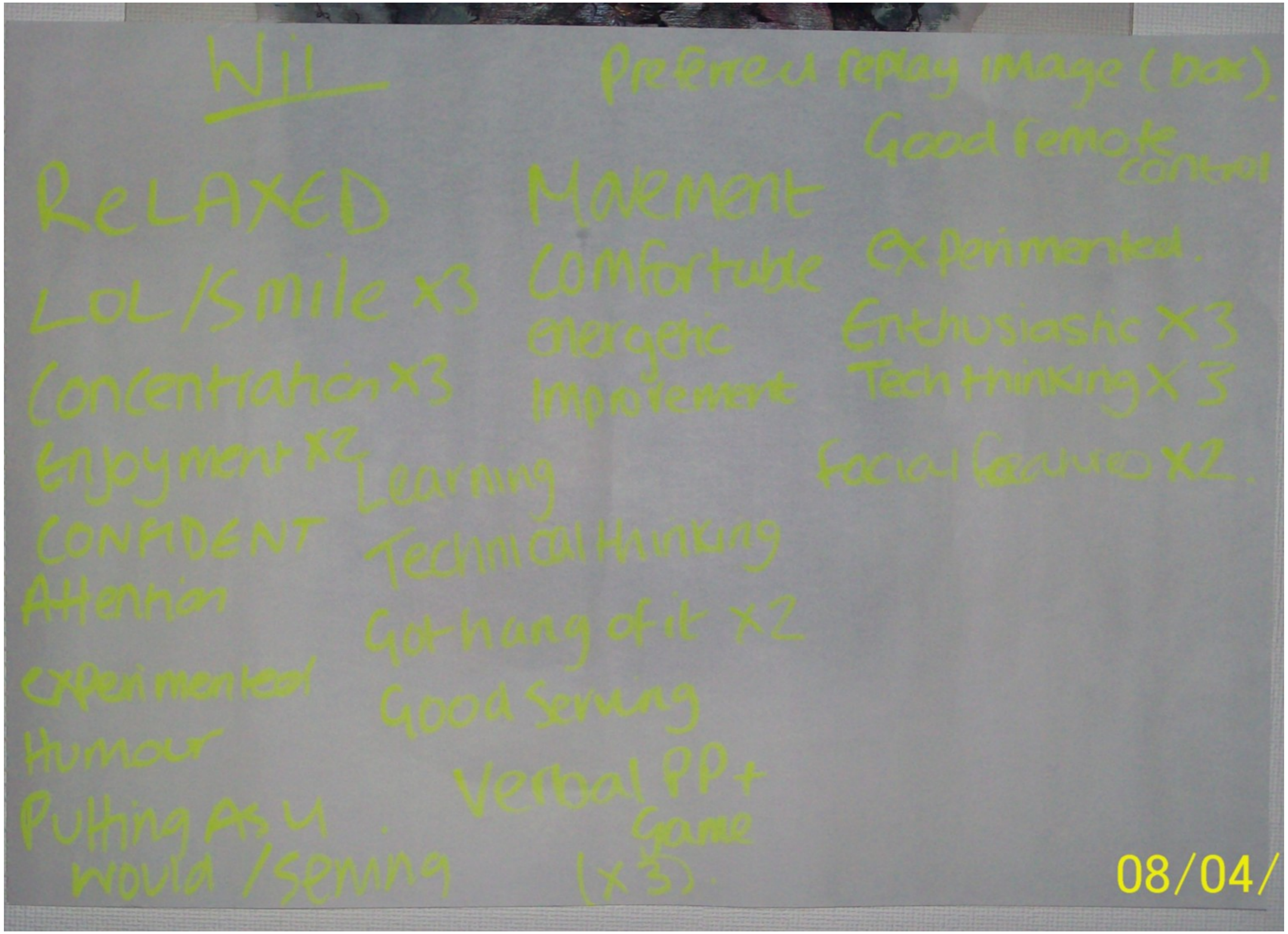


Figure XIV.132

IPOD/IPHONE

- Lips (karaoke game) (user can sing along to songs on IPod)
- User quickness/silliness/fun
- App store/user centred/created
- Variety of applications
- On the go/easy accessibility
- Original games featured - Tetris

OTHER:

- Facebook – user centred/created
- Multi/single player
- Services – easy access (Phone, laptop)
- Simple/quick games:
- Tetris/bejewelled/arcade machine games

INTERACTION:

- Experimentation
- Given the choice
- Simplicity
- Realistic
- Build upon prior knowledge – mental modals
- Variety for the user
- Easy movement
- User responsibility
- Technical thinking
- Learning
- Goal

ACTIVITY BASED games/genres:

- Performance/interactive:
- Puzzles, music,
- Full body movement for interaction

FUTURE GAMING/INTERACTIVE ENTERTAINMENT – Design guidelines

USER CENTRED/CREATED…..GENRE/CONTENT

- Download content to insert into game(s) – from server
- Upload content to insert into game(s) – digital photos etc
- User to take responsibility
- Experimentation – during game/general
- Choice for mode of interaction (mouse, voice, motion, buttons, joystick)
- Relative to real world/life experiences
- Control of game – interaction/scenarios
- Add/delete content – gaming experience
- Responsive to real life mode of interaction & situations
- Wider audiences – older adults, casual gamers
- Will hardcore gamers become affected? Not catered for by the industry?
- Advancements in health & well being (benefits)
- Build upon prior knowledge – mental modals
- Technical thinking
- Purpose to playing?
- Learning
- Variety of content & perspectives
- Challenge

Increase in SOCIAL GAMING:

- Intergenerational – family oriented
- Nature of games
- Genres?
- Online
- Realistic/normality – content/ interaction
- IPod/IPhone
- Bridge groups together

THE PERFECTION OF GAMES? WHAT NEXT…..

- VR environments/gaming within the home – 3D world
- Clothing – gloves, goggles, helmets, suits
- Experience game theory – agency, presence, immersion etc
- Could be the standard for home gaming (VR)
- Suit linked via motion sensors, pressure devices (damage or rocky activity)

Figure XIV.133

OWN RESPONSIBILITY:

- Choice of interaction to use in game
- Choice of viewing – perspective for the game

PURPOSE:

- Using the game
- Learning
- Fun/enjoyment
- Social interaction – intergenerational
- Achievement
- Build confidence
- Experimentation
- Improvement
- Experience positive emotions
- Simplicity

ROLE PERSPECTIVE:

- Actions to do in game
- Perspective of game
- Add/delete content
- Choice to do…

USER GROUPS/ OLDER ADULTS

TECHNICAL THINKING:

- How the interaction is working during game play
- Characters react during game play
- Additional information on screen to aid playing

Genre/content:

- Variety of perspectives
- Adding/deleting content to aid game play experience
- Learning
- Relative to normality/real life experiences
- Choice/variety of visual(s) within game
- Sounds
- Realistic content

Figure XIV.134

GENRE

- Action: quick reflexes, basic, broadest, combat, (FPS, fighting)
- Beat em up/hack & slash: combat, fighting through levels, hand 2 hand combat
- Fighting: 1-1 combat, dramatic moves
- Maze: navigation, quick thinking/reactions (Pac man)
- Platform: sub of action, borrow elements from other genres, (Mario, Sonic, DK)
- FPS/Shooter: combat, weapons, being there, peripherals used FPS
- MMOFPS: internet, combine FPS
- Shoot em up: (shooter game), controls char or vehicle (Spacewar, space invaders)
- Action adv: long term obstacles, exploration, puzzle solving, combat, collecting
- Adventure: earliest (ADVENT) not defined by narrative, more game play, challenges/action, puzzles
- Man sim games: tasks, build, expand projects etc (sim city)
- Pet Sims/Social Sims – Nintendogs, The Sims, Tamagotchi
- RPG: adventurers, specialise in a specific role, through storyline, statistical character – final fantasy 4, may also involve combat
- MMORPGs/MUDS: completing quests, strengthening character (WOW)
- Music genre: follow sequences, input rhythm by feet or dance mat or device
- Party games – (Mario party) specifically for multiplayer, variety of mini games
- Puzzle games- (Tetris), hand eye, quick reflexes

WHATS INVOLVED?

- Certain constants
- Obstacles/challenges throughout to overcome
- Single or multiplayer
- Variety of hardware
- Variety of content depending upon game genre
- Sound
- Become more realistic in recent years

INTERACTION

- Goals: completing task, entertaining player
- User wants to play
- Human centred design
- Encourage or hinder user interaction through design/content
- Learn by playing – competency (increase game mechanics)
- Feedback regarding actions
- A game consists of many game mechanics
- Engagement, participation, motivation
- Enables cognitive skills
- Social activity
- Immerse players in environments – alternative realities
- Agency = level of participatory
- Game play = fun
- Closed captions (disabilities)

WHATS INVOLVED

- Choice of interaction mode
- Intuitive
- Physical movements – body,
- Hand eye coordination
- Quick reaction
- Complicated
- Simplistic
- Internet – online gaming, downloading etc
-

Figure XIV.135