EXPLORING THE THOUGHTS AND THINKING STRATEGIES USED BY GAMERS DURING MULTIPLAYER GAMEPLAY IN DIFFERENT GENRES OF POPULAR COMPUTER GAMES.

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ABSTRACT

Subject: **Exploring the thoughts and thinking strategies used by gamers during multiplayer gameplay in different styles of popular computer games.**

Key Terms: Gaming research, digital games, verbal analysis, thoughts, thinking strategies, gamer, network gaming, protocol analysis, cognition, game theory.

In light of the growing concern about the psychological impact of computer, console and handheld electronic games (digital games), this research explores the thoughts and thinking strategies of game players (gamers) during gameplay. It attempts to achieve this goal by means of using a form of verbal analysis based on the 'think out loud' method of Protocol Analysis.

The recordings of gamers engaged in the 'think out loud' exercise during gameplay at a gaming networking session were transcribed and analyzed. These gamers participated in two different genres of games. The fist was a First-Person Shooter (FPS) and the second a Real Time Strategy (RTS). The content of the different transcripts were categorized using cognitive models and theories. From this process a nine category classification framework was developed. By dividing identified thought segments into these different categories, a quantitative frequency analysis was possible. This supplemented the overall qualitative exploration of gamers' thoughts and thinking strategies.

The results of this study indicate that different genres of games stimulate different concentrations of different types of thoughts. Overall these concentrations numerically classify gaming as an activity in terms of perception, cognition, emotion, and self immersion. It also indicated that each genre has its own unique influence and that each player is uniquely engaged. Besides providing insight into gamers' thoughts and thinking strategies, this study also provides evidence that an adapted form of verbal analysis is suitable in exploring a visually absorbing activity such as gaming.

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CHAPTER 1

INTRODUCTION

1.1 Background

Psychological research in the field of digital games (computer games, video games, or handheld electronic games) has traditionally focused on the link between playing digital games and aggression. The possible psychological impact of gaming has been studied through both correlational and experimental studies. A discrepancy exists between the findings of various studies, with some studies finding a positive correlation between digital game violence and aggression (e.g., Fling, Smith, Rodriguez, Thornton, Atkins & Nixon, 1992; Irvan & Gross, 1995), while others find no such correlation (e.g. Graybill, Strawniak, Hunter & O'Leary, 1987; Van Schie & Wiegman, 1997). The research conducted in this study steers away from this mainstream trend of trying to discover the nature of this correlation, and instead attempts to examine what is cognitively happening to the gamer (player of the digital game) during the gaming process.

This study follows the assumption that digital games elicit thoughts and thinking strategies from the gamer during gameplay that are partially translated into in-game actions, and may be partially vocalised by the gamer. Successful strategies are rewarded (e.g. with points) while unsuccessful strategies are punished (e.g. death of the digital character). This may lead to the reinforcing of certain patterns of thought and strategies, or the adoption of new ones. These thoughts and strategies may differ between different games and different gamers. They may also differ at various times within the sequence of the game. The individual gamer, the gaming environment and the rules of the game are some of the variables that should dictate the nature of the gamers' thoughts during the game. But are there patterns of thought that are game genre or gamer specific? What is the nature of thoughts encouraged by certain types of popular games?

The popularity of digital games continues to grow and marketing figures continuously reflect massive sales growth in the entertainment software market each year. A boom in research, regulations, bills, and legal battles are all indicative that the market and field of digital games is definitely worthy of attention. Digital gaming research is becoming in itself an academic field, characterized by its own journal (www.gamestudies.org), its own conferences, and actual informed discussion (Smith, 2002).

1.1.1 Need for Research in This Field

"Video games, the Internet and other interactive technologies are transforming classrooms, workplaces and homes, yet there's been little scientific research on their impact, a panel of psychologists said at a June 8 congressional briefing sponsored by APA" (Rabasca, 2000).

The multi-billion dollar leisure software industry has grown at a phenomenal rate. According to the Entertainment Software Association (ESA) electronic games and related hardware sales already exceeded an annual 10 billion dollar level in 1996. In the United States alone, video and computer games sales had risen from 3.7 billion in 1996 to 7.3 billion dollars in 2004.

In 2000, Anderson and Dill, described social research into the gaming phenomenon as quite sparse and generally regarded as trivial. By 2003, Wolf and Perron (2003) described game research as "the hottest and most volatile field within new media theory", and that "…the idea of video game theory is gaining acceptance in academia" (p. 1). Game research has flourished due to a rapidly growing market and advancing technical innovations. On the other hand, the renewal of interest in conducting social research on the impact of gaming has been mainly due to the possible negative consequences of exposure to violent games. Media has highlighted these consequences especially by linking extremely violent incidents such as school shootings to violent digital games. The most popular example being the Columbine school massacre where two students labelled as computer game enthusiasts shot and killed 13 people and wounded 23 (Anderson & Dill 2000).

Currently, although gaming research as a whole is booming, available social research into the gaming phenomenon has until very recently been quite sparse and also limited to specific topics. Examples include the exploration of experiences and attitudes towards digital games (Barnett, Vitaglione, Harper, Quackenbush, Steadman & Valdez, 1997), the impact of gaming on eye-hand motor coordination (Griffith, Voloschin, Gibb & Bailey, 1983), gaming impact on sociocognitive abilities (Sakamoto, 1994), and gaming influence on school performance (Van Schie & Wiegman, 1997). Out of all the studies done on gaming, game violence and the negative consequences associated with it remains the forerunner. Anderson and Dill (2000) identify and discuss at least 17 studies focusing on violent videogames and aggression. There is certainly a need for more research on the already established topics in the field of social research into gaming, and there is an even greater need for further diversification in topics.

Digital games are becoming the entertainment activity of choice in many households. With it comes a whole variety of impacts to consider - physical, sociological, and psychological. As described in section 2.4.1 the game industry, games, and even gameplay is becoming regulated. It is necessary to generate an accurate understanding of the impacts of gaming in order for law makers, parents and gamers themselves to make informed decisions.

1.1.2 Need for This Research

This research employs an adapted form of verbal analysis to uncover to a degree the thoughts that dominate the thinking of gamers during the gaming process. The importance of this exploration is that games act as a stimulus for these thoughts to be repeated over and over, sometimes for hours on end. This research departs on the premise that it is first necessary to understand what is cognitively happening during gaming before attempting to draw conclusions on the psychological impact of gaming. It also explores to what extent computer games stimulate thinking strategies, and what the nature if these strategies are.

This research focuses on quite a specific segment of digital entertainment. Two of the most popular genres of Personal Computer (PC) games were chosen for this study. The reasons for this choice are discussed in section 1.5 which helps to contextualize this research in a field that is not only largely under-researched, but also extremely diverse. To successfully implement a verbal analysis method to one segment of the field of gaming could potentially reveal a powerful tool to the rest of the field.

Gaining an insight into the cognitive content and cognitive state induced by gaming can provide a platform and a reference for further research towards the true psychological impact of gaming. Exploring two genres of games also may start highlighting possible differences in impact between different genres which in turn will highlight the necessity of game classification in future research.

1.2 Problem Statement

What are the thoughts and thinking strategies that dominate the conscious thinking of gamers during gameplay?

1.3 Aim

Using an adapted form of verbal analysis the nature of the thoughts and thinking strategies that dominate the thinking of gamers during gameplay will be explored.

1.4 Contributions of this Research

Digital game research as a field comprises of a wide array of research topics. It includes areas such as game design, aesthetics, business, philosophy and more. The research conducted in this study specifically centres around the topic of the psychological impact of games that can be classified as falling under the field of social research in gaming. It tries to uncover the thoughts that are elicited by digital gameplay, to start unravelling the true psychological impact of digital gameplay.

Exploration of digital games and academic research on digital games has in the past been very underdeveloped, and it has only been at the turn of the millennium that digital game study rooted itself and started generating a wider, growing interest (Wolf & Perron, 2003). As in many new areas of research methodological flaws existed in this field of research. For example, all digital games were grouped together irrespective of their genre or nature. Violent action games were grouped together with card games or racing games all under the one title of video games. Furthermore, little research was done on popular digital games as can be seen in the subject matter of pre 90's studies. Instead the findings of studying more academically 'fitting' games, like chess, were accepted as the foundation for subsequent studies. It was only in 2000 that Anderson and Dill solidified the first distinction between violent and non-violent games in research. A more distinctive categorization of digital games has subsequently been occurring in the field. The research conducted in this study seeks to further clarify the distinctions and categories to help the field of digital gaming towards maturity. This is done by incorporating terms, statistics and findings amongst others, from the most recent developments in the gaming market and social research (see Chapter 2).

By using an adapted method of verbal analysis, this study will give insight into the applicability of such methods to this field of research. This adapted method originates from the method of classic protocol analysis. Various restrictions to using protocol analysis in certain situations limit its applicability in many circumstances (Ericsson & Simon, 1993). By adapting the rigid classical protocol analysis to a more flexible form of verbal analysis, this research attempts to gather meaningful data. Even if the data were to be sparse, this research would still be meaningful in

revealing the incompatibilities between the method and the objectives set in the field of digital games research.

Besides building on knowledge of game research and verbal analysis, this study incorporates another, more cognitive component. Thoughts and thinking strategies are investigated and a strategy to identify and categorise these elements needs to be developed. To identify a suitable strategy, various established models and qualifiers are initially combined to provide a framework for categorization. Based on the level of success in the application of these models and qualifiers, it can be determined which of these are more suitable for this type of study. This framework in itself may prove valuable to future cognitive or game orientated studies.

1.5   Focusing the Research

Being a relatively young field of study, digital games research is still very wide open for ground research in many of its areas. Conflicting results and confusion about the actual impact of digital games can partly be attributed to the lack of game categorization and classification in gaming research (Smith, 2002). It is also impractical to differentiate all the types and then conduct a study across the whole spectrum of digital games. There is simply too much diversity in both the software and hardware currently available. This section of the study therefore takes a look at this diversity and explains the choice of focusing on this area. Selecting participants for involvement in the research also offers a range of possibilities. It is therefore necessary to look at some of the options available and describe who were selected and how they were selected.

1.5.1   Categorizing Digital Gaming and Selecting an Area of Focus

There is an enormous range of possibilities encapsulated by the term *Digital Games,* which necessitates a focus to be set on a specific area to make the study practical and manageable. To look at the available possibilities and to focus this research, three categories have been created to classify the range of digital gameplay. These categories are platform, single versus multiplayer, and game genre. In this study the PC was chosen as the platform, multiplayer was selected as the style of gaming, and the two most popular genres of multiplayer PC games were selected because they represent the majority of games played at social gaming gatherings. Although the field of digital game research encompasses all forms of electronic gaming the PC was chosen due to its popularity in multiplayer gaming.

Platform

Digital gaming can take place on a range of platforms including the PC, console games (also traditionally known as Video Games), arcade games, and handheld games (e.g. GameBoy Advance, PlayStation Portable and mobile-phone games). Although mobile gaming is growing at a rapid rate (gamepress.com), Console games (e.g. PlayStation2, GameCube and XBox) and PC games systems currently still dominate the digital gaming market (Informa Telecoms and Media, 2005).

The choice of selecting a platform was based on the evolving trends in the gaming industry. In terms of popularity reflected by games sales figures, console platforms maintain a substantial and consistent lead over the PC. In 2004 in the US the PC game sales totalled about 45 million units while console game sales reached 203 million units (ESA, 2005). Various factors contribute to these figures, for example the ease of setting up a consol system makes it a choice item for parents to buy for their children. Although console games tend to be more expensive, they are guaranteed to work with their platform. Every PC game has its own specifications and hardware requirements. Recently released PC games require costly high-end systems to allow them to run smoothly. Another factor contributing to the lower PC game sales statistic is the ease at which PC games can be copied which result in high levels of software piracy. According to Informa Telecoms and Media's 5th *Dynamics of Games* report, in a worldwide entertainment software industry where rentals and sales are estimated at 35 billion US dollars for 2005, the industry is expected to lose a further 6.6 billion to piracy (Informa Telecoms and Media, 2005).

Still, for this study the PC was chosen as the platform for investigation, for two important reasons. Firstly, the PC is currently the platform of choice for experienced and *Hardcore Gamers*. In short, *Hardcore Gamers* can be described as the 'professional sportsmen' of the gaming world, dedicating long hours to their pursuit of playing games and maintaining their gaming machine to be able to handle the latest game releases. The versatility of the PC combined with its large multiplayer support capabilities makes it an attractive system to those willing to invest more time into gaming.

To further substantiate the claim of PC gaming popularity largest gaming events such as the World Cyber Games (WCG), Cyberathlete Professional League (CPL), World Series of Video Games (WSVG) can be looked at. These tours and events are dominated by games played on the PC (www.worldcybergames.com, www.thecpl.com, www.thewsvg.com)

Table 1. The leading international gaming competitions and their official games.

Event/Tour	Platform	Game	Genre
WCG	PC	Counter-Strike 1.6	First-Person Shooter
	PC	Warcraft III: The Frozen Throne	Real-Time Strategy
	PC	Starcraft: Broodwar	Real-Time Strategy
	PC	Warhammer 40,000: Winter Assault	Real-Time Strategy
	PC	Need for Speed: Most Wanted	Racing
	PC	FIFA 2006	Sports
	XBox360	Project Gotham Racing 3	Racing
	XBox360	Dead or Alive 4	3D Fighting
CPL	PC	Painkiller	First-Person Shooter
WSVG	PC	Quake 4	First-Person Shooter
	PC	Counter-Strike 1.6	First-Person Shooter
	PC	Warcraft III: The Frozen Throne	Real-Time Strategy

The second reason for choosing the PC over the console is because the technical specifications of future console gaming platforms indicate that they are moving in the direction of the PC. Certain console gaming platforms already indicate this trend by incorporating features that were in the past only associated with the PC. For example the Microsoft's Xbox, was the first mainstream console game that had a built in hard drive (www.xbox.com). Looking at some of the recently proposed console game designs it is possible to see that a hard drive may soon become a standard feature in the future. Other PC associated features are also incorporated in upcoming *next-generation* consol systems, the Xbox 360 and PlayStation 3. For example support for USB keyboards and mice. The most focused upon feature of next-generation of console releases is its ability to support multiplayer gaming via networking and the internet(www.xbox.com), both features currently dominated by the PC as can be seen by the Pc's almost exclusive use at large gaming events (Table 1.).

Single versus multi-player

Depending on the game, one player can play digital games alone, or two or more gamers may share one digital environment. Multiplayer game modes may further be categorized into competitive (gamer versus gamer), cooperative (gamers versus computer), or combinations of both (teams of gamers competing against each other).

This study was conducted in a multiplayer environment. According to www.mmogchart.com, a site dedicated to tracking online game developments, active monthly gaming subscriptions rose from round about 500, 000 subscribers in July 2000 to over 7.5 million in July 2005. From www.worldcybergames.com the website of the leading international gaming event, it can be seen that the number of competitors rose from approximately 389,000 in 2001 to 1,250,000 in 2005 while the prize money rose from $600,000 to $2,500,000 for the same period. Multiplayer gaming has therefore firmly established itself as can be seen massive growth of online multiplayer games and the growing popularity of social gaming events. This type of environment was not just chosen for its growing popularity but also because it offers a lot of benefits for this study. It serves as a great setting for conducting a field experiment because the research process can be conducted in the background with the researcher subtly guiding the experiment without distorting the activities. Furthermore this type of environment offers easy access to gamers. Multiplayer games are gaming is also more prone to evoking emotional responses because it is not difficult to see that gamers are more expressive when competing against or co-operating with other gamers compared to only interacting to a game's artificial intelligence. It is this expressiveness that this study uses to help facilitate the verbal analysis method.

Game genre

Game genre refers to the type of game. For example chess would be classified as a strategic turn-based board game. Although there is no official set of categories in which to classify digital games, a certain set categories have become more distinct over the last few years because of their popularity. The genres used by the ESA are: Strategy, Shooter, Children's, Role-playing, Family Entertainment, Sports, Simulation, Fighting, Adventure, Action, and Other/Compilation. Further qualifiers are used to separate each category, for example: first-person or third-person, turn-based or real-time. Two genres were chosen for this research. The choice was made based on the popularity of these different genres at social gaming events and competitions. As such the *First-Person Shooter* (FPS), and *Real-Time Strategy* (RTS) genres were selected. Their prevalence at gaming competitions can be seen in Table 1. Both genres are discussed in more detail in Chapter 4 (see section 4.2).

1.5.2 *Selecting a Sample of Gamers*

Distinctions between different categories of gamers can be found in Chapter 2, while the process of selecting suitable participants for this study is detailed in Chapter 4. Essentially the participants needed to be representative of the average gaming population. Participants were therefore chosen from a typical sample of social gamers. All gaming participants were male South Africans,

between the ages of 19 and 28, and regularly played digital games. They were also required to have experience in the different games selected this study.

1.6 Brief overview of dissertation

1.6.1 Literature Review

This research provides a brief look at the evolution of the digital gaming phenomenon to its present day form. This serve to contextualise this dissertation in the larger field of digital gaming research as well as provide insight and even explanations to many of the terms associated with this field. Social gaming or multiplayer gaming and gaming culture are also explored. More focus is given to the social research conducted in this field of digital gaming research; specifically the branch of digital gaming research that focuses on psychological research. The sociological and physical impact of gaming is also looked at briefly.

1.6.2 Theory

A thorough discussion follows on the theoretical and methodological departure of this research. This dissertation draws some of its terminology from 'Game Theory', a field of study mainly associated with Economics. Game theory is explored as it provides helpful structures and definitions that can easily be adapted to the field of digital game research. To capture data a method of verbal analysis was used. This method is a derivative of classical protocol analysis as described by Ericsson and Simon (1993). It is necessary to look at both the classical method and derivative methods, like Chi's (1997) Verbal Analysis method to see which of their elements are more suitable for the task at hand. It is also necessary to specifically address all the adjustments and assumptions to provide future researchers with a clear point of departure.

Lastly, the method of interpretation is discussed. This stage of the research draws more heavily on cognitive psychological theories. Different models are used to provide a unique categorization model. A cognitive experiential model from Jordaan and Jordaan (1992) is combined with theoretical assumptions about basic cognitive mechanisms provided by Ericsson and Simon (1993). The goal is to identify different categories of thought. To further examine thinking strategies, categories explained by Hong and Liu (2003) are used. They used these categories to examine strategies in an experimental setting similar in many ways to this research.

1.6.3 Experimental Setup and Implementation

Once the theoretical structure has been addressed the focus shifts onto the more practical side of the investigation. The equipment, the games and the quasi-experimental setup is discussed and clarified. The participants are selected, profiled and some background information is added to provide insight into the games used during this study.

1.6.4 Coding, Data Analysis and Discussion

The results are then coded using the unique categorization framework which is based on both the contributions of various cognitive models and further concepts that evolve throughout the study. The effectiveness of some of the components of the different cognitive models, dictate which elements are adopted and which are discarded to form a final categorization template. The final product of various verbal reports are then coded and summarised.

The data generated is then analysed as a whole and comparisons across different genres of games and different gamers are made. A discussion with recommendations follows this analysis. This includes commentary on the effectiveness of using verbal analysis in gaming research, and the cognitive framework used in the interpretation of the results.

1.6.5 Final Conclusions

Finally conclusions are highlighted at the end. This dissertation aims to provide findings that are not only in themselves valuable, but also indicative of the applicability of various methods and models to gaming research.

CHAPTER 2

LITERATURE REVIEW: THE DIGITAL GAMING PHENOMENON

The rapid rise of digital gaming over a relatively short period of time gives credibility to gaming being described as a phenomenon instead of just an event. In order to understand this phenomenon it is necessary to take a brief look at the history surrounding its origin. Following the path of major developments and breakthroughs, it is possible to see where and when the mass-market appeal developed. Furthermore, the change in technologies and gaming concepts has led to a change in the way that gamers interact with and experience games (Latti, 2003).

Due to the fast changing pace of the game market and product development, the phenomenon ultimately has to be understood in terms of its current state. In addition, the impact of gaming is also reflected by the development of a gamer subculture. By following the evolution of the gaming phenomenon and gaming culture it is possible to start generating a clearer definition of the 'modern gamer' and explore some fundamental questions like: Who are the modern day gamers, and what exactly is currently going on in their world of gaming? One of the most important aspects of modern gaming that needs to be explored is the rise of the social gaming dimension. Where games initially only supported a maximum of two players competing, modern multiplayer games allow numerous players to share one gaming environment, and online games now allow even thousands to do so at the same time.

From sales statistics released in 1993 and 1994, Van Schie and Wiegman (1997) noted that the increase in digital game sales appeared to be coupled with an increasing debate about the positive and negative effects of these games. With further debate came an increase in social research. Over the last few years social research into gaming has rapidly developed in a field which was previously largely unexplored. Wolf and Perron (2003, p. 11) states that by the year 2000, "…video game theory, as a field of study, included a handful of books, several academic programs, the first online academic journal (*Game Studies*), and over half a dozen annual conferences".

Research has provided diverse, and sometimes contradictory, findings. What is clear is that playing games does have unique psychological, social and physical consequences. It can be called unique because of inconsistencies found between the impact of digital games and that of more traditional forms of media such as television.

This chapter has many purposes. Besides providing a background on the gaming phenomenon, it also introduces some of the terms synonymous with this field of research. By exploring these concepts and looking at previous gaming research endeavours it is possible to develop a point of departure for future research, and avoid classification and methodical pitfalls. Finally the importance of conducting research in this field is highlighted by looking at the scope of the gaming industry and its societal and individual impact.

2.1 Historical Overview

The history of digital games and its associated hardware is colourful and diverse. Numerous groundbreaking developments, successes and failures mark the course of gaming development. There are many sources that plot this course in detail, for example: *Joystick nation: How Videogames ate our quarters, won our hearts, and rewired our minds* (Hertz, 1997); *High score!: The illustrated history of electronic games* (DeMaria & Wilson, 2003); and *The ultimate history of video games: From Pong to Pokemon --The story behind the craze that touched our lives and changed the world* (Kent, 2001). For this study some of the more noticeable and influential developments are looked at. Advances in graphics and sound are not the only important characteristic that has driven the gaming industry. Innovations and constantly evolving hardware to support games have further facilitated this process. The evolution of game genres and modes of play have also contributed to the gaming revolution. Finally, overlap between the gaming industry, the traditional entertainment industry, and academia has also increased over the years. This section therefore serves as an introduction to the contemporary gaming situation and acts as a counterpart to the development of social research into gaming.

Works published in print on the history of games are complemented by internet sources which contains rich sources and *museums* on the history of gaming. Three particularly comprehensive sources include the site www.thedoteaters.com, the "The History of video games" hosted on www.gamespot.com, and Wikipedia's *History of computer and video games* (www.wikipedia.org). From these sources some corresponding highlights were pulled to plot the rise of commercial gaming and gaming research. According to Herman, Horowitz, Kent and Miller, (2002) the first commercially released digital game was in 1971. It was an arcade game called "Computer Space" and only about 1500 units were manufactured and released. A year later the Magnavox's Odyssey was released which was the first home video game system. *Pong*, a tennis-type game was also released in 1972 (Gentile & Anderson, 2006). By 1975 with Atari release of its home-system of *Pong*, all of the 150 000 units of the game sold out at its launch. *Pong*, a basic game consisting of two paddles bouncing a ball between different sides of a television screen can be seen as a good indicator of the technical quality of games available during the 70's. Sound in

videogames evolved from basic pings and squeaks in the early 70's to the first digitized voice offerings in 1979's videogame *Major League Baseball* (Oguro, 2004). Although the concept of networking gaming systems only occurred in the 90's, the concept of multiplayer games was already evident right from the beginning. Pong' already allowed two players to compete against one another (Herman et al., 2002). Movies and movie characters were often translated into game subjects. Articles concerning video games at this time were almost entirely focused on the available games and the technicality behind commercially available systems (Wolf & Perron, 2003). The 70's had by far the most diverse release of commercial 'gaming systems' due to the fact that most systems only provided one game. Wolf, Perron and Winter (2003) identified over 300 released systems in the seventies, while the 80's had roughly 40 and the 90's approximately 30.

Steady growth followed in the in the digital games market and by 1980 commercial gaming was well on its way with 300 000 units of *Pac-man* released worldwide (www.thedoteaters.com). In the same year the first introduction of the 'virtual world' as well as the first three-dimensional game. The massively popular 'Donkey Kong', a franchise still going strong today, was released in 1981 by Nintendo (Trueman, 2000). In the United States the first billion game cartridges were also sold the same year. Although two revolutionary gaming systems were released in 1982, the Commodore 64 and the ZX Spectrum the video game craze lost its momentum by the end of the year when two of the major role-players in the gaming market, Warner Communications and Mattel, announced lower than expected earnings and financial difficulties for their fourth quarter. (Herman et al., 2002). The digital games market rapidly declined until 1984 when there was a period that was called the video game market crash (De Maria & Wilson, 2003), which led to the cancellation of many games. The first psychological study of videogames also appeared in 1984 (Klein, 1984).

By 1985 the gaming industry was back with new improved offerings. Nintendo released its new system, the Nintendo Entertainment System, and 'Super Mario Bros.' (Herman et al., 2002). Characters created for video games were now starting to appear in television and movies. Publications in the field of digital games now became increasingly diverse, with documentations about the history of the gaming industry, and many more academic studies following in fields such as education (Harris & Williams, 1985), communication (Dominick, 1984), developmental psychology (Silvern & Williamson, 1987), and social psychology (Lin & Lepper, 1987).

2.2 Modern Overview

There is no specific date that hails in the era of modern gaming, although there are significant milestones throughout gaming's history and it could be argued that the era of modern gaming started in about the early 90's. This time period saw some of the most significant happenings in digital games history (Elmer-Dewit, 1993). It was then that the sale of multi-media PC's took off at a staggering rate, while Sony released its first PlayStation and Sega released its own Saturn gaming console (Davies & Lopez, 2000) During this period some of the most influential games in gaming history were released. Firstly there was the game *Myst* which became the most sold computer game of all time, until 2002 (Bates, 2002). Then there were also two of the most notoriously violent games, Mortal Kombat and Doom. While questioning the possible negative impact of videogames was nothing new (for example: Klein's 1984 article: "The bite of Pac-Man"), these visceral violent games set the stage for a renewed interest into gaming research. It also sparked a US senate investigation into gaming violence, and the establishment of the Entertainment Software Rating Board (ESRB), a body that applies and enforces game ratings and restrictions (Entertainment Software Ratings Board, 2003). Exceptional growth in the sales of games occurred in the latter half of the 90's. In the United States, game unit (e.g. the actual game in a box) sales rose from 105 million for the year of 1996 to 215 million for 1999 (Entertainment Software Association, 2005). Major advances were made in terms of digital games' sound, graphics and accessibility. The release of CD Rom based games further sparked interest into gaming due to the medium's increased storage capacity which allowed more detailed graphics to be accessible to home game users (Wolf & Perron, 2003). Music and sound in digital games reached its pinnacle in a sense during the 90's. Previously expensive sound cards were becoming more affordable, and improvement in sound quality became less noticeable to the untrained ear. Console game systems like the PlayStation already supported CD quality stereo sound capabilities (Oguro, 2004). Graphics processing hardware continued to break new ground and advanced graphics video cards became available to the general consumer. The game *Doom* changed the face of multiplayer gaming with its ability to network computers together, allowing up to four players on different machines to share one gaming environment. The 1990's saw the release of many more feature films based on digital games such as Streetfighter (1994) and Mortal Kombat: The Movie (1995).

Now in the early 21st century, three gaming companies dominate the videogame console market. PlayStation, Microsoft and Nintendo to date remain the top producers. Sony released its PlayStation 2 in 2000, while in 2001 Microsoft released its Xbox and Nintendo released its GameCube. These three systems were the top of the line video game platforms to date. It's only by the end of 2005 that Microsoft released its *next generation* console, the Xbox 360 (Carnoy,

2005). Sony and Nintendo expect to introduce their next offerings during 2006 (Dubbin, 2006). Many other previous competitors, like Sega, have given up competing in the hardware market and now exclusively focus on developing software products. Game unit sales have risen again, now to 248 million units sold in 2004 in the United States (Entertainment Software Association, 2005).

The popularity and success of gaming drives the massive entertainment hardware and software industry. These days most entry level PC's have affordable onboard graphics and sound capabilities. To enjoy the latest game offerings however, an expensive graphics accelerator card is still required. Currently, a top of the line graphics card targeted at the gaming market costs approximately the same as five entry level computers and two graphics card manufacturing companies, ATI and Nvidia compete for the top position (Carnoy, 2005). Even at seemingly high costs, the gaming market continues to flourish. The recent launch of Microsoft's Xbox 360 gaming console for $399 had many suppliers struggling to meet sales demand. Movies based on computer have become quite commonplace with examples like Tomb Raider, Resident Evil, Final Fantasy and Doom.

2.2.1   The Modern Gamer

The *modern gamer* is an evolving concept that aims to provide a definition of the gamer in the current state of time. In this study the term gamer refers specifically to digital gamers and not the broader category of game players in general. The profile of the gamer changed as digital gaming has become more mainstream and to a degree socially acceptable. A typical gamer is not some socially isolated, adolescent boy anymore. Social stigma and stereotyping still exists, but the growth of the gaming industry alone provides evidence of a very different situation. The modern gamer embraces a degree of gamers, from the *casual gamer* to the *hardcore gamer*. While casual gamers can be defined as those who on occasion participate in simplistic, uninvolved games, hardcore gamers can be defined as those that accept gaming as a major pastime activity, at the exclusion of most other types of entertainment (Zeschuk, 2006). What ties gamers together is a common enjoyment of digital games that causes them to seek out game play either on occasion or on a regular basis. This then forms the base of the definition of the modern gamer, while different categories of gamers complete it. Distinctions between the terms gamer, player, and character also needs to be made. Finally, to quantify the exploration of the modern gamer concept, statistical and other research on the gamer are looked at.

A c*asual game*r is a player that only occasionally plays games. Games favoured by *casual gamer'*s usually include only mildly engaging games such as puzzle or card games. But playing a

few of rounds of the card game Solitaire daily does not necessarily classify someone as a regular *gamer* since gaming is more like a hobby. Wikkipedia qualifies the term *'gamer' as* often being a self-assigned title (www.wikipedia.org). On the opposite side of the spectrum from the *casual gamer* is the *hardcore gamer*. This group of gamers consider gaming as a top priority activity. They usually invest a lot of money into maintaining their PC's in order to keep them up to standard with the latest games. They may even own the latest console gaming system. They are also the group that purchase or pirate the latest games. *Hardcore gamers* regularly attend Local Area Network's (LAN's) and often participate in games for hours on end. Certain *hardcore games* become *competitive gamers*, a class of gamer that consider gaming a sport, and regularly compete in gaming tournaments.

The term 'player' can be a bit ambiguous. As used in the above context (casual player) it refers simply to someone who plays games. In reference to a digital gaming situation, a player refers more specifically to an in-game representation of the gamer. For example in a fighting game two gamers will play the game while player 1 will fight against player 2. At the most submerged level is the *gaming character*. In most games a gamer plays the role of one or many characters. Sometimes gamers are given the option of selecting or even customizing their characters to change their gaming experience by changing their character's abilities or looks. Another term, with slightly different connotations for a gamer's character is an *avatar*. The avatar can be described as a human player's double, that "merges spectatorship and participation in ways that fundamentally transform both activities" (Rehak, 2003, p. 103).

Sales statistics and surveys provide insight into the gamer demographic. The ESA released a comprehensive report in 2005 on the state of the digital game industry. While these findings appear very representative of the gaming industry situation in the United States, a mixture of sales statistics and sampled surveys has lead to ambiguous media releases. Furthermore, many important qualifiers and groupings have been excluded from the report such as the classification and separation of gamers into different categories. Media sources have inaccurately used these statistics to describe the state of the gaming population. At times sources like magazines and newspaper articles have failed to mention the circumstances in which this survey was conducted. One of the important facts is that the survey was conducted only in households identified as having either or both a gaming consol or a PC with entertainment software. Statements like the one published by BBC News declaring "75% of American heads of households play computer and video games" (Hermida, 2005) provides a skewed assessment of the actual situation because it is given without the contextual information. Keeping this in mind there are the statistics which can provide valuable insight if they are discussed properly. At present the term *modern gamer* is more represented by males. The difference between the sexes is not that great if

statistics by released in the ESA report is consulted, but to clarify the actual situation, this difference is more clearly examined in section 2.3. The main distinction remains that overall, both male and female gamers exist, but most hardcore gamers are male. The same ESA report also states that the average age of the gamer is 30 years old, with only 35% of the gamer sample being under the age of 18. Again this report is misleading if the statistic is not placed in perspective. By looking at other studies such as the *UK Interactive Entertainment Industry 2005* report (Entertainment and Leisure Software Publishers Association, 2005) it can be seen that the age group of 10 to 15 year olds is almost double that of the other 5 year interval categories. The ESA's claim that only 35% of gamers are under the age of 18 is also misleading in that only approximately 30% of the population fall into this category.

2.2.2   Social Gaming

Social gaming refers to the interaction between different gamers via the medium of a computer game. This means that gamers compete against one another or cooperate with each other in a virtual gaming environment. The research conducted by this study took place in the context of a Local Area Network (LAN). A LAN refers specifically to computers in the same vicinity connected to each other by a network connection. Social gaming also includes game play across an Internet connection, which is referred to as online gaming. Online gaming is in itself a massive dimension of gaming. In both LAN's and online gaming arenas, one gamer starts a multiplayer enabled game that other gamers can join into through their own computers. Gamers are represented to each other in the game by their onscreen characters, usually partially customised and bearing the names of those players.

Gamers set up their own LAN's at events that they organize for the purpose of social gaming. LAN events, or LAN parties, take place anywhere including gamers' homes, offices, or specially rented venues. Gamers may use computers already available at the locality or, what happens more often, the attending gamers bring their own computers. This is referred to as BYOB, meaning "Bring Your Own Box". It is in the context of a regularly occurring LAN party that the research for this study took place.

Compared to online gaming, LAN parties are more sociable in nature. Manninen (2001) states that the one underlying theme of all multiplayer games is togetherness, and that organizing a LAN event is partly to do with overcoming the communication limitations inherent in online games. When attending a LAN it is easy to see that with all the gamers in one location various social activities result such as the verbal coordination of gaming efforts, making jokes, congratulating or even insulting other players, all during gameplay.

LAN's are often open to any gamer wishing to participate. Some LAN organisers charge a fee for setting up a LAN especially when it has to accommodate a large number of gamers. A LAN can be created between two gamers or more, even LAN's with thousands of players have been organised. Larger LAN regularly host gaming competitions, not only for monetary prizes, but also for ranking gamers. Gamers compete either as individuals, or in organised groups called *clans.* In participating countries, top ranking gamers and clans are annually able to compete in the World Cyber Games tournament. This is the largest international gaming tournament. It is traditionally hosted in Korea. In 2004 it was held in San Francisco where 642 top gamers from 63 countries attended to compete for prizes adding up to 2.5 million dollars (www.worldcybergames.com).

Game play sessions can lasts from a few minutes to hours and hours of gameplay. Gaming is usually the priority at LAN's but between these sessions a large percentage of time is also spent socialising outside the virtual environment, usually discussing the highlights of the previous gaming sessions.

 With the increased availability of fast reliable, Internet connections, online gaming is becoming increasingly popular. Online gaming relies on the same principle of a LAN, but without the need of a direct physical network connection between the different participating gamers. Instead gamers are connected to each other through their Internet connections. Online gaming has the advantage of being able to connect a multitude of players from all around the world, but it also has some limitations. Although gamers are able to 'chat' via typing messages to one another, communication and socialization is inhibited to a certain degree. Certain newer games incorporate Voice Over IP (VOIP) technology that allows players to talk over their Internet connection just like they would be able to using a standard telephone connection.

Two of the most popular genres of popular multiplayer LAN games are First Person Shooters (FPS) and Real-Time Strategies (RTS). These two categories of games are also some of the most popular online game genres. Other popular online genres are Multi-User Dungeons (MUD) and Massively Multiplayer Online Role-playing Games (MMORPG). All these types offer thousands of gamers a virtual space in which they can socialize and compete with other players. There are several examples to attest to the popularity of online gaming. A FPS called Counter-Strike, allows players the chance to assume the role of either a terrorist or a counter-terrorist in order to compete against the opposing faction. In a study done on creative player actions, Wright, Boria and Breidenbach (2002), found that at any one time there were approximately between 23-25,000 players online playing Counter-Strike. Another example is Sony's *EverQuest*. In May

2001, it was found that this MMORPG, was hosting between 60,000 to 80,000 players daily (Ahuna, 2001).

Online gaming and specifically developed online games provide a unique gaming experience. This experience is more appealing and sometimes more accessible to different demographic populations. According to AOL (America Online, 2004), American women over the age of 40 spend nearly 50% more time each week playing online games than men. Women were also more likely to play online games daily than men or teens. Online gaming is a colossal market in the eastern societies such as China and Korea. So much so that the societal and physical impact of this market has lead to legislative measures being taken to control it (see section 2.5).

Social gaming and multiplayer options is becoming integrated into most forms of gaming. Even new gaming consoles come with the capability of connecting to the internet to compete or cooperate with other gamers. Social gaming has been the driving force behind the formation of gaming communities and the gaming subcultures.

2.3   Gaming subculture

With the advent of social gaming the emergence of a gaming subculture became apparent. Large gatherings of gamers continually reflected the same trends. The first and most apparent was that social gaming appears to be mostly male dominated (Green & Adam, 1998). Other sub-cultural considerations include age, values, beliefs and behaviour. While age and values vary to a great extent, the belief in gaming and the behaviour of playing games is a unanimous trait in this subculture. The rise of digital gaming as a leisure activity was met with criticism from parents, journalists and educators alike. Games were associated with violent content, stereotyping of women and ethnic groups, and addictive qualities (Jansz & Martens, 2005). Over the last couple of years social gaming has become more mainstream and acceptable. Large gaming communities have come into being. These communities are supported by websites, magazines, gaming events, competitions, expos and television shows.

The focus of most studies in gaming culture is on the gender dynamic present in gaming, specifically the absence of girls and women from this culture (Yates & Littleton, 1999). Before looking at the possible causes for this trend it is necessary to first establish whether this trend still exists and how prominent it is. According to the Entertainment Software Association (ESA), this trend would not appear as prominent in the recent years. In their *ESA's 2005 Essential facts about the computer and videogame industry*, 43% of gamers are female. This statistic was

reached by conducting a survey across almost 1500 American households that have access to a gaming platform (Entertainment Software Association, 2005). According to the Entertainment and Leisure Software Association (ELSPA) the women gamers in the UK made up a quarter of the gaming population compared to 39% in the US and 69% in South Korea (Entertainment and Leisure Software Association, 2005). Smith (2001) argues that these types of statistics are misleading due to the possible nature of the research methodology employed. He also states that common sense assessments of gaming stores and internet cafes would dispute these statistics, and argues that academic research needs to be more careful in its approach. Smith agrees that there a there are a large amount of female gamers but believes that the majority of dedicated hardcore gamers remain male. In an interview at www.womengamers.com (Lowenstein, 2001) a representative of the ESA admits that they do not distinguish between *casual* and *hardcore* gamers, but that 30% of all sampled gamers that played more than 10 hours a week were female. A study done by Roe and Muijs (1998) found that only 23.2% of a sample of *heavy users* of computer games was female. If a gaming culture is then defined by the more hardcore gamers, it can be said to be predominantly male.

Various studies attempt to provide answers for the trend that gaming culture is male dominated. One of the main topics is the alienation of girls from gaming culture which can be accounted for by a variety of reasons such as the negative or stereotypical portrayal and absence of female characters in games (Dietz, 1998), girls' lack of engagement with technology as compared to boys 'comfort' with technology (Yates & Littleton, 1999), and a lack of gaming experience on the part of female gamers (Subrahumanyam & Greenfield, 1994). Then there are other studies that have explored why female gamers actively choose to distance themselves from gaming. To illustrate this statement, Yates and Littleton (1999), identifies a social stigma associated with gaming. Especially in the past, being a gamer was socially strongly associated with terms such as nerd and loner, while public discourse qualified gaming with terms such as addiction, social isolation, and violence. Subrahumanyam, Greenfield, Kraut and Gross (2001) attributes the predominance of male gamers to game design and marketing that focuses on the male market. They also state that the gender imbalance seen in gaming has been a strong topic of discussion due to computer gaming possibly being a precursor for computer literacy.

As social gaming has become better known, it has become a more acceptable social activity. Many factors have contributed to this growth; from the relatively inexpensive cost of setting up a small network to the popularity of large annual gaming events and expos such as the Electronic Entertainment Expo (E3). Gaming has also become much more visible in the media, with popular magazines featuring game advertisements and television shows exclusively focused on gaming (example: www.gamer.tv). With further advances in gaming technology and its availability,

gaming culture is not just growing, but also becoming more universal. Even the diversification in research topics in the field of digital gaming and calls for gaming to be studied in an independent academic structure (Arseth, 2001) is an indication of the field's maturation.

2.4 Social Research in the Field of Digital Gaming

Gaming research is a diverse field spanning many disciplines. Social research into gaming is only of the sub-categories of gaming research as a whole, while psychological research into gaming is in turn one of its subcategories (see Figure 1). This study highlights many of the issues in the social research branch but it ultimately positions itself in this branch that can be termed gaming psychology. Many of the branches in gaming research overlap in some way. In such a mosaic research field it is necessary to clearly position any new research to allow fellow researchers a starting reference point and to aid in understanding.
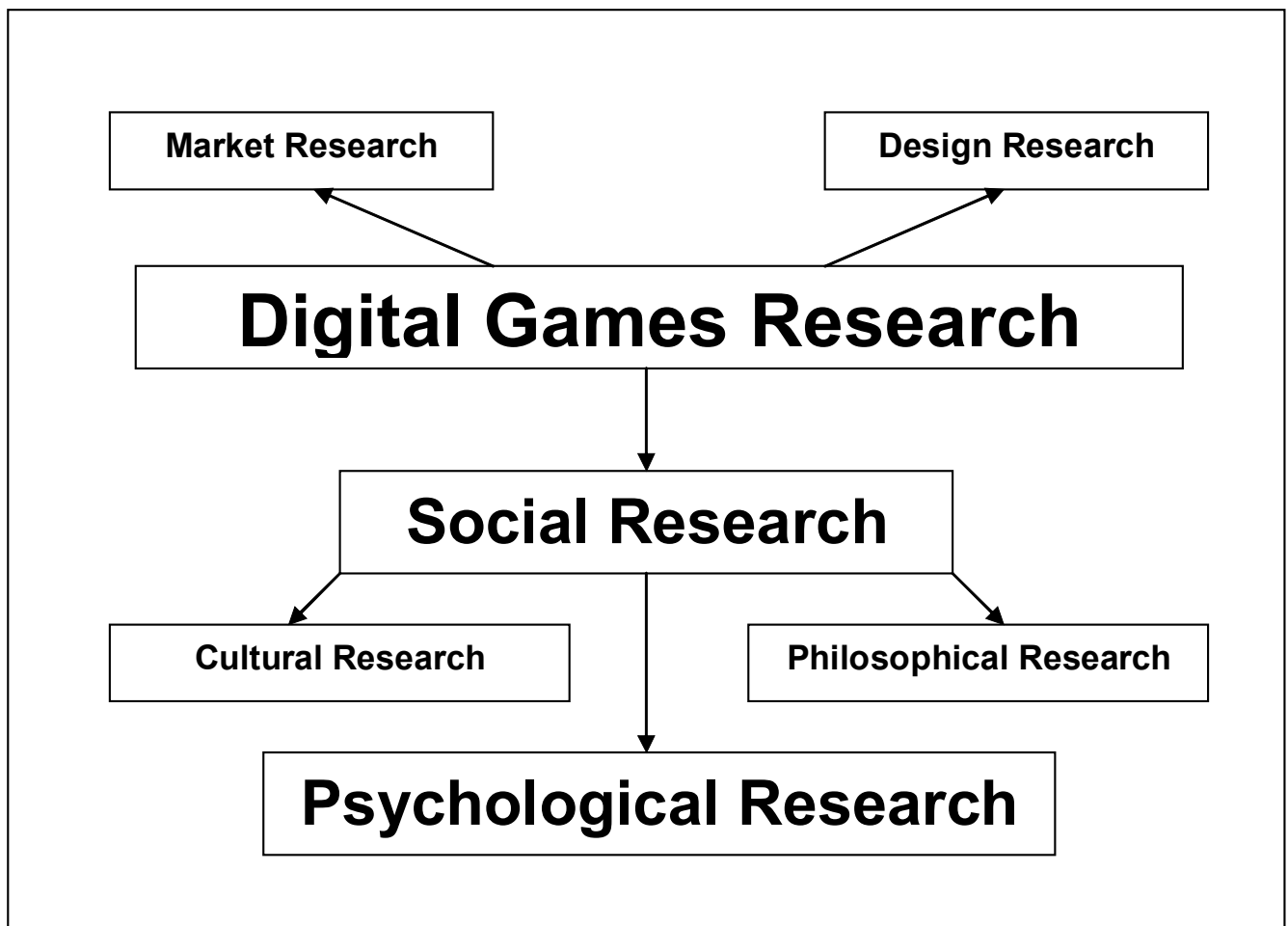
Figure 1. Psychological research in the field of Digital Games Research

Although the field of Digital Games Research has come a long way, it has been criticized until quite recently. Eskelinen (2001) noted that the study of digital games was still not yet established and even said that almost 'anything goes'. Game and gaming research is conducted by a diversity of scholars including graphic designers, students of film and theatre, computer scientists, and sociologists, just to name a few. The game research community has been described as "*essentially a non-unified research community with huge differences in outlook and priorities*" (Smith, 2002). To compensate for this lack of having a universally accepted and encompassing digital game theory, researchers often have to bring in and explain the theories and models from their own fields of expertise. In an attempt to place digital game studies theorists have drawn mostly from popular fields of study and other less known fields such as *Narrology* (the study of narratives), and newly created fields such as *Ludology* (the study of games and play activities – Frasca, 1999). These fields provide a valuable platform of departure but they do not address the full complexity of the digital gaming phenomenon. The lack of an encompassing and unified theory still exists (Aarseth, 2001) and it is necessary to elaborate on the theoretical standpoint of most research endeavours including this one. The theoretical basis of this research is described in the next chapter to both clarify the theoretical point of departure and serve to make this research more accessible to other researchers in the gaming research community.

The rapid growth of the gaming market was at first not followed by a growth in social gaming research. Research was initially more focused on the marketing and game development side (Wolf & Perron, 2003). Breakthroughs in computer hardware and software technologies were a much more attractive area of focus. As with the study of other media, such as film, the study of digital games has taken its time to become an acceptable academic endeavour. Smith (2002), claims that only five years ago it would have been easily possible to survey the entire field of games research, while now the field can be described as booming with common terminology, competing paradigms, and serious discussions. The catalyst for this growth in social research into gaming can definitely be linked to the emergence of violence in games which created renewed interest, from public, political and scientific sectors (Kirsh, 2002). The release of Mortal Kombat in 1993 with its realistic depiction of human blood and dismemberment in itself inspired a range of academic articles (Ballard & Weist, 1996; Cassel & Jenkins, 1998; Kirsh, 1998.). No development in the gaming industry could have fuelled the interest in social gaming research as much as a rash of school shootings which were partially blamed on violent digital games. The perpetrators of the Columbine shooting were known as avid video game players with their own customized versions of the game Doom. By 2002, over twenty studies have assessed the relationship between violent video game play and aggression during the adolescent period. (Kirsh, 2002).

It would seem reasonable to look at the impact of violent television programs to form a basis for the study of game violence, but Professor Craig Anderson, a leading game violence researcher, comments on the difficulty in comparing the two mediums. Although there are unpublished studies that attempt to compare the two mediums, Anderson (2003) believes that matching the dimensions of the two in terms of variables such as levels of violence and realism would prove very difficult. He states that digital games may have a larger impact than watching television because games have an 'active and repetitive learning' characteristic that is not present in television.

The debate on the impact of violent games rages on:

> *"The real puzzle is that anyone looking at the research evidence in this field could draw any conclusions about the pattern, let alone argue with such confidence and even passion that it demonstrates the harm of violence on television, in film and in video games. While tests of statistical significance are a vital tool of the social sciences, they seem to have been more often used in this field as instruments of torture on the data until it confesses something which could justify publication in a scientific journal. If one conclusion is possible, it is that the jury is not still out. It's never been in. Media violence has been subjected to lynch mob mentality with almost any evidence used to prove guilt"* (Cumberbatch, 2001).

In response to criticisms like these, Anderson (2003) compiled a list of facts surrounding the study of violence in games. He states that when studies on the effects of violent games are combined in a meta-analytic analysis (Table 2), the overall conclusions indicate a range of negative effects. He also claims that:

- The more methodologically stronger the studies were, the greater the effects found were.
- That it is a fact that high levels of violent video game exposure have been linked to delinquency, fighting, and even violent criminal behaviour.
- Even games with unrealistic, cartoon style graphics can lead to increased aggression.

Table 2. Anderson and Dill (2000) comparing the findings of various studies on digital game violence.

Types of studies	Number of studies	Number of studies supporting the statement that violent digital games have a negative effect
Correlational (surveys)	4	3
Experimental (laboratory studies)	7	5
Cognitive (availability of aggressive thoughts)	3	3
Affective (effects on mood)	9	5

Not all research on games has been on its possible negative impact. Research articles span the whole spectrum, to include studies that focus on more neutral or positive aspects of games. The more neutral studies (i.e. studies not bias against or supportive of the impact of games), omit commenting on the impact of games, but rather use digital games as a medium of exploration. Examples include human–computer interactions or human–human interactions via the medium of a game (Taylor, 2003; Manninen, 2000; Wright et al., 2002). Some studies on game culture and social gaming have already been discussed (see section 2.2), but the topic of interactions is a key focus area and will be further explored.

 Digital games have provided a whole new way for humans to interact with machines, themselves, and others. Examples of research into these three forms of interaction are quite common. Taylor (2003) provides an exploration between human interaction with machines and how players operate both on, and in the game space. Manninen (2000) explores interactions in Networked Virtual Environments, explores the term Interaction, and develops an interaction taxonomy, all through the use of multiplayer games. Wright et al. (2002), also explores social interactions and creative innovations in multiplayer games. All these studies point out the unique characteristics of the new virtual environment.

Studies on the possible positive impact of games consist of studies and commentaries on the educational potential of games (Brody, 1993; Condry & Keith, 1983; Silvern, 1986), the therapeutic and assessment use of games (Gardner, 1991; Spence, 1988), and the overall benefits of playing digital games (Salonius-Pasternak & Gelfond, 2005). While games and the concepts behind them have been successfully used as tools for academic exploration, it is the positive impact of popular games in general that needs to be more deeply explored.

The concepts behind popular digital games have been beneficially applied to real life situations. Brody (1993), states that collaboration between educational software developers and game manufacturers are starting to offer games that teach players things of value. The elements that successfully add to the gaming experience are therefore adopted to create educational tools.

At this stage a distinction needs to be made between all digital games and popular digital games. In this study, the digital games under investigation are classified as popular digital games. These are financially successful games readily available to the public, and not specially developed games for an ulterior motive such as stress alleviation or education. The benefits of specially developed games seem quite self-evident. They provide services, like education, in a novel, entertaining fashion. They are however not the subject of this investigation because they lack the mass market appeal associated with games that are sought out as an entertainment activity of choice.

Gardner (1991) identifies a list of positive uses for, and effects of, popular games. He states that games can aid in the assessment and development of the child's problem-solving abilities and help them predict consequences of actions and improve perceptual-motor coordination. They also serve as a way of releasing or controlling aggression, a way of dealing with success and failure, and provide opportunities to mutually coordinate activities through cooperation in games (Gardner, 1991). Salonius-Pasternak and Gelfond (2005), identify similar possible effects by adding that digital games may provide some crucial play elements to help children's emotional, social, cognitive and linguistic development, in a modern society where there has been an increase in supervision and limitations to a child's free time and imagination.

Studies on the beneficial use of popular games are far outnumbered by those investigating their possible harm. Besides the possible developmental benefits inherent in games, there are a few other areas where popular games have been noted to have beneficial impact. These, along with the negative impacts are looked at more closely in the next section.

2.5   The Impact of Gaming

Besides looking at the social research done on digital games and the debates raging if the field of gaming impact, it is necessary to delve deeper into the actual impact of games on various levels: psychological, sociological, and physical. Using research findings, and media reports, three sub-categories in particular will be looked at in each level: the effects resulting from regular gameplay, the effects of violent gameplay and the effects of excessive gameplay.

2.5.1   *Psychological*

Most studies on the topic the psychological impact of playing modern popular games makes a differentiation between the short-term and long-term effects of gaming. Words that are commonly used to describe gaming can give an indication of the short-term psychological consequences of gaming. These words include: fun, exciting, challenging, stressful, and addictive. With the growing popularity of games and amount of time children and adults invest in them concern over long term-effects of games has become paramount.

Research on the short-term effects of gameplay are as in most digital game related topics still vary varied. Psychological involvement while playing is quite evident when looking at elements involved in gameplay. The player becomes immersed in a different setting controlled by different rules. The player then engages with this environment by selecting from a limited set of possible 'movements' or reacting to a limited set of possible stimuli. During immersion and engagement the player dissociates to an extent from the real world. This state, characterized the suspension of the logical integration of thought, feelings and experiences (Preston, 1998) can be labelled as non-pathological dissociation (Putman, 1993). In both violent and non-violent games, no short term hostility changes were found using the Buss–Durkee Hostility Inventory (Baldaro, Tuozzi, Codispoti, Montebarocci, Barbagli, Trombini & Rossi, 2004). Anderson and Dill (2000) found similar results, stating that although violent digital games increased the accessibility of aggressive thought, they could not find a reliable increase in state hostility scores which are calculated using a measure based on self-reported internal states. From experimental studies, Anderson and Dill

(2000) did however find a positive relationship between violent digital gameplay and aggressive behaviour. They suggest therefore that digital game violence takes a cognitive and not affective path to increase short-term aggressive behaviour.

Long-term side effects of gaming are more difficult to isolate. There are various studies that address this issue. From correlational studies that include both types of games, Anderson and Dill (2000) again found a positive relationship between violent digital gameplay and aggressive behaviour. Green and Bavelier (2003) found that habitual playing of action-type games altered visual selective attention. This is supported by Subrahumanyam et al. (2001) who states that the structural features of digital games also impacts on special representation (e.g. mental rotation and special visualisation) and iconic skills (i.e. the ability to read images).

Excessive gameplay is another problematic area associated with gaming. Cases have been identified where non-stop gaming has met with extremely negative consequences. For example, Miller (2002) documented a case where a 21 year old suffered a psychotic breakdown after playing 36 hours. But excessive gameplay does not necessarily mean in one stretch of time. The term *computer addiction* has been coined to describe situations when long hours of gameplay become habitual. Psychological consequence associated with computer addiction or gameplay, according to Orzack (1999), includes symptoms more commonly associated with chemical addiction:

- Having a sense of well-being or euphoria while at the computer
- Inability to stop the activity
- Craving more and more time at the computer
- Feeling empty, depressed, irritable when not at the computer

2.5.2   *Sociological and Political*

Games have provided a new method for both *self–self*, and *self–other*, interactions. Social gaming has become very popular as can be seen in the development of gaming subcultures and the massive success of online games. Violent games have had their societal impact as well. Whether they were, or not, to blame for violent incidents such as school shootings or vengeance killings, they definitely have created a media uproar and civil backlash. So much so that government legislation on various occasions has stepped in to regulate game distributions, access, sales, content and even gameplay itself (Andersen, 2005).

As with movies and other forms of popular media, digital games are age-rated to regulate game sales and inform the public about their content. The ratings are done by the Entertainment Software Ratings Board (ESRB), who also regulate and promote responsible advertising practices within the gaming industry. Since its establishment in 1994, the ratings system has undergone many changes to accommodate the evolving games market (Entertainment Software Ratings Board, 2003). At present there are six age categories available to be assigned to games. These, with their recommended ages are: Early Childhood (3+), Everyone (6+), Everyone (10+), Teen (13+), Mature (17+), and Adults Only (18+). The ESRB also add qualifiers to these ratings to describe the content in the game. By looking at this list it is possible to see some of the classifications of digital games and the themes that have caused concern over the past.

Table 3. ESRB content descriptors (*www.esrb.org/esrbratings_guide.asp*).

- **Alcohol Reference** - Reference to and/or images of alcoholic beverages
- **Animated Blood** - Discolored and/or unrealistic depictions of blood
- **Blood** - Depictions of blood
- **Blood and Gore** - Depictions of blood or the mutilation of body parts
- **Cartoon Violence** - Violent actions involving cartoon-like situations and characters. May include violence where a character is unharmed after the action has been inflicted
- **Comic Mischief** - Depictions or dialogue involving slapstick or suggestive humor
- **Crude Humor** - Depictions or dialogue involving vulgar antics, including "bathroom" humor
- **Drug Reference** - Reference to and/or images of illegal drugs
- **Edutainment** - Content of product provides user with specific skills development or reinforcement learning within an entertainment setting. Skill development is an integral part of product
- **Fantasy Violence** - Violent actions of a fantasy nature, involving human or non-human characters in situations easily distinguishable from real life
- **Informational** - Overall content of product contains data, facts, resource information, reference materials or instructional text
- **Intense Violence** - Graphic and realistic-looking depictions of physical conflict. May involve extreme and/or realistic blood, gore, weapons, and depictions of human injury and death
- **Language** - Mild to moderate use of profanity
- **Lyrics** - Mild references to profanity, sexuality, violence, alcohol, or drug use in music
- **Mature Humor** - Depictions or dialogue involving "adult" humor, including sexual references
- **Mild Violence** - Mild scenes depicting characters in unsafe and/or violent situations
- **Nudity** - Graphic or prolonged depictions of nudity
- **Partial Nudity** - Brief and/or mild depictions of nudity
- **Real Gambling** - Player can gamble, including betting or wagering real cash or currency
- **Sexual Themes** - Mild to moderate sexual references and/or depictions. May include partial nudity

- **Sexual Violence** - Depictions of rape or other sexual acts
- **Simulated Gambling** - Player can gamble without betting or wagering real cash or currency
- **Some Adult Assistance May Be Needed** - Intended for very young ages
- **Strong Language** - Explicit and/or frequent use of profanity
- **Strong Lyrics** - Explicit and/or frequent references to profanity, sex, violence, alcohol, or drug use in music
- **Strong Sexual Content** - Graphic references to and/or depictions of sexual behavior, possibly including nudity
- **Suggestive Themes** - Mild provocative references or materials
- **Tobacco Reference** - Reference to and/or images of tobacco products
- **Use of Drugs** - The consumption or use of illegal drugs
- **Use of Alcohol** - The consumption of alcoholic beverages
- **Use of Tobacco** - The consumption of tobacco products
- **Violence** - Scenes involving aggressive conflict

Ratings and fines are not the only control measures instituted against games and gaming. Parental control, via a password protected menu, to regulate the level of violence and time spent on the game is a feature added to certain games and is currently making its way into online gaming. The Financial Times has reported that in China, a country renowned for its online game player community, the situation has gotten to a point where legislation is forcing online gamers to play less by penalizing their game character development after three hours of online play (Dickie, 2005).

According to the Ang (2005), China has even opened the first rehabilitation centre for online game addicts. Even in America some hospitals offer 'Computer Addiction Service' programs. According to Orzack (1990) sociological consequences of computer and game addiction includes:

- Lying to employers and family about activities
- Problems with school or job
- Neglect of family and friends

According to an article in the Massachusetts Institute of Technology's newspaper, Senator Faircloth of North Carolina proposed an amendment to a Senate appropriations bill that would eliminate all computer games in the federal workplace, because of excessive time wasting (Berry, 1997). These proposed amendments passed the Senate vote unanimously. Further in America, stricter game control laws are currently under debate, with heavier fines to resellers selling to the under-aged being considered (Broache, 2006).

2.5.3 *Physical and Physiological*

Diverse physical and physiological effects have been studied and documented in relation to playing digital games. These range from observable physical actions and physical symptoms resulting from gameplay to such as epileptic seizures (Rushton, 1981) to changing physiological states and even severe physiological consequences.

Physical movement during games can give an indication of underlying psychological and physiological occurrences. Although the majority of gaming is characterized by a relatively motionless posture, a gamer may at times move closer to the screen, try and look around corners by leaning, duck, or even pull away completely from their monitor and control interface, due to the onscreen action. This could indicate that the gamer is focused, absorbed, tense, or even stressed.

The physical symptoms of excessive gameplay range from lapses in personal hygiene to, in the most extreme cases, death. While certain cases of death have been linked to excessive gameplay, like that of a mother knowingly leaving her child locked in a car while she played games, other cases have been directly attributed to gaming. According to the BBC News (2005, August 10), a 28 year old South Korean man collapsed and died after playing an online game for about 50 hours without taking many breaks. But gameplay does not need to be excessive to be harmful. Trenite (1994) identified 50 published cases where playing digital games have been linked to epileptic seizures. While these extreme cases are still rare, other physical symptoms are much more common and usually only manifest after longer periods of gameplay. Orzack (1999) identified some physical symptoms that are usually found with heavy use of computer games:

- Repetitive stress disorders
- Dry eyes and migraine headaches
- Backaches
- Eating irregularity, like skipping meal
- Lapse in personal hygiene
- Sleep disturbance

The visual component of gaming has led to investigation in this area. Green and Bavelier (2003) found that playing action filled digital games altered a range of visual skills. They found that digital game players outperformed non digital game players in visual recognition experiments. Hadfield (1994) on the other hand reports on a Japanese study linking digital gameplay to the

development of poor eyesight in school children.

Gameplay in most modern popular action games is quite intensive and often described as tense or stressful. To gauge the stress reaction induced by games Mazur, Susman and Edelbrock (1997) measured the cortisol, or 'stress hormone' levels in groups of digital game players participating in a tennis type game. They found an overall decline of cortisol over time for both the winners and losers. Hebert, Beland, Dionne-Fournelle, Crete and Lupien (2005) on the other hand found that video games, especially the music in them, act as a cortisol secretion trigger which is comparative to the physiological reaction caused by stress. They suggest that this may even be the biochemical basis for an addiction process, and further note that the game participant is usually unaware of the stress reaction. Herbert et al. (2005) attribute incompatibility between their findings and the findings of Mazur et al. (1997) to the types of games used and the more primitive cortisol measurement procedures used.

Measurable physiological effects of gaming include increases in cardiovascular reactivity, blood pressure, and oxygen consumption (Segal & Dietz, 1991). In both violent and non-violent studies, a range of short term effects were found on arterial pressure and state anxiety measurements have been documented (Baldaro et al., 2004). More specifically, a larger increase in systolic blood pressure was found in the players playing the violent games (see Figure 2). Their state anxiety scores were also significantly higher. Both players of the violent and non-violent games also had lower diastolic blood pressures after participating in gameplay. This indicates that although violent games elevate anxiety levels during gaming, these levels return to normal quickly after gameplay has ceased. The violent game used as a stimulus by Baldaro et al. (2004) was the First Person Shooter (FPS) Unreal *Tournament* (© 1999, Epic Games,), the predecessor to the FPS *Unreal Tournament 2004* (© 2003, Epic Games) used in this study.

SYSTOLIC BLOOD PRESSURE
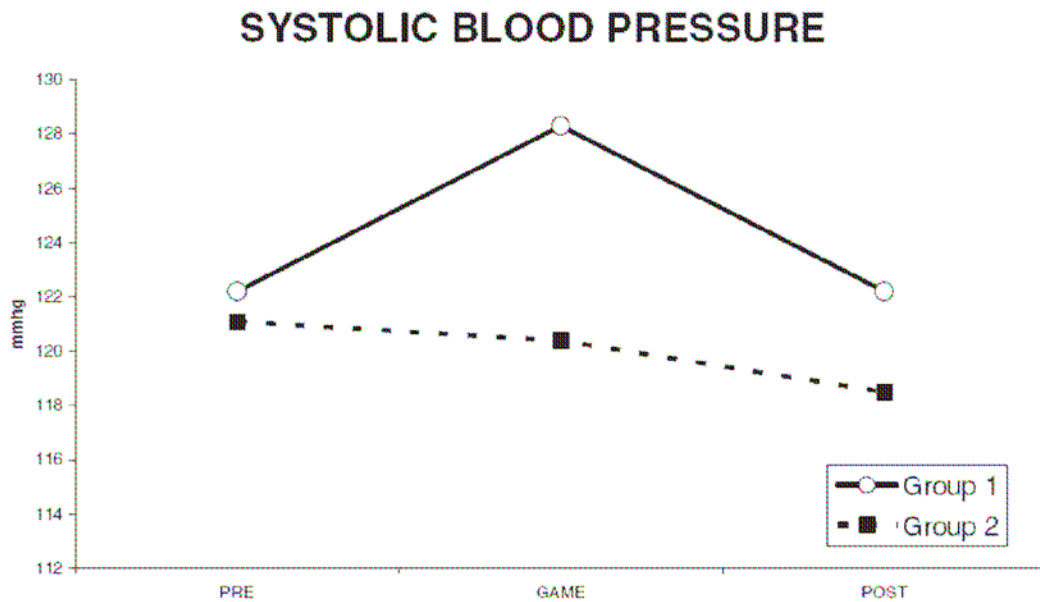
Figure 2. Systolic blood pressure of the two groups. (Baldaro et al., 2004)

Note: group 1: Violent videogame; group 2: non-violent videogame, in the pre-game, game, and post-game periods.

2.6   Chapter Summary

This chapter provided an introduction to many aspects of gaming such as the gaming market, the modern gamer, gaming culture, social research into gaming and the impact of gaming. Gaming is described as a rapidly growing phenomenon characterised by unique developments since its commercial rise in the 1970's. Gaming research, which initially focused on the technical side of games, mainly shifted its attention onto the impact of gaming with the rise of games with violent content. A variety of studies have published findings on the psychological, sociological and physical effects of gaming. This study aims to contribute to this growing body of knowledge by conducting research using a method of verbal analysis in the context of gaming. To facilitate this process a set of theoretical points of departure is established in the next Chapter. It also explains how the method of verbal analysis is adapted to studying gaming.

CHAPTER 3

THEORIES AND METHODS USED IN THIS RESEARCH

This chapter revisits the objectives of this study and describes the framework and the methods that will be used to achieve these objectives.

Chapter 2 positions this study in the branch of gaming research termed gaming psychology. Before going into more detail on the theories and methods used in this research it is necessary to clarify its positioning further by looking back at the objectives of the study. As seen in the Chapter 2 review on previous gaming psychology studies, the majority focus on the psychological impact of gaming. The objectives of this study make no such claim. Instead it is only an exploration of the thoughts and thinking strategies stimulated by popular genres of games (see Figure 3). It does not attempt to address the actual long term implications of entertaining these thoughts. Instead this research tries to identify these thoughts and also provide comment on the applicability of an adapted form of verbal analysis in this identification. With a successful implementation of verbal analysis method there are additional befits. There may be for example the possibility of identifying a variety of gaming strategies which may be very appropriate to the field of *game theory*. Lastly at the apex of this study lies the possibility of making cognitive inferences on the thinking strategies used during gaming which may offer future researchers a valuable method of approaching the topic of the psychological impact of gaming.

The encompassing theoretical orientation used in this exploration is largely based on cognitive psychological theory. While this study is classified as an exploration, the method of exploration (i.e. verbal analysis) has already been mentioned as allowing for cognitive inferences to be made from the resulting data. Relying on the wide scope of cognitive theory and the set method of verbal analysis is however not enough. They need to be integrated and grounded into the field of digital game studies. New sources of gaming theory are currently emerging as can be seen in *The Video Game Theory Reader* by Wolf and Perron (2003). These sources contain a multitude of topics, approaches, and definitions, but still point out the lack a solid unified theory. Gaming has also been studied from a variety of previously established fields such as psychology, anthropology, economy and sociology (Frasca, 1999). For this research *game theory* was chosen as theoretical point of reference to help classify digital games and the different game genres used in this research. Game theory's focus on different interactions and strategies makes it an ideal tool for this study.

An adapted form of verbal analysis was used as the method of data collection. This method termed the *hybrid method* (see section 3.2.4) contains characteristics of classical protocol analysis as well as the later developed forms of verbal analysis. These methods of data collection also provide a methodological framework for the interpretation of the data. The adopted hybrid method selects the elements of these other methods that are most conducive to an exploratory study, while also maintaining elements that heighten validity and reliability.

The cognitive elements of this exploration are interpreted with the basic cognitive models accepted by classical protocol analysis (Ericsson & Simon, 1993), as well as further cognitive models deemed suitable (see section 3.3). These include models that contextualise cognition and qualify thoughts: the linear model of psychology as the science of human experience and behaviour from Jordaan and Jordaan (1992), and a thinking strategy classification model presented by Hong and Liu (2003)

Gamer's thinking definitely influences In-game actions

GAMER

DIGITAL GAMEPLAY

Gameplay definitely influences gamer's in-game thinking

Focus of this Research

Verbal Analysis

THOUGHTS

COGNITIVE INFERENCES
Thinking Strategies

GAME THEORY
Gameplay strategies reflects strategies used in real-life interactions

PSYCHOLOGICAL IMPACT
Gameplay possibly influences real-life thinking after gameplay has ceased.

COGNITIVE MODELING
Cognitive inferences and additional data may provide useful information

Figure 3. The focus of this research.

3.1 Game Theory

Game theory is mostly recognised as a branch of study in the field of economics. The seminal work in game theory was largely credited to John von Neumann, one of the co-inventors of the hydrogen bomb, and Oskar Morgenstern (Mansfield, 1994). Their co-authored book *The Theory of Games and Economic Behaviour* (von Neumann & Morgenstern, 1944) introduced novel theories on interdependent behaviour. Game theory was further popularised in the 1950's by John Nash who is portrayed as the main character in the movie *A Beautiful Mind* from Universal Studios and DreamWorks LLC (2001). The movie centres on him and also briefly introduces his theory. Essentially, game theory addresses serious real-life interactions using the metaphor of a game. By studying games, game theorists seek to better understand everyday interactions including business strategies and political actions. Game theory is very versatile and has even been applied in the study of warfare, technology licensing auctions, and even divorce settlements (Singh & Saunders, 2002). The theory is based on the assumption that, "in serious interactions, as in games, the individual's choice is essentially a choice of a strategy, and the outcome of the interaction depends on the strategies chosen by each of the participants" (McCain, 1999). Game theory and social studies on computer games complement each other very well. The definitions and theories already generated by studies in the field of game theory provide a good basis for social game studies. The high level of interactions, the variety and the complexities of the modern computer game also offer in return a unique tool for studies in game theory.

Game theory involves the use of mathematical equations based on psychological assumptions to describe and predict situations in which multiple parties have an interest. The outcome of the situation is determined by the interrelationship of the decisions made by these parties. In a competitive environment then, people do not just make a decision based on their own assessment of the situation, but also based on what they perceive others to do and how that will change the situation. Colman (1982) suggests that "the theory of interdependent decision making" captures the essence of the theory in a less misleading way than the chosen title of *game theory*.

The main aim of this study is not to unravel or mathematically describe the digital gaming environment in terms of game theory. Instead some of the principles of game theory are introduced and serve as a supplement for the explanations of the digital gaming environments and illuminate the origin of the thoughts examined by this study.

3.1.1 Game Theory Terminology and Digital Gaming

Bierman and Fernandez (1995), provide a formal definition of a game from a game theory perspective, by describing six elements inherent to a game. These elements are described below with their relevance to digital gaming:

The players

The players in a game are defined as the decision making entities. Human players are labelled *strategic players* while a changing gaming environment is a non-purposeful 'player' in the game.

Order of play

Order of play categorizes games into either *sequential move* games (e.g. Chess) or *simultaneous move* games (e.g. FPS and RTS games, see section 4.2). The variety of genres of computer games on the market includes examples of both these types, and mixtures thereof.

Information available

Each player in the game has a degree of information available to them about the game and about the actions taken by the other players. Usually different degrees of information are available in digital games. It is unlikely that here will ever be an entertainment based game with *perfect information* available. Perfect information would eliminate the need for choices and turn gaming into a purely mechanical activity. Digital games are therefore games of *imperfect information*.

Actions available

The actions available are the set of choices available to players at each part of the game. Players may have a *pure strategy* which is a rule that tells them what to do at every point and in every contingency of the game, or a *mixed strategy*, with which they choose randomly between the actions available to them. Purposefully playing a game with one strategy in mind based on extensive knowledge may qualify as a pure strategy. Haphazard play with spur of the moment strategic changes would be a mixed strategy.

Outcome and payoffs

Strategies and their outcomes can be associated with a set of payoffs. Actions are based on the perceived outcomes and payoffs most in line with the goals of the player. A player's strategies

and actions may be modified depending on whether the gaming situation is satisfying the highest rank goals of that player. For example, players may start out with the goal of quickly crushing an opponent, but then later decide to withdraw from attacking to allow their opponent to recuperate in order to prolong an entertaining gaming experience. An enjoyable gaming experience therefore becomes the *highest payoff*.

Based on further developments in the field of game theory, additional qualifications can be awarded to games. Games can be divided into one of two main categories, *cooperative* and *competitive*. Digital gaming particularly, can be classified at various levels. At first glance, digital gameplay falls into the category of competitive games. It would appear that competitive digital games should be labelled *zero sum* games. In these types of games, like in chess, someone wins and someone loses (McCain, 1999). In contrast, in a non-zero sum game both sides can win or lose. Luce and Raiffa (1989) states that although the rules of certain games make them strictly competitive, they are not always played competitively. In most digital gaming situations it would be plausible to term the gameplay as non-zero sum because even losing players gain from the gaming experience. Participating in playing digital games can thus be said to be cooperative in nature, with all sides 'winning' by enjoying the gaming experience. Gaming can also be said to be cooperative in terms of cooperating with team-mates to achieve certain goals. Even though gaming is described as an enjoyable activity for all the core basis of the game itself still dictate that one side wins and the other side loses. Competitive multiplayer games are therefore zero sum games.

Cloman (1982) classifies games into the factors which decide the game's outcome, namely: skill, chance, and strategy. In games where a player's skill determines the games outcome it can be said that decisions are made under the condition of certainty. In games of chance decisions are made in uncertain conditions. In such games players do not control the game outcome completely. The outcomes for games of strategies are based on the decisions made by multiple decision makers. Multiplayer digital games contain elements of all three these game classifications. Initial strategic decisions made by players put them in advantageous or disadvantaged positions in which they have to use their skills to engage other players. Game players choose a strategy to attempt to gain the upper hand. The strategy that gets chosen is in response to the perceived strategy employed by the opposing players. The strategy that a player uses the most frequently in response to a variety of opposing strategies is said to be that player's *dominant strategy* (McCain, 1999). In a recurring game, players will employ their dominant strategies to ultimately form dominant strategy equilibrium. It is in the development of this state and the maintenance of this strategic deadlock that this study investigates the conscious thoughts of the gamer.

3.2 Verbal Analysis

3.2.1 Introduction to Verbal Analysis and Protocol Analysis

The primary method of data collection is based on specific methods of analysing verbal reports that are collected concurrently to gameplay. One of these is Michelene Chi's *Verbal Analysis*, which was developed over years of research (Chi, 1997). Although verbal analysis is a term that can be applied to techniques such as interviewing and discourse analysis, it differs considerably in this case. Chi's verbal analysis is a method based around the method of protocol analysis (or verbal protocol analysis) as described by Ericsson and Simon (1980). Protocol analysis is the other method used as a guideline in this study. It involves the recording and analysing of constant verbal reports given during an activity like problem solving. It has a stringent set of rules and assumptions. A variety of methods, like Chi's method, have evolved from Ericsson and Simons' classical protocol analysis in order to diversify the scope of its applicability. Where other methods of verbal analysis (like interviewing) focuses on the linguistic content of verbalizations, classic protocol analysis and its derivatives also allows for making inferences about the cognitive processes involved in producing the verbalizations. As such it is ideally suited to the task of exploring thinking strategies. A variety of reasons prohibit the use of purely classical protocol analysis in this study. Mainly the context of recording data during an activity like digital gameplay which involves a high level of perceptual-motor tasks and visual encoding tasks, is especially unsuited for protocol analysis (Green, 1998). Chi's verbal analysis on the other hand does allow for situations like this. Her method is more centred on discovering representations of knowledge. Verbal analysis can therefore be said to be more suited to exploring the 'thought' component. The research conducted in this study is not purely the use of one of these methods, but instead it is an amalgamation to achieve the goals set in the research design. By combining elements of these methods it is possible to then both explore thoughts and thinking strategies, while maintaining a high level of validity. The applicability of the components of both methods will then also be made known.

3.2.2 Classical Protocol Analysis

To get an understanding of the verbal analysis method it is necessary to first understand the assumptions of classical protocol analysis as described by Ericsson and Simon (1980). Their work strived to formalize a method of carrying out and analysing verbal reports generated by thinking aloud exercises. Prior to their research, the use of these types of exercises was still closely associated to the psychological method of 'introspection'. There were already cases of

researchers moving away from introspection to focus on reporting rather than interpretation in an effort to move away from the subjectivity of introspection (Harzem, 2004). The same problems that plagued introspection were still however a concern in these cases (Ericsson & Crutcher, 1991). Most noticeably were issues of validity which Ericsson and Simon attempted to address by providing a formal theoretical framework for classifying, obtaining and analysing verbal reports (Crutcher, 1994).

The use of verbal reports as data in psychological research was deemed as unscientific in the advent of behaviourism (Harzem, 2004). Behaviourism rejected the concept that people have privileged access to their own experiences and that they would report honestly on their experiences. This study specifically incorporates elements of classical protocol analysis as described by Ericsson and Simon (1980) because they adapted protocol analysis in an effort to restore claims of validity to the analysis of verbal reports. Increasing the objectivity of the analyzed data is inherent to that. In line with the focus of this study, classical protocol analysis also allows for making inferences on underlying cognitive structures. This is based on using an a priori model in researching verbalizations. It is therefore also necessary to look at the general model of cognition adopted by Ericsson and Simon in their studies, and to understand their practical implementation of their method to better understand how the safeguards to validity translated into procedure.

3.2.2.1 Validity.

Ericsson and Simon (1980) agreed with the assumption of behaviourism that people's descriptions of their cognitive processes and experiences did not clearly relate to their observed behaviour. They stated that one cannot rule out the possibility that information retrieved when eventually generating a verbal report is different from the information retrieved while actually performing the experimental task. To bypass this problem they proposed that the collection of verbal reports be done concurrently with the behaviour being researched. They suggested that an instruction to research participants to "think aloud" would generate useful and more valid data on the thoughts and their sequences when those participants are engaged in the phenomenon being studied. Also the instruction to "think aloud" would not change the sequence of the thoughts as long as the subject was instructed to only report on the thoughts entering the attention and then not to try and explain them. Behaviourism research principles, however, still disregard verbal reports even if they were given concurrently to the actions under investigation (Ericsson & Simon, 1993). To then further validate the protocol analysis method, an established theoretical perspective was applied a priori to the research implementation. This involved a developed, usually as neutral as possible, theory or model to be adopted before testing and analysis occurs.

Using predefined categories consistent with that theory, verbalizations can then be deemed relevant or not, and be categorized summarily. Lastly, the relevance of questioning issues of methodology in different types of studies is another concern raised by Ericsson and Simon (1980). They noted that methodological questioning was more apparent in studies that dealt with understanding cognitive structures. Other types of studies, for example those exploring a certain type of behaviour, may therefore lack a component of validity. The goals of a study was said to possibly have bearing on the validity of its results when using protocol analysis. Following is a look at these points of validity in more detail and a brief description of how the issues raised here were controlled for in this study.

Effects of verbalization

Ericsson and Simon (1993) noted that the instruction to "think aloud" usually is related to a noticeable change in observable behaviour. To "think aloud" may be coupled with a variety of secondary effects such as embarrassment or removing some of the attention away from the task at hand. Nevertheless, they maintained that the "thinking aloud" exercise was a valid form of the gathering data because even additional inferences brought on by this exercise translated into observable behaviour and that these inferences may be minimized through repeating or practicing the task at hand. They also argue that the "thinking aloud" exercise comes naturally and must therefore be an exercise consistent with normal cognitive processes. The impact of the verbalization during the performance of a task is influenced by two characteristics of the participants. These are: a) their degree of expertise in relation to the task being performed and, b) their degree of verbalisation skill (Someren, Barnard & Sandberg, 1994). The degree of expertise of different participants may prove problematic to studies focused on problem solving. To address this, the current study screened participants in regards to various factors relating to their gaming familiarity and skill (see Chapter 4). Good verbalization skills would have been preferable in order to not let verbalizing hinder the gaming experience, but the degree of verbalization skill was not screened for, specifically to maintain a generalisable sample of participants. By testing various participants it was possible to see the difference in their various verbalization skill levels. Although the level of verbalization skill influences the volume of the data, it does not mean that it influences the validity thereof. As stated by Chi, "…individual differences in verbosity can be factored out by focusing on what the subjects say rather than how much they talk" (Chi, 1997, p. 306).

Deception in verbal reports

Behaviourist principles argue that forms of deception may still arise during verbalizations, even if they were collected concurrently to the behaviour under investigation. During the gathering of verbal reports, research subjects may add preconceived statements in order to portray themselves in a positive light. They may also actively guard against making statements that could

be perceived as negative. In order to try to please the researcher, participants may try to produce responses that they think are desired from them (Rosenthal, 1963). Behaviourism therefore rejects any verbal reports as an unscientific source of data. Ericsson and Simon countered this argument by noting that with enough externalized information it is possible to eliminate the need to trust the subject being studied (Ericsson & Simon, 1993). Opposing or recurrent verbalizations may serve to reveal the honesty or accuracy of other verbalizations. They also made the point that the acceptance of one invalid verbal report should not force a researcher to reject the analysis of verbal reports in general. In this study, practice, repeated testing, and long recording sessions, ensure that enough data is generated to minimize and highlight attempts at deception.

An a priori model

Ericsson and Simon's method uses an a priori, established model as a method of validation. The degree of match between the sequence of verbalizations and the sequence of states predicted by the model is related to the degree of validation in Classical Protocol Analysis. (Chi, 1997). In this type of analysis a neutral as possible model is chosen over a model capable of making the strongest predictions. This allows for data to be generated with the least amount of subjectivity. In this study validity is rather mainly controlled by other methods. A basic model of cognition is however used as a guideline and predefined categories of thinking strategies are used in the task of classifying thinking strategies (see section 3.3)

Analysis of verbal reports

From the analysis of various protocols, the data generated can either be categorized as hard or soft. The more this data is open to different forms of interpretation, the softer it is said to be. This highlights the issue of moving away from producing subjective interpretations towards objective reflections. Ericsson and Simon (1993) note that the interpretation of non-verbal behaviour is especially prone to subjective interpretation. To decrease the incidence of subjective interpretation it will be necessary to verify the generated data by independently recoding the verbal reports in other rounds of coding. Transcribed data in this study was therefore recoded in a second round of coding. Due to a possible transfer effect the results are compared and inconsistencies between the results are addressed. A third round of coding was also carried out, which was in a sense done by working backwards. This was done by assigning the categories created in the first round, and verified during the second round, to the statements instead of generating the category by dissecting the statement (explained in section 5.2.1.3).

The goal of protocol analysis and the goal of this study

Ericsson and Simon stated that methodological questions and concerns are not a priority to studies that collect data for the purpose of formulating hypotheses and generating ideas about

certain behaviour (Ericsson & Simon, 1993). These concerns are however important when the research being conducted wishes to contribute to the understanding of cognitive processes. As stated, uncovering cognitive processes, such as thinking strategies, is part of the focus of this study. The applicability of concurrent verbalization methods to understanding psychological aspects during gaming is also an objective. Issues of methodology are therefore of greater importance to this study. In exploring and clarifying methodological issues and practices, this study attempts to add another component of validity.

3.2.2.2 A general model of cognition and verbalization.

The general model of cognition used by Ericsson and Simon (1993) is based on information processing. It was mentioned that they needed a model that is as neutral as possible and therefore it bears very basic, almost accepted as common sense, characteristics. Elements from the model of problem solving developed by Newell and Simon (1972) were used as reference for creating this model. The model also draws heavily from the cognitive structures summarised by Simon (1979). The two main components of the model are the two sensory stores, the Short Term Memory (STM) and Long Term Memory (LTM) which are regulated by the Central Processor (CP). In addition to these there are four processing mechanisms related to these states. These are recognition, control of attention, fixation, and automation (Ericsson & Simon, 1993). There are two important sections to the model. The first is the interaction of the various components. The basic premise is that information attended to by the central processor is kept in the STM. This information is accessible for further direct processing, for example the creation of verbalizations. Information stored in the LTM must first be transferred to the STM before it can be processed in this way. Information does not stay long in the STM and is either lost after processing or partially transferred and stored in the LTM. The characteristics of the various components are the second important part of the model. The working theory being that the STM is limited in capacity with short term storage capabilities. Only a small number of familiar patterns (chunks) can be stored in the STM. Each chunk is represented by one symbol or pointer to information in the LTM (Simon, 1979) which has a large capacity with relatively permanent storage capabilities.

The processing of information starts with the process of recognition. Ericsson and Simon (1993) use recognition as a process instead of bringing Sensory Memory into their model. Recognition is the process of using information already stored in the LTM to identify information received from the organs. Once a stimulus is recognized, pointers to the information in the LTM get stored in the STM. Links between various types of information stored in the LTM may additionally send information to the STM. This is labelled as association. It is a process that is much slower than

the recognition process. It may even use the STM as an intermediate step. An example here would be recognizing someone and trying to recall where last you've seen them by using an associative path of bringing places you have recently been to into the STM. The Central Processor (CP) regulates the flow of information into the STM via the processes of recognition and association. In the STM this information is heeded. With only a small amount of information capable of residing in the STM at any one time, as new information is heeded, previous information may be lost. The control of attention is another mechanism regulating the heeded information. This mechanism can cause a shift in attention if incoming stimulus is deemed more important. Shifts in attention can be caused sudden movements in peripheral vision, loud noises, and emotions operating through the reticular system (Simon, 1979). This mechanism also rejects other superfluous information from entering the STM. New additions to the recognition network, and storing information in the LTM is termed fixation. Lastly, as processes become more practiced, processing becomes more automated. Automation implies that intermediate steps in the processing model do not enter the STM and are not heeded. According to Ericsson and Simon (1993), only information in the STM can be verbalised, and the contents of the STM can be classified as thoughts.

This proposed model of cognition is linked to a further set of assumptions which describe the thoughts in the STM that can be verbally expressed, and the correspondence between these thoughts and their verbal representations. Firstly, only heeded thoughts can be expressed and verbalization is initiated as thoughts are heeded. Protocol analysis therefore excludes peripheral thought elements that are not directly heeded. Ericsson and Simon (1993) therefore describe verbalizations as reflecting the only the structure of heeded thoughts. Secondly, units of verbalizations correspond to integrated cognitive structures, and pauses and hesitations are good predictors in shifts in processing these cognitive structures.

3.2.2.3 Implementation of protocol analysis.

Elements of implementation have already revealed themselves through the discussion of validity. The important elements of implementation relevant to this study are more thoroughly revealed during the discussion of the final method used during this study (section 3.2.4) and the Data Analysis Chapter (Chapter 5). There is one major aspect that needs to be addressed; the instruction given to research participants. The instruction given to participants directs the process of verbalization, allowing it to yield relevant or irrelevant information.

Protocol analysis focuses on the sequence of thoughts in order to draw conclusions about the underlying cognitive structure. An instruction used for this purpose therefore needs to dissuade

other forms of miscellaneous or introspective thoughts. It needs to draw out only currently heeded information. Ericsson and Simon (1993) developed different sets of instructions to accommodate different types of studies. The three main types of studies that they identified are talk–aloud, think – aloud, and retrospective studies. Talk-aloud instructions are used when the temporal aspect of verbalizations are of the utmost importance. The think-aloud and retrospective type of instructions encourage the verbalization of information that was encoded in the non-verbal form (Ericsson & Simon, 1993). Depending then on the goals of a study, an appropriately adjusted instruction is used to facilitate the generation of acceptable verbalizations.

3.2.3   Chi's Verbal Analysis

Both Chi's (1997) verbal analysis and Ericsson and Simon's (1993) protocol analysis investigate conscious thoughts by means of recording thinking aloud-type information from participants engaged in a specific task. The main difference between the two methods is that where protocol analysis focuses on the process of problem solving, verbal analysis rather seeks to uncover a representation of the knowledge that a person has and applies to a specific task. In order to achieve this goal verbal analysis differs on a number of points. It includes elements of both qualitative and quantitative methodologies. It is these differences and elements that make verbal analysis suitable for use for the collecting of verbal reports in the context of gaming. By looking at the deviations between protocol analysis and verbal analysis it is possible to get an understanding of the method of verbal analysis. Besides the differences between the two methods, there is also a difference in the way protocol analysis and verbal analysis is presented. Where protocol analysis provides more of a theoretical guideline to ensure validity, Chi's verbal analysis is presented as a practical step – by – step process. Furthermore, Chi provides technical details and recommendations to ensure that each step and thereby the overall process maintains a high degree of validity.

3.2.3.1 Key differences between the methods.

The first difference between the methods is the types of verbalizations that they seek to collect. Protocol analysis only wants to collect information directly associated to the thoughts related to the task at hand. It is interested in mapping out the sequence of thoughts in solving a problem, and not subjective explanations from the participants as to why these thoughts were uttered. Verbal analysis seeks to address exactly those verbalizations given outside the boundaries set in the protocol analysis method. It seeks to understand explanations, which include: descriptions, justifications and rationalizations (Chi, 1997).

Types of verbalizations given by participants in a protocol analysis study are regulated by the instruction given by the experimenter and reinforced by practice and the prompting of participants during the experiment. This differs from the acceptable methods of collecting data according to verbal analysis. Any transcribed protocol, including for example that of a straightforward interview, may be subjected to Chi's verbal analysis method for analysis.

In protocol analysis an a priori theoretical model is developed or adopted. Data collected is then tested against this model. In verbal analysis a post-priori model is developed as data analysis uncovers new information.

Both verbal analysis and protocol analysis have their own way of analysing data, and both these analyses need to be justified in terms of validity. In protocol analysis the wellness of fit between the model and the data is an indication of the validity of the model. In the case of verbal analysis both quantitative and qualitative methods of data analysis are accepted as means to test validity. In a quantitative analysis, statistical tests can be used to show whether the data accepts or rejects a hypothesis by finding significant indicators in that data. For a qualitative analysis, validity relies on finding internal measures to substantiate the findings.

Verbal analysis also does not deny the influence of the unconscious, or which protocol analysis describes it as inaccessible and therefore unimportant. Protocol analysis is only concerned with heeded information, not with inexpressible thoughts or other impacting elements like feelings. This is an important consideration when selecting a method suitable to any task under investigation. Protocol analysis, as is, is therefore unsuitable to absorbing, emotive tasks like gaming.

3.2.3.2 Implementation of the verbal analysis method.

Looking at the differences between the verbal analysis and protocol analysis provides an understanding of some of the core components of verbal analysis. It does not however say much about the practical applications of the method itself. Chi (1997) developed an 8 step process to address this issue. These steps are described as sometimes optional and sometimes sequential. In the practical application of them a researcher may have the need to move between, back and forth, and even to skip some steps altogether.

These steps are:
  i) Reducing or sampling the protocols
  ii) Segmenting the reduced or sampled protocols
  iii) Developing or choosing a coding scheme or formalism
  iv) Operationalising evidence in the coded protocols that constitutes a mapping to some chosen formalism.
  v) Depicting the mapped formalism
  vi) Seeking patterns in the coded formalism.
  vii) Interpreting the patterns.
  viii) Repeating the whole process, perhaps coding at a different grain size.

The steps that are relevant to this study are further explored during the actual analysis of the protocols. Chi (1997) does however highlight other technical concerns that may not be related to the above steps, but are related to other aspects of the verbal analysis process. Those concerns that are relevant to this study need to be discussed.

3.2.3.3 Technical concerns.

Firstly there are relevant concerns on the process of collecting verbal reports. Chi highlights the need for researchers to provide objective guidelines that were, or should be, adhered to during the collection phase of the process. These guidelines should include: methods used by the researcher to remain as unobtrusive as possible, the frequency and types of prompts to be used, and descriptions of the practice trials.

The second major set of concerns deals with data analysis issues. There is a variety of techniques available to ensure the validity of the analysis phase. These include: inter-rater reliability, successive analysis, within-subject analysis, and top-down and bottom-up processes. This study mainly uses successive analysis. For such an analysis Chi recommends a preliminary coding session and subsequent rounds of coding without referencing the previous rounds. A high correlation between the different sets of results would already indicate results with a higher degree of objectivity. After the first round it is then possible to identify general or more suitable categories for the purpose of performing a second coding session. After that, a final comparison will show the degree of fit and the areas of discrepancy between the different results. At this stage any remaining discrepancies in the results can be resolved to yield the final product.

3.2.4 A Hybrid Method of Analysis

In uncovering the differences between the two methods described above, it is possible to see that there are elements in both that are suitable for the goal of this study. It has already been described how some of these elements were used in this research. This section now describes exactly what evolved from a combination of these methods to form the final product, a hybrid model, used in this study.

In line with the goal of exploring and Chi's method of verbal analysis, this study seeks to collect a variety of verbalizations and not purely those directed towards problem solving. This research also wants to uncover those thoughts and thinking strategies that are prominent during regular gaming without the process of collection information impacting strongly on the results. To achieve this an instruction, like one used in protocol analysis, is given to participants to discourage explanation. Training only involves acclimatising participants to the process of thinking-aloud while minimal prompting directs the process. This sets the mood for participants to verbalize their thoughts concurrently to gameplay without too much worry of methodological constraints, while at the same time steering away from any thought deviation that may be brought on by too much introspection.

Again it would seem that the exploratory nature of this study sides more towards verbal analysis instead of classical protocol analysis when it comes to developing a model post-hoc as information is uncovered. Where the thought content of gamers during gameplay may be speculated upon, it would be premature to suggest an absolute a priori model to predict this. Instead descriptions and categories of thoughts from three different cognitive models are used (see section 3.3.1 and section 3.3.2).

This study incorporates aspects of exploring both thoughts and thinking strategies. Types of thinking strategies have been better researched within the context of gaming (Hong & Liu, 2003). This means that the incorporation of an absolute a priory theory on types of thinking strategies and cognitive processes associated with them is possible. This hybrid method of analysis therefore develops a post hoc classification system for the thoughts uncovered during the study, and adopts an a priori model for the classification of thinking strategies (see section 3.3.3). The overall developed thoughts classification system is then further modified and substantiated by qualitative exploration during the course of analysis (see Table 4.).

The validity of the hybrid model as a method of analysis has to be discussed to see if it complies with either the precepts of protocol analysis or verbal analysis. This study, being primarily

qualitative in nature, relies mostly on factors of validity inherent to qualitative research designs. These are factors such as finding internal support for any form of interpretation done in the study, especially when categorizing and analysing thoughts. This is the same as the assumptions of verbal analysis. Although an a priori model is used to categorize thinking strategies, it is not the intention of this research to validate or dispute this model. It merely uses it as a reference and stating point in the exploratory process.

3.2.4.1 *Implementation of the hybrid model.*

So far the parts of the hybrid model have been mostly academically described, mainly in terms of their positioning in relation to protocol analysis and verbal analysis. Following is a diagrammatic breakdown (see Figure 4) of the actual steps involved in applying the theoretical hybrid model to the research process.
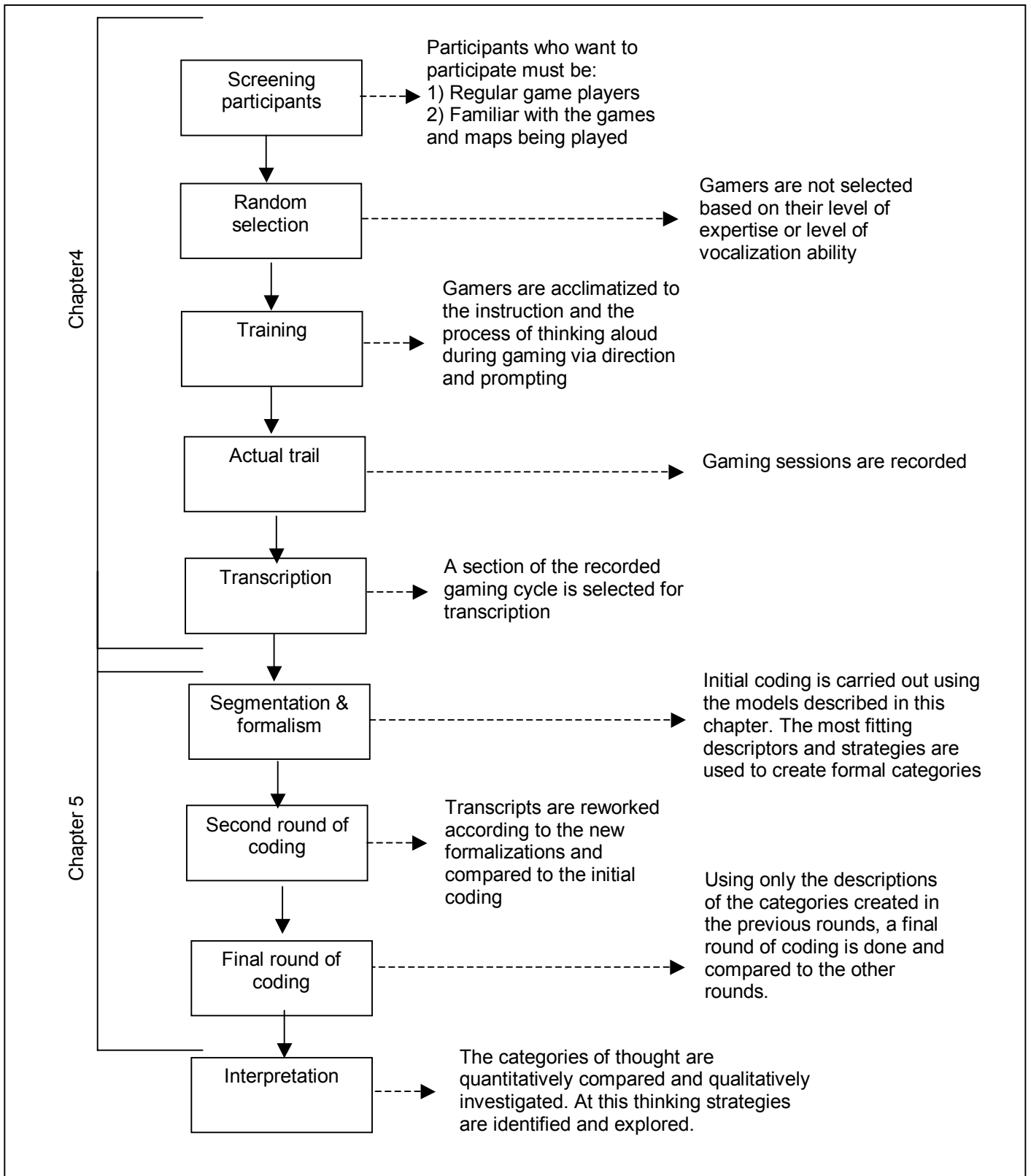
Figure 4. Implementation of the hybrid model in relation to thought exploration.

3.3 Thoughts and Thinking Strategies

Thoughts and thinking strategies are very broad terms. Each can be defined and approached from numerous perspectives. Before a study can be presented on one of these subjects some issues need to be addressed to clarify the approach used in that study. Firstly it needs to be looked at exactly what aspect of thoughts and thinking strategies can be accessed through the method of research employed. Then, what aspect of these the researchers choose to present. Finally, in line with their theoretical approach, how they choose to interpret and represent their findings. In this section then, thoughts and thinking strategies are first viewed in their broader psychological context, and then by looking at the method, aim, and theoretical perspective, of this research, they are more specifically defined for the context of this study.

3.3.1 *Context of cognition*

At its most basic form the current assumption of this study is as follows: the stimulus of the gaming experience elicits thoughts that are translated into behaviour and in-game actions and expressed through concurrent verbalizations. This assumption may be misleading without further classification. The two major considerations that need to be highlighted are that not all that is expressed is purely cognitive in nature and secondly, not all thoughts are expressed. The first consideration can be clarified by placing cognition in context. This is done by providing a basic model to show some of the interrelated components surrounding cognition (see Figure 5). The latter consideration is addressed by discussing the relationship between thoughts and vocalization, the categories of thoughts, and identifying those categories that may be accessed by the use of verbal analysis.

Jordaan and Jordaan (1992), classifies cognition as a subsystem of experience in a model on the conversion of stimulus into behaviour. Looking at this model it is possible to see some of the other interrelated subsets that interact to produce behaviour.
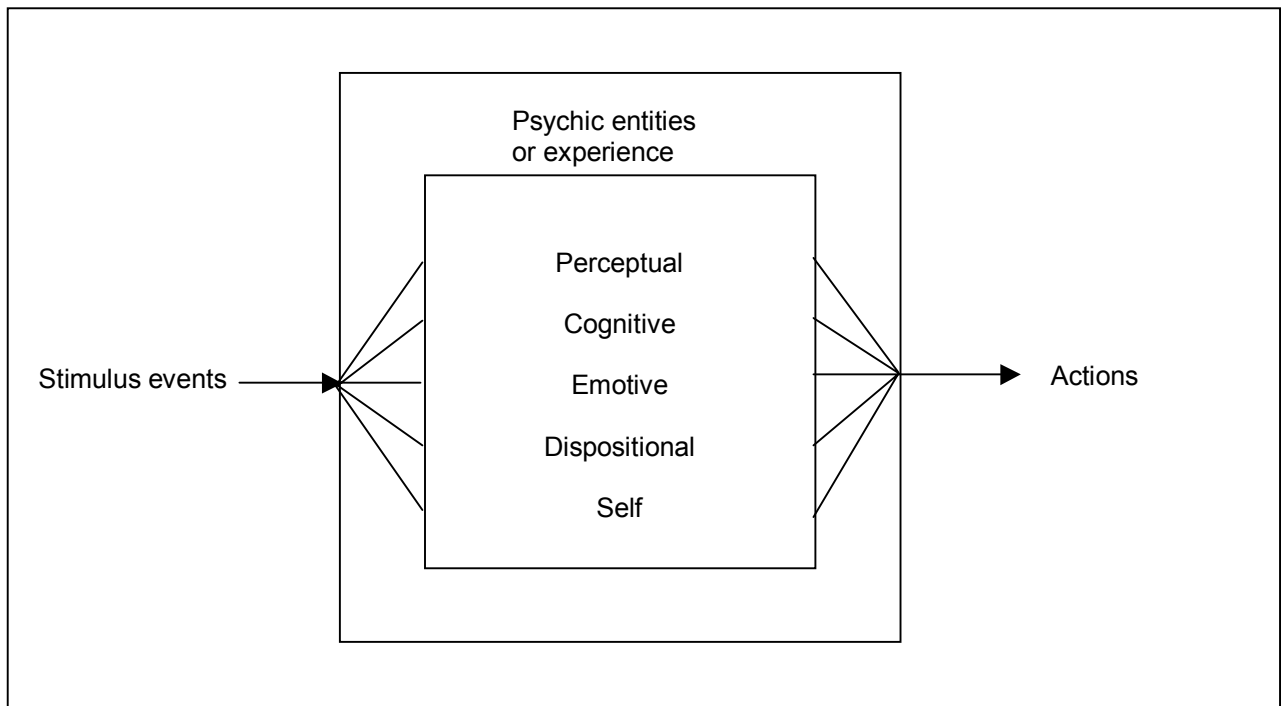
Figure 5. The linear model of psychology as the science of human experience and behaviour (adapted from Jordaan & Jordaan, 1992, p. 325).

During data analysis it is imperative to remember these subsystems in order to gauge their possible impact on the behaviour displayed. In a normal problem solving task like explaining the process involved in solving a mathematical equation, these additional subsystems have only a small bearing on the results. They do however have a much larger impact on the results of this study because an activity like gaming is highly visual, emotive, and absorbing. The protocol analysis method focuses on the former type of problem solving task, and verbal analysis method more on this latter type of study.

Although the protocol analysis method steers clear of including unexpressed thought elements and unclear expressed influences such as feelings (Ericsson & Simon, 1993), it is necessary to do so in this study. In this research the focus remains on thoughts that are vocalised, but because of the nature of gaming and the goals of this study, inferences must also be made on the un-verbalised components. This can be achieved by analysing vocalised and behavioural sources of information like: the nature of statements, tone of voice, emotive indicators such as laughing, body language, and actions. The interpretation of these components is more subjective in nature and the validity of the interpretations must be controlled by strategies advocated by the method of verbal analysis.

The concept of thought as it is presented in this study only starts to emerge from the preceding discussions. Concrete simplified definitions are still required before models and categories can be selected to compliment this study. A simplified definition of thoughts comes from Ericsson and Simon (1993), who describes thoughts as information structures held in the STM. To explain these structures it is necessary to go further than this to the concept of *thinking*. Thinking can be described as "…a set of processes whereby people assemble, use and revise internal symbolic models" (Gilhooly, 1997, p. 1). The nature of these processes is therefore used to categorise thoughts as explained in the next section (section 3.3.2). Thinking strategies on the other hand refer rather to specific approaches employed in problem solving. These approaches are highlighted in section 3.3.3.

3.3.2 Categories of Thought

So far thoughts in this study can be qualified by two sets of determinants. These are, firstly the nature attributed to types of thinking, and secondly components identified by Ericsson and Simon (1993), and the psychological model of Jordaan and Jordaan (1992).

There are numerous ways in which to categorise thinking, but most methods incorporate some form of *directedness*. Thinking may be more concretely defined as directed (e.g. problem solving), or undirected (e.g. daydreaming). Gilhooly (1997), adds another category alongside these, namely creative thinking. Jordaan and Jordaan (1992), does not categorise creative thinking as a separate form of thinking but does say there is something special about it. These three categories serve as the first qualifier for thoughts in this study. Special attention is given to directed thinking since this study studies a task orientated activity. Jordaan and Jordaan (1992), then further categorises directed thinking into reproductive and productive categories. Reproductive thinking is the execution of mental tasks by means of reproducing already acquired knowledge. Productive thinking involves the systematic manipulation of symbols to "…create information by discovering new relationships and by reorganising existing information in an original way" (Jordaan & Jordaan 1992, p. 437). Problem solving is a form productive thinking and is dealt with in more detail under the label of thinking strategies in section 3.3.3.

These categories serve as a starting point in the analysis of the verbal and non-verbal data generated by the thinking-aloud exercises. They can then be adjusted or expanded upon based on assessment in the interpretation of the data.

The categories of thought can be further qualified by incorporating ideas defined by Ericsson and Simon and the psychological model of Jordaan and Jordaan (see Figure 5). Ericsson and Simon (1993) identified three kinds of verbal information. Verbalizations that reflects the current problem situation is termed Current-State information, and are characterised by verbs such as "be" or "have". Next there are verbalizations that that reflect goals or intentions. These are termed Future-State and they are characterised by phrases such as "One day I will…" or "When I get…". Lastly there are verbalizations that reflect Modal-State information. These are hypothetical assumptions or guesses characterised by words such as "if" or "maybe". Jordaan and Jordaan's model, provide further terms that can be used for thought qualification. Thoughts may then be labelled as *perceptual* ("Oh, there they are…"), cognitive (" I must get there before them to get the supplies…"), *emotive* ("Oh no!"), *dispositional* ("I want to win, I am a winner"), and related to the *self* ("I am picking up the ammunition.").

The different models and classifications are all combined to provide a classification framework that is used to develop salient coding categories during the course of investigating thoughts (see Figure 7)

3.3.3 Thinking Strategies

Thinking strategies has been linked to problem solving which is a form of productive thinking.

Hong and Liu (2003) classify thinking strategies into three distinctive modes namely: trial and error, heuristic, and analogical. These categories were used by Hong and Liu (2003) in a study conducted to distinguish between expert's and novice's modes of thinking. For the purpose of this study, it provides a reference to the question: If productive thinking is elicited by gaming, what is its nature?
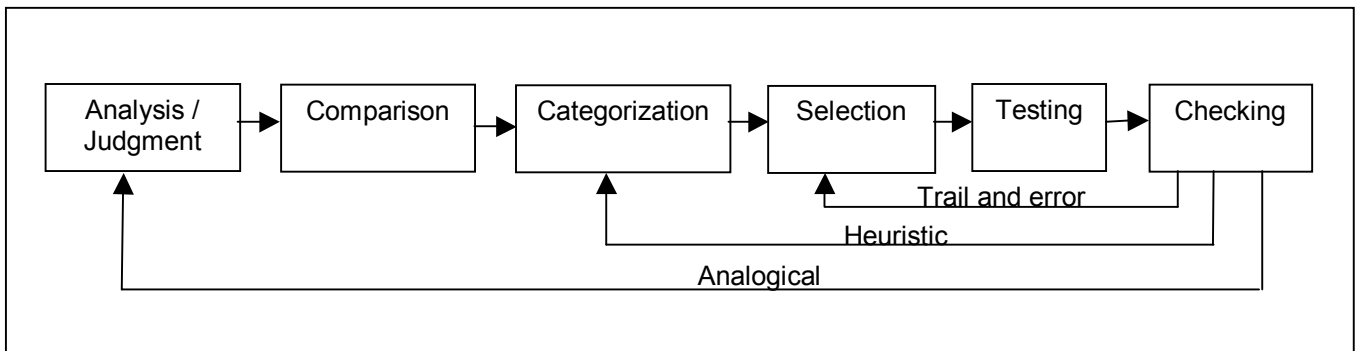
Figure 6. Different mental processes in problem solving, Hong and Liu (2003).

The three categories each have a different degree of complexity. A trial and error type of thinking strategy represents the most basic thinking method in problem solving. It is characterised by the thinker dealing with a problem without any particular plan or strategy. A heuristic type strategy is the next level of complexity and implies the thinker approaches a problem with a set strategy or plan in mind based on information gathered by applying trial and error type thinking. At the most complex level of these thinking strategies is analogical thinking. This type of thinking is characterised by an initial selection of a 'best strategy'. Analogical thinking has been found to be more prevalent in expert players as opposed to novice players in non-competitive gameplay (Hong & Liu, 2003).

3.4   Interpretation and Data Representation

This section summarises the method that will be used to gather and interpret data. It also provides clarity on the theoretical framework which was used to classify the data.

From protocol analysis and verbal analysis a hybrid method was formed to investigate thoughts and thinking strategies during gaming. This method is used to gather and interpret data in this study (Table 4.).

Table 4. Framework for data interpretation using the hybrid method.

	Thoughts	Thinking Strategies
Coding	Coding is guided by: 1)The context of cognition (section 3.3.1) 2) Categories of thought (section 3.3.2)	Coding adheres to the model used Hong and Liu (2003).
Interpretation	Coding categories are changeable based on emerging data. Once categories are established and assigned to statements they can be proportionally compared (section 5.3.2)	Which are the dominant modes of thinking strategy employed: 1) In different genres of games? 2) By different participants? (section 5.3.3)

Thoughts elicited during gaming have been described as not just products that are purely cognitive in nature. A variety of components, conscious and unconscious, impact on thoughts. To prevent highly subjective data interpretation an initial classification framework was developed (see Figure 7).
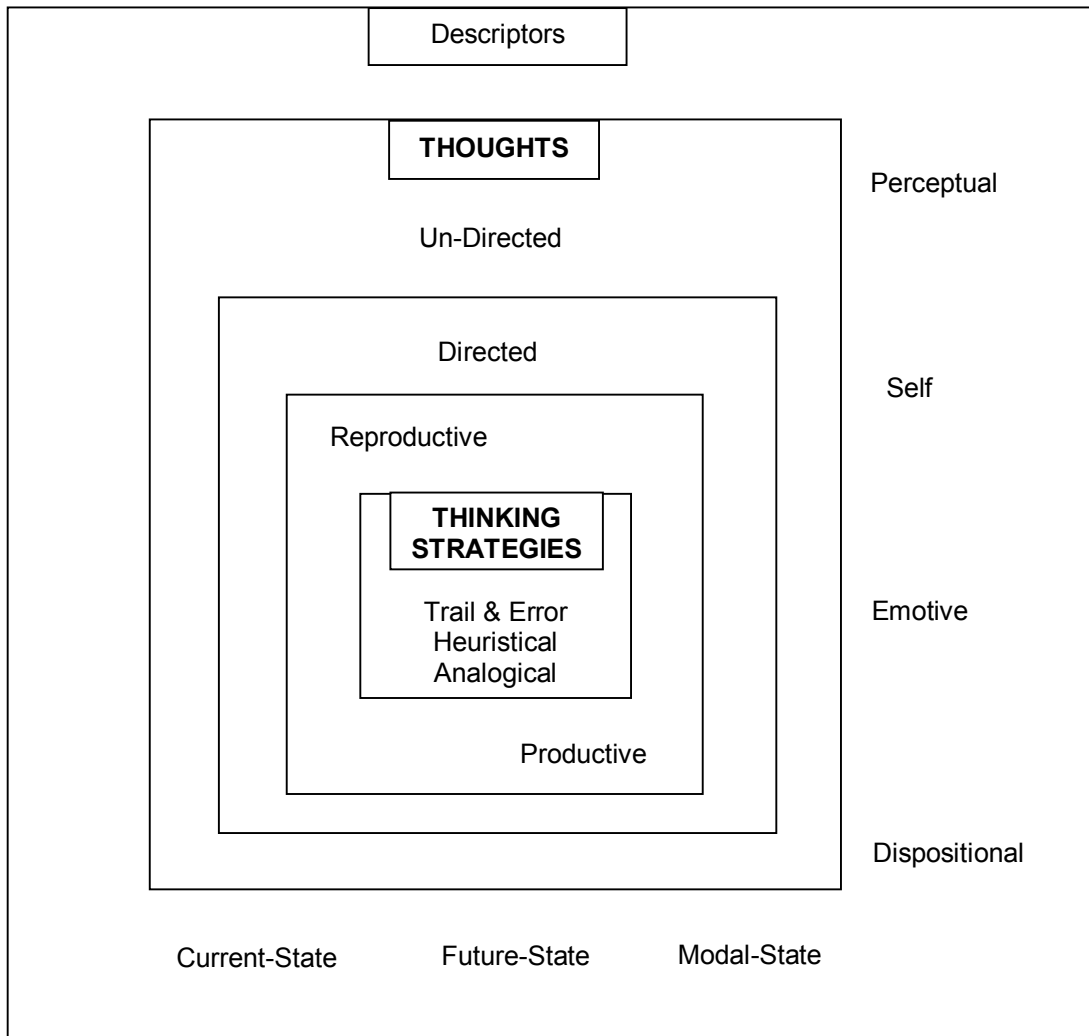
Figure 7. The classification framework.

Data gathered for different gamers playing different games can be separated into categories (Table 5.). From the data the overall thoughts and thinking strategies elicited by gameplay can be explored. By comparing the data generated by the different gamers to each other, it would be possible to see how well a verbalization exercise functions in this context. Lastly the different genres of games can be compared to each other to see if they impact differently on the thinking process.

Table 5. Framework for data representation.

Overall comparison			
	Gamer description	**First-Person-Shooter**	**Real-Time Strategy**
Participant 1 **Participant 2** **Participant 3**	How often do they play games? How good are they at playing? Why do they play games? What style of gamer are they?	Thoughts and thinking strategies exploration	Thoughts and thinking strategies exploration
Participant comparison		Genre comparison	

3.5   Chapter Summary

This chapter examined the theoretical background and models that were used in this research. Terms and principles of *game theory* were looked at to provide classifications and tools to contextualise and explain gaming. Then the main process of investigation *verbal analysis* was explored and adapted to the context of gaming. The verbal analysis method used in this study contained elements of both classical protocol analysis as described by Ericsson and Simon (1980) and the verbal analysis method developed by Chi (1997). Finally, a *hybrid method* of analysis was developed to interpret the results of implemented the verbal analysis method. This hybrid method provided tools to classify *thoughts* namely by exploring the context of cognition and advocating the use of various thought descriptors to develop coding categories during analysis. The hybrid method prescribes concrete categories, as described by Hong and Liu (2003), for the analysis of *thinking strategies*. This Chapter also includes diagrammatic representations to summarize the different models and to show where they fit into the practical implementation. This leads into the next chapter which specifically deals with the quasi-experimental setup and the implementation.

CHAPTER 4

THE COMPONENTS AND THE QUASI-EXPERIMENTAL SETUP

This chapter discusses the nature of the research, its design and its practical implementation. The research method is best described as quasi-experimental. This involves adding elements of an experimental design to a setting, such as a natural social setting, where the stringent controls required for a true experiment is lacking (Cook & Campbell, 1979). It is essential to discuss some of the methodological and the practical components of the research. This includes the games and participants that were selected and the steps taken in eliciting and capturing the responses. The genres of games, chosen on the merit of their popularity have various characteristics that need to be explored. The selection of participants during the implementation of the quasi-experiment is also discussed in this chapter. Along with a pilot testing session that aided in identifying problematic areas of implementing the research, the implementation of the hybrid method is discussed in a step by step manner according to the procedure detailed in Chapter 3. Finally participant profiles are presented based on their interview results and on the overall impressions that they made.

4.1   The Research Design

This study has many of the characteristics of both a participant observation study and a qualitative case study. It is highly exploratory in its nature with the researcher also participated in the field setting. Still, it is more appropriate to categorize this study as being quasi-experimental instead of a highly controlled participant observation. There are various reasons for this classification. The research design includes a screening process as well as randomization in the selection process. The testing took place in a structured environment using uniform procedures and instructions. Finally there is the nature of the data collected that lends itself to both qualitative and quantitative analysis. Characteristics of the participants in the study were scrutinized in a cases by case basis and compared to the quantitative results

The exploratory nature of this research and the method used to conduct this research both advocate small sample sizes. Protocols are broken down into a statement level which provides rich data for every participant for every minute of recording. Ahmed, Wallace and Blessing (2003) note that for every hour of observation an additional 25 hours are required planning, transcription

and analysis. It was initially decided that four participants playing both selected genres of games should suffice in adding enough variety without sacrificing too much detail. In the end only the protocols of three participants were transcribed and analysed (see section 4.3.2). The results of six protocols (one for each genre of game per gamer) were compared to each other and in a case study fashion related back to the individual gamers.

4.2 The Games

There are thousands of games and a multitude of game genres. Selecting the appropriate games for this study was done in accordance with the parameters explained in the beginning of this dissertation namely their popularity in multiplayer environments (see section 1.5.1). Before exploring the choice of games further there are two other important concerns that need to be elaborated upon. Firstly, why select two genres of games? Secondly, what is the nature of multiplayer games?

If only one game would have been chosen for this study the more obvious choice would be selecting the most popular genre of game. This would have meant conducting the study using only a First-Person Shooter game. It is necessary to read the subsequent examinations of the two different genres of games to understand why the FPS may be less suited to the process of verbal analysis. Selecting two genres of games serve a dual function. Due to the seemingly more intellectual nature of the Real-Time Strategy it may be more suited to verbal analysis and therefore provide a possible substitute if the data gathered from the FPS sessions prove to be limited. The other major benefit to having two genres is the possibility of discovering similarities and differences between the natures of the thoughts and thinking strategies that they may induce. Similarities may lead to being able to generalizing findings across all types of multiplayer games while differences may highlight game qualities unique to specific genres. This may also identify areas of concern or specific game properties for future gaming research studies.

Multiplayer games in general are competitive in nature and usually allow for cooperative gameplay. Game players use their abilities sometimes in conjunction with strategies to compete against one another or artificial opponents. Gaming therefore instils the need to outperform or outsmart opponents. While the majority of gameplay can be described as fun or challenging, it may at times easily switch to stressful or frustrating. The multiplayer environment with the physical presence of the different gamers encourages verbal interaction and expression. The seemingly heightened emotion of multiplayer games caused by human-human interaction was also a big contributor towards the choice of multiplayer games for this study.

Following in the next section is a detailed look at the different genres and the games chosen for this study. Both games can be termed multiplayer zero-sum games with elements of skill, chance and strategy (see section 3.1). The selected games are typical games for the genres for which they were chosen.

4.2.1   The First-Person Shooter (FPS) Game

The First-Person Shooter or FPS is a game genre describing the games where the gamer plays the role of someone carrying a gun (for example a hitman or a soldier), from a first- person perspective. This means that the player moves around a virtual environment as if they themselves were in that environment. It is easy to recognise this game by the characteristic weapon appearing in the bottom middle of the screen as if it was carried by the player. The FPS is currently the most famous or infamous genre of game around. While looking at game sales charts the Real-Time Strategy genre outsells the FPS genre in terms of sales, it is the FPS that dominates social gaming events in terms of gameplay time. Jansz and Martens (2005) conducted a survey at a LAN on 176 gamers and found that 65,5% of the gamers preferred FPS genre games. FPS games are referred to as infamous because its usually explicit violent content makes it the target of many aggression studies. Television shows and magazine articles follow this trend by typically using the FPS as the main example in their discussions of the violent influence of games.

There are quite a few studies that focus on the FPS genre of game (Morris, 2002; Wright et al., 2002). Many studies portray the impact of the FPS in a negative light, concentrating on the possible influence they have on players' aggression. Anderson and Dill (2000), drawing their conclusions from studies involving a violent FPS, argues that these violent games prime aggressive thoughts in the short term and they are also likely to have longer lasting effects due to the player learning and participating in "…new aggression-related scripts that become more and more accessible for use when real-life conflict situations arise" (p. 788). In contrast to this, Tamborini, Eastin, Lachlan, Fediuk, Brady and Skalski, (2000), found that immediate enjoyment experienced from playing a FPS resulted in a short-term reduction of hostility. Nevertheless, they do acknowledge the merit of Anderson and Dill's statement that violent games impact on chronic-long term aggressive tendencies. Only a few research articles can presently be found researching the FPS where the focus is not on the topic of violence and aggression. Wright et al. (2002), conducted a study on the social nature of online FPS games. They argue that playing FPS games can "…both reproduce and challenge everyday rules of social interaction while also generating

interesting and creative innovations in verbal dialogue and non-verbal expressions" (Wright et al, 2002, Introduction section, para. 2).

FPS games start off with players *spawning* at different locations in the shared digital environment, meaning the players' digital characters are created within the game. Players usually start with a relatively weak or predetermined set of weapons. Players can then usually choose to attack, defend, find better equipment or in some games, obtain vehicles. Players pursue their objectives either by themselves, or with other team-mates. Eventually opposing team players will clash, usually resulting in the 'death' of some of the players. Those players eventually *re-spawn* somewhere else to repeat the cycle. Besides only attacking each other (a game style referred to as a Deathmatch), certain games types adds extra objectives like capturing flags, controlling strategic points, defusing bombs or protecting one specific player.

The FPS game cycle is usually fast paced and action filled, and most players 'die' at least a couple of times every few minutes. In game theory terms the FPS sides more towards being classified as a game of skill. An initial strategy can be used but ultimately it is the gamer's skill at manipulating the in game character.

The recording sessions for the FPS genre of games lasted for approximately 5 to 10 minutes. After this amount of time the games or maps would change, or players would start getting tired or bored of the recurrent vocalizations. The FPS game played by participants in this study was titled *Unreal Tournament 2004* (© 2004, Epic Games).

4.2.2   *The Real-Time Strategy (RTS) Game*

The second most popular genre of game in terms of playtime at social networking gatherings is the Real-Time Strategy or RTS. In this type of game the action is viewed from a perspective above the game. Players look down at their game units, much like a chess players would look down at their chess pieces. These units are then used for various purposes in an attempt to conquer the other players in the game. As the name of the genre implies, the action is in 'real-time', as opposed to the turn-based nature of many strategic games like chess. RTS is a genre of game that requires both strategic thinking and coordinated action from gamers if they are to be victorious. This genre would therefore seem to be more suitable to providing richer verbalizations.

RTS games usually start with each player controlling one unit or building and a set amount of money or recourses. Players then start to build structural and mobile units. These units serve to gather more resources or intelligence, attack or defend. Players eventually have to expand in

order to secure more locations that provide resources. Different strategies come into play. Certain gamers attack early on, while others prefer to build heavily guarded bases. Skirmishes occur quite regularly but a player can usually only achieve victory by eliminating all of the other players' units.

RTS games have loosely defined phases. During the initial building phase players build up their resources, defences and forces. After this an engagement phase starts where different units of players start coming into contact with each other and fighting. Various scenarios follow. A player's base may for example be damaged so much that he or she may have to retreat and start building from scratch. Once a player has a large enough army to dominate the game they may attack and win the game if other players do not manage to stop him or her. During this end phase that player moves around the map and destroys all opposing units, eventually winning the game. Another strategy may be to rush opponents early in the game with quickly assembled forces in order to cripple them early on. In terms of game theory the RTS game relies much more on strategy to determine the final outcome.

The recording sessions for the RTS genre of games lasted for one cycle from the initial building phase to the end phase when players were destroyed, winning or surrendered. During this study this cycle lasted for about 15 to 25 minutes. No players participating in this study won their games.

The RTS game played by participants in this study was titled *Command and Conquer: Generals* (© 2003, Electronic Arts Inc.)

4.3 Implementation

From the results of the pilot test it was possible to streamline the final testing procedure. The pilot testing and the final testing both took place at regularly hosted LAN at different occasions. The sample of participants for the final testing was also drawn from the previous sample of LAN participants.

4.3.1 The Pilot Test

After attending a few gaming sessions to get to know the regular attendees, a pilot test was proposed and conducted. The pilot test uncovered some of the difficulties and methodological flaws that were encountered in the implementation of the research procedure. Steps 1 to 4 of the

procedure described in the next section were carried out in the latter part of the LAN session. Getting everything into place took some time and felt like a bit of a disruption and inconvenience to the regular LAN activities. Once everything was in place however, things progressed smoothly. Learning from this experience it was decided that the investigation should idyllically start at the beginning of a LAN session. One room was dedicated to the researcher and participant, while the other gamers participated from various other rooms via the network connection (see Figure 8). The presence of a researcher may impact on the verbalisation of the participants (Rosenthal, 1963), but the benefits far outweigh this possible influence. By being in the room with the participating gamer the researcher may observe the participant, prompt the participant to continue verbalising, and contribute to the multiplayer 'feel' of the LAN environment. Ensuring the participant that their abilities were not being evaluated and they would remain anonymous lessens the impact of the researcher being present. With practice, time, and long recording sessions, participants seem to become oblivious of the researcher in the room, and responds more naturally.
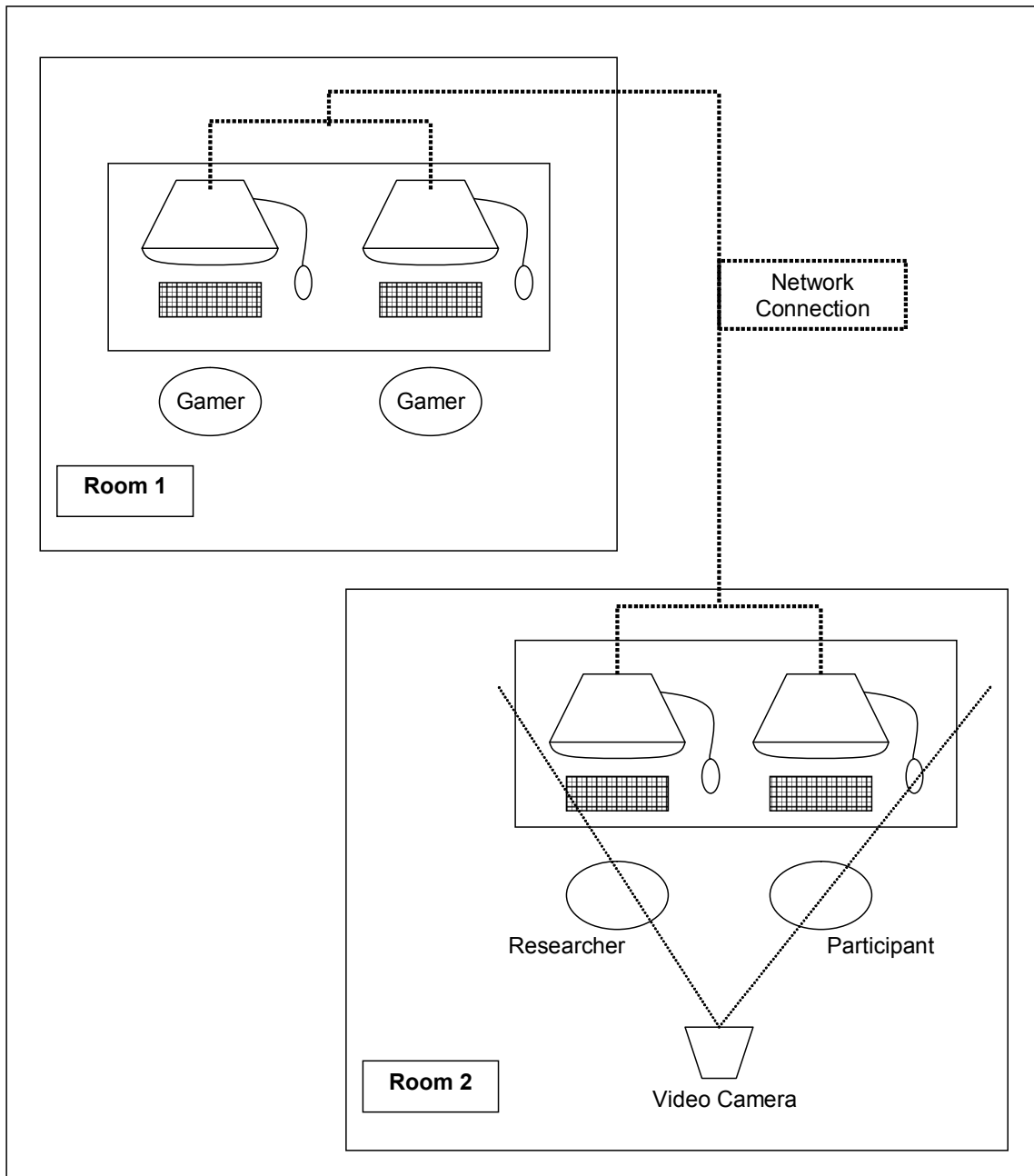
Figure 8. The physical setup.

One of the first problems was encountered right in the beginning of the recording sessions. The instruction that was initially developed proved to be too long and detailed. The true essence of the instruction felt lost in the length of the paragraph. After the second attempt it was decided to rather quickly re-brief the participating gamer, using elements from the instruction, and then read only the most essential parts of the instruction prior to recording (see Appendix B).

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Training participants was done with the FPS game due to its shorter gaming cycles facilitating fewer interruptions by the study on the LAN gaming as a whole. A RTS game would be impractical for training because a participant may become comfortable with the verbalization process a short period into the gaming cycle after which everyone would need to restart for the actual recording.

The only other noteworthy problem was that of game controls setup. When a new participant started a session, customizing the games controls was often neglected at the beginning of the session. This led to interruptions in the gaming session because players would have to periodically stop to change button setups.

4.3.2 Description of the Procedure

The hybrid method as described in Chapter 3 was developed to ensure a uniform testing procedure which is easily replicated. Gamers were informed before attending the LAN that research will be conducted and that they do not need to participate if they did not want to. At the LAN the gamers were briefed on the nature of the study, including the purpose, proceedings and what will be done with the data. Gamers are assured that only the researcher will access the raw data and only release sections thereof with their express permission. They are then invited to participate in the research proceedings.

One of the major advantages to the testing is that it has only a very minimal impact on the regular gaming activities. The only noticeable difference to the gaming event at large is the exchanging of physical positions of the research participating gamers between certain gaming sessions. The steps described in Figure 4 were followed to ensure a uniform testing procedure which is easily replicated.

4.3.2.1 Participant screening.

Gamers were briefed on the requirements of participating and the games and the levels that would be used during the testing. A set of criteria was developed to ensure that those participants selected for the study represented dedicated gamers. To qualify as an adequate candidate for participation the gamer must meet the following criteria:

Avid gamer

The candidate must play the genres of games used in this study on a regular basis, at least for two or more hours a week. This is to ensure that the participant's verbalizations represent the thoughts of gamers and not someone who is still adapting to gaming.

Game familiarity

The candidate must be familiar with the specific games selected for this study. They must also be relatively familiar with the specific game levels (the basic map layouts) selected for testing. This study does not want to investigate the learning curve of gamers when they are exposed to a totally new level. The focus remains on the thoughts and thinking strategies that dominate the average gamer's average state of mind.

Those gamers that believe that they qualify are quickly questioned to make sure that they do indeed fit the criteria. A short questionnaire was given to each of the gamers to address variables that may have an impact on those gamers' state of mind during their regular gaming. The questions asked may give insight into the possible thoughts that are expressed during gaming. The specific questions include:

- Why do you play games?
- How would you classify your usual style of gaming? (If unsure about the question, Prompt: as 'competitive', more as 'just playing for fun', or 'other'?)
- Which genre of game do you prefer, RTS (like Generals) or FPS (like Unreal Tournament)?
- How long have you been playing games, and how would you rate yourself?

Those gamers that meet the given criteria and still express interest in participating are given indemnity forms to read through and sign. A copy of the indemnity form can be found in Appendix A.

4.3.2.2   Participant selection.

To help minimise experimenter biases and introduce an element of randomness, participants were randomly selected from eligible, consenting gamers. This was done by randomly drawing six of the completed consent forms from a concealing box.

4.3.2.1   Participant training.

Some steps have been developed to put the participants in the right state of mind and to help aid them in their forthcoming participation. The specially adapted instruction (Appendix B) was given and explained to them.

There are some very important points to clarify about the process before they start. Firstly, they should play the game as they normally would. The fact that this is not a competition and that there is no testing of ability happening should be stressed. Secondly, it should be highlighted that prompting from the researcher will occur if they remain silent for too long. The recorded trial run was carried out to help ease participants into the process. Prompting participants occurred at more regular intervals during the training.

4.3.2.1   Actual recording.

After the training session the participant were told that the actual recording was starting, and the actual instruction was read again. A FPS game was then joined and recorded. Participants always took part in a FPS game first and then in the RTS game at a later time. After the recording, players were debriefed and thanked.

Out of the six participants only one struggled a lot with vocalization during gaming. Even numerous prompts did not help much in facilitating the process. This participant's protocols were therefore left out of the final analysis. Another two participants' protocols were also not selected for transcription because they did not participate in both FPS and RTS games due mainly to time constraints and availability. After the pilot test an additional two recording sessions were held, but not all of the gamers initially selected for participation could attend both. In the end there were three participants that yielded usable protocols for both FPS and RTS games. On a qualitative level this small number of participants allowed for a more in-depth comparison between the different gamers. With three gamers, six protocols were recorded (one per gamer for each genre of game).

4.3.2.1 Transcription.

Three FPS and three RTS protocols were transcribed. Vocal and visual cues were added to the transcriptions. Full visual descriptions proved to be ineffective. For this reason video tapes were usually reviewed during coding sessions to help decide on the appropriate codes. Almost 600 statements were identified during the next phase where transcribed protocols were segmented (see section 5.1).

4.4 The Participants

The gamers selected for participation were drawn from the attendees of a regularly held LAN. This LAN is most frequently attended by exclusively male gamers although there have been exceptions in the past. The ages of attendees range from late teens to early thirties. This study was implemented over three sessions of this LAN, one for the pilot test and two for the actual protocol recording. The number of gamers attending the LAN on the three occasions was 12, 7 and 8 respectively. During the pilot test six gamers were drawn randomly using the consent forms. The initial participants were all white male South Africans with ages ranging from 19 to 28. Although this homogenous sample affects the ability of this study to draw generalised conclusions across the wide spectrum of gamers, the age and gender group represented in this study does account for a selection of the more typical dedicated gamer (see section 2.2.1). During the next gaming session, six gamers were again selected. Those gamers that were selected for the pilot test were given priority to participate. Four of the original gamers participated in this round. The final round of recording had three gamers that attended all three recording sessions. The most complete data were collected for these three participants which included the initial interview to determine their eligibility for participation, the short questionnaire to determine their gaming style and motivation, and the protocols generated during the pilot test and the two subsequent recording sessions. Overall ten protocols were transcribed and analysed. Four protocols (two FPS, and two RTS) were transcribed from the pilot test. These were used to help start identifying possible categories of thought and thinking strategies. They were also used to fine-tune the instruction given to gamers prior to testing. Six protocols were transcribed from the subsequent two recording sessions. These included a FPS and RTS protocol for each of the core participants. These six were used in combination with the gamers' profiles for the final comparative exploration.

For the sake of analysis, the final selected participants were ranked and labelled according to their gaming expertise. Participant 1 was the most experienced gamer while Participant 3 had the

least gameplay experience. Below is a compiled profile for each gamer. Some of the participants mentioned that they struggled to vocalize during the recording of protocols but their concerns were not justified. Even though the different protocols had varying degrees of richness they were all still very usable.

Participant 1

Participant 1 was a 27 year old business manager. Out of the three participants he can be considered the strongest gamer. He has been playing the longest (at least 15 years) and also plays on a more regular basis than the other participants. He states his main reason for playing is for fun, but that he also gets competitive, especially during RTS type games. He sees gaming as stress relieving and an as an escape. He states that he likes FPS and RTS type games equally, just in different ways. He also states that he dislikes scary FPS games because he becomes too absorbed in the game and hates getting frights. During recording sessions, Participant 1 had the least reservations or difficulties expressing himself.

Participant 2

Participant 2 was a 24 year old Information Technologies (IT) student working at an IT company. He was the most competitive gamer of the three although he states that he mainly play games because of their social nature and that he does not take them too seriously. He prefers FPS types of games and states that although he immensely enjoys RTS games they get too personal. He also says that he never gives up and that he hates losing. During recording sessions Participant 2 was more reserved with his vocalizations, stating that he struggled a bit to concentrate on playing and talking at the same time. When prompted to speak he would try to backtrack a bit and explain what he has been silently thinking or make statements like "My mind is blank". Participant 2 has also been playing games for approximately 15 years, but not as frequently as Participant 1.

Participant 3

Participant 3 was a 26 year old aircraft technician. Out of the three participants he had the least gaming experience, but was by no means an inadequate gamer. Although he has been playing for about 10 years, he does not play as frequently as the other participants. He would occasionally ask technical questions about the game or the map being played, but usually only to himself to help him remember. He states that he plays mostly for fun and to relax. He also likes the challenging nature of games and prefers RTS genre games. Although Participant 3 is the most quiet and reserved outside the game, he had no problems vocalizing during gameplay.

All final participants knew each other for at least three years and were eager to participate in the study. The data generated from their protocols, combined with the pilot study protocols, were

used to develop the thought categorisation scheme (see section 5.2). Their protocols also allowed for a limited comparison between the different gamers and between the different genres of games (see section 5.3). In line with the main objective of this study, thoughts and thinking strategies are explored throughout this process.

4.5 Chapter Summary

This chapter discusses the practical implementation of the adapted method of verbal analysis in the context of a quasi-experimental setup. The most important variables in the study, namely the different games and the different participants, are also examined to provide qualitative information necessary for the analysis of the next chapter.

This study is described as primarily qualitative in nature. Through the various information gathering activities, the process of developing a coding structure, and comparing results along the lines of different genres of games and different participants, thoughts and thinking strategies can be explored. The FPS and RTS genre of game were chosen due to their popularity in multiplayer gaming. In this chapter these genres are explained and their gaming cycles are described. Practical concerns such as the physical setup and implementation are also discussed in detail. A pilot test was conducted to identify problematic issues with this whole process. Lastly the participants are discussed. Four recorded and transcribed protocols (two for each genre) from the pilot test were used to start developing the coding scheme while six protocols (2 per gamer, 1 for each genre) were used for comparative purposes. The development of the coding structure and subsequent exploration of thoughts are discussed in the next chapter.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Transcription and Segmentation

Transcripts were converted into a digital format for easier manipulation. The transcribed protocols were initially segmented into sections representing thoughts. These chunks or *thought segments* were distinguished by various indicators such as pauses between sentences, change in tone of voice, and changes in the idea expressed. Video recordings were used as a visual aid in understanding the context of the verbalizations. From the four protocols selected from the pilot test 333 segments were identified. Thought descriptors (see Figure 7) were assigned to these segments in an attempt to start grouping them into different categories. This exercise proved to be inconsistent. It was decided to develop concrete categories (see Table 6) prior to assigning descriptors to the segments. Segments could then be assigned to the most fitting category. Each category contained two descriptors and 'type' qualifier (section 5.2.1.1). Only the results of the protocols recorded during the two sessions after the pilot test were used for determining which categories to keep (see Table 7). These results were also the only data used for further analysis. Initially the six protocols from the two recording sessions yielded 559 thought segments altogether. During the first round of coding additional segments were differentiated and the final amount of 577 segments were identified.

A second round of segmentation was attempted to represent the thinking strategies. These strategies were represented by both single thought segments and larger collections of these segments. It was found that there was not enough information to clearly assign one of the three identified thinking strategies to the different segments. Instead of trying to force codes onto segments, overall strategies for different phases of the gaming cycle for each game were identified for each participant (section 5.3.3).

5.2 Coding Categories

5.2.1 Thoughts

The classification framework developed in Chapter 3 was used to code the different thought segments and identify different thinking strategies. To insure the validity of the coding, 3 separate uniquely characterised rounds of coding was carried out.

5.2.1.1 Initial coding.

To start, the descriptors of thought identified in Chapter 3 were used. There are two categories with various options in each. Firstly Jordaan and Jordaan's (1992) model of the subsystems of experience was used to classify thoughts as having a character that was either *Perceptual*, *Cognitive*, *Emotive*, *Dispositional*, or related to the *Self*. Next Ericsson and Simon's (1993) types of verbal information categories were used. These classify thoughts as *Current-State*, *Future-State* or *Modal-State*. Finally, besides assigning descriptors, thoughts were qualified into the identified categories of *Undirected*, *Directed Reproductive*, and *Directed Productive* thought. Combining all these options provided 45 different coding categories.

Table 6. The 45 possible coding categories.

	Descriptor 1	Descriptor 2	Thinking Type	Code
1	Perceptive	Current-State	Undirected Thinking	pCu
2	Perceptive	Current-State	Directed Reproductive Thinking	pCr
3	Perceptive	Current-State	Directed Productive Thinking	pCp
4	Perceptive	Future-State	Undirected Thinking	pFu
5	Perceptive	Future-State	Directed Reproductive Thinking	pFr
6	Perceptive	Future-State	Directed Productive Thinking	pFp
7	Perceptive	Modal-State	Undirected Thinking	pMu
8	Perceptive	Modal-State	Directed Reproductive Thinking	pMr
9	Perceptive	Modal-State	Directed Productive Thinking	pMp
10	Cognitive	Current-State	Undirected Thinking	cCu
11	Cognitive	Current-State	Directed Reproductive Thinking	cCr
12	Cognitive	Current-State	Directed Productive Thinking	cCp
13	Cognitive	Future-State	Undirected Thinking	cFu
14	Cognitive	Future-State	Directed Reproductive Thinking	cFr
15	Cognitive	Future-State	Directed Productive Thinking	cFp
16	Cognitive	Modal-State	Undirected Thinking	cMu
17	Cognitive	Modal-State	Directed Reproductive Thinking	cMr
18	Cognitive	Modal-State	Directed Productive Thinking	cMp
19	Emotive	Current-State	Undirected Thinking	eCu
20	Emotive	Current-State	Directed Reproductive Thinking	eCr
21	Emotive	Current-State	Directed Productive Thinking	eCp
22	Emotive	Future-State	Undirected Thinking	eFu
23	Emotive	Future-State	Directed Reproductive Thinking	eFr
24	Emotive	Future-State	Directed Productive Thinking	eFp
25	Emotive	Modal-State	Undirected Thinking	eMu
26	Emotive	Modal-State	Directed Reproductive	eMr

			Thinking	
27	Emotive	Modal-State	Directed Productive Thinking	eMp
28	Dispositional	Current-State	Undirected Thinking	dCu
29	Dispositional	Current-State	Directed Reproductive Thinking	dCr
30	Dispositional	Current-State	Directed Productive Thinking	dCp
31	Dispositional	Future-State	Undirected Thinking	dFu
32	Dispositional	Future-State	Directed Reproductive Thinking	dFr
33	Dispositional	Future-State	Directed Productive Thinking	dFp
34	Dispositional	Modal-State	Undirected Thinking	dMu
35	Dispositional	Modal-State	Directed Reproductive Thinking	dMr
36	Dispositional	Modal-State	Directed Productive Thinking	dMp
37	Self	Current-State	Undirected Thinking	sCu
38	Self	Current-State	Directed Reproductive Thinking	sCr
39	Self	Current-State	Directed Productive Thinking	sCp
40	Self	Future-State	Undirected Thinking	sFu
41	Self	Future-State	Directed Reproductive Thinking	sFr
42	Self	Future-State	Directed Productive Thinking	sFp
43	Self	Modal-State	Undirected Thinking	sMu
44	Self	Modal-State	Directed Reproductive Thinking	sMr
45	Self	Modal-State	Directed Productive Thinking	sMp

Each thought segment was assigned a first descriptor (p, c, e, d, or s), then a second descriptor (C, F, or M), and then a type (u, r, or p). Combining these after three rounds of assigning created one code matching one of the 45 coding categories. Appendix C contains a transcript example with codes assigned to the different thought segments. During this coding procedure a few thought segments were identified as containing two different categories of thought, while other categories could be combined into one central idea. By implementing these changes a final amount of 577 thought segments were identified.

To clarify the coding procedure an excerpt from the transcripts can be used. For example the first thought segment of Appendix C: "Our main node is going to go (resigned)". The brackets indicate additional information such as the on-screen occurrences or the participants tone or speed of voice. In this case the participant made the statement sounding like he was judging what was going to happen but could do nothing about it, hence 'resigned'. The 'main node' refers to the in-game structure which players need to protect from other opposing players. If your 'main node' is destroyed, you lose the round. Referring to the main node as 'going to go' refers to the destruction of the node. The participant made this statement while heading towards the node. This thought segment was given the code cMp:

First descriptor (p / c / e / d / s)
Firstly 'c' (cognitive) was assigned because the player was not commenting on what he saw on-screen. He was not looking at the main node but commenting on what he believed was going to happen due to seeing the node was under attack earlier in the game. A 'p' (perception) would have been assigned if he was seeing the node being attacked. An 'e' (emotional) would have been assigned if he was shouting in surprise that the node was being attacked. A dispositional descriptor 'd' would not have been applicable in this case unless it was clearly qualified by a description of the participants own character. For example if the statement was "Our main node is going to go, and I am not one to accept defeat", with the emphasis falling on the last half of the sentence, the statement would have been assigned a 'd' (dispositional). Similarly, the 's' (self) descriptor also requires more to be added to the statement for it to be considered a viable descriptor. The statement would be assigned a 's' if it read "I am as good as dead, our main node is going to go", and the emphasis fell on the first part of the sentence.

Second descriptor (C / F / M)
For the second descriptor, a 'M' (Modal-State) was assigned. This was due to the statement being based on an assumption. The node was under attack earlier in the game, before the participant made this statement but he could not be sure that it was currently being attacked and that it would be destroyed. The statement would have been a 'C' (Current-State) statement if he knew for certain that the node was currently under attack and he judged that it would be destroyed. The Future-State descriptor 'F' would only have been assigned if future intentions were stated. If the participant stated "I have to get to the node in order to protect it", an 'F' would have been assigned.

Thinking Type (u / r / p)

A 'p' (productive thinking) was assigned as a 'thinking type'. The participant created this verbalization by incorporating knowledge of what was happening in the game, with previous game experience, and created new information by judging that the node would be destroyed. A 'r' (reproductive thinking) would have been assigned if the participant, for example, stated that they were in trouble because the main node was previously under attack. This means he commented on the situation using previous gaming knowledge, but he did not create new information such as the assumption that the node would be destroyed. A 'u' (undirected thinking) would have been assigned if new information was not created, and the statement was made as a matter-of-factly without further consideration, thought, or focus.

5.2.1.2   *Identifying viable categories and the second round of coding.*

In the resulting data, certain of the 45 codes were very prevalent, while others did not feature at all. To determine which of the coding categories were not feasible a qualitative analysis was done on the all of the different categories. Descriptions were given to each category to indicate the character or characteristics of the different thoughts which could be encompassed by those categories. Common sense deductions about the different descriptors and type of thinking, as well as examples from the text were used to create these descriptions. These descriptions indicated that some of the categories were logically impossible or at the least improbable.

The frequencies of thought segments occurring in each category were examined to further help determine which categories were viable options. In this way categories containing no examples in the protocols were isolated. Those containing extremely few examples (under .02) were re-evaluated. The .02 limit was set to allow more categories to be included in the analysis. A .05 limit would have cut down on the variety of categories included in the analysis and possibly caused the loss of useful distinctions. This re-evaluation confirmed that there were other better suited categories for most of the thought segments initially coded into most of these sparse categories. The examples in the remaining sparse categories were found to be able to be coded into more than one category.

Table 7. Qualitative descriptions of each coding category and the frequencies of thought segments initially coded into each of these categories.

Code	Descriptions	Discard on basis of qualitative analysis	Frequency of occurrences after the initial analysis	Discard on basis of quantitative analysis (< .02)
pCu	Neutral perception about the situation.		.107	
pCr	Evaluated perception about situation.		.279	
pCp	Perceptive statements do not convey deeper thought.	X	.024	
pFu	You can' see something in the future.	X	0	X
pFr	You can' see something in the future.	X	.017	X
pFp	You can' see something in the future. Perceptive statements do not convey deeper thought.	X	.002	X
pMu	The modal state implies some type of thinking not perception.	X	.003	X
pMr	The modal state implies some type of thinking not perception.	X	.005	X
pMp	The modal state implies some type of thinking not perception. Perceptive statements do not convey thought.	X	.003	X
cCu	Cognitive descriptor usually implies some form of directed thought	X	.012	X
cCr	Thinking in or about the current situation		.139	

cCp	Planning is related to the future state	X	.047	
cFu	Cognitive descriptor implies some form of directed thought	X	.007	X
cFr	Stating intentions / wants		.035	
cFp	Stating intentions related to planning		.041	
cMu	Cognitive descriptor implies some form of directed thought. The modal descriptor implies productive thinking	X	.002	X
cMr	The modal descriptor implies productive thinking.	X	.009	X
cMp	Hypothetical thinking or guessing.		.022	
eCu	Emotion derived from a reaction to the situation.		.151	
eCr	Emotion derived from thinking about the situation.		.054	
eCp	Intense emotion is not likely linked to careful planning.	X	.003	X
eFu	Emotional descriptors are only dominant in the current state.	X	0	X
eFr	Emotional descriptors are only dominant in the current state.	X	.002	X
eFp	Emotional descriptors are only dominant in the current state.	X	0	X
eMu	Emotional descriptors are only dominant in the current state.	X	0	X
eMr	Emotional descriptors are only dominant in the current state.	X	0	X
eMp	Emotional descriptors are only dominant in the current state.	X	0	X
dCu	A statement revealing a persons character.		.002	X
dCr	In this situation participants would		.002	X

	not actively think about their dispositions.	X		
dCp	In this situation participants would not actively think about their dispositions.	X	0	X
dFu	Describing future desires in line with their disposition.		.002	X
dFr	In this situation participants would not actively think about their dispositions.	X	.002	X
dFp	In this situation participants would not actively think about their dispositions.	X	.002	X
dMu	The modal state implies some type of thinking	X	0	X
dMr	In this situation participants would not actively think about their dispositions.	X	.002	X
dMp	In this situation participants would not actively think about their dispositions.	X	.000	X
sCu	Self evaluation	X	.012	X
sCr	Introspection is unlikely	X	.010	X
sCp	Deep introspection is unlikely	X	0	X
sFu	Self evaluation can only be in the current-state	X	0	X
sFr	Self evaluation can only be in the current-state	X	0	X
sFp	Self evaluation can only be in the current-state	X	0	X
sMu	Self evaluation can only be in the current-state	X	0	X
sMr	Self evaluation can only be in the current-state	X	.002	X

	Self evaluation can only be in the current-state	X	0	X
sMp				

Note. X indicates the categories that should be discarded based on the analyses.

By combining the results of the qualitative descriptions and quantitative comparison, thought segments that were initially coded into statistically unpractical categories were recoded into viable ones during a second round of coding.

From the analysis of coding categories, it was determined that the *dispositional* and *self* descriptors seldom featured. Especially examples of the *dispositional* descriptor were difficult to identify within the collection of thought segments. Even combining all the *dispositional* categories still resulted in less than .02 of the examples. For this reason the *dispositional* descriptors were removed altogether from the analysis. The *self* descriptor contained enough examples to warrant one category. The category sCu, described as *Self Evaluation*, was chosen as a representative category of all those categories with the *self* descriptor. sCu represents instances where a participant expresses verbalizations indicating a submersion of the self within the game. These thought segments could be identified by forms of self evaluation or identification within the context of the game. A thought segment is only categorized as sCu when the expression of immersion is greater than the expression of perception, cognition or emotion.

One of the more popular coding categories to fall away is cCp. Initially 0.047 of the identified thought segments were assigned to this category. The qualitative analysis pointed towards *productive thinking* (p) being related to creating new information most probably by thinking about the future events and planning. Productive thinking was therefore linked to the *Future-State* descriptor. The segments in this category were also found to be suitable for other categories especially cFr, the category described as *Stating intentions or wants*. The segments were therefore reassigned to the more suitable categories. Nine concrete categories were chosen and named for use in the second and third phase of the coding (see Table 8).

Table 8. The final 9 coding categories and their descriptions.

	Final Codes	Description	Example	Category Name
1	pCu	Perceptual comment. Neutral perception about the situation.	"The sky looks overcast" "He is running into the base" "Car…tree…"	Visual Acknowledgement
2	pCr	Evaluated perceptual comment. Evaluated perception about situation.	"Look like its going to rain today" "Seems like the base is quiet"	Visual Assessment
3	cCr	Thinking in or about the current situation.	"I have got to get off this vehicle" "Guard this point"	Thinking
4	cFr	Stating intentions.	"I am going to get off this vehicle"	Stating Intention
5	cFp	Stating intentions related to planning.	"I am going to sneak attack on their weak side"	Planning
6	cMp	Hypothetical reasoning or guessing. "If", "maybe", or making assumptions.	"It must already be overrun" "I wonder if I can build this over here?"	Assumptions
7	eCu	Emotion derived from the situation or an experience.	"Owww, aaah!"	Emotional Response
8	eCr	Emotion derived from thought.	"Damn! Got to get the next vehicle!"	Emotional Thought
9	sCu	Self evaluation within the game.	"I am taking strain…and I am dead"	Self Immersion

As with the removal of the cCp category, certain statements could easily fall into more than one category. By listening to vocal cues and by observing visual occurrences it is possible to determine the most suited category. "Ah! There is someone here…", for example should be coded into:

- pCr when responding to seeing someone.
- cCr when seeing something is missing and knowing someone is close.
- eCr when the "Ah!" part of the sentence is the main focus of the sentence.

A second round of coding commenced using only the above 9 categories.

5.2.1.3   *Final round of coding.*

The third and final round of coding occurred to ensure the accuracy of the overall coding process. Instead of assigning the component descriptors individually to each thought segment, the nine descriptions assigned to each of the final coding categories were used as a template to assign one of the nine codes to each thought segment. Audio and visual cues from the recorded sessions were used extensively during this phase of the analysis to ensure the thought segments were assigned to the category that they were most representative of. After each assignment, the third phase code was compared to the second phase's code to see if there was an agreement. In cases where the second round of coding did not match the third round, a reanalysis was done to select the best fitting code. In this way thought segments were divided into the most suitable coding category. Appendix C contains an example of the transcripts and the coding.

Throughout the different rounds of coding, there were a total of 286 (0.496) changes. Of these 92 (0.159) recordings were done due to different categories falling away or amalgamating. That leaves a still very high amount of 194 (0.336) changes done between existing categories. Following (Table 9) are the overall results of this final coding. A comparison between the initial coding is also included to provide the reasons for the most notable changes.

Table 9. The final and initial coding scores and the reasons for the changes.

	Code	Initial Amount	Final Amount	Difference	Reasoning
1	**pCu**	62	**99**	37	Some of the pCr comments were found to be pCu during a deeper analysis in the final round.
2	**pCr**	161	**110**	-51	Many of the pCr comments were found to be cCr or pCu comments during a deeper analysis in the final round.
	pCp	14	0	-14	The segments identified for this category were more suitable for other categories, especially cFr .
	pFu	0	0	0	
	pFr	10	0	-10	You cannot perceive the future therefore many of these were recoded into the cMp category which implies hypothetical thinking.
	pFp	1	0	-1	
	pMu	2	0	-2	
	pMr	3	0	-3	
	pMp	2	0	-2	
	cCu	7	0	-7	Mostly incorporated into the cCr category.
3	**cCr**	80	**128**	48	Many of the pCr comments were found to be cCr comments during a deeper analysis in the final round.
	cCp	27	0	-27	The segments identified for this category were more suitable for other categories, especially cFr and cFp.
	cFu	4	0	-4	
4	**cFr**	20	**40**	20	Many segments were adopted from cCp.
5	**cFp**	24	**25**	1	
	cMu	1	0	-1	
	cMr	5	0	-5	
6	**cMp**	13	**23**	10	Many of the pFr thought segments ended up here.
7	**eCu**	87	**89**	2	

8	**eCr**	31	**39**	8	Some of the thought segments initially assigned to the *dispositional* categories ended up here.
	eCp	2	0	-2	
	eFu	0	0	0	
	eFr	1	0	-1	
	eFp	0	0	0	
	eMu	0	0	0	
	eMr	0	0	0	
	eMp	0	0	0	
	dCu	1	0	-1	
	dCr	1	0	-1	
	dCp	0	0	0	
	dFu	1	0	-1	
	dFr	1	0	-1	
	dFp	1	0	-1	
	dMu	0	0	0	
	dMr	1	0	-1	
	dMp	0	0	0	
9	**sCu**	7	**24**	17	The new sCu category contains most of the other *self* and *dispositional* categories.
	sCr	6	0	-6	This category was combined with the sCu category.
	sCp	0	0	0	
	sFu	0	0	0	
	sFr	0	0	0	
	sFp	0	0	0	
	sMu	0	0	0	
	sMr	1	0	-1	
	sMp	0	0	0	

As discussed in Chapter 4, different lengths of the game cycles yielded different length protocols. The lowest amount was 59 thought segments for a protocol while the largest was 156. The amount of thought segments and the categories of thought are shown below (Table 10). The results were all combined to examine the gaming in general.

Table 10. A breakdown of the amounts of thought segments for each genre of game per participant.

		Participant 1		Participant 2		Participant 3		
Category	**Code**	**FPS**	**RTS**	**FPS**	**RTS**	**FPS**	**RTS**	**Total**
Visual Acknowledgement	pCu	15	12	8	10	30	24	**99**
Visual Assessment	pCr	10	13	17	12	21	37	**110**
Thinking	cCr	15	13	12	28	17	43	**128**
Stating Intention	cFr	12	4	2	3	7	12	**40**
Planning	cFp	6	11	0	5	0	3	**25**
Assumptions	cMp	5	6	0	4	1	7	**23**
Emotional Response	eCu	23	9	13	15	12	17	**89**
Emotional Thought	eCr	16	3	2	3	5	10	**39**
Self Immersion	sCu	11	0	5	1	4	3	**24**
	Total segments	**113**	**71**	**59**	**81**	**97**	**156**	**577**

From this point the amounts of thought segments for each participant were converted into frequencies to allow for a better comparison (section 5.3).

5.2.2   Thinking Strategies

Identifying *Trial and Error*, *Heuristical* and *Analogical* thinking strategies proved to be problematic. Although it was possible to identify strategies it was much more difficult to confine them to specific segments. Even audio and visual cues together with the transcripts did not provide enough information to accurately code different segments or groups of segments with different thinking strategies, especially during FPS genre games where the game situation changes rapidly. What seemed like an analogical approach to a situation, soon degraded into a reactive situation as the action heated up. General trends like these could be identified throughout the gaming cycles of the different genres of games. There were noticeable differences between the different participants. At times some of the participants engaged in *Trial and Error* strategies. At

some instances it was due to reacting to the happenings of the game, but at other times it was used as an active strategy to gather information about the activities of the other players. *Heuristical* approaches could be seen when participants would try to repeat successful strategies. Finally, *Analogical* strategies could be seen, as participants started certain gaming cycles based on a best judgement approach.

In contrast to Participant 1, the absence of a clear *Analogical* strategy at the start of both Participant 2 and 3's FPS game protocols served as an indication that there were definitely differences in thinking strategies between the various participants. So while it may be impractical to identify segments of *Analogical*, *Heuristical* or *Trial and Error* thinking without post verbal analysis interviews, it was possible to identify broad overall strategies. It was also possible to see that these strategies changed most noticeably with a change in the gaming pace and objectives. This meant that these changes could best be identified with a change in the amount of onscreen action or at different phases of the game. Using this information, broad strategies were identified to contribute to the overall exploration (see Table 5.11).

5.3   Discussion of the Results

The content of the protocols were briefly looked at to start the discussion of the results. The identified thoughts and the thinking strategies, and the frequencies of their occurrence, are then examined. Finally the results of the thinking strategies and thought categories are combined to examine the degree of fit between the two.

5.3.1   Comments on the Content

The transcribed protocols mainly reflect thoughts related to the activity of gaming. Commenting on the frequency and nature of these thoughts is done in the next sections. Before this there is a need to comment on the protocols' content free of any synthetically developed structures. This can be achieved by looking at the individual words and how they fit into the overall context of gaming. After completing such an analysis it was found that the content was not as extreme as the prevalent image of gaming would give. This image created by sensationalist media articles and the prominence of researching games in relation to aggression and violence was not reflected in the overall spirit of the analysed protocols of this study. On the whole violent content was only minimally reflected. Only Participant 1's FPS protocol had more evident violent content. This only implies that there were a higher number of violent words in the protocol. Words such as: shooting, blasting, die, dead, and kill. The expression of this content is most likely indicated by his

higher *Emotional Thought* (eCr) score. These statements do not imply that there are not elevated violent thoughts, merely that violent thoughts were not overtly expressed during the verbalizations. The impressions of gaming that the analysis of protocols gave were that the expression of emotion elevation or strain was related to in-game success and failure. This emotional fluctuation, affected by the pace of the action of different genres of games, may also be heightened by players' competitiveness or the violent content in the game.

Swearing may be seen in a negative light, but in this study it serves a positive purpose. Freely swearing while being video recorded can indicate a high level of trust between the researcher and the participant or an un-inhibiting environment. It may also be due to high levels of immersion within the game. Overt swearing on the other hand could indicate a participant is attempting to portray a different image. Throughout the protocols recorded in this study swearing occurred naturally and seemingly unforced. This impression was supported by experiences gained through attending and observing numerous LAN sessions. Swearing is quite a regular occurrence during multiplayer gaming, and one usually linked to heightened emotional moments and planning during stressful situations.

The last significant trend in the protocols' content that requires commenting on is the participants' identification with the game. The following sentence describes the duality of the gamer and the in-game character: "I have always liked fast cars so I am taking one to go faster". Firstly the gamer describes himself as liking fast cars in real life. Secondly he describes himself on the in-game level taking the car. Such 'self inside the game' references are prominent in gaming and qualified by terms such as "I" and "my". Described actions and reactions also indicate this immergence within the game. For example: "Ouch, that hurt!" indicates a deeper level of association with an in-game character. Although references to the self were prominent throughout the different protocols, only those thought segments whose dominant characteristic reflected submergence was categorized as *Self Immersion* (sCu).

5.3.2   Thoughts

The results of the study in terms of exploring *thoughts* are mainly derived from a comparison and exploration of the different frequencies of the different scores between the final nine categories. Although numerous measures were taken to ensure an accurate portrayal in the translation of verbalizations to workable statistics, the number of participants contributing to the final result remains too small to warrant intense statistical extrapolation. Overall there were 577 thought segments available for analysis which justifies quantitative commenting. The score frequencies between the different genres of games may also be compared since all participants competed in

both. So although the smaller sample size may not give an extremely robust quantitative portrayal, it does start to identify trends. Pareto charts were used to identify the categories that contributed the greatest. The smaller sample size also allows for deeper individual explorations and comparisons. The quantitatively derived conclusions must therefore be tempered with the awareness of the sample size, substantiated where possible with qualitative information, and seen in the light of an exploratory investigation.

5.3.2.1 Overall frequencies.

Table 11. Overall frequencies.

Code	Name	Frequency
pCu	Visual Acknowledgement	.171
pCr	Visual Assessment	.194
cCr	Thinking	.219
cFr	Stating Intention	.064
cFp	Planning	.048
cMp	Assumptions	.039
eCu	Emotional Response	.161
eCr	Emotional Thought	.062
sCu	Self Immersion	.042

All the combined thought segments (n=577) were combined to give the overall gaming frequencies. The scores for each protocol were converted to frequencies, then added together to give these final balanced frequencies. By itself it provides a representation of cognition during gaming. In certain ways this representation is limited. Firstly it must be remembered that it is only a cognitive representation which is primarily based on verbalizations and secondarily on visual cues. Secondly that this is a newly developed method and there is no other comparable activities to compare to the overall gaming frequencies. Lastly, only two genres of popular games were used to generate these frequencies, so while the *overall gaming frequencies* can be used as an index in this study, it will first need to incorporate data from other genres of games if it is to be used in studies on different game genres. The overall gaming frequencies can however provide the first look at the cognitive happenings during popular multiplayer gameplay, and as mentioned serve as an index for a psychological comparison of two of the most popular genres of multiplayer games (see Table 12 & 13).
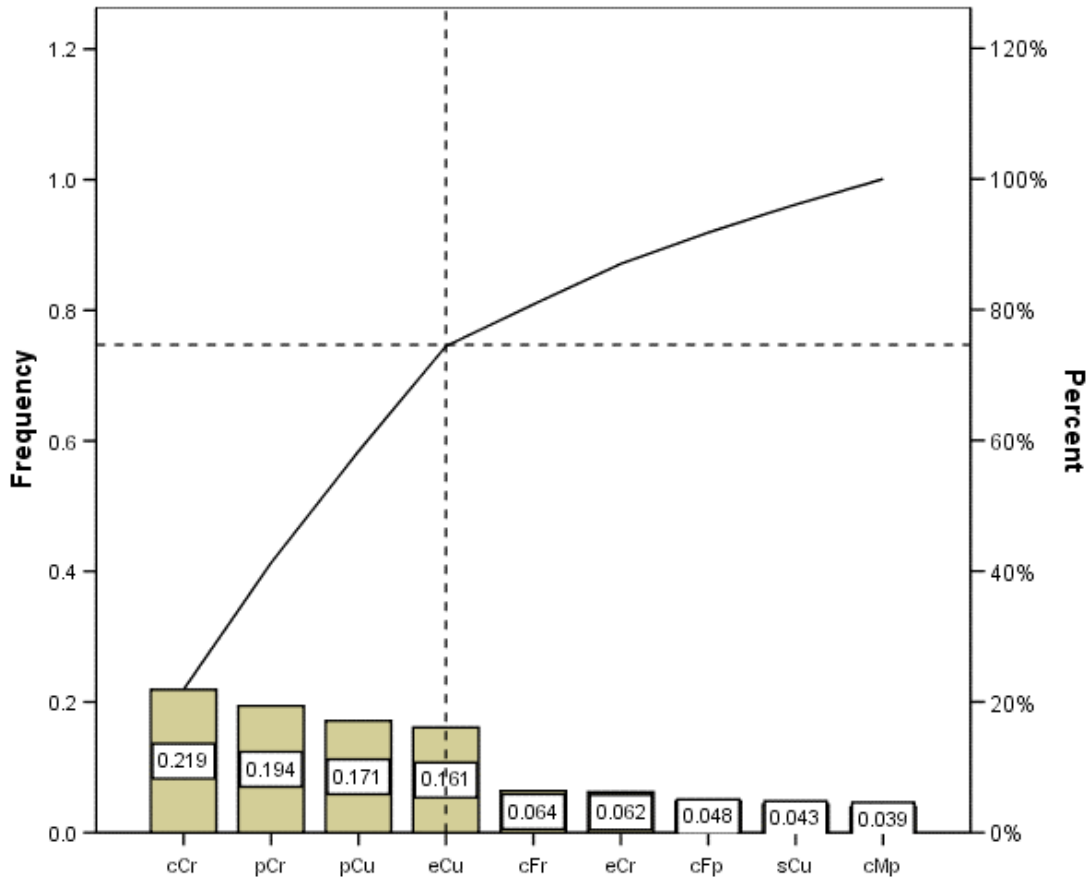
Figure 9. Pareto chart of the overall frequencies for the different categories of thought.

By looking at the Pareto graph of the overall frequencies (Figure 9) it can be reasoned that gaming mostly stimulates thinking, visual acknowledgement, visual assessment, and emotional responses. These four categories contribute close to 80% of the identified thoughts.

By combining the different categories into groups based on their descriptors it is possible to simplify the deductions. All the perceptual comments (pCu and pCr) add up total frequency of .364, while the cognitive comments (cCr, cFr, cFp, and cMp) equal 0.370. It can therefore be said that popular multiplayer gaming in general is an activity that mostly, and in almost equal amounts, stimulates thoughts related to visual and cognitive verbalizations. Emotional verbalizations (eCu and eCr) add up to .223 which is about half of that of the perceptual and cognitive categories. The *Self Immersion* category (sCu) was .043. Both the emotional and self categories may be very high or very low when compared to other activities, but as mentioned there are no other activities currently analysed by this method. Verbal cues and general informal assessment would however suggest that gaming is a highly emotionally charged and immersive activity.

5.3.2.2 *FPS versus RTS.*

The major strength of this research resides in the ability it offers for the quantitative comparison of different protocols. Grouping together the protocols for different styles of games can provide insight on how these two games differ in terms of thought stimulation. Firstly by using a statistical test such as the Chi-square test for significance to see whether the distribution of scores amongst the different categories of the FPS and RTS games are statistically similar. Secondly Pareto charts are used to visually compare the different categories of thought.

Table 12. Simplified categorizations for the overall and genre frequencies.

Descriptor Categories	Overall	FPS	RTS	Difference
Perception (pCu, pCr)	.364	.390	.338	.052
Cognition (cCr, cFr, cFp, cMp)	.370	.277	.463	**.186**
Emotion (eCu, eCr)	.223	.258	.188	.070
Self (sCu)	.043	.074	.011	.064

Table 13. Categorizations for the overall and genre frequencies.

Code	Name	Overall	FPS	RTS	Difference
pCu	Visual Acknowledgement	.171	.193	.149	.044
pCr	Visual Assessment	.194	.198	.190	.008
cCr	Thinking	.219	.171	.268	**.097**
cFr	Stating Intention	.064	.071	.057	.014
cFp	Planning	.048	.018	.079	**.061**
cMp	Assumptions	.039	.018	.060	.042
eCu	Emotional Response	.161	.183	.140	.043
eCr	Emotional Thought	.062	.076	.048	.028
sCu	Self Immersion	.043	.074	.011	**.063**

The FPS games and RTS games are both digital competitive multiplayer games. It cannot just be assumed that they stimulate significantly different thoughts. A null hypothesis of 'similarity' must firstly be assumed:

H_0 = There is no statistical difference between the thoughts stimulated by the FPS genre and that of the RTS genre of game.

The alternative hypothesis would be:

H_1 = There is a statistical difference between the thoughts stimulated by the FPS genre and that of the RTS genre of game.

To test which hypothesis to accept a Chi-square test for significance was carried out on the total scores achieved in the nine categories of the different tested genres of games. The Chi-square value, $X^2(8, N=577) = 36.9$, $p = .01$, surpasses the $X^2_{crit} = 20.09$. This indicates that there is a significant difference between the two genres of games and that H_0 must be rejected and H_1 accepted.

Stating that there is a significant difference between thoughts stimulated by the two genres of games under investigation is not the main focus of this study. Exploring these differences is, and Pareto charts allows for this exploration in a graphical manner. They show which categories contribute the most significantly in different genres of games. For example Figure 10 shows that 4 different categories, in different proportions, contribute for approximately 75 – 80% of the analysed thought segments for FPS genre games.
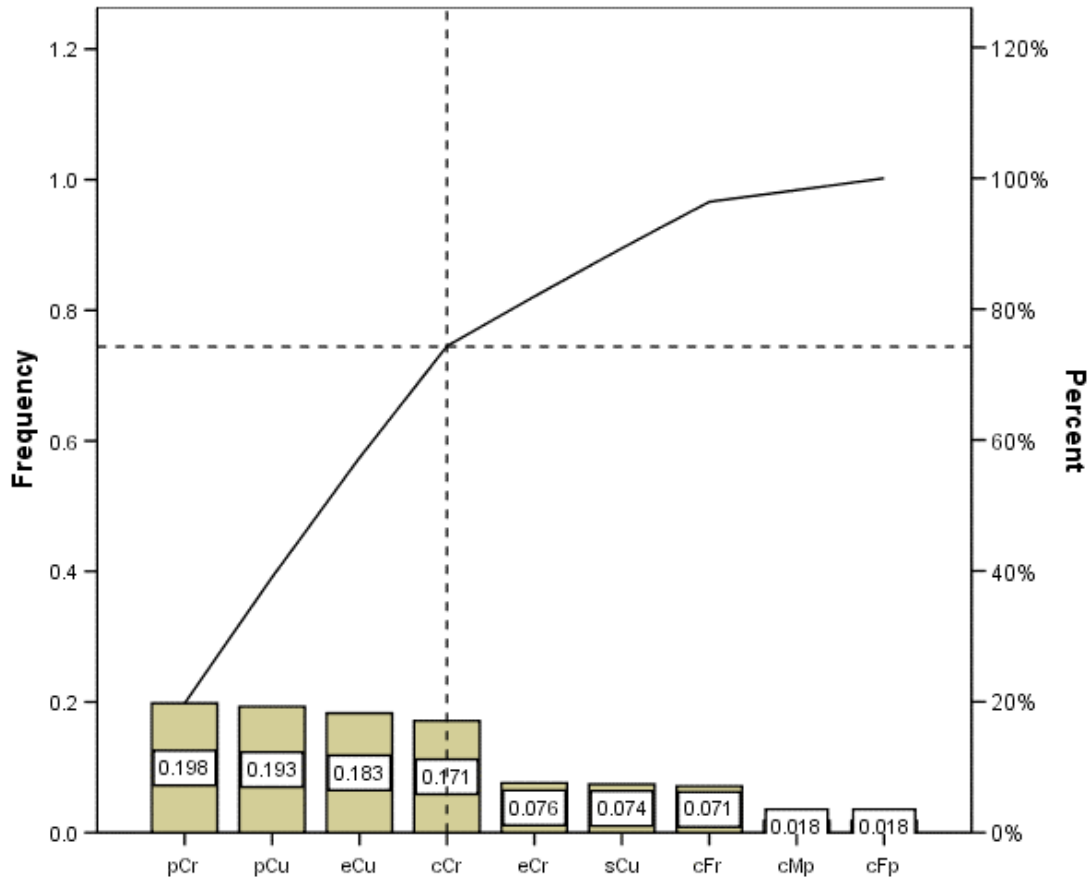
Figure 10. Pareto chart of the FPS frequencies for the different categories of thought.
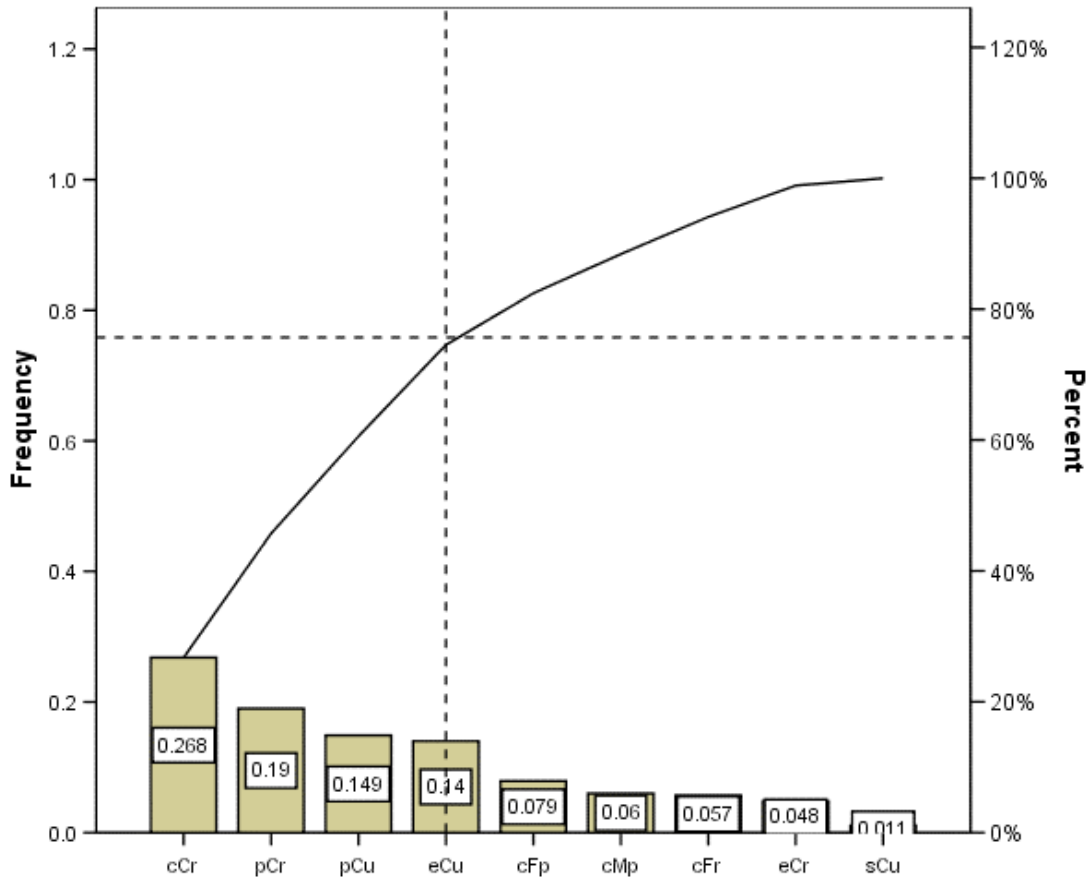
Figure 11. Pareto chart of the RTS frequencies for the different categories of thought.

The FPS and RTS Pareto charts (Figure 10 & 11) show these game genres to have the same four thought categories featuring as the top categories. These main categories do however feature with different strengths and in different proportions. The most prominent difference between the FPS and RTS profiles is the category of *Thinking* (cCr) which features as the strongest category in the RTS game. In the FPS game this category featured as the fourth strongest after the *Visual Assessment* (pCr), *Visual Acknowledgement* (pCu) *and Emotional Response* categories.

The nine categories were again combined in relation to their first descriptor to provide an overall picture. As can be seen form Table 12, the categories of perception, emotion and self scored higher in the FPS genre protocols. Cognition was however much higher for the RTS genre. Even when examined in its component parts, three out of the four cognitive categories are higher for the RTS genre games. Only *Stating Intentions* (cFr) was slightly higher for the FPS genre. *Planning* (cFp), the category with the most difference, and *Thinking* (cCr), the third most varying

category, indicates that the RTS genre is definitely more prone to stimulate cognitive related type responses. The second most varying category, *Self Immersion* (sCu), indicates that FPS genre games had approximately six times more indications of immersion than the RTS genre in this study. This could be directly attributed to the first person nature of the FPS compared to the third-person point of view of the RTS. The first person perspective allows a player to imagine themselves in the game with the graphics displayed on the monitor being your field of vision. The third person perspective is more detached because the player imagines themselves as an entity above the game looking down on the action. Together with the higher frequencies for emotional categories (eCu and eCr), these results indicate a deeper level of submersion or projection into the game for FPS genres. In contrast, playing RTS games on the remained a more cognitive or intellectual pursuit.

5.3.2.3 *Participant score frequency comparison.*

The purpose of this investigation was not to develop an assessment tool. The nature and scale of this investigation also does not allow for a large sample size of participants. As discussed above the real strength of this study is in the comparison of the different effects of different genres of games. The effects of different participant personalities and abilities should not have a great effect on a comparison between the FPS and RTS, since all the participants are competent in, and participated in both games. Participants are also from a specific homogenous sample meaning that other variables such as age, gender and socio-economic background should not impact on the results. The participant score frequencies must nevertheless be scrutinised to make sure that any individual does not unnecessarily skew the overall interpretation. Extreme frequencies must be highlighted to clarify the final interpretation. A comparison between the quantitative frequencies and the qualitative data from the initial player screening can also be done to reveal congruencies.

Table 14. Frequency contributions to the overall scores by participants for the FPS genre of games.

		Participant			
Code	Name	1	2	3	FPS - Totals
pCu	Visual Acknowledgement	.133	.136	**.309**	.193
pCr	Visual Assessment	**.089**	.288	.217	.198
cCr	Thinking	.133	.203	.175	.171
cFr	Stating Intention	.106	.034	.072	.071
cFp	Planning	.053	0	.000	.018
cMp	Assumptions	.044	0	.010	.018
eCu	Emotional Response	.204	.220	**.124**	.183
eCr	Emotional Thought	**.142**	.034	.052	.076
sCu	Self Immersion	.097	.085	.041	.074

There are four obvious deviations from the overall frequencies for the FPS genre of games. Firstly is Participant 3's *Visual Acknowledgement* (pCu) frequency which is almost double that of the other participants. He also scored quite lower in the *Emotional Response* (eCu) category. Participant 1 scored much lower in the *Visual Assessment* (pCr) category and much higher in the *Emotional Thought* (eCr) category. Before commenting on these trends, more information on the participants on the whole can be gauged by contrasting their scores in the FPS and those in the RTS games (see Table 15).

Table 15. Frequency contributions to the overall scores by participants for the RTS genre of games.

		Participant			
Code	Name	1	2	3	RTS - Totals
pCu	Visual Acknowledgement	.169	.124	.154	.149
pCr	Visual Assessment	.183	.148	.237	.190
cCr	Thinking	**.183**	**.346**	.276	.268
cFr	Stating Intention	.056	.037	.077	.057
cFp	Planning	**.155**	.062	**.019**	.079
cMp	Assumptions	.085	.049	.045	.060
eCu	Emotional Response	.127	.185	.109	.140
eCr	Emotional Thought	.042	.037	.064	.048

sCu	Self Immersion	0	.012	.019	.011

For the RTS genre there was quite a difference between the lowest and highest frequencies in *Thinking* (cCr) and *Planning* (cFp) categories. Comparing the FPS and RTS frequencies for each participant shows some interesting results. All the frequencies that deviate the most in the FPS genre normalize in the RTS genre. The same is the case with the most extreme frequencies of the RTS genre when compared with those of the FPS genre. This would imply that different genres of games can stimulate different extreme thought reactions in different people. Furthermore there were frequencies that retained a congruency for different participants between the different genres. For clarification, the frequencies need to be compared to the participant profiles.

Participant 1

Participant 1 has been playing games the longest and can be considered the most competent gamer out of all the participants. His player profile matches the score frequencies generated from his protocols.
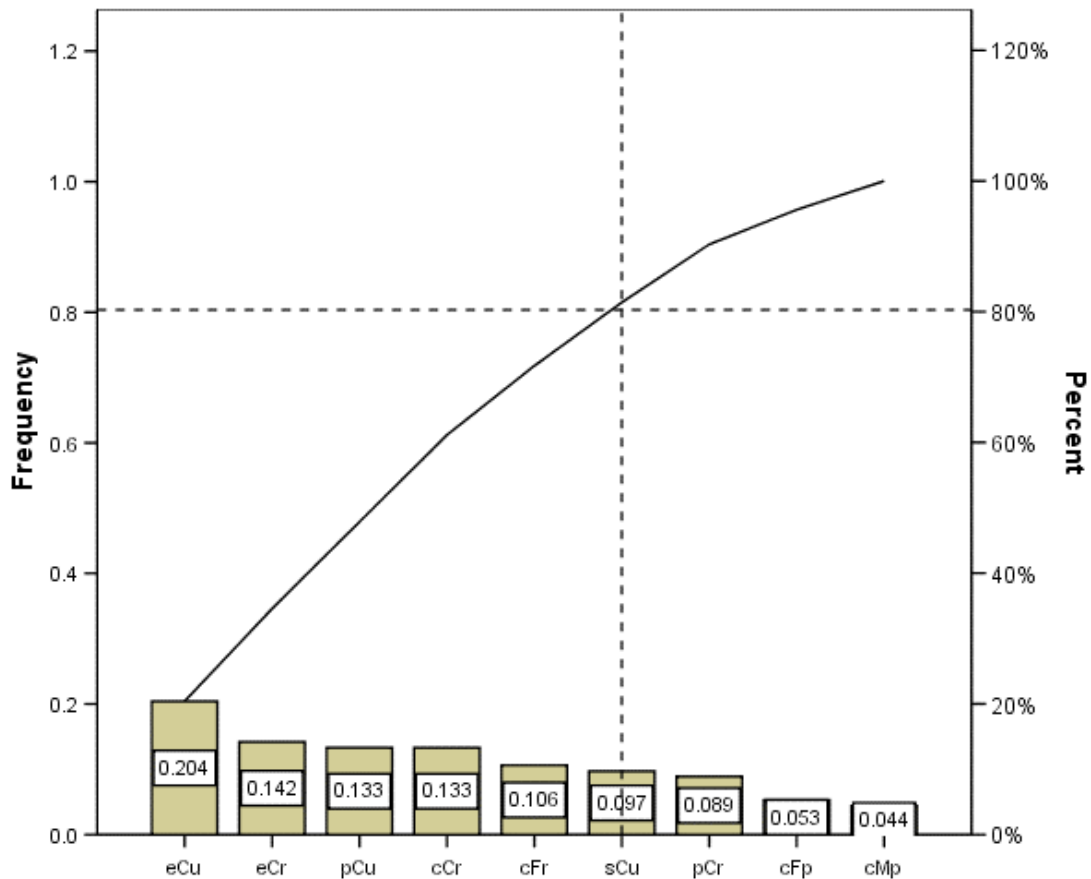

Figure 12. Pareto chart of the Participant 1's FPS frequencies for the different categories of thought.

Participant 1's Pareto profile for FPS games (and RTS games as seen later) differs substantially from the other two participants' profiles. He has six main categories, instead of four, strongly expressed during gaming. The category *Emotional Response* (eCu) is one of the top four categories for each participant, but it is the top category only for Participant 1. In FPS games where all the participants are also emotionally reactive, he scored much higher than the others in *Emotional Thought* (eCr) instead of just *Emotional Response* (eCu). He is also the only

participant to have the category of *Self Immersion* (sCu) as a top category. These observations correspond with his self proclaimed hatred of playing scary FPS's because he gets too involved.
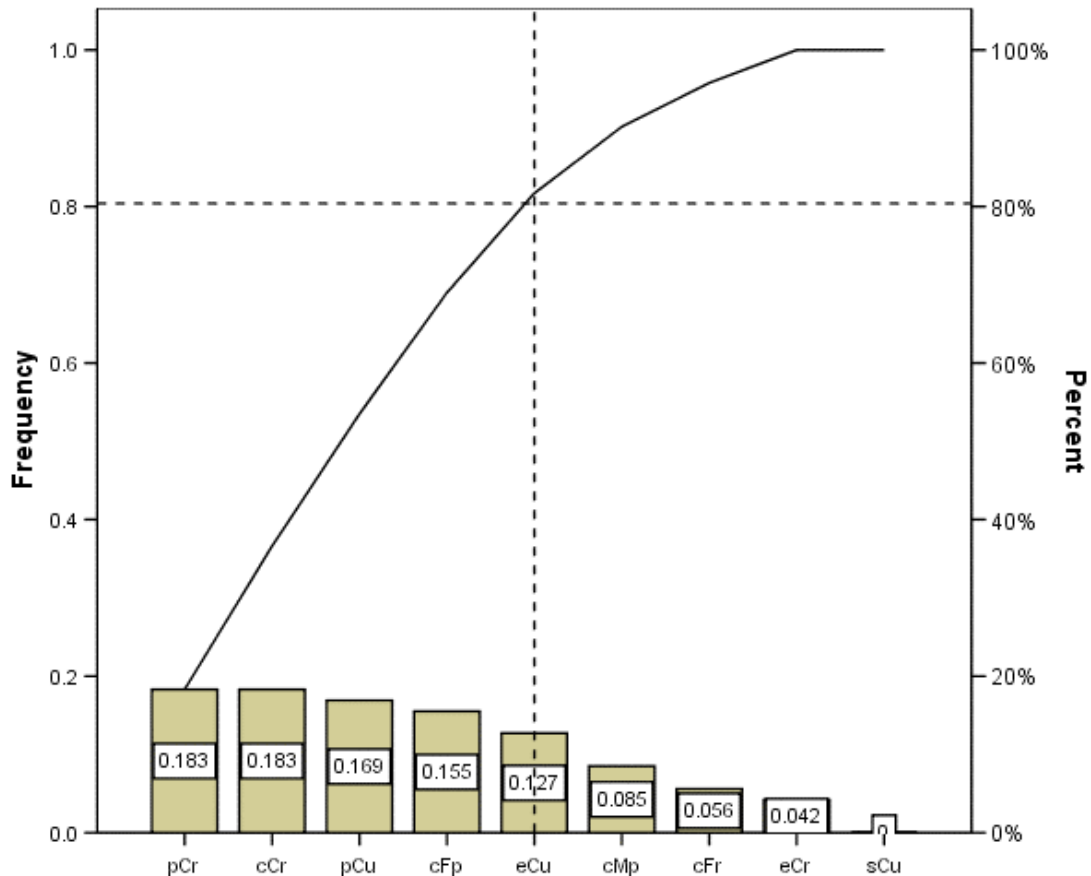

Figure 13. Pareto chart of the Participant 1's RTS frequencies for the different categories of thought.

Thinking (cCr) and *Visual Assessment* (pCr) scores are evenly matched for the top position. The category *Planning* (cFp) featured the strongest in Participant 1's RTS protocol compared to all the other protocols. From the strengths of the different categories it can be said that Participant 1 is cognitively and visually cognitively orientated during RTS games. He acknowledges, assesses, thinks, and plans.

For Participant 1 strongly emotional responses were seen for the FPS game, while he was strongly visual and cognitively focused during RTS game. Compared to other participants, he also scored the highest for *Planning* (cFp) during both genres of games. This could be indicative of a deeper level of comfort with gaming and the ability to think under pressure when necessary.

Many are scenario's are possible. The overall assumptions about the different categories are integrated in section 5.3.4.
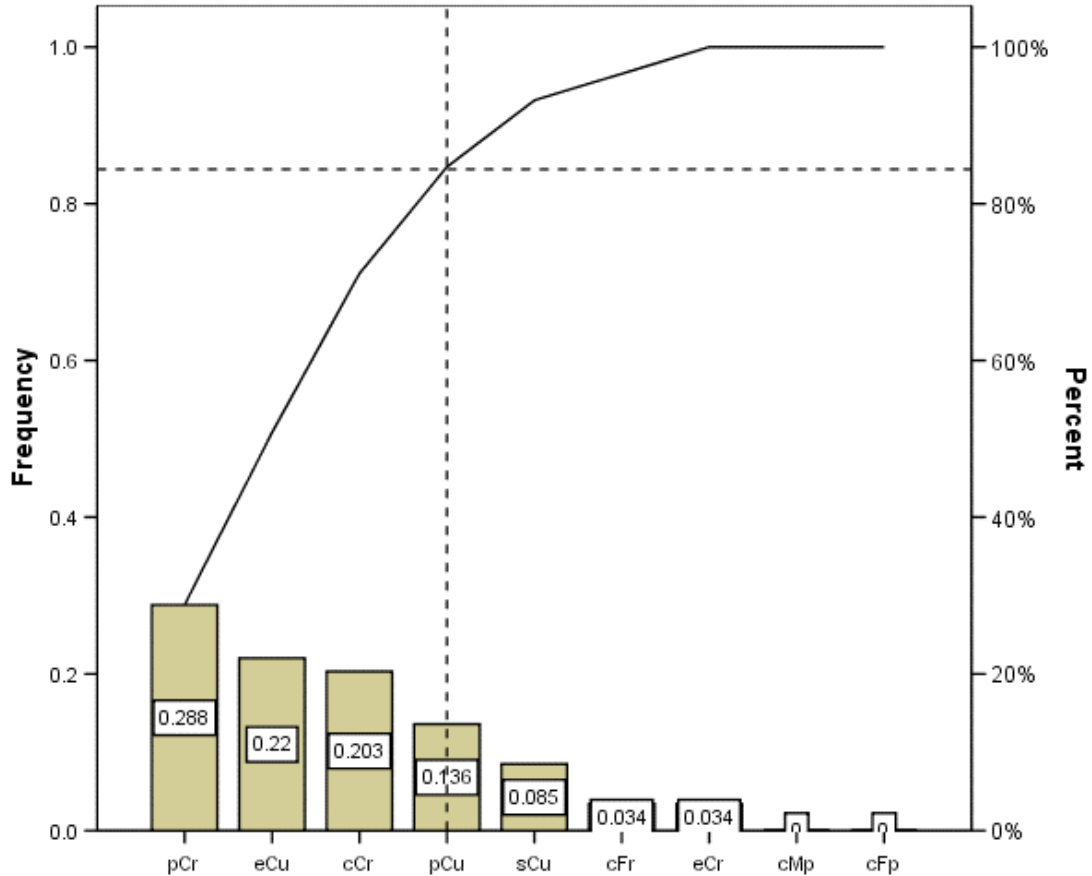
Participant 2

Figure 14. Pareto chart of the Participant 2's FPS frequencies for the different categories of thought.

During the FPS game Participant 2 scored the highest in *Visual Assessment* (pCr). He appeared strongly vigilant and focused on the gaming situation. Additionally he was highly tense and reacted strongly to in-game victories and successes.
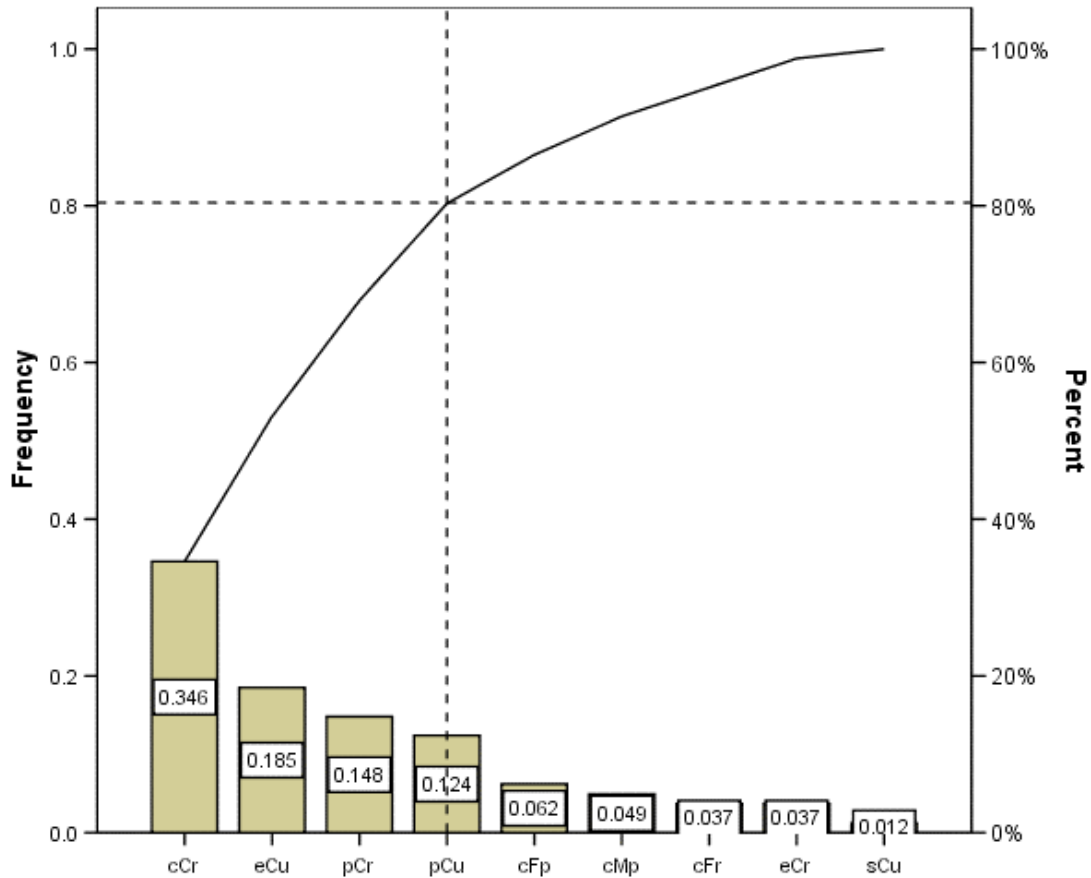
Figure 15. Pareto chart of the Participant 2's RTS frequencies for the different categories of thought.

The RTS genre revealed Participant 2 as being very cognitively focused due to his very high *Thinking* (cCr) score. Once he settled into the game he seemed to rely on reacting to the situation based on reactionary preconceived strategies. This implies that he was constantly assessing what other players were doing and reacting in accordance. *Planning* (cFp) did not feature at all in Participant 2's FPS profile but it did appear in his RTS game profile.

Participant 2 scored consistently higher for the *Thinking* (cCr) category in both genres of games. This could be attributed to either his competitive nature, or his self-proclaimed difficulties with vocalizing during gameplay. It is most probably the former because it is more likely that difficulty with vocalization would be associated with more perceptual comments (i.e. scoring much higher in the perceptual categories pCu and pCr). Further support for his score frequencies reflecting his competitive nature can be reflected in his high *Emotional Response* (eCu) frequency.
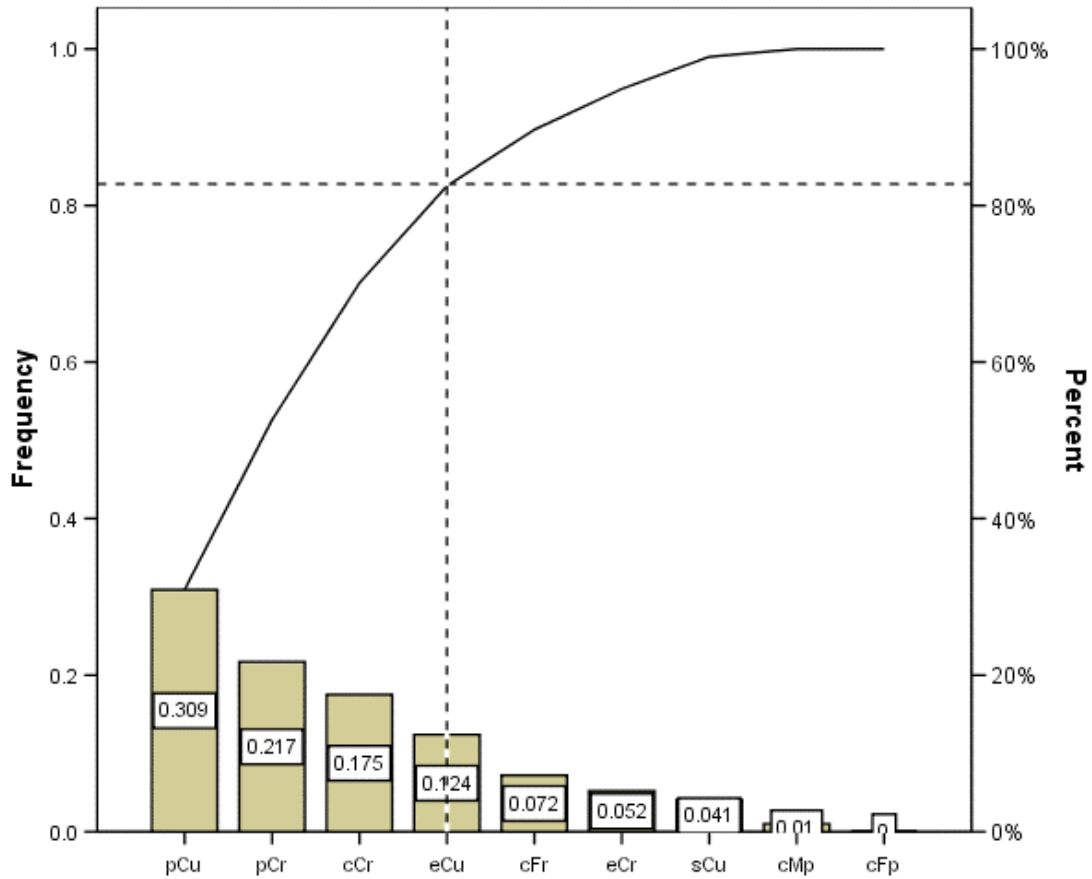
Participant 3

Figure 16. Pareto chart of the Participant 3's FPS frequencies for the different categories of thought.

Participant 3 had a very strong visual approach to the FPS genre of game (high pCu and pCr). His *Self Immersion* (sCu) score was also lower compared to other participants in the FPS genre. As with Participant 2, the category *Planning* (cFp) did not feature at all.
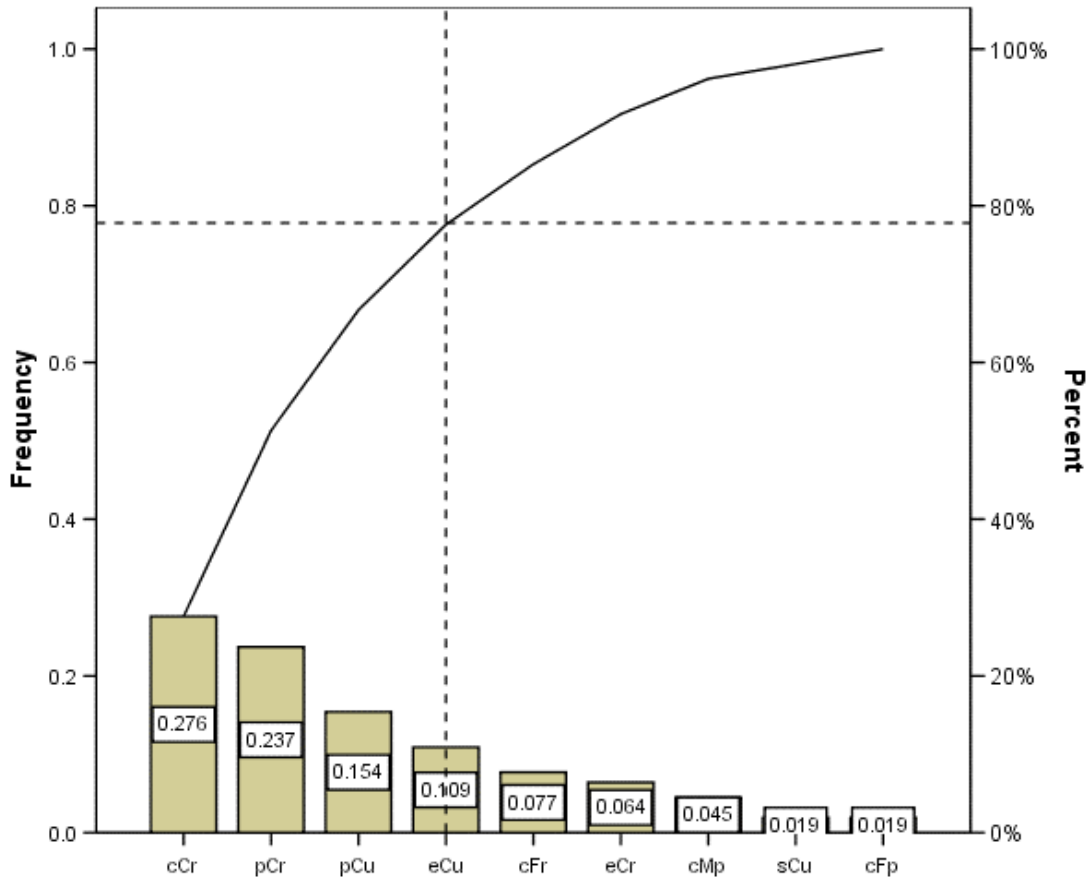
Figure 17. Pareto chart of the Participant 3's RTS frequencies for the different categories of thought.

Participant 3's RTS scores closely resemble his FPS profile with the exception of the Thinking (cCr) category moving into first place. The trend of this category featuring much stronger in RTS genre was noticeable for all participants.

Overall, the most noticeable score frequency of Participant 3 is his extremely high *Visual Acknowledgement* (pCu) for the FPS game. There are two likely contributors to this phenomenon. Firstly Participant 3's self, described as quiet and reserved in nature may be reflected by the in-game verbalizations. This effect may not be that strong because his pCu score frequency is on par with the other participants in the RTS game. The second contributor for the elevated pCu score frequency in the FPS game could be the fast paced, action orientated nature of the FPS on a less experienced player. Participant 3 is by no means an inexperienced gamer, but his level of expertise may force him to be more visually focused on the game, and less immersed (the lower sCu score).

5.3.3 Thinking Strategies

As discussed in section 5.2.2, thinking strategies were assigned to overall trends noticeable in different phases of the different genres of games. It must be kept in mind that both FPS and RTS games are games of imperfect information. *Analogical* thinking is characterised by adopting a sound approach based on incorporating experience with the available information. It can be identified by a participant providing good reasoning for their decisions or even strategies revealed by monitoring the gaming cycle. A *Heuristical* strategy is characterised by players choosing what they believe to be their best strategy based on the available information, without taking into consideration how these actions fit into their overall strategy. *Trial and Error* strategies are more random and are characterised by haphazard decision making and regular haphazard strategic changes. Listed below (Table 16) are the different dominant strategies employed by the different participants.

Table 16. Strategic approaches to the different genres of games.

FPS			RTS		
Participant	Dominant Approach		Initial phase	Engagement phase	End phase
1	Analogical		Analogical	Analogical	Heuristical
2	Trial and Error		Analogical	Heuristical	Heuristical
3	Trial and Error		Heuristical	Heuristical	Trial and Error

Participant 1

During FPS games Participant 1's dominant strategy was to acquire the most lethal weapon and pursue objectives in areas where he is bound to engage in conflict. He maintained this strategy and it enabled him to be successful in achieving in-game objectives and still achieve his personal objective of having fun. In the initial building phase of the RTS games he methodically created units in anticipation to a variety of enemy attacks. By being mostly on the defensive for the latter part of the game he engaged in more reactive planning. This reactive planning was more characteristic of *Heuristical* thinking than making *Trial and Error* decisions as he purposefully and strategically defended.

Participant 2

Participant 2 competed in the FPS without expressing any planning. He moved around with the sole purpose of eliminating other players, only using a *Trial and Error* approach. It was only during the RTS that he started describing his strategies and motivations. Clear strategic movements could also be visually seen. He started out with *Analogical* convictions, which later

changed into a *Heuristical* approach as he struggled to survive. He also maintained this *Heuristical* approach to the end.

Participant 3

During the FPS Participant 3 also did not guide his actions by adopting a clear strategy. He mostly engaged situations as they happened, without expressing plans through vocalizations or actions. In the RTS game he mainly vocalized what seemed to be a *Heuristical* approach. During the later phases of the game when a lot of fighting was going on, he switched a to more *Trial and Error* approach by building random units.

5.3.4 Integrating the Results

After independently commenting on the participants' thoughts and thinking strategies it is interesting to go back and compare the score frequencies in the different thought categories and the overall thinking strategies. Links between the thinking score frequencies were searched for by looking at specific higher frequencies and seeing whether there was a corresponding thinking strategy. The participant profiles as well as their performance help to justify these links.

The category of thought, *Planning* (cFp), reflect Participant 1 as being the only one to approach the FPS game with a strategy and maintaining that strategy. Overall cFp is also higher in the RTS genre of games. These facts indicate that cFp acts as the best indicator of *Analogical* thinking. A code that could be related to *Heuristical* thinking strategies is *Thinking* (cCr). Both Participant 2 and 3 used this approach intently during the RTS game and the frequencies of their scores reflect it. Overall Heuristical strategies are exclusively identified in the RTS genre games by the exploration of thinking strategies (see Table 16). This lends further support to the link between the category cCr and *Heuristical* strategies because the biggest difference between FPS and RTS score frequencies can be seen for this category (see Table 13). The third possible connection between the thinking strategies and the thought codes is the *Visual Assessment* (pCr) category which seems to be related to *Trial and Error* type thinking strategies. In the FPS Participant 2 and 3 used this strategy and their pCr frequencies are much higher than Participant 1.

5.4 Chapter Summary

This chapter follows the development of the coding framework by starting with segmentation and moving through the different phases of coding. Following this is the discussion of the results which include a concise content analysis, a deeper thoughts and thinking strategy analysis, and finally a comparison between the thought categories and the thinking strategy trends.

Transcripts were segmented into pieces expressing thoughts. Overall 577 different segments were identified. These segments were coded into different categories. Initially, 45 categories were created using the different cognitive models identified in Chapter 3. Assigning thought segments to these categories identified nine viable categories. These nine were then used as the basis for further analysis. They consist of 2 perceptual categories, 4 cognitive categories, 2 emotional categories, and 1 self category. Before further exploring and comparing the different categories, comment on the actual content of the protocols was given. It was noted that the protocols were not as violent as expected. The different categories were then compared by looking at the different frequencies of segments assigned to them. Pareto charts were used to identify the major contributing categories. Overall frequencies, game genre frequencies, and different participant frequencies were analysed and discussed. Different profiles were therefore identified for the different genres of games as well as for the different participants.

Dominant thinking strategies were then assigned to the different participants competing in the different genres. These strategies were compared to the scores achieved by the different thought categories to identify links between the two. A degree of overlap between the results was found.

The next chapter provides a summary of the results of the investigation and findings. It also makes methodical and subject recommendation for further research.

CHAPTER 6

CONCLUSION AND SUMMARY

This study has achieved numerous goals as dictated by the aims presented in Chapter 1. Most noticeably it has achieved its primary goal of exploring gamers' thoughts during different genres of popular multiplayer games. It has also achieved its secondary goal by showing that a verbal analysis method could be adapted and applied to a visually absorbing activity such as gaming. Besides the initial goals, additional accomplishment has been achieved. A useful cognitive coding scheme has been developed and to some extent validated through quantitative comparisons to qualitative observations. This coding scheme can serve as a useful tool in many cognitive investigations. The method and the coding scheme also proved to provide profiles for gaming as a whole, the different genres of games, and the different gamers. This indicates that it may be useful as an assessment tool.

6.1   Verbal Protocol Analysis and Gaming

Classical protocol analysis is a method of data gathering described as unsuitable for visually absorbing tasks. Later, adapted forms of verbal analysis provided an approach better suited to such activities. Combining classical protocol analysis with a later approach, specifically the method of verbal analysis described by Chi (1997), provided a hybrid method with elements of validity from classical protocol analysis and the flexibility of Chi's method. Putting this method into practice revealed its successful application in studying gaming.

Classical protocol analysis contributed towards many aspects of the hybrid model used in this study. One of the major contributions was its help to develop an instruction to initiate the experimental sequences. This instruction had to be specific in order to facilitate verbalizations consistent with cognitive exploration. The assumptions of classical protocol analysis therefore helped to contextualize verbalizations and develop the experimental procedures. Another of the major contributions of the classical protocol analysis method was the implementation of established cognitive models to the analysis of the different thought segments identified in the protocols. A descriptor from each model was assigned to the different thought segments during the first round of coding.

Chi's verbal analysis also contributed significantly to the hybrid approach. It mainly assisted in adapting the experimental design to be more flexible in terms of the type of the data it collected. It did so by influencing the way the data collection was carried out. It was carried out in a less formal, non laboratory setting. Participants received training and they were prompted to respond, but not in a limiting way as prescribed by classical protocol analysis. By recording and analysing video footage in conjunction with this approach, the goal of exploration was achieved. Further, instead of only analysing the degree of fit between the data and the established cognitive models, Chi's verbal analysis was used to justify changing these models to form a better fit classification framework consisting of nine categories. During a second round of coding thought segments were coded again using the descriptors, and re-assigned to one of the nine categories.

The validity of the scores assigned to each of these nine categories was heightened by coding all the identified thought segments for a third time using only the descriptions assigned to the nine categories. The third round of coding was compared to the second round's results and discrepancies were settled with the aid of the audio and video recordings. Lastly, the scores were further validated, but not altered, by a qualitative comparison between the score's frequencies, the assumptions about the different genres of games, and the participant profiles. This all pointed towards the fact that the adapted form of protocol analysis is a method that can be successfully applied in studies in a game playing context.

6.2   The Classification Framework

The core categories that gave rise to the final nine categories are very closely related to a model of human experience explained by Jordaan and Jordaan (1992). The major changes are the removal of the dispositional subsystem, and the added variation of the core categories brought on by the incorporation of categories of thought as classified by Ericsson and Simons (1993), as well as a classification of the *directedness* of thought.

1	Visual Acknowledgement
2	Visual Assessment

3	Thinking
4	Stating Intention
5	Planning
6	Assumptions

7	Emotional Response
8	Emotional Thought

9	Self Immersion

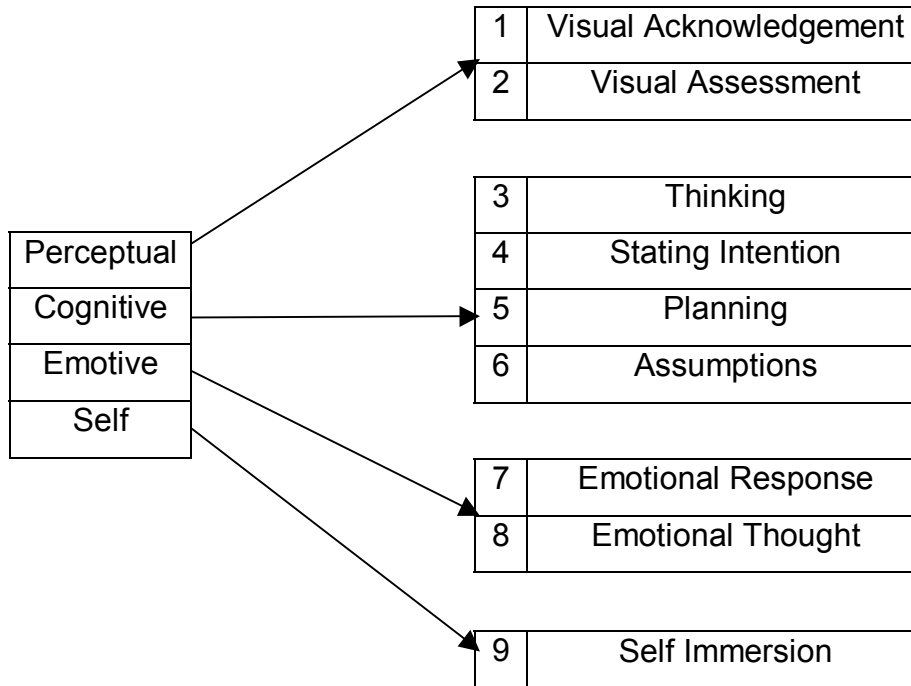Perceptual
Cognitive
Emotive
Self

Figure 17. The developed classification framework.

Using the transcribed content together with audio and visual cues, thought segments can be assigned to one of these nine categories. Each category has its own unique characteristics, allowing them to be used in drawing conclusions on how engaging in an activity stimulates a participant.

Four categories in particular featured strongly for gaming as a whole. These categories were: *Visual Acknowledgement*, *Visual Assessment*, *Thinking*, and *Emotional Response*. Pareto charts showed that these categories contribute for approximately 80% of the verbalised thoughts. These were the dominant categories for both FPS and RTS games. The categories *Visual Assessment*, *Visual Acknowledgement*, and *Emotional Response* featured in both games in this order (from highest to lowest). *Thinking* on the other hand featured less than these 3 categories in the FPS game while it was the strongest category for in the RTS game.

Participants 2 and 3 both had *Visual Assessment* as their strongest featuring category of thought, while *Thinking* was the strongest for the RTS game. Participant 1, the strongest gamer, had quite a different profile. For the FPS genre he scored highest for *Emotional Thought* and he was the only gamer where the *Self-Immersion* category also featured as a top contributing category. He is also the only gamer where the category of *Planning* features as a top category for the RTS genre of game.

The higher score frequencies in certain categories can indicate what kind of thinking strategy a participant may be engaged in. It was found that there is a possible positive relationship between the score frequencies of *Visual Assessment* and *Trial and Error* strategies, the score frequencies of *Thinking* and *Heuristical* strategies, and the score frequencies of *Planning* and *Analogical* strategies.

6.3 The Impact of Popular Multiplayer Games

Analysed verbalizations during gaming revealed that participants engaged in thoughts with different characteristics. The defining characteristic of these thoughts were mainly perceptual, cognitive, emotive, or related to self immersion. The activity of participating in popular multiplayer games was mainly characterised by almost equal amounts of perceptual and cognitive thoughts as revealed by gamer verbalizations. Emotive thoughts only represented about half of the amount of either perceptual or cognitive thoughts, while thoughts most strongly related to self immersion contributed just less than .05 of the total. While the frequencies of the emotive and self categories were lower than that of the perceptual and cognitive categories, these frequencies may be very high when compared to other, non-gaming tasks. This possible trend could be investigated by applying this hybrid method of verbal analysis to another non-gaming activity. On the other hand the low *self* frequencies could be an indication that although gaming is a visually absorbing activity, it may have a lower level of self immersion within the game than what is commonly assumed.

The number of thought segments contributing to each category of thought differed between the different participants and different genres of games. A comparison between the different frequencies of the different categories for each player and their player profile revealed that certain of the participants' abilities and character traits were reflected in the frequencies. The different frequencies in the different genres of games showed that different game types stimulate different cognitive responses and helped identify genre specific characteristics.

Different levels of gamer experience were one of the possible variables influencing the different category frequencies. Higher levels of experience and gaming success corresponded with the category titled *Planning*. Lower levels of experience and subsequent gaming success seemed to corresponded with high frequencies in the category *Visual Acknowledgement*. This could indicate that gaming is more cerebral for experienced players and a more visceral activity to less experienced players. The ability to think under pressure possibly indicated by a higher *Emotional Thought* frequency is another ability possibly related to higher gaming success.

Certain categorical trends noticed between the different genres of games indicate the different influence of these genres. This also highlights the importance of differentiating between and specifying games in any study. RTS score frequencies indicate that this genre is more conducive to stimulate cognitive assessment, indicated by the consistently higher score frequency in the *Thinking* category. RTS games also scored much lower in the emotional categories compared to the FPS's frequencies. Although the more advanced thinking strategies, *Heuristical* and *Analogical* thinking, are not exclusive to RTS genres, they were much scarcer in FPS games. Besides the most experienced participant, the other participants' dominant strategies for FPS genre games were that of *Trial and Error*. So while different games influence different participants in different ways, certain overarching genre specific characteristics exist.

Participating in gaming is not entirely linked to winning, although winning seems the biggest driving force. This can be seen in players that participate in gaming mostly for the 'fun' aspect thereof. It is highly likely that the higher the stakes, the more advanced thinking strategies are encouraged. For example, the longer gaming cycle present in RTS games places higher demands on players not to engage in *Trial and Error* strategies. Comparative gaming and participation in gaming competitions would most likely also encourage higher levels of thinking strategies.

6.4   Recommendations for Future Work

The nine category method developed in this study could be refined and applied to the study of different games or even different activities. Before using it in more experiments it would first need to be further validated and tested. This could include studies with larger sample sizes, different games, more in-depth participant assessment prior to games, and more control over the gaming cycle and levels of action. Although explanations and examples were given for each of the nine categories, they were mainly used to distinguish between different thought segments. A deeper investigation into the nature of these categories of thought will give greater understanding on how

these have relevance to the psychological impact of gaming. This can be done by exploring for example the emotional component, its content in the protocols, its nature, and its relationship to aggression. Or does aggression arise more from a cognitive dimension as suggested by Anderson and Dill (2000) (see section 2.5.1)?

The 9 category method may become a tool to supplement other psychological research. It may be used to create a psychological profile for different genres of games, or even specific games. Other very popular game genres with a totally different gaming dynamics like the role-playing game (RPG) or Sports games can be compared to the initially analyzed FPS and RTS. One could also see what the differences are between gaming on different platforms such as console games or mobile phone games. Using this method to investigate other activities such as watching television, playing chess, or even a more physical sport, could reveal how gaming differs between these activities, and shed light on the overall impact of gaming.

6.5   Final Thoughts

Gaming is an engaging activity that stimulates different thoughts and thinking strategies amongst players. Different genres of games also engage different players in different ways. There are unique differences in thought stimulation between different genres of games. The nine category classification framework developed by this study worked well to show and categorise these differences in quantifiable way

Players' thoughts are consistent with their overall thinking strategies. Different variables such as gaming experience and motivation were shown to have an effect on how a game engages players, as revealed by comparing the results to the player profiles. So while the different genres of games have their unique impact, this impact was ultimately regulated by the players themselves.

Finally, gaming as a whole and the different genres of games needs to be explored from many angles and many different ways. This exploration revealed that a quantifiable method of exploration is possible. This is ultimately necessary if it is taken into account that gaming is already a major acceptable entertainment activity, and that by some it is engaged in for hours and even days at a time.

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APPENDIX A: **Consent form**

CONSENT & INFORMATION FORM

The intention of this letter is to inform you about the research project in which you may choose to participate. It also serves to formally obtain your permission to be video recorded during this project for the purposes of analysis.

The name of the research project is "**Exploring the thoughts and thinking strategies used by gamers during multiplayer gameplay in different genres of popular computer games**". This research seeks to explore the thoughts that dominate the conscious thinking process during computer gameplay. It does not in any way test your abilities.

To explore your thoughts, you will be asked to "Think-out Loud" during gameplay. A specific instruction will be give to you at the start of the session that will tell you exactly how to do this. Basically, you just have to try and keep a running commentary on what you are thinking during gameplay. Your verbalizations are then video recorded and its content and structure is analyzed. The recording will take place in a separate room that you and the researcher will occupy.

The recorded data will be transcribed into words. Only the researchers involved in this undertaking will see the recordings, unless you specify differently. Others may see the transcribed material but your anonymity will be maintained by means of a pseudonym. With your permission the researcher will retain a copy of the recorded sessions for the purpose of further analysis.

Please Note:

- You are not obliged to take part in this research and you may withdraw at any time.

- If you have any concerns about this research, please ask the researcher for further clarification.

Declaration:

I,_____, have read and understood this form. By signing this form, I choose to participate in this research project. I also agree to be video recorded for the purpose of analysis. I understand that this information may be published.

_____   _____
Signature   Date

_____
Witness

Please also indicate:

The researcher may / may not retain my recorded information after the completion of this project. (Please tick the relevant option)

APPENDIX B: Instructions

Instructions

Initial instruction issued prior to practice rounds

"In this research project I am interested in what gamers think about when they are busy playing games. In order to do this I would like you to THINK ALOUD, as you are busy playing. What I mean by think aloud is that I want you to tell me EVERYTHING that you are thinking from the time you start playing. I would like you to talk CONSTANTLY. I do not want you to plan what you are going to say or try to explain to me what you are saying. Just act like you are alone in the room speaking to yourself. It is most important that you keep talking. If you are silent for long periods of time I will ask you to talk. Do you understand what I want you to do?"

"Good now lets begin with a few practice rounds"

Instruction issued prior to actual recording

"I would like you to THINK ALOUD as you are busy playing. Tell me EVERYTHING that you are thinking. Try talking CONSTANTLY. If you are silent for long periods of time I will remind you to talk. Are you ready?"

"Good now lets begin"

APPENDIX C: Transcript example

Transcript Example: Participant 1 playing the FPS game.

Verbalization	Descriptor	State	Thinking
Our main node is going to go (resigned)	c	M	p
Gonna head towards our node so that I can blast it	c	F	r
even though it looks like blue's going to hold on to it,	p	C	r
maybe a tank has got enough power to hold it off (uncertainty)	c	M	p
Ok they are building it	p	C	u
Yes! (hope),	e	C	u
ok I am going to head off straight towards the middle node to see if I can nail that so that we can	c	F	p
...oh shit...	e	C	u
being nailed by an air troop (disappointment/strain),	p	C	u
got to get undercover, just..	c	C	r
ooooh! a tank (pleasure),	e	C	r
first priority tank, ok second priority of make it up the hill.	c	F	r
.aaaahh falling falling falling falling.(strain)	e	C	u
Shit shit.. Next vehicle take that, got nex..that vehicle, and falling (strain)	e	C	r
ow... Ow... .(strain).	e	C	u
Gotta get off,	c	C	r
ok got that vehicle….(strain).	p	C	u
Shit.(strain/nervous laugh).	e	C	u
Ejecting so I can get the node..(concern)	c	F	p
Aww (concern)	e	C	u
I don't have any big gun ..(concern)	s	C	u
gotta get a gun, a gun..	c	F	r
Getting..	p	C	u
Oww	e	C	u
I can't see what kind of guns I got..(disappointment) Oh (realization)	p	C	r
Aw shit, they have got the um...they got our thing… (angry concern / concentration)	e	C	r
I am going to try get the tank seeing it's the biggest weapon we have …	c	F	r
See if I can manage to (strain) move it	c	M	p
Aaahe …mooove…..moooove tank… (strain)	e	C	u
Need the tank to defend…need the tank…need the tank…got to have the tank (heavy strain)....o yeah! (accomplishment/satisfaction)	e	C	r