The Effect of Violent, Competitive, and Multiplayer Video Games on Aggression

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

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Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed. I acknowledge the support I have received for my research through the provision of an Australian Government Research Training Program Scholarship.

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# Table of Contents

Declaration........................................................................................................................................... ii  

Acknowledgements............................................................................................................................... iii  

Table of Contents.................................................................................................................................... iv  

List of Tables ........................................................................................................................................... xii  

List of Figures ......................................................................................................................................... xiv  

Abstract.................................................................................................................................................. 1  

Chapter 1: Introduction .......................................................................................................................... 3  

1.1 Brief History of Violent Media Research ....................................................................................... 3  

1.2 Who Plays Video Games and Why? ............................................................................................... 9  

1.3 Dissertation Overview and Aims .................................................................................................. 12  

Chapter 2: Literature Review ................................................................................................................. 15  

2.1 Theories of Aggression ..................................................................................................................... 16  

2.1.1 Theories of aggression: Violent video games ......................................................................... 17  

2.1.1.1 General Aggression Model (GAM) .................................................................................. 17  

2.1.1.2 Desensitisation and empathy ......................................................................................... 22  

2.1.1.3 Catalyst Model ................................................................................................................ 25  

2.1.1.4 Catharsis .......................................................................................................................... 27  

2.1.2 Theories of aggression: Competitive video games ................................................................. 29  

2.1.2.1 Frustration-Aggression Hypothesis and Cognitive Neo-association Model .................... 29  

2.1.2.2 Self Determination Theory ............................................................................................ 32
2.1.3 Theories of aggression: Interaction between violence and competition
within video games ................................................................. 32
2.1.4 Summary of theories of aggression ........................................ 34
2.2 Violent Video Games and Aggression ........................................ 35
  2.2.1 Experimental research: Previous meta-analyses ......................... 36
  2.2.2 Experimental studies: Review of studies ................................... 38
    2.2.2.1 Findings of the literature review on experimental studies: The
    impact of violent video games on aggression ................................. 48
  2.2.3 Correlational and longitudinal studies ....................................... 49
  2.2.4 Practical significance ........................................................ 51
  2.2.5 Summary ............................................................................. 53
2.3 Competitive Video Games and Aggression .................................... 54
  2.3.1 What makes a video game competitive? ..................................... 55
    2.3.1.1 Score feedback ............................................................. 56
    2.3.1.2 Rewards ...................................................................... 57
    2.3.1.3 Rivalry ....................................................................... 57
    2.3.1.4 Number of competitors ................................................. 58
    2.3.1.5 Competing groups compared to individuals ....................... 58
    2.3.1.6 Time pressure ............................................................... 58
    2.3.1.7 Frequency ..................................................................... 59
    2.3.1.8 Summary ....................................................................... 60
  2.3.2 Evidence for video game competition increasing aggression .......... 60
3.2.6 Summary ........................................................................................................ 101

3.3 Assessing Aggression .......................................................................................... 102

3.3.1 Assessing aggressive behaviour ......................................................... 103

3.3.1.1 Modified Taylor Competitive Reaction Time Task (TCRTT) .................. 103

3.3.1.2 Hot Sauce Paradigm .............................................................................. 107

3.3.1.3 Summary of measures of aggressive behaviour .................................. 108

3.3.2 Measures of trait aggression, affect, cognition, and arousal .................. 109

3.3.3 Summary of measures of aggression ......................................................... 112

3.4 Conclusions and directions for future research ............................................. 113

3.5 Research Questions ............................................................................................ 114

Chapter 4: Study 1A: Relationship that Violent, Competitive, and Multiplayer Video Games have with Trait Aggression .................................................................................. 116

4.1 Introduction ......................................................................................................... 116

4.1.1 Overview and hypotheses ......................................................................... 120

4.2 Method ................................................................................................................ 122

4.2.1 Participants ................................................................................................. 122

4.2.2 Materials ..................................................................................................... 122

4.2.3 Procedure .................................................................................................... 124

4.2.4 Data analysis .............................................................................................. 124

4.3 Results ............................................................................................................... 125

4.3.1 Descriptive statistics ................................................................................ 125
4.3.2 Main analyses

4.3.2.1 Video game exposure

4.3.2.2 Video game preference

4.3.2.3 Interactions

4.3.2.4 Multiplayer analysis

4.3.2.5 Competitive and violent game ratings

4.3.2.6 Sex moderation

4.3 Discussion

Chapter 5: Study 1B: Assessment of Level of Competitiveness within Video Games

5.1 Introduction

5.2 Method

5.2.1 Participants

5.2.2 Materials

5.2.3 Procedure

5.2.4 Development of expert competitive video game rating scale

5.2.5 Predictions

5.2.6 Data analysis

5.3 Results

5.3.1 Inter-rater reliability of participants’ ratings

5.3.2 Internal reliability of ECS

5.3.3 Predictive validity ECS and participants’ competition ratings
5.3.4 Predictive validity of ESRB as a violence predictor and participants’ violence ratings .......................................................................................................................... 159

5.4 Discussion .................................................................................................................. 159

Chapter 6: Study 2: Causal Impact of Violence and Competitiveness within Video Games on Aggression .................................................................................................................. 167

6.1 Introduction ................................................................................................................ 167
   6.1.1 Competition ........................................................................................................ 168
   6.1.2 Losing .................................................................................................................. 171
   6.1.3 Violence .............................................................................................................. 172
   6.1.4 Interaction effect .................................................................................................. 173
   6.1.5 Aims and hypotheses .......................................................................................... 174

6.2 Method ......................................................................................................................... 175
   6.2.1 Participants ......................................................................................................... 175
   6.2.2 Materials ............................................................................................................ 175
   6.2.3 Procedure .......................................................................................................... 183
   6.2.4 Data analysis ...................................................................................................... 184

6.3 Results ........................................................................................................................ 185
   6.3.1 Descriptive statistics and missing data ................................................................. 185
   6.3.2 Manipulation checks and subjective experience .................................................. 187
   6.3.3 Main analyses ...................................................................................................... 188
      6.3.3.1 Aggressive affect (SHS) ............................................................................... 188
      6.3.3.2 SHS subscales ............................................................................................. 188
6.3.3.3 Aggressive behaviour (TCRTT) ........................................190
6.3.3.4 Arousal (Heart rate) .....................................................191
6.3.3.5 Reliability of violence and competitiveness scales............191
6.3.4 Secondary analyses ................................................................192
6.3.4.1 Sex moderation ..............................................................192
6.3.4.2 Predictive validity and internal reliability of the TCRTT.....192
6.4 Discussion .............................................................................193
6.4.1 Competition and aggressive affect......................................193
6.4.2 Losing and aggressive affect..............................................197
6.4.3 Violence and aggressive affect ...........................................198
6.4.4 The effect of video games on aggressive behaviour ............200
6.4.5 Arousal .............................................................................202
6.4.6 Interaction between violence and competition ..................204
6.4.7 Summary ...........................................................................204
Chapter 7: General Discussion ...................................................206
7.1 RQ1: Competition within Video Games ..................................207
7.2 RQ2: Violence within Video Games ......................................212
7.3 RQ3: Interaction between Violence and Competition .............215
7.4 RQ4: Multiplayer ...................................................................218
7.5 Model Summarising this Dissertation ....................................221
7.5.1 Model description .............................................................224
7.6 Limitations ................................................................. 226

7.7 Future Directions .......................................................... 229

7.8 Implications ........................................................................ 235

7.9 Summary and Conclusions .................................................. 239

References ............................................................................ 242
List of Tables

Table 2.1 Studies using Different Games between the Violent and Non-violent Condition ....41
Table 2.2 Studies using Same Game across Conditions but Different Goals .........................46
Table 2.3 Studies using Same Game across Conditions and Same Goals ............................47
Table 4.1 Descriptives and Sex Differences for Hours Playing Video Games, Exposure and Preference for Competitive and Violent Video Games, and Preference for Multiplayer Video Games ..................................................................................................................126
Table 4.2 Descriptives and Sex Differences for the BPAQ and Subscales ..........................127
Table 4.3 Exposure to Violent, Competitive, and Multiplayer Games and Spearman’s Rho Correlation with the BPAQ and its Subscales .........................................................128
Table 4.4 Preference for Violent and Competitive Games and Spearman’s Rho Correlation with the BPAQ and its Subscales .................................................................................130
Table 5.1 Call of Duty™: Competition (ECS) and Violence (ESRB) Ratings .....................148
Table 5.2 Candy Crush™: Competition (ECS) and Violence (ESRB) Ratings ......................149
Table 5.3 DOTA 2™: Competition (ECS) and Violence (ESRB) Ratings ..........................150
Table 5.4 FIFA™: Competition (ECS) and Violence (ESRB) Ratings .................................151
Table 5.5 Grand Theft Auto™: Competition (ECS) and Violence (ESRB) Ratings ................152
Table 5.6 Pokémon™: Competition (ECS) and Violence (ESRB) Ratings ..........................153
Table 5.7 Skyrim™: Competition (ECS) and Violence (ESRB) Ratings .................................154
Table 5.8 Competition (ECS) and Violence (ESRB) Ratings for All Games ......................154
Table 5.9 Means, Standard Deviation, and Subsets for Participants’ Competitive and Violence Ratings ..........................................................................................................................157
Table 5.10 Internal Reliability and Predictive Validity of Each Factor in the ECS ..................157
Table 6.1 High Competition Condition: ECS Rating ..............................................................178
Table 6.2 Low Competition Condition: ECS Rating ..............................................................179
Table 6.3 Descriptive Statistics for Violent and Low-Violent Condition, Competitive and Low-competitive Condition, and Overall

186
List of Figures

Figure 1.1. The Wheel of Moral Panic ................................................................. 7

Figure 2.1. General Aggression Model overview ............................................... 18

Figure 2.2. General Aggression Model personality process .................................. 21

Figure 2.3. General Aggression Model desensitisation process .............................. 24

Figure 6.1. Violent and competitive condition of Unreal Tournament 3: Black Edition(TM). 176

Figure 6.2. Low-violent, competitive condition of Unreal Tournament 3: Black Edition(TM) 
........................................................................................................................................ 177

Figure 6.3. Low-violent and low-competitive condition of Unreal Tournament 3: Black Edition(TM) 
........................................................................................................................................ 177

Figure 7.1. Model summarising this dissertation ..................................................... 223
Abstract

With such a large proportion of people playing video games the negative effects of these games continue to be an important and debated area of research. Studies have primarily focussed on the effect of violence within video games on aggression, with the majority demonstrating a positive causal effect. However, there has been little research assessing the effect of competition and multiple human players within video games on aggression. In addition, competition is rarely controlled for in violent video game studies, thus competition may be confounding results as violent video games are generally more competitive. Furthermore, the interaction effect between violence and competition has not been previously assessed. Based on the review of the literature five research questions were posed and assessed: (1) Does competition within video games affect aggression?; (2) Does violence within video games affect aggression when competition is controlled for?; (3) Is there an interaction between competition and violence within video games on aggression?; (4) Do multiplayer games have a relationship with aggression and competition?; (5) Can a more comprehensive model of how video games impact aggression be created, i.e. beyond violence within video game? The first study to address these research questions (Study 1A) assessed 99 participants (51 males, 48 females) using a cross-sectional design and found that real world exposure to and preference for competitive video games had a significant positive correlation with trait aggression. Playing multiplayer games was also correlated with trait aggression and this was most likely due to preference for multiplayer games being correlated with preference for competitive video games. Contrary to the majority of previous research, exposure to and preference for violent video games did not significantly correlate with trait aggression. In addition, no interaction between violence and competition was found. Study 1B further investigated the responses of a subset of 60 participants from Study 1A (36 males, 24 females) to clarify whether participants can reliably and validly assess competition, as
well as clarifying which aspects increase a video game’s rating of competitiveness. Participants’ responses were found to be reliable and valid. In addition, frequency of competitive events, clear opponent’s score feedback, leader boards, team gameplay, time pressure, and multiplayer aspects were found to be predictors of competition within video games and these factors were used to develop a new measure that rates the level of competitiveness within a video game. A final two by two (violence x competition) experimental study assessed 64 participants (40 males, 24 females) to investigate the role of video game competition and violence on player aggression. To control for all possible confounding variables, the same game was used across all conditions and only the levels of violence and competition were varied. Participants who played the competitive version had higher levels of aggressive affect post gameplay, but the level of violence within the game had no effect. Both violence and competition had no impact on aggressive behaviour or arousal, although this was most likely due to limitations of the measures and procedures used. No interaction between violence and competition was found for any measure. The results in this dissertation suggest that competition within video games rather than violence increases aggression post gameplay. Multiplayer games are also related to increased aggression and this is most likely due to the increase in the competitiveness of the game when playing other humans. The findings from the studies were also used to create a more comprehensive model of how video games impact aggression. The major implication of this dissertation is that competition should be considered in official video game ratings (e.g., R18+ (Australian rating), M17+ (US rating) etc.) and the measure of competitiveness developed in Study 1B could be used as a rating guide. In addition, there should be a greater focus by educators and parents to teach children how to deal with competition appropriately and this could be done through adult or parent supervision of children playing competitive video games.
Chapter 1: Introduction

The impact that violent video games have on aggression has been a topic of interest for several decades. However, debate surrounding this area has intensified in recent years following shooting sprees by reported avid gamers. In 1999 there was the Columbine High School massacre with reports indicating that the perpetrators played violent video games, including *Doom*\(^{TM}\) (Anderson & Dill, 2000). Later, Florida attorney Jack Thompson claimed that violent video games were the reason behind the 2007 Virginia Tech shootings (Benedetti, 2007). A more recent example is the 2012 Sandy Hook Elementary School shooting in which the perpetrator, who was reported to be an avid player of violent video games such as *Call of Duty*\(^{TM}\), killed 20 children and 6 educators (Kleinfield, Rivera, & Kovaleski, 2013). The Sandy Hook shootings sparked some US politicians to call for violent video games to be more heavily regulated (Sandoval, Friedman, & Hutchinson, 2013). However, US President Barack Obama proposed $10 million of research funding to further assess the relationship between video games and aggressive behaviour (Sandoval et al., 2013), suggesting that more studies need to be conducted before policies are implemented. While these recent shootings have brought violent video games into the spotlight, there have been concerns about the negative effect of violent media for centuries.

1.1 Brief History of Violent Media Research

The earliest documented concern about the corrupting effect of the media date back to the Greek and Roman eras. In 399 BC Socrates was condemned to death for negatively influencing his young students through speeches (Starker, 1989). Later in the Roman Gladiatorial era, Tertullian (200) theorised that Christians should not go to the gladiator games because it might seduce them into sinful bloodlust. Then in the mid-19th century the negative effect of books became an issue as literacy spread to the general population (Kutner & Olsen, 2008). Some members of society began linking controversial publications to social
issues and increases in juvenile crime rates (Kutner & Olsen, 2008; Trend, 2007). While scientific research was not conducted during these times it is clear that some were already hypothesising that violent media was causing people to become more aggressive. What is also evident is that violence has been a part of general entertainment for a very long time.

The creation and distribution of feature films in the early 1900s again often had violence as a central theme (Trend, 2007). Concerns about the depiction of violence arose and in 1922 a regulatory body was established in America leading to content guidelines for what was appropriate within movies (Trend, 2007). Similar steps were also taken with the introduction of television (Trend, 2007). Unlike previous media, such as print, one aspect that differed when movies and television programs were released was the parallel growth of the modern era of social science. This lead to several studies scientifically assessing the effect of violent media on levels of aggression in the community.

However, by the end of the Twentieth century researchers still had mixed views on the impact that violent movies and television have on aggression. A comprehensive meta-analysis by Paik and Comstock (1994) found a moderate effect size (r = .37) for experimental studies between 1957 and 1990. In addition, the famous experiment by Bandura, Ross, and Ross (1963) showed that children were more likely to be aggressive (hit a bobo doll) after watching a violent video (of an adult hitting a bobo doll). This work was the basis of social learning theory and demonstrated that children could learn to be aggressive through observing aggressive acts. Therefore, it was concluded that violent movies and television may be teaching children to be violent and aggressive. Contrary to this argument, Freedman (2002) found that after removing studies that were argued to use dubious measures of aggression (see Freedman, 2002, for further information), only 28% of studies supported the hypothesis that violent media affects aggression. In fact, 55% of the studies did not support the hypothesis and the rest were either ambiguous or not directly relevant. However,
Freedman’s impartiality was questioned as his book (Freedman, 2002) was funded by the Motion Picture Association of America and Freedman had not conducted any studies on media violence himself (Bushman, Gollwitzer, & Crus, 2015). As this dissertation focuses on video games, the debate around other forms of media will not be discussed further. However, the findings from researchers such as Freedman (2002) and Paik and Comstock (1994) highlight that even during the rise of video games there was still a debate amongst researchers as to whether other forms of violent media had an effect on aggression.

In the 1970s video games, such as Space Invaders™, became available to the public through arcade games and home consoles. By the 1980s and early 1990s video games had improved graphics and were starting to feature person on person violence (Ferguson, 2010), e.g. Street Fighter™ and Mortal Kombat™. These games, as well as later games that are popular and violent (e.g., Grand Theft Auto™), would have been concerning to people who had already concluded that violent movies and television programs were having negative effects. One major concern was that players were able to act out violent actions within the game, rather than just passively watching it (Lin, 2013a). For example, players of Grand Theft Auto™ could interact within the game to steal, murder, and create destruction. These concerns appear to be valid with recent research finding that actively playing a violent video game increases aggression to a greater extent than just watching the game (Lin, 2013a).

The ability to interact with a video game, rather than just watching it, created other differences between video games and movies/television. One such difference is the role of competition. While movies and television cannot really create a sense of competition, many video games are built on the concept of competition, for example in Street Fighter™ a player competes against another player or computer in a virtual fight. However, due to the history of research into violence in the media, most studies concentrated on the violence within these games and consequently competition was largely ignored. Evidence for this is discussed in
Chapter 3, although as violence within the media was already a hot topic amongst researchers, it is understandable that it became the main focus of video game research. In addition, societal beliefs carried over to video games from the debate surrounding violence in movies and television.

Ferguson (2008, 2010) argues that these societal beliefs, which may include “common sense notions”, moral beliefs, religious beliefs, and scientific dogma, created a wheel of moral panic (Figure 1.1). Adapted from Gauntlett (1995), one aspect of Ferguson’s (2010) wheel of moral panic is the influence of the media. An example of this is the coverage surrounding the perpetrator of the Sandy Hook Elementary School shootings. Reports from media outlets suggested the perpetrator was an avid player of violent games, such as Call of Duty™, and that he had scored 83,000+ online kills, including 22,000+ head shots (Bates & Pow, 2013; Kleinfield et al., 2013). Politicians then called for video games to be more heavily regulated (Sandoval et al., 2013), which is also a step in the wheel of moral panic where politicians promote fear. However, despite the speculation from the media and politicians, an official report for the Office of the Child Advocacy in the State of Connecticut (2013) only detailed Dance Dance Revolution™, a non-violent dancing game, as a video game that the perpetrator played heavily. This provides a good example of the suggestions by Ferguson (2008), that the media will “sell” the negative effect of violent video games to an already anxious population, while politicians will seize upon the panic. Another example is the Virginia Tech shootings. Just days after the massacre US Florida attorney Jack Thompson said that the perpetrator was a devoted player of violent video games (Benedetti, 2007). However, during a detailed review it was found that the perpetrator of the Virginia Tech shootings did not play video games at all (Virginia Tech Review Panel, 2007).
The implication of moral panic is that it can affect the quality and reporting of scientific research. Calls for research are made and as Ferguson (2008) has argued, studies that fit in with societal beliefs are apparently accepted uncritically while research critical of societal beliefs are ignored. This suggests that there may be a publication bias (see Mahoney, 1977 for evidence of how reviewers’ perspectives can influence a paper’s ability to be published), a point that will be discussed in more detail during Chapter 2. It is likely that the media will also preference studies supporting societal beliefs which will continue the cycle of moral panic. One factor that could be added to the wheel of moral panic is that the research, media, and politicians’ concerns feed back into the societal belief that violent video games

increase aggression. Therefore, the societal belief is strengthened which perpetuates the cycle.

A criticism of the moral panic theory is that making hypotheses before public debate occurs can be very difficult. Public debate does not always, and should not always, come after scientists have made conclusions about what is occurring. Public concern should drive scientific research as it gives an indication of what is important, relevant, and has implications in the real world. However, it is up to the scientific community to conduct and report studies objectively; a cornerstone of scientific research. Apparent lack of objectivity appears to be demonstrated in a meta-analysis by Greitemeyer and Mugge (2014). In this paper, studies by three leading researchers in the field were found to produce consistently different outcomes. Papers (co)authored by Anderson and/or Bushman had on average a significant effect, while studies in which Ferguson was an author had on average no significant effect. Further, most studies conducted by other researchers aligned with the Anderson and Bushman studies. One conclusion is that there may be several issues with Ferguson’s research (Bushman et al., 2015), although there are other researchers that find similar results (see Chapter 2). Alternatively, the reason that most studies align with the Anderson and Bushman studies could be a result of publication bias, although this does not appear to be the case (discussed further in Chapter 2). Regardless, the findings from Greitemeyer and Mugge (2014) do demonstrate that there is still debate amongst researchers about the effect violent video games have on aggression.

In summary, the impact of violent media on aggression has been debated for a very long time. Video games are the latest platform for this debate and this may have led researchers to ignore other aspects of video games, such as competition. The theory of moral panic and arguments from both sides about issues with the others’ findings demonstrates how furiously this topic is debated. It is imperative that this topic continues to be researched as
there are significant concerns in the public arena with so many people playing violent video games.

1.2 Who Plays Video Games and Why?

Since the first commercialised video games in the 1970s the video game industry has continued to grow. According to a report by the Entertainment Software Association (ESA, 2015) sales of video games in the US have risen from $7 billion in 2003 to $15.4 billion in 2014. An extra $7.01 billion was also spent on video game accessories and hardware in 2014 (ESA, 2015). From 2014 to 2016, Australia’s video game sales have risen by 20% to a total of $2.462 billion (Interactive Games & Entertainment Association [IGEA], 2016). With the industry still growing in the last two years, video games appear to show no sign of becoming less prominent.

The ESA (2015) also reported that 155 million Americans play video games, with 42% of the population playing three or more hours a week. Other reports suggest the proportion may be even higher in adolescent populations with Gentile (2009) finding that 81% of Americans aged 8 to 18 played video games at least once a month. A 2016 report found that 68% of the Australian population played video games, up from 65% in 2014 (IGEA, 2016). While only 39% of children aged 1 to 4 played video games, 91% of children aged 5 to 14 did. Of people aged 15 to 24, 84% played video games, while 85% and 76% of people aged 25 to 34 and 35 to 45 respectively, played video games. The percentage of people playing video games steadily declined as the age groups got older than 45. While there was no age breakdown of how often people played, the average gaming time per day was 88 minutes (IGEA, 2016).

Of this large proportion of people playing video games in Australia, 47% are female (IGEA, 2016). This is a sizable increase from 38% being female players in 2005 (IGEA, 2016). This statistic, taken with findings that 44% of people playing video games in the US
are female (ESA, 2015) dispels stereotypes that gamers are predominantly male. Although, it should be noted that when males do play video games they play for longer. On average males play for 100 minutes a day while females play for 77 minutes (IGEA, 2016).

From these statistics it is clear that video games are very popular amongst both men and women. The reason why they are so popular is their entertainment factor. Indeed, the IGEA (2016) report found that the main reasons people play video games are to have fun, pass-time/relieve boredom, and to relax/reduce stress. Mobile or tablet games were mainly played to pass the time and alleviate boredom, while console/PC games were mainly played to have fun (IGEA, 2016). This difference may be due to mobile phone games generally being used more for casual play, e.g. played for short periods of time (IGEA, 2016). For example, people may play on their phone during the commute to and from work to pass the time. Olson et al. (2007) also found that 87.9% of boys (aged 12 to 14) and 90.2% of girls (aged 12 to 14) played video games because they were bored. However, an even stronger motivation to play was because it was fun with 97.3% of boys and 92.4% of girls agreeing that it was one of the reasons they played. It seems clear that people play video games because it is a source of entertainment, and researchers have discussed several reasons why people find them fun and what motivates people to play (e.g., Olson, 2010; Przybylski, Rigby, & Ryan, 2010).

One main source of motivation and fun within a video game is competition. To “compete and win” and the “challenge of figuring things out” are two strong reasons why children play video games (Olson et al., 2007). While the motivation to compete was significantly stronger for boys (84.4%), just over 60% of girls agreed it was a reason they played. Greenberg, Sherry, Lachlan, Lucas, and Holmstrom (2010) also found competition to be the strongest source of gratification when playing video games for adolescents aged between 9 and 17. In addition, when opponents’ scores are close during a competitive game,
enjoyment is the greatest (Abuhamdeh, Csikszentmihalyi, & Jalal, 2015). Other studies have also shown that being challenged in a video game appears to be a source of enjoyment (Greenberg et al., 2010; Olson et al., 2007). It is also important to note that competing against a human rather than a computer has been reported to be even more entertaining (Weibel, Wissmath, Habegger, Steiner, & Groner, 2008).

While competition appears to be a source of motivation, it is less clear whether violence is a reason people play video games. As demonstrated in the previous section, violence has historically been a part of society’s entertainment suggesting it must have some sort of appeal. In the study by Olson et al. (2007) less than 20% of girls agreed that one reason they played video games was because they “like guns and weapons”. However, 55.7% of boys agreed that it was a reason they played, suggesting that boys are more likely to be drawn to violent video games than girls. Although, in a study by Przybylski, Ryan and Rigby (2009) violent content by itself was found to have little to no effect on enjoyment of video games. Instead, opportunity to demonstrate competence and autonomy were found to be the biggest predictors of video game enjoyment. This may further support the motivating factor of competition within video games as it offers players the chance to demonstrate competence against an opponent. Despite these findings that violence does not increase enjoyment, violent video games dominate the top selling lists. In 2015, four of the top five most sold games in the USA involved violence, i.e. *Call of Duty: Black Ops III* (M17+), *Fallout 4* (M17+), *Star Wars: Battlefront* (Teen, however it has content descriptor of “violence”), and *Grand Theft Auto V* (M17+) (Grubb, 2016). A potential reason why violent video games are so popular is because they are more competitive. Indeed, Olson et al. (2007) found that children who played at least one Mature rated game reported “compete and win” as a motivating factor for playing video games significantly more often than those who did not play Mature rated games. It may be that the violence within violent video games is not the
reason why they are so popular. Instead it may be that the violent content provides a platform for competition. However, there are very few studies addressing why people enjoy and are motivated to play violent video games (Kasumovic, Blake, Dixson, & Denson, 2015).

Regardless of whether violence is a motivating factor for playing video games, violent video games are some of the most popular video games. With 155 million Americans (ESA, 2015) and 68% of Australians (IGEA, 2016) playing video games it is imperative for research to investigate the possible negative effects of violent video games on aggression. In addition, with competition, especially against a human (Weibel et al., 2008), being a very popular reason why people play video games, the impact of competition and multiplayer aspects on aggression also needs to be assessed.

1.3 Dissertation Overview and Aims

The primary aim of this dissertation was to assess the impact of violent and competitive video games on aggression. The secondary aim was to assess the relationship multiplayer games have with competition and aggression. The first step taken to address these aims was to discuss, evaluate, and summarise the theories and studies focusing on the impact violent, competitive, and/or multiplayer video games have on aggression. This is done in Chapter 2. Chapter 3 then evaluates the methodological issues with video game research. From these two review chapters, four key areas that required further research were discovered.

Firstly, despite the majority of studies finding that violent video games affect aggression (see Chapter 2), there are concerns about the impact of confounding variables. Specifically, competition, which is suggested to be at a greater level in violent video games (Carnagey & Anderson, 2005), has not been sufficiently controlled for (see Chapter 3). In addition, as different games are generally used across conditions, it increases the likelihood of other confounding variables impacting the results (see Chapter 3). Therefore, the impact of
violence within video games needs to be assessed when competition and other potential confounding variables are controlled for. The second key area that required further research was the impact of competitiveness within video games. This is due to the limited research in the area and the potential to build upon previous research to address some of the limitations (see Chapter 2). Thirdly, the interaction between violence and competitiveness within video games has not been adequately assessed (see Chapter 2). Finally, there have been inconsistent results in regard to the effect multiplayer games have on aggression and the impact of multiplayer games on competitiveness has not been assessed (see Chapter 2).

To address these gaps in the literature, two studies were conducted. The first was a survey based study as outlined in Chapters 4 (Study 1A) and 5 (Study 1B). Study 1A helped identify whether exposure to and preference for violent, competitive, and multiplayer video games predicted trait aggression (the personality predisposition to be aggressive). In addition, the interaction between violence and competition was assessed to explore whether a combination of these two variables would relate to aggression further than one variable alone or whether competition within video games would reduce violent video games’ ability to predict aggression. The relationship between multiplayer games and competitiveness was also assessed. Study 1B was conducted to support the methodological approach taken in Study 1A and to help identify aspects within a video game that make it more competitive. While the results from the survey based study provided information about the relationship real-world video games played outside the laboratory have with aggression, it did not provide any causal evidence. Therefore, an experimental study was conducted (Chapter 6). To reduce the potential effect of confounding variables, the same game was used across conditions. Only violence and competitiveness were manipulated within the game so that the impact of these variables on aggressive affect and behaviour could be assessed. This study (Study 2)
helped identify whether violence and competitiveness had a causal effect on aggression. In addition, as with Study 1A, the interaction between violence and competition was assessed.

The final chapter, Chapter 7, discusses the findings from Studies 1A, 1B, and 2 and their importance in addressing the four gaps in the literature. In addition, a model summarising the findings is discussed. Limitations and suggestions for future research are then discussed. Finally, the implications and conclusions are presented.
Chapter 2: Literature Review

As discussed in the previous chapter, the influence that different forms of media have on people has been a concern to the public for a long time. However, with the recent rise in popularity of digital gaming, the impact of video games on aggression, especially violent ones, has become a major focus. Shooting sprees, where it was reported that the perpetrator played violent video games (e.g., Benedetti, 2007), also heightened the already substantial concerns within society. In addition, there are established rating systems for video games in various countries (e.g., the American Entertainment Software Rating Board [ESRB], 2016) that essentially warn people about the negative aspects of video games, such as their level of violence, sexual content, and language. There has been a lot of research assessing the impact that video games have on aggression, but firstly it is important to understand what aggression is and how video games may affect it. Therefore, this chapter begins with a definition of aggression and the theories on how it is influenced. As the primary focus of this dissertation is violence and competition within video games, the theories were used to help explain how these factors may increase aggression.

Following an outline of aggression theories, a literature review of the empirical research is included. As was discussed in the previous chapter, despite a large amount of research, there is a divide amongst some researchers as to whether violence within video games affects aggression (mainly due to differences in methodological approaches, see Chapter 3). Therefore, the evidence is examined and a conclusion drawn about the impact that violent video games have on aggression based on the research available at the present moment. Following this, while there is a limited amount of research, studies assessing the impact of competition within video games on aggression are discussed thoroughly. In addition, theories on what makes a video game more or less competitive are put forward. Lastly, the impact of multiplayer games on both aggression and competition are discussed.
2.1 Theories of Aggression

Aggression is defined as any behaviour aimed at another human or living being with the intention of causing harm (Anderson & Bushman, 2002). Violence is considered a form of aggression where the aim is to cause extreme harm (Anderson & Bushman, 2002). Harm that is a by-product of perceived helpful behaviour towards the target, e.g. a dental procedure, is not viewed as aggression because the target is not motivated to avoid the action. Traditionally aggression is split into two types, hostile and instrumental (Bushman & Anderson, 2001). Hostile aggression is impulsive, unplanned, driven by anger, and is in reaction to perceived provocation. Instrumental aggression is proactive and thought out, with the perpetrator trying to obtain a certain goal. While often useful, this dichotomy is argued to be too simplistic; hostile aggression can involve features of instrumental aggression and vice versa (Bushman & Anderson, 2001). In addition, the motive of the aggressor can be unclear and involve both anger (hostile aggression) and planning (instrumental aggression). Therefore, aggression can be viewed as a continuum on four independent categories: degree of hostile affect, degree of automaticity, degree to which the goal is to harm the victim versus benefit the perpetrator, and degree to which the consequences are considered (Anderson & Huesmann, 2003; Bushman & Anderson, 2001).

There are several different perspectives or theories on aggression. However, most include a combination of both basic principles of nature and nurture. From an evolutionary perspective, it is hypothesised that humans would have had to use aggression to gather resources from others, defend against attacks, compete with sexual rivals, and demonstrate dominance to reach a status of power (Buss & Duntley, 2006). This suggests an innate biological reason for the existence of aggression. There is also the impact of learning which is explained primarily through the social learning theory (e.g., Bandura, 1977). Studies surrounding this theory find that aggression can in fact be learned (e.g., Bandura, Ross, &
Ross, 1961, 1963). Several theories have expanded upon the initial understanding that aggression is both innate and learned. This section will cover the theories most relevant to video game research.

2.1.1 Theories of aggression: Violent video games

2.1.1.1 General Aggression Model (GAM)

The General Aggression Model (GAM) (Anderson & Bushman, 2002) appears to be the most comprehensive theory of aggression in video game research. This model was created through the integration of several other theories including the frustration-aggression hypothesis (Berkowitz, 1989), cognitive neo-association theory (Berkowitz, 1990), social learning theory (e.g., Bandura, 1973), script theory (e.g., Huesmann, 1986), excitation transfer theory (e.g., Zillmann, 1983), and social interaction theory (e.g., Tedeschi & Felson, 1994). It is also the most widely cited theory in video game research. As seen in Figure 2.1, the episodic process (proximate causes & processes) of the GAM has three main focal points that influence the behaviour taken in a single encounter.

The first focal point is “input” which includes person and situation factors. Person factors are characteristics of the individual and include traits, sex, beliefs, attitudes, values, and scripts. Situation factors are features of the situation and include the presences of aggressive cues, provocation, pain/discomfort, drugs, and incentives. Frustration is also included as a situational factor and is defined as the blockage of goal attainment. Later, distal causes and processes were added above the “inputs” and included biological and environment modifiers (e.g., maladaptive family or exposure to media violence) (Anderson & Carnagey, 2004; Anderson & Huesmann, 2003). While the proximate causes are active and present during an episode, the distal causes exert their effect over a long period of time. They do this by influencing personality, which in turn affects person and situation factors during an
episode. Both the personal and situational factors influence the final behaviour through the *present internal state* which is the “route” to the “outcome”.

Cognition (e.g., hostile thoughts), affect (e.g., anger), and arousal make up the present internal state. These three states are not completely independent from each other and are interconnected. For example, hostile thoughts may lead to increased anger and arousal. When related to violent video games the GAM posits that the presence of aggressive cues (e.g., guns, fighting, or violence in game) leads to a short-term increase in aggressive cognitions, affect, and arousal. This is supported by large meta-analyses (Anderson et al., 2010; Greitemeyer & Mugge, 2014) which found that all three states were affected by violent video games. However, the dominant “route” for violent video games is theorised to be cognitions as other non-violent games can have an effect on arousal and affect (Anderson & Dill, 2000; Anderson et al., 2010). Anderson et al. (2010) suggest that any game that involves intense concentration and rapid response may increase arousal, while games that are fast paced or difficult are likely to increase aggressive affect. However, violent video games by nature will have violence that will prime aggressive thoughts and related concepts, while non-violent games will not have any violent cues. Even though cognition is theoretically the primary route, as the GAM states, cognitions, affect, and arousal are interconnected and activate one another. Therefore, activation of aggressive cognitions will likely lead to an increase in aggressive feelings and arousal. This explains why all three aspects of the present internal state (cognition, affect, and arousal) have been shown to be affected by violent video games (Anderson et al., 2010; Greitemeyer & Mugge, 2014).

The overall present internal state will then affect the “outcome” or appraisal and decision process which will determine how the individual will act. The first step in this process is to make an immediate appraisal, which is affected by the present internal state. For example, if a person is cognitively primed to aggressive thoughts they will be more likely to appraise an accidental bump from another person as being hostile. If no further appraisal is taken, then it will lead to impulsive action. However, if the individual has enough resources
(e.g., time and cognitive capacity), and the outcome is important and unsatisfying, then reappraisal will occur. This will lead to a thoughtful action, although, it is important to note that the present internal state will still affect the reappraisal process. Once a decision has been made the individual will act in an aggressive or non-aggressive way. Depending on environmental responses to the behaviour chosen by the individual the decision will either be reinforced or inhibited. This results in learning and long-term effects. For example, in a violent game the player will often use aggression to deal with certain situations and may receive a positive environmental response from within the game for acting aggressively, therefore the player is taught that aggression is an acceptable behaviour.

Expanding on the long-term effects, Figure 2.2 outlines the personality process of the GAM (Anderson & Bushman, 2002). Repeated exposure to a certain event, for example violent video game play, causes learning, rehearsal, and reinforcement of aggression related knowledge structures. This influences aggressive beliefs, attitudes, schemas, and scripts, as well as desensitisation to aggression. Through this mechanism there is an increase in aggressive personality traits which then feed back into the episodic process of the GAM (Figure 2.1). As such, this learning process will increase the chances of the individual behaving aggressively in following encounters.
The main strength of the GAM is that it combines a range of mini-theories which have been supported by empirical research (see Anderson & Bushman, 2002). This unified theory takes into consideration a multitude of factors, from biological to situational causes. The combination of several different evidence-based factors has made the GAM the most comprehensive and widely used theory of aggression for violent video game research. In

addition, findings from meta-analyses (Anderson et al., 2010; Greitemeyer & Mugge, 2014) support the GAM. That is, as the GAM predicts, violent video games have been shown to increase aggressive cognitions, affect, arousal, and behaviour in the short and long term. However, despite these strong attributes there are criticisms of the GAM (e.g., Elson & Ferguson, 2014; Ferguson & Dyck, 2012).

One limitation of the GAM is its application to violent video game research. Ferguson and Dyck (2012) argue that the GAM makes the assumption that aggression is mainly learned and cognitive. While the model incorporates a wide range of factors, there is less emphasis on other predictors of aggression such as genetics and other biological factors. For example, Bushman and Anderson (2002, p. 1680) stated that according to the GAM, “aggression is largely based on the activation and application of the aggression-related knowledge structures stored in memory (e.g., scripts, schemas)”. This could be seen as a criticism of the application of the GAM, rather than a criticism of the model itself. Aggression is a complex behaviour influenced by a multitude of factors, as the GAM theorises. Consequently, when applying the model to research, all these factors need to be taken into consideration. This does not mean testing every factor of the GAM in one study, but rather acknowledging the other factors and how they might be influencing the findings when the entire research area is discussed. In violent video game research, it is argued in this dissertation that the role of competition cannot be ignored (see Chapter 3). In addition, other researchers argue that biological and environmental factors, other than video games, are ignored (see catalyst model later in Chapter 2, and third variables/individual differences in Chapter 3).

2.1.1.2 Desensitisation and empathy

Desensitisation to violence is defined as “a reduction in negative emotional response to scenes of violence” (Anderson et al., 2010, p. 157). While desensitisation was included in the original GAM (Anderson & Bushman, 2002) it was not given prominence. However,
Carnagey, Anderson, and Bushman (2007) elaborated on its role. Figure 2.3 theoretically demonstrates how repeated exposure to violence within video games will reduce reactions of fear and anxiety to violence. Once this desensitisation has occurred it is more likely that in future violent events the individual will believe the injuries sustained by the victim are less severe, have less sympathy for the victim, believe violence is normal and have less negative views of violence, as well as being less likely to notice aggression.
These perceptions appear to be related to a lack of empathy which is defined as the “degree to which a person subjectively identifies and commiserates with a victim and feels emotional distress” (Anderson et al., 2010, p. 157). For example, an aggressor will not be able to accurately identify and commiserate with a victim if they underestimate the amount of
injury they have caused and have less sympathy towards the victim. Due to this they will feel less emotional distress when committing aggressive acts and will therefore be more likely to act aggressively.

To support the theory of desensitisation and empathy researchers have demonstrated that violent video games can lead to decreased sensitisation/empathy towards violence/aggression (Anderson et al. 2010). In addition, Engelhardt, Bartholow, Kerr, and Bushman (2011a) demonstrated that when participants were desensitised to violence after playing a video game (assessed through EEG recordings of the P300 component of the event-related brain potential while viewing neutral or violent pictures post gameplay) it increased aggressive behaviour assessed through the Taylor Competitive Reaction Time Task (see Measures of Aggression in Chapter 3).

2.1.1.3 Catalyst Model

While the GAM predicts that violent video games increase aggression, the catalyst model (Ferguson et al., 2008a) suggests that violent video games have no direct causal effect. The catalyst model suggests that aggressive personality is developed largely through a genetic predisposition. Environmental factors, such as family violence, can moderate the impact of biology in either a positive or negative direction. The resulting level of aggressive personality will determine how likely an individual is to act aggressively to a catalyst.

The model explains catalysts as short term environmental stressors, for example relationship issues, which provide the motive for aggression. If the amount of environmental stress is high, then an individual will be more likely to act aggressively. However, it is theorised that individuals who have an aggressive personality require less environmental stress to act in an aggressive manner. In other words, a certain situation may provide an opportunity and motive to be aggressive, however it is the individual’s aggressive personality that determines whether they act aggressively. Conceptually this sounds quite similar to the
GAM; personal and situational factors contribute to whether someone is aggressive; however, it is the role of violence within a video game that differs between the two theories.

The GAM would argue that violence within a video game provides an aggressive cue that leads to aggression, but the catalyst model suggests that the cue is just a *stylistic catalyst*. Unlike a catalyst, a stylistic catalyst will not affect whether an individual will be aggressive, but rather how the aggression will be displayed. Therefore, the individual may express their aggression modelled on a video game, but if they had not been exposed to that video game they would have displayed their aggression anyway, just in a different form.

The model also suggests that aggressive individuals will seek out violent video games as they fit with their innate motivation to be aggressive. This is known as the “selection hypothesis” (Moller & Krahe, 2009). In contrast, there is the “socialisation hypothesis”, i.e. violent video games increase the player’s aggression (Moller & Krahe, 2009). These two hypotheses can work in conjunction with each other as demonstrated by the downward spiral model (Slater, Henry, Swaim, & Anderson, 2003). The downward spiral model posits that aggressive people are drawn to violent video games (selection) and then they will become more aggressive after playing (socialisation) and therefore be even more drawn to violent video games. Therefore, there is a causal relationship in both directions and they continue to reinforce each other resulting in a continuous cycle. However, in contrast to the downward spiral model, the catalyst model appears to refute the “socialisation hypothesis” altogether as it suggests that violent video games do not actually have a causal effect on aggression. This is opposed to the GAM which would include the socialisation hypothesis as it argues that violent video games do affect aggression.

The strength of the catalyst model is that it provides a theoretical explanation as to why some studies find no relationship between violent video games and aggression, as violent video games only stylise aggression rather than cause it (e.g., Ferguson et al., 2008a).
In addition, it highlights the importance of biological factors and environmental factors other than violent media. Indeed, there are studies finding that when controlling for biological and other environmental factors, violent video games do not affect aggression (e.g., DeCamp, 2015). However, there have been other studies that still found that violent video games have an effect (Gentile, Li, Khoo, Prot, & Anderson, 2014) (see “Third Variables” in Chapter 3 for further discussion). In addition, as discussed previously, the GAM still includes biological and environmental factors.

A weakness of the catalyst model is that the majority of research has found that violent video games do affect aggression (Anderson et al., 2010; Greitemeyer & Mugge, 2014). Even if the studies in the meta-analyses did not control for other factors, such as trait aggression and family violence, random sampling should have protected against these extraneous variables.

Another issue is the assumption that modelling aggression from video games is not a substantial consequence as the aggression would have occurred anyway. However, violent video games often involve violent behaviour that is far more extreme than most individuals would see in real life. If an individual learns to display aggression by yelling, as modelled by their family for example, this is less detrimental than displaying aggression through shooting someone, as displayed by a violent shooting game. However, there does not appear to be any evidence that violent behaviour is precisely modelled from violent video games. In addition, as the theory argues, a person would need to have an extreme tendency or cause to be violent. Also, individuals with aggressive tendencies, as the catalyst model suggests, seek out violent models anyway, such as delinquent peers.

2.1.1.4 Catharsis

The catharsis hypothesis predicts that venting or acting out aggression through video games would reduce the likelihood of later aggression (Bushman, 2002; Gentile, 2013). This
theory, first described by Aristotle and then later reformulated by Freud, was created well before the modern era, although it is a common belief that it is applicable to video games (Gentile, 2013). Despite its historical persistence, there is a lack of empirical evidence to support the catharsis hypothesis.

Meta-analyses have generally found that playing violent video games increases rather than decreases post gameplay aggression (Anderson et al., 2010; Greitemeyer & Mugge, 2014). As discussed later in this dissertation, methodological issues may have confounded previous violent video game research, although only to the point of a null finding, not to the point that violent video games reduce aggression. In fact, in the review of violent video game literature displayed later in the dissertation, no studies found a reduction in aggression over all measures after violent video game play. Gentile (2013) also discussed findings from studies not related to video games that also fail to support the catharsis model. For example, Bushman (2002) found that venting anger through hitting a punching bag increased aggression compared to sitting calmly and doing nothing.

Despite evidence that the catharsis hypothesis is not supported, there is still an urban myth amongst some that violent video games reduce aggression. Studies have found that people who believe in the catharsis hypothesis, e.g. they stated that they played video games because they believed it “helped get the anger out”, preferred and had a desire to play violent video games (e.g., Bushman & Whitaker, 2010; Ferguson, Olson, Kutner, & Warner, 2014). Therefore, people who trust the catharsis hypothesis will be drawn to violent video games because they believe it will reduce aggression. However, the opposite appears to be true, or at the very least there is a null effect (see Violent Video Games in Chapter 2). In addition, if violent video games increase aggression this may cause a downward spiral (Slater et al., 2003). That is, playing violent video games increase aggression, therefore a person who believes in the catharsis hypothesis will attempt to play violent video games more often in an
attempt to reduce their increased aggression. However, it will only cause further increases in aggression and consequently the cycle will continue.

2.1.2 Theories of aggression: Competitive video games

2.1.2.1 Frustration-Aggression Hypothesis and Cognitive Neo-association Model

While violent video games appear to primarily impact aggression through the cognitive route of the GAM, competition within video games may primarily impact affect. The frustration-aggression hypothesis (Dollard, Doob, Miller, Mowrer, & Sears, 1939; later reformulated by Berkowitz, 1989) defines frustration as an individual’s goal being thwarted (or threatened). When a goal is interfered with it can lead to negative feelings, such as anger and hostility, which results in the individual being more likely to behave aggressively. In addition, when an individual’s goal is believed to be illegitimately and deliberately blocked, rather than being accidently thwarted, the person will be even more likely to develop aggressive feelings and act aggressively. Also, an unexpected failure to obtain a goal is more likely to lead to aggression than an expected failure.

This theory helps explain why competitive video games may increase aggression as competitive encounters involve opponents trying to block each other’s goal (Berkowitz, 1962). For example, in a competitive first-person shooting game (i.e., the player shoots other characters while viewing the video game through their in-game character’s eyes) two players (one can be a computer) have the goal to win the game by killing their opponent. This results in both players actively blocking each other as only one player can survive and win the game. While both players’ goal will be blocked deliberately (which is theorised to increase the likelihood of aggression) the attempted block will usually be legitimate as it is within the rules of the game. Therefore, the players may feel less angry and hostile than they would if the interference from the opponent was illegitimate, as the frustration-aggression hypothesis theorises. However, the legitimacy of the opponent’s attempts to block the player is open to
perception. If the player believes their human opponent cheated or their computer opponent was designed poorly and is unfairly powerful, this may result in further aggressive feelings.

In addition to the legitimacy of the defeat affecting the strength of the frustration-aggression link, the degree to which the defeat is expected can also have an influence. If the player expects to win the game but ends up losing the frustration-aggression hypothesis theorises that they will feel more aggressive than if they did not expect to win in the first place. However, a defeat, which results in the blockage of a goal, may not even be necessary for aggression to occur in a competitive situation. For example, Nelson, Gelfand, and Hartmann (1969) found that boys displayed more aggressive acts against a bobo doll after playing a competitive game compared to boys who did not play a competitive game. Further, boys who lost the competitive game displayed the most aggression. However, this study still suggests that, regardless of winning or losing, competitive games can increase aggression. This may be due to the fact that there is still an opponent threatening or interfering with the goal of winning. However, a methodological issue with this study was that key significance tests were not given.

According to the frustration-aggression hypothesis competitive video games can primarily impact on aggressive affect through feelings of frustration, anger, and hostility, but this aggressive affect also spreads to cognition and arousal. Discussed briefly by Berkowitz in 1989 and then later covered in depth by Berkowitz in 1990, the cognitive neo-association model theorises that aggressive affect activates aggressive cognitions. This is also a feature of the GAM where affect, cognitions, and arousal interact with each other within the present internal state. The cognitive neo-association model suggests that a negative affect such as anger, will be linked to thoughts, memories, expressive motor reactions, and physiological responses associated with aggression and anger. However, if the event produces feelings of fear rather than anger, this will trigger avoidance cognitions which will result in the person
trying to escape the event. Therefore, if the event produces anger it will result in a fight response, while if it produces fear it will result in a flight response. This has implications for video games as the anonymity and separation from the opponent may mean that a fear response is less likely. Players will therefore attempt to fight rather than flee resulting in more aggressive behaviours during the game. Indeed, Wright (2013) found that being anonymous online increased cyber aggression, though this was not specifically in a video game.

Frustration (a situation input) and the cognitive neo-association model (interaction of affect, arousal, and cognition within the internal state) are part of the GAM so the same reasoning can be used to explain the long-term effects of competitive video games. A competitive game will increase the likelihood of aggressive behaviour by influencing the player’s present internal state. If the player aggresses and it is perceived to be the right action, for example yelling at an opponent and then either the player wins or feels better, the behaviour is reinforced. Repeated exposure can affect the individual’s beliefs, attitudes, schemas, and scripts through which a person may see aggression as an appropriate way to deal with an event that is competitive, frustrating or anger inducing.

It is also important to note how the frustration-aggression hypothesis can be linked to the catalyst model. In the catalyst model, environmental stressors can create a motive to be aggressive and therefore increase the likelihood of an aggressive act. As competition appears to be frustrating it seems logical that it can be classed as an environmental stressor. This was not mentioned by the authors of the catalyst model (Ferguson et al., 2008a), although a competitive situation does seem to fit with the definition of a catalyst. If competition is thought of as a catalyst, then the catalyst model would predict that a competitive video game would lead to an increased likelihood of short term aggression. However, violence within the video game would still have no causal effect as it is only a stylistic catalyst.
2.1.2.2 Self Determination Theory

Self Determination Theory (SDT) (Deci & Ryan, 1985; Deci & Ryan, 2000; Ryan & Deci, 2000) offers a different perspective on how competition may increase aggression. SDT states that humans have a motivation to satisfy three fundamental psychological needs: competence, autonomy, and social relatedness. If these needs are impeded it can make people more prone to being aggressive (e.g., Przybylski, Deci, Rigby, & Ryan, 2014, Weinstein, Hodgins, & Ostvik-White, 2011). Therefore, instead of the impedance of a goal, as theorised by the frustration-aggression hypothesis, it may be the impedance of satisfying a fundamental need that potentially increases aggression after gameplay.

When related to competitive video games, competence is the most applicable need. A player wants to be competent at the game and if the player is defeated or impeded by other opponents then the need to be competent may not be fulfilled. Przybylski et al. (2014) demonstrated that this could lead to aggression when SDT was assessed in relation to video games. Increasing the difficulty of a video game, and thus impeding participants’ competence, led to an increase in aggression. While the increase in difficulty could have just made it harder to reach the goal of winning, which is consistent with the frustration-aggression hypothesis, self-determination theorists would argue that the increased aggression was due to an impedance of the need for competence (Przybylski et al., 2014). SDT addresses the link between competition in video games and aggression in a different way, although more research is needed to demonstrate whether SDT or frustration-aggression hypothesis is more applicable.

2.1.3 Theories of aggression: Interaction between violence and competition within video games

As demonstrated, the more comprehensive theories suggest that both violent and competitive video games can independently increase aggression. It is therefore reasonable to
hypothesise that these two factors can interact to have an even stronger effect. As the GAM incorporates both the frustration-aggression hypothesis and the cognitive neo-association model it can be used to explain a potential interaction effect between violence and competition within video games on aggression. This interaction does not appear to have been discussed by researchers, although some have mentioned the violent-only versus competitive-only hypothesis (e.g., Anderson & Carnagey, 2009; Carnagey & Anderson, 2005). The reason violence and competition are displayed as competing hypotheses is to demonstrate that violence within video games can affect aggression independently. However, while each variable may affect aggression independently it is also important to discuss how they might interact. Therefore, this section will attempt to explain a theoretical interaction between violence and competition within video games on aggression using the GAM.

As discussed above, violence within video games is theorised to primarily influence cognition and then activate affect and arousal. Competition on the other hand will influence affect primarily and then activate cognition and arousal. Activation of cognitions, affect, and arousal related to aggression should then occur for either a violent or competitive video game independently. However, a combination of the two, through different pathways within the GAM’s present internal state should increase the likelihood of aggressive behaviour even further. For example, violence within video games primes aggressive thoughts, however competition, through feelings of frustration and anger, may strengthen the priming of those aggressive thoughts or prime other aggressive thoughts. In addition, violence within the video game, through priming related aggressive thoughts, may activate even more feelings of anger beyond the frustration of competition. The further increases in aggressive affect and cognition should therefore make the individual more likely to act aggressively in the short term.
There may also be long-term consequences from a game being both competitive and violent. If a violent cue, e.g. shooting a gun, and anger from a competitive situation are activated at the same time, the connection between them should be strengthened. Therefore, for example, the presence of a gun in the future will be more likely to activate anger. In addition, a frustrating but non-violent situation may be more likely to activate violent thoughts, such as shooting a gun. Also, if a player gets frustrated and angry they may become more violent within the game which may teach them that aggression is an acceptable way to deal with those feelings. The GAM posits that repeatedly playing a violent video game can affect aggressive schemas, scripts, beliefs, and attitudes, however it may be that a combination of violence and competition has a stronger long-term effect.

2.1.4 Summary of theories of aggression

In summary, while the catalyst model (Ferguson et al., 2008a) suggests that violent video games only styles displayed aggression, the larger, more comprehensive, and more researched GAM (Anderson & Bushman, 2002) argues for a direct causal relationship between violent video games and aggression. The increase in aggression is due to a violent video game providing aggressive cues which prime aggressive thoughts leading to an increase in aggressive affect and arousal as well. This increase in aggressive cognition, affect, and arousal makes the gamer more likely to act aggressively. Repeated exposure to violent video games and the aggression associated leads to learning and reinforcement of aggressive responses and the development of a more aggressive personality in the long term.

The frustration-aggression hypothesis (Berkowitz, 1989), cognitive neo-association model (Berkowitz, 1990), and SDT (Deci & Ryan, 1985; Deci & Ryan, 2000; Ryan & Deci, 2000) on the other hand can be used to explain why competition within video games may increase aggression. The frustration or lack of competence results in an increase in aggressive affect which then links to aggressive cognitions and arousal. This then makes the gamer more
likely to act aggressively. Again, repeated exposure could lead to an aggressive personality through learning and reinforcement of aggressive responses resulting in long-term effects.

As violence in video games appears to primarily take a cognitive route to aggression, while competition takes an affective route, it is suggested that these two aspects of video games may interact. If violent video games prime aggressive thoughts and competition makes the individual angry then the player will be even more likely to act aggressively in a competitive violent game compared to if the video game was only violent or competitive.

Based on the GAM, frustration-aggression hypothesis, cognitive neo-association model, and SDT it was hypothesised that the majority of research would find that violent and/or competitive video games affect aggression. However, the catalyst model would hypothesise null findings when it comes to violent video games. The rest of this chapter will explore the research to discover whether these hypotheses are supported.

2.2 Violent Video Games and Aggression

Violence is a form of aggression where the aim is to cause extreme harm (Anderson & Bushman, 2002). However, in video games the level of violence can often vary. For example, the ESRB (2016) in America can rate a game as having mild or intense violence. “Mild” refers to low frequency, intensity, or severity, while “intense” violence may have extreme amounts and/or realistic and graphic depictions of blood, gore, weapons, human injury, or death. Using another method, US experts in the Busching et al. (2015) study determined the level of violence by assessing each video game on eight categories: Aggressive acts by the player, aggressive acts toward the player, rate of violent acts per minute, humanoid targets (human or human appearance), blood and gore, use of weapons, realistic violence, and whether body parts were severed, torn, or exposed.

The debate as to whether violence within video games increases aggression has been raging for many years. Recently it was argued that a consensus had been reached within the
scientific community with 8 out of 10 researchers, who had an opinion, agreeing that violent media increases aggression (Bushman et al., 2015). However, others argue that this consensus is inaccurate (Ivory et al., 2015). The “8 out of 10” statistic ignores researchers who neither agree nor disagree but this response represents a valid position (Ivory et al., 2015). Indeed, in scientific research if the null hypothesis is not experimentally rejected then by de facto the hypothesis that there is no effect must be accepted. A neither agree nor disagree statement implies the inability to reject the null hypothesis, that is, violent video games have no effect. When including researchers that gave a neutral response, 61.1% of media psychologists and 56.3% of communication scientists agreed that there is a causal relationship between violent media exposure and aggression (Bushman et al., 2015; Ivory et al., 2015). This is a slight majority rather than consensus. However, for violent video games, 71.9% of media psychologists and 62.6% communication scientists agreed that violent video games increase aggression (Bushman et al., 2015). While this is a larger majority, it does not necessarily indicate a strong consensus; for example, the climate change consensus is considered to be between 90% to 100% (Cook et al., 2016). What is clear though is that despite numerous studies there is still a debate surrounding the effect that violent video games have on aggression. The following section will review the literature on violent video games and aggression to assess the evidence of a relationship.

2.2.1 Experimental research: Previous meta-analyses

There have been several meta-analyses conducted over the years assessing the research area of violent video games and aggression (e.g., Anderson et al., 2004, 2010; Ferguson, 2007a, 2007b; Greitemeyer & Mugge, 2014). These meta-analyses often provide a breakdown of the different effect sizes across research designs, i.e. experimental, correlational, longitudinal. Meta-analysis effect sizes for experimental studies will be discussed first.
Anderson et al. (2004), building upon Anderson and Bushman’s (2001) meta-analysis, is one of the earlier meta-analyses assessing the effect of violent video games. Anderson et al. (2004) noted that when researchers used the best methodology during experimental studies, violent video games affected aggressive behaviour ($r^+ [\text{effect size average}] = .23$), cognition ($r^+ = .31$), and affect ($r^+ = .29$), as well as physiological arousal ($r^+ = .22$). The best method studies were also found to produce stronger effect sizes than those that used less rigorous methodologies. There was a range of criteria for best method studies and they included: the study had a low or non-violent control condition, the violent condition had a suitable level of violence, and aggressive behaviour was measured against another human. In addition, the video games had to be matched on certain variables other than violence (e.g., level of difficulty and excitement). However, it should be noted that competition was not mentioned as a matching variable, and matching was not done through the use of the same video game (see Chapter 3 for discussion on using the same game and the influence of competition on violent video game studies).

In contrast, Ferguson (2007a, 2007b) found evidence to suggest that publication bias influenced the results of previous meta-analyses, and less standardised and reliable measures produced larger effect sizes. Anderson et al. (2010) responded to this by conducting another meta-analysis that included 136 papers, far exceeding previous meta-analyses. Best practice methodologies were once again taken into consideration (similar to Anderson et al., 2004). Most importantly, the measures assessing aggression were scrutinized and publication bias was considered. In fact, the trim and fill procedure (Duval & Tweedie, 2000) was used to assess and control for publication bias. Very little publication bias was found and any bias that was apparent had very little impact on average effect sizes (e.g., reduced the experimental effect size by .017). This comprehensive meta-analysis, which controlled for publication bias and poor methodologies, found violent video games had a causal impact on
aggressive behaviour ($r^+ = .21$), cognition ($r^+ = .22$), and affect ($r^+ = .29$) (for experimental studies).

Subsequently, Greitemeyer and Mugge (2014) conducted a follow up meta-analysis by including all 57 experimental studies published after the Anderson et al. (2010) study was conducted. Again, they found that violent video games had an effect on aggression in experimental studies ($r^+ = .20$). In addition, the trim and fill technique was used to demonstrate no evidence of publication bias.

In comparison, Ferguson (2015) found a very minimal effect ($r^+ = .09$) for experimental research on children. However, only studies that assessed the effect of violent video games on children were included, and there were only 16 experimental studies in this analysis. Therefore, larger meta-analyses conducted by Anderson et al. (2010) and Greitemeyer and Mugge (2014) provide a more comprehensive view of the area of violent video games and aggression. However, as will be discussed in Chapter 3, there are flaws with the majority of studies assessing violent video games and aggression which may impact the strength of the effect sizes shown in meta-analyses and affect how the results are interpreted.

2.2.2 Experimental studies: Review of studies

A comprehensive literature review of experimental research assessing violent video games and aggression was conducted for this dissertation. The primary aim of the experimental literature review was to assess whether competition had been controlled for. Results for this primary aim are discussed in Chapter 3. However, the results of the papers reviewed were also recorded to demonstrate the number of studies that reported significant positive relationship, null relationship, or negative relationship between violent video games and aggression.
Search terms.

For the literature review the databases ProQuest Psychology Journals, PsychARTICLES, and PsycINFO were searched. If full texts could not be found on these databases, the “Find it” RMIT University link was used to acquire the full text. An initial literature review was conducted in 2013 and included all studies from 2005 to 2013. The search started from 2005 because it appears to be the first year competition was assessed or controlled for, apart from one study (Anderson & Morrow, 1995). The following search terms were used: (aggression OR aggressive) and (video OR game) and (violent OR violence OR competition OR competitive). These search terms could be found anywhere except in the full text, so for example the title, abstract, key words, etc.

A follow up review was conducted in mid-2016. This review included all studies published between 2013 to 2016 using the same databases and “Find it” link as used in the first review. The search terms were slightly different however: (violence OR violent OR aggression OR aggressive OR competition OR competitive) and (Video OR Game OR Videogame). The search terms could again be found anywhere except in the full text. Due to the large number of studies (over 11,000) found using these search terms, the studies were sorted by relevance. Papers were primarily assessed on their relevance by viewing the title and abstract. Papers that were in any way related to competitive or violent video games were then read and any papers that fulfilled the eligibility criteria were included into the systematic literature review. After 300 papers in a row were found to be not related to the topic at all the search was halted.

Eligibility Criteria.

The core eligibility criteria were that the study had to assess the effects of violence or competition in video games on aggression through an experimental design. Aggression included behaviour, cognition, affect, arousal, or desensitisation to aggression/violence. In
regard to experimental design, the studies needed to compare a violent or competition condition with a no or low-violent or competition condition. The studies also had to involve participants actually playing a video game. The research could be journal articles or dissertations.

Data Included in the Review.

Overall 68 papers were included in this review (see Tables 2.1, 2.2 and 2.3), with a total of 85 separate studies as some papers included multiple studies. The tables include the experimental design used in the study and confounding variables controlled for (through subjective matching, described further in Chapter 3). They also summarise factors of aggression assessed, e.g. aggressive behaviour, cognitions etc., and the results of the study in relation to the impact of violence within the video game. All papers that had multiple studies had the same result (significant positive effect, null, mixed) for all their studies, with the exception of one (see Table 2.1 notes). It is important to note that the “Results” column only represents the finding for the violent compared to the non-violent condition. For example, in a 2 (violence) x 2 (competition) study, only the results of the violent compared to non-violent condition is reported. There may be cases of an interaction effect, but this was not recorded as the aim was to assess the impact of violence only. It should be noted that research assessing competition, multiplayer, and competition and violence interactions are discussed later. In addition, a breakdown of results for each sex was not given unless the article did not report the combined results of males and females. Table 2.1 includes all studies that used different games between the violent and non-violent condition. Table 2.2 shows studies that used the same game across conditions but each condition had different goals that needed to be achieved. Table 2.3 lists studies that used the same game without varying the goals. Further explanation of the different tables will be discussed in Chapter 3.
### Table 2.1

**Studies using Different Games between Violent and Non-violent Conditions**

<table>
<thead>
<tr>
<th>Author and Date</th>
<th>Design [Sample Size]</th>
<th>Relevant conditions subjectively matched on… [Pilot Study was Conducted]</th>
<th>Aggression Measured</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arriaga et al. (2015)</td>
<td>2 (Violence) x 3 (Victim display context) [134]</td>
<td>Pleasantness, Satisfaction, Boredom, Frustration, Excitement, Arousal</td>
<td>Behav, Desens</td>
<td>+ve</td>
</tr>
<tr>
<td>Ballard et al. (2012)</td>
<td>2 (Violence) x 3 (Single-player vs CoOp vs Competitive) [171]</td>
<td>Relaxing</td>
<td>Arousal</td>
<td>Mixed</td>
</tr>
<tr>
<td>Barlett et al. (2009)</td>
<td>2 (Violence) x 3 (Time) [91]</td>
<td>Excitement</td>
<td>Behav, Cog, Aff, Arousal</td>
<td>+ve</td>
</tr>
<tr>
<td>Barlett et al. (2008b)</td>
<td>2 (Violence) x 3 (Graphics) for both experiments [198, 108]</td>
<td>Realism, Frustration, Fun (for one experiment)</td>
<td>Cog, Aff, Arousal</td>
<td>+ve</td>
</tr>
<tr>
<td>Author and Date</td>
<td>Design [Sample Size]</td>
<td>Relevant conditions subjectively matched on… [Pilot Study was Conducted]</td>
<td>Aggression Measured</td>
<td>Results</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------</td>
<td>-------------------------------------------------------------------------</td>
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<td>---------------</td>
</tr>
<tr>
<td>Bartholow et al. (2005)</td>
<td>Violent vs. Nonviolent [76]</td>
<td>Frustration, Performance</td>
<td>Behav</td>
<td>+ve</td>
</tr>
<tr>
<td>Beene (2015)</td>
<td>2 (Single vs. Multiplayer) x 2 (Violence) [55]</td>
<td>None (Participants did rate how enjoyable the game was but it appears the results of this was not given)</td>
<td>Aff</td>
<td>Null</td>
</tr>
<tr>
<td>Bonus, Peebles, and Riddle (2015)</td>
<td>2 (Frustration) x (Violence) [82]</td>
<td>Action-Packed, Enjoyment, Difficult</td>
<td>Cog</td>
<td>Null</td>
</tr>
<tr>
<td>Bushman and Gibson (2011)</td>
<td>2 (Violence) x 2 (Rumination) [126]</td>
<td>Absorption, Action, Arousal, Boredom, Enjoyment, Entertainment, Excitement, Frustration, Fun, Involvement, Stimulation, Addictive</td>
<td>Behav</td>
<td>+ve for men ruminating only</td>
</tr>
<tr>
<td>Charles, Baker, Hartman, Easton, and Kreuzberger (2013)</td>
<td>2 (Violence) x 2 (Controller) [82]</td>
<td>None</td>
<td>Behav, Cog</td>
<td>Null</td>
</tr>
<tr>
<td>Cicchirillo and Chory-Assad (2005)</td>
<td>Violent vs. Nonviolent [64]</td>
<td>None</td>
<td>Behav, Cog</td>
<td>Mixed (Behav) Null (Cog)</td>
</tr>
<tr>
<td>Drummond (2014)</td>
<td>2 (Violence) x 2 (Single-player vs. multiplayer) [100]</td>
<td>Frustration, Ease of Play, Pace of Play, Entertainment [Pilot]</td>
<td>Behav, Cog, Aff</td>
<td>+ve (But Null Cog)</td>
</tr>
<tr>
<td>Author and Date</td>
<td>Design [Sample Size]</td>
<td>Relevant conditions subjectively matched on… [Pilot Study was Conducted]</td>
<td>Aggression Measured</td>
<td>Results</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------</td>
<td>-------------------------------------------------</td>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Eastin and Griffiths (2006)</td>
<td>3 (Violence) x 2 (VR) x 2 (Human vs. Computer) [219]</td>
<td>Presence</td>
<td>Cog</td>
<td>Mixed</td>
</tr>
<tr>
<td>Eden and Eshet-Alkalai (2014)</td>
<td>2 (Violence) x 2 (Comp vs. CoOp) [56]</td>
<td>None</td>
<td>Aff</td>
<td>Null</td>
</tr>
<tr>
<td>Engelhardt, Bartholow, Kerr, and Bushman (2011a)</td>
<td>Violent vs. Nonviolent [64]</td>
<td>Enjoyment, Arousal, Frustration [Pre-Tested but no data given]</td>
<td>Behav, Desens</td>
<td>+ve</td>
</tr>
<tr>
<td>Gitter et al. (2013)**</td>
<td>2 (Moral context) Violent vs. Nonviolent for both [81, 131]</td>
<td>Difficult, Enjoyable, Exciting, Fast, Frustrating for Study 2 only [Pilot]</td>
<td>Behav, Cog</td>
<td>+ve (Behav) Null (Cog)</td>
</tr>
</tbody>
</table>
Table 2.1 CONT.

<table>
<thead>
<tr>
<th>Author and Date</th>
<th>Design [Sample Size]</th>
<th>Relevant conditions subjectively matched on… [Pilot Study was Conducted]</th>
<th>Aggression Measured</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greitemeyer (2014b)</td>
<td>2 (Violence) x 2 (In group vs. outgroup bias) [99]</td>
<td>Difficulty, Frustration, Pace, Mood, Exciting</td>
<td>Behav</td>
<td>+ve (outgroup) Null (Ingroup)</td>
</tr>
<tr>
<td>Hollingdale and Greitemeyer (2013)</td>
<td>2 (Violence) x 2 (Avatar) [130]</td>
<td>Frustration (Others were assessed but not controlled for the violent vs. nonviolent analysis)</td>
<td>Behav</td>
<td>+ve</td>
</tr>
<tr>
<td>Hollingdale and Greitemeyer (2014)</td>
<td>2 (Violence) x 2 (Online vs. Offline) [101]</td>
<td>Difficulty, Enjoyable, Pace</td>
<td>Behav</td>
<td>+ve</td>
</tr>
<tr>
<td>Ivory (2005)</td>
<td>2 (Violence) x 2 (New vs. Old Game) [120]</td>
<td>Enjoyment, Frustration, Presence, Involvement, Pleasure, Ease of Play, Interactivity</td>
<td>Cog, Aff, Arousal</td>
<td>Null</td>
</tr>
<tr>
<td>Jerabeck and Ferguson (2013)</td>
<td>3 (Violence) x 2 (CoOp vs. Single-player) [100]</td>
<td>Competition, Difficulty, Enjoyment</td>
<td>Behav</td>
<td>Null</td>
</tr>
<tr>
<td>Konijn et al. (2007)</td>
<td>2 (Violence) x 2 (Realism) [99]</td>
<td>Frustration, Desire to play game</td>
<td>Behav</td>
<td>+ve</td>
</tr>
<tr>
<td>Author and Date</td>
<td>Design [Sample Size]</td>
<td>Relevant conditions subjectively matched on… [Pilot Study was Conducted]</td>
<td>Aggression Measured</td>
<td>Results</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Kryszak (2013)</td>
<td>2 (Violence) x (Verbal Interaction) [112]</td>
<td>None</td>
<td>Behav, Cog, Aff</td>
<td>Null</td>
</tr>
<tr>
<td>Mahood (2006)</td>
<td>Violent vs. Nonviolent [79], and 2 (Violence) x 2 (Frustration) [126]</td>
<td>Enjoyment, Intense, Excitement, Humour, Frustration, Difficulty</td>
<td>Behav, Cog, Aff</td>
<td>+ve</td>
</tr>
<tr>
<td>Pentzien (2015)</td>
<td>2 (Violence) vs. 2 (Play vs. Watch) [96]</td>
<td>Pace, Difficulty, Frustration, Entertainment [Pilot]</td>
<td>Behav, Cog, Aff</td>
<td>Null (but -ve Aff)</td>
</tr>
</tbody>
</table>

*Note. VR = Virtual Reality; Behav = Behaviour; Cog = Cognition; Aff = Affect; Desens = Desensitisation; +ve = violence within game increased aggression; -ve = violence within game decreased aggression; Null = violence within game had no effect on aggression; Mixed = violence within game increased aggression for some measures of aggression, but not for other measures. Anderson and Carnagey (2009) and Carnagey (2005) appear to have used the same participant cohort for two of their three studies. Therefore, these two papers produced 4 unique studies in total. Gritter et al. (2013) did have mixed results, although this was across two studies rather than one. Therefore, study 1 (behaviour) was counted as +ve, and study 2 (cognition) as null.
### Table 2.2

**Studies using Same Game across Conditions but Different Goals**

<table>
<thead>
<tr>
<th>Author and Date</th>
<th>Design</th>
<th>Relevant conditions subjectively matched on...</th>
<th>Aggression Measured</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin (2013b)</td>
<td>2 (Violence) x 2 (Interactivity) [169]</td>
<td>Enjoyment, Frustration, Difficulty, Action, Excitement</td>
<td>Cog, Aff</td>
<td>Null (Cog) +ve (Aff)</td>
</tr>
<tr>
<td>Lull and Bushman (2016)</td>
<td>2 (Violence) x 3 (Display) [194]</td>
<td>Enjoyment</td>
<td>Aff</td>
<td>+ve</td>
</tr>
<tr>
<td>Persky and Blascovich (2007)</td>
<td>2 (Violence) x 2 (VR) [155]</td>
<td>Enjoyment, Boredom</td>
<td>Aff, Arousal</td>
<td>+ve</td>
</tr>
<tr>
<td>Staude-Muller et al. (2008)</td>
<td>High vs. Low Violence [40]</td>
<td>None</td>
<td>Aff (Desens), Arousal</td>
<td>+ve</td>
</tr>
</tbody>
</table>

*Note. VR = Virtual Reality; Behav = Behaviour; Cog = Cognition; Aff = Affect; Desens = Desensitisation; +ve = violence within game increased aggression; Mixed = violence within game increased aggression for some measures of aggression, but not for other measures*
Table 2.3

Studies using Same Game across Conditions and Same Goals

<table>
<thead>
<tr>
<th>Author and Date</th>
<th>Design</th>
<th>Relevant conditions subjectively matched on...</th>
<th>Aggression Measured</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barlett et al. (2008a)</td>
<td>4 Blood Levels [74], and High Blood vs. No Blood [31]</td>
<td>None</td>
<td>Behav, Cog, Aff, Arousal</td>
<td>+ve</td>
</tr>
<tr>
<td>Elson et al. (2015)</td>
<td>2 (Violence) x 2 (Pace of Action) [84]</td>
<td>None</td>
<td>Behav, Arousal</td>
<td>Null</td>
</tr>
<tr>
<td>Farrar et al. (2006)</td>
<td>2 (Third vs. First-Person) x 2 (Blood vs. No Blood) [184]</td>
<td>None</td>
<td>Aff</td>
<td>Mixed</td>
</tr>
<tr>
<td>Kneer et al. (2016)</td>
<td>2 (Violence) x (Difficulty) [84]</td>
<td>None</td>
<td>Behav, Cog, Arousal</td>
<td>Null</td>
</tr>
<tr>
<td>Krcmar and Farrar (2009)</td>
<td>2 (Violent vs. No Game) [184] x 2 (First vs. Third-Person) x 2 (Blood vs. No Blood) [148]</td>
<td>None</td>
<td>Behav, Cog, Aff</td>
<td>Mixed</td>
</tr>
<tr>
<td>Przybylski et al. (2014)</td>
<td>Violent vs. nonviolent for 3 studies. One used different non-matched games. Competency also assessed [99, 101, 112]</td>
<td>Mastery of Controls</td>
<td>Aff</td>
<td>Null</td>
</tr>
<tr>
<td>Stermer (2013)</td>
<td>2 (Violence) x 2 (Character Choice) for both [190, 98]</td>
<td>None</td>
<td>Behav, Cog</td>
<td>Null</td>
</tr>
</tbody>
</table>

Note. Behav = Behaviour; Cog = Cognition; Aff = Affect; +ve = violence within game increased aggression; Mixed = violence within game increased aggression for some measures of aggression, but not for other measures.
2.2.2.1 Findings of the literature review on experimental studies: The impact of violent video games on aggression

This section will discuss only the results of the papers reviewed. The methodologies used in the studies and confounds controlled for will be discussed later. As can be seen in Tables 2.1, 2.2, and 2.3, 35 of the 68 papers (51.47%) reported that violent video games had a significant positive impact on all measures of aggression assessed. Another 10 (14.71%) found an effect for some measures of aggression (mixed results). There was also a proportion that found no effect on any measures of aggression used, with 23 papers (33.82%) showing null results. None were found to have negative relationship with all measures of aggression.

When assessing each of the 85 unique studies (rather than looking at the papers as a whole), 46 (54.12%) found a significant positive impact, 10 (11.76%) a mixed result, and 29 (34.12%) a null result. These findings do not fully support the previous large meta-analyses (Anderson et al., 2010; Greitemeyer & Mugge, 2014), as only just over half the papers and studies reported a significant effect for all measures of aggression.

One potential reason for this is that in recent years there appears to be a shift towards more null findings, perhaps due to recent research designs controlling for confounds. Looking at the 19 papers published in 2014 or later, only 7 (36.84%) reported a significant positive effect for all measures of aggression. On the other hand, 10 (52.63%) had null results, and 2 (10.53%) mixed results. In addition, when assessing the 22 unique studies, 13 (59.09%) had null results, 2 (9.09%) mixed, and still only 7 (31.81%) found a significant effect. This might explain why the findings from the review in this dissertation, which only included papers post-2004, differed from meta-analyses which were conducted pre-2014 (Anderson et al., 2010; Greitemeyer & Mugge, 2014).

Another potential reason for the differences is that this review was not a meta-analysis. The quality of the measures used, sample sizes, and effect sizes were not taken into
consideration, which is done during a meta-analysis. A meta-analysis was not undertaken for this dissertation due to the review tables (Tables 2.1, 2.2, and 2.3) being primarily conducted to assess whether competition had been controlled for. However, a strength of this review on experimental research, which meta-analyses may not have, is that it demonstrates that there is still a large proportion of studies finding null results or mixed results when it come to the effect that violent video games have on aggression. In addition, as will be discussed in Chapter 3, it demonstrates differences in findings across certain methodologies and when competition is controlled for. However, based on the fact that still over half of the papers and unique studies reviewed found a significant positive effect, and that comprehensive meta-analyses have found meaningful effect sizes (strength of effect sizes is discussed shortly), experimental studies as a whole are indicating that violent video games have an effect on aggression.

### 2.2.3 Correlational and longitudinal studies

A breakdown of all correlational and longitudinal studies was not conducted because the primary aim of the experimental review was to assess whether competition was controlled for in experimental research. However, it is important to still review correlational and longitudinal studies as they assess the relationship violent video games have with aggression outside a laboratory setting. Therefore, a review of the most comprehensive meta-analyses (i.e., Anderson et al., 2010; Greitemeyer & Mugge, 2014), as well as a meta-analysis from a researcher on the other side of the argument (i.e., Ferguson, 2015), was conducted.

Correlational studies assessing violent video games and aggression appear to produce weaker relationships compared to experimental studies, although there still appears to be an effect. After controlling for sex, the Anderson et al. (2010) meta-analysis found that violent video game exposure was on average correlated with aggressive behaviour ($r+ = .17$), cognition ($r+ = .11$), and affect ($r+ = .11$). Greitemeyer and Mugge (2014) also found violent
video game exposure to be related to aggression \((r+ = .17)\). Ferguson (2015) on the other hand found very little evidence to support the correlation between violent video games and aggression \((r+ = .04)\). A major limitation of the Ferguson (2015) meta-analysis, as noted above, was that it only included studies of children. However, it is important to note that there are still correlational studies that find null results (for examples, see Elson & Ferguson, 2014).

Correlational studies cannot assess causation. That is, they cannot determine whether aggressive people just like playing violent video games (selection hypothesis) or whether violent video games cause people to become more aggressive (socialisation hypothesis). However, if there is a causal relationship (in either direction) then correlational studies should still provide significant results. In addition, an important strength of correlational studies is that they can assess forms of aggression in real life. As discussed later in Chapter 3 it can be hard to assess aggressive behaviour in a laboratory setting. Correlational studies on the other hand can assess participants’ real-world aggression through reports of aggressive behaviour throughout their life and their trait aggression. Therefore, correlational studies assist in understanding how violent video games affect real-world aggression. However, as discussed in Chapter 3, there are issues with how correlational and longitudinal studies are conducted.

Longitudinal studies are important in the discussion surrounding violent video games and aggression. While it may be troubling that people become more aggressive in the short term after violent video game play, it would also be concerning if violent video games have long-term effects. If this is the case, then violent video games could be making the society as a whole more aggressive and violent. However, meta-analyses of longitudinal studies provide lower average effect sizes than both experimental and correlational studies. When controlling for sex and outcomes at time 1, Anderson et al. (2010) only found very small average effect size for aggressive behaviour \((r+ = .08)\), cognition \((r+ = .06)\), and affect \((r+ = .04)\). For
aggression overall, Greitemeyer and Mugge (2014) and Ferguson (2015) found an average effect of .10 and .08 respectively. The reduction in effect size is to be expected somewhat as it would be much harder to demonstrate an effect after a long period of time when other factors could interfere. However, effect sizes this small do bring into question whether the results have any practical significance.

2.2.4 Practical significance

If the highest reported effect size (.10) in a recent meta-analysis of longitudinal studies is taken (Greitemeyer & Mugge, 2014), this still represents a small effect size according to Cohen’s (1992) guidelines. Indeed, only 1% (.10²) of the variance in aggression is explained by violent video game exposure in longitudinal studies. Therefore, violent video games appear to have very little impact on aggression. However, it has been argued that as the effect of violent video games accumulates over time, a large percentage of the population are exposed to violent video games, and the consequences are extreme, then this small effect size is still meaningful (Anderson et al., 2010).

There is certainly a substantial percentage of the population playing violent video games, as discussed in Chapter 1, although whether there are extreme consequences may be taking the interpretation of the data too far. Studies usually assess mild forms of aggression (e.g., blasting someone with noise or the participant stating that they are angry); they do not assess extreme aggressive behaviour (e.g., physical assaults or murders). Aggression as assessed through violent video game studies does not appear to be “extreme”. Another issue is the argument that the effect of violent video game exposure accumulates over time is based on theory and does not appear to be supported by empirical evidence. If the effect accumulated over time, then stronger results from longitudinal studies should be apparent. Nevertheless, it is also expected that longitudinal studies may produce lower effect sizes as
they would be influenced by factors outside the laboratory. It is also difficult to influence the relatively stable trait of aggression.

Adachi and Willoughby (2015) discussed that, due to stability over time, longitudinal studies should be interpreted differently. If a trait is quite stable over time, for example aggression (e.g., Adachi & Willoughby, 2015; Huesmann, Eron, Lefkowitz, & Walder, 1984; Vaillancourt, Brendgen, Boivin, & Tremblay, 2003), then, in a longitudinal study controlling for outcome at time 1, the effect size is reduced markedly. This is due to the shared variability between time 1 and 2. Therefore, it can be quite difficult to statistically find a change due to so much of the variability being factored out already. Therefore, Adachi and Willoughby (2015) suggest that the stability of the trait, as well as the correlation strength when time 1 is not controlled for, should be taken into consideration when assessing how meaningful the effect size is. No specific calculations were given but Adachi and Willoughby (2015) argue that if the stability is strong and the non-controlled correlation is strong, then a small effect size in a longitudinal study would still be meaningful. Based on the Adachi and Willoughby (2015) findings, aggression is quite stable (time 1 to time 2 correlation, \( r = .67 \)), therefore a longitudinal effect size of .10 might still be meaningful. However, the effect size of cross-sectional studies is still quite small, e.g. .17 in Greitemeyer and Mugge (2014), so perhaps a longitudinal effect size of .10 is questionable. Unfortunately then, how meaningful longitudinal findings are in relation to violent video games’ effect on aggression is still up for debate.

Effect sizes for cross-sectional and experimental data are easier to interpret. As demonstrated previously, the effect size of the impact of violent video games on aggression can vary depending on the way aggression is assessed. However, for simplicity, the Greitemeyer and Mugge (2014) effect size of .20 for experimental studies will be used as it combined multiple measures of aggression (e.g., measures of aggressive cognition, affect,
and behaviour). The effect size of .20 would still be classified as small according to Cohen’s (1992) guidelines, although it is approaching moderate. While still only 4% (.20²) of the variance is explained, the fact that it is still well above the small cut-off of .10 suggests that it is meaningful. It is also important to consider that aggression is caused by several different factors as the theories of aggression discussed previously suggest. As such, it is expected that violent video games would have a relatively small impact on explained variance. This 4% of explained variance will have a meaningful effect as it influences millions of people worldwide (e.g., 155 million people in America play video games [ESA, 2014]).

2.2.5 Summary

While the review of experimental studies indicated that only just over half of the studies since 2005 have found a significant effect on all measures of aggression, it was still the majority of studies. In addition, evidence of violent video games having an impact on aggression is apparent in comprehensive meta-analyses that include experimental, correlational, and longitudinal studies. Further, given the fact that so many people play video games and that aggression is affected by several factors, it is argued that the impact of violent video games on aggression is meaningful. In regard to longitudinal findings, which demonstrate an effect size of .10 or lower, violent video games still appear to have a meaningful long-term effect as aggression is quite stable over time and factors outside the laboratory would reduce the strength of the relationship. It is also important to note that there is considerable theoretical evidence to support that violent video games increase aggression both in the short and long term. Overall, while there are some limitations to violent video game research (which are discussed in Chapter 3), the weight of evidence currently available demonstrates that violent video games do increase aggression.
2.3 Competitive Video Games and Aggression

Competition is defined as two or more units (e.g., individual, group, or computer player) pursuing the same rewards, where if one unit attains these rewards there are fewer or no rewards for the others (Berkowitz, 1962). In a competitive situation the rewards or goals can be described as being “contriently interdependent” (Deutsch, 1973). This means that the goal attainments between the units are negatively correlated. That is, as someone attains a goal others lose the attainment of that goal. This negative correlation can be conceptualised as a value varying from 0 to -1 (Deutsch, 1973). In a “pure” competition situation, if someone attains their goals the others cannot attain any of their goals. A “pure” competition scenario can be quite rare as most situations involve a complex set of goals and sub-goals, hence the negative correlation is on a scale rather than dichotomous. Deutsch (1973) uses the example of firms who manufacture the same product. They will work together to attain the goal of expanding the market, but they will also compete to get a greater share of the market. In relation to games, when someone wins it may block others’ attainment of the goal of winning overall, but others may have sub-goals such as wanting to finish in the top three or completing a personal best score. Therefore, the winner does not stop others from achieving all goals and rewards. However, while individuals may bring different goals and motivations to the situation, competitive games are generally designed to be a “pure” competition. That is if one player wins the other players lose. This is also known as a zero-sum game, which is where one player’s gain results in an equal amount of loss for the other player.

Many video games have some level of competitive aspects, but there are still many that do not. For example, there are games in which the player explores and/or communicates with others in a virtual world. In addition, there are puzzle video games where players are just set a task, they do not compete against another entity to see who can complete the task better. It could be argued that in a puzzle game players compete against the computer to complete
the task. However, the computer does not compete with player, rather it just sets the task that
needs to be competed. Another argument is that a puzzle game involves competing against
yourself to do better, but as per the definition of competition it must be two or more entities
competing for the same goal. Competing against yourself is classified as challenging oneself
to do better, not competition.

While there are games that do not involve competition, many do. Even though all
competitive games will involve two or more entities competing for a goal, video games that
involve some level of competition are often described as varying on levels of competition.
For example, in one condition of Adachi and Willoughby’s (2011a) study, participants fought
against a horde of zombies in *Left for Dead 2* (TM). While it was still a zero-sum or “pure”
competition game, i.e. the player either “lives” and wins or “dies” and loses, participants
rated it as less competitive than other games (this may be due to the condition having few
other competitive factors which are listed during this section). Therefore, feelings of
competition can vary depending on how the game is designed. However, after an extensive
review, unlike violence within video games, there are no clear published guidelines that
indicate what makes a video game more or less competitive. Therefore, this section will
discuss some aspects that may make a video game competitive before moving on to
discussing whether competition within video games can affect aggression.

**2.3.1 What makes a video game competitive?**

Before discussing what makes a video game competitive it is important to note that
individual differences can play a role in whether someone is competitive or not (e.g., Garcia,
Tor, & Schiff, 2013; Ross, Rausch, & Canada, 2003; Tauer & Harackiewicz, 1999).
Therefore, an individual’s perception of the level of competition and their desire/motivation
to win will determine how competitive the game actually is. As described previously,
competition is trying to achieve a goal against an opponent, but if that goal is perceived to be
valuable they will compete harder compared to when a goal is considered less valuable. For example, it has been shown that if an individual commits a lot of time and effort to a task, thus perceiving the reward as more valuable, they will have a stronger motivation to win (Ku, Malhotra, & Murnighan, 2005). This reasoning is likely why Anderson and Carnagey (2009) included the item “How hard were you trying to win?” when they created their measure of competition within a video game. While individuals may appraise the importance of winning a video game differently, video game design features such as score feedback, rewards, rivalry, number of competitors, group compared to individual competition, time pressure, and frequency of competitive event may make the video game more competitive and increase players’ desire to win.

2.3.1.1 Score feedback

The level of competition within a video game can be affected by the type of score feedback given. McClintock and McNeel (1966), and McClintock and Nuttin (1969) found that when an opponent’s score is displayed, as well as the player’s own score, it increased competitive behaviour. King, Delfabbro, and Griffiths (2010) also discussed that leader boards are an important aspect that can affect the competitive nature of a game. While not appearing to be assessed, it is likely the display of a leader board would provide more feedback as to how well the player is doing in relation to others. Therefore, as it provides the player’s score as well as that of others it should theoretically increase competitive behaviour. Leader boards may also intensify rivalry as the player tries to beat opponents who are relatively near them on the leader board. Indeed, there have been studies that demonstrate that competitiveness increases when the opponent is of a relatively similar standard (see Garcia et al., 2013). Score feedback in-game, and post-game through leader boards, therefore appears to be a predictor of level of competition.
2.3.1.2 Rewards

Operant conditioning studies have demonstrated that rewards can influence behaviour (Burton, Westen, & Kowalski, 2012). When applied to a competitive situation, if a reward is given then the players will be more likely to compete to win that reward. Indeed, a study by Huguet, Dumas, and Monteil (2004), for example, found that if a reward was given for winning a competitive Stroop task then participants stated that they put more effort into the task. This was in comparison to a competitive Stroop task with no reward. In addition, rewards were found to be some of the main reasons why people enjoy video games and why they play for longer, to the point of video gaming being a problem behaviour (King, Delfabbro, & Griffiths, 2011). This indicates that rewards are a motivation to play, and in a competitive game they would intensify the motivation to compete. Therefore, if the reward is perceived as being important, based on both individual differences and generally how desirable the reward is, the more likely the player will compete harder, therefore making the game more competitive.

2.3.1.3 Rivalry

Rivalry is defined as “heightened consciousness of a competitor’s role in obstructing goal achievement” (Malhotra, 2010, p. 141). Rivalry will also increase when there are fewer opponents, with a head-to-head competition promoting the highest level of rivalry (Ku et al., 2005). When one on one rivalry occurs during an auction, there is a greater display of competitive behaviour and desire to win (Ku et al., 2005; Malhotra, 2010). Therefore, games that create or intensify rivalry may be more competitive. However, Griffiths, Eastin, and Cicchirillo (2016) found that within a competitive game, enjoyment and hostility were not affected by rivalry, though they did not assess if it actually impacted on the competitive nature of the game.
2.3.1.4 Number of competitors

Eastin’s (2007) study on the impact of the number of players within a video game appears to contradict the impact of rivalry. It was found that a larger group of players (6 players in a game compared to 4 or 2 players) produced more state hostility. They argued that this is due to individuals being allowed the freedom to compete and display dominance more openly without offending any one person. In addition, in a non-video game study, Beneson, Nicholson, Waite, Roy, and Simpson (2001) found that groups of male children behaved more competitively than dyads. However, others have found the opposite, with competitiveness increasing as the number of competitors decrease (see Garcia et al., 2013). It therefore appears unclear as to what effect the number of competitors in a video game has on competition and more research is needed.

2.3.1.5 Competing groups compared to individuals

Studies assessing group competition compared to individual competition may indicate that there is an interaction between the group size and rivalry. For example, McCallum et al. (1984) found that two competing groups played more competitively than two competing individuals. When taken in conjunction with Eastin’s (2007) view on group size this makes sense as an individual within a group can be more competitive without offending any one person. However, it also means that an increase in rivalry is possible, as Ku et al. (2005) suggest rivalry should be heightened when there are fewer opponents, i.e. only one other group opponent. Therefore, while rivalry and being in a group of players can increase competitiveness, it appears that a combination of group play and rivalry may have an even stronger impact.

2.3.1.6 Time pressure

Time pressure, or imposition of a deadline, has been shown to increase anxiety and arousal (Maule, Hockey, & Bdzola, 2000). Maule et al. (2000) argue that this reflects an
increased awareness of the need to work harder, with this awareness increasing further as the deadline comes closer. If applied to a competitive situation, working harder to win the game when time is nearly up would make it more competitive. Indeed, it has been found that in auctions individuals display more competitive behaviour when the bidding time is almost over (Ku et al., 2005; Malhorta, 2010). Therefore, it may be that in a video game, when the game is nearly over it will become more competitive. However, this would only occur if the results of the game were still close, as each player would still have to perceive the game as being winnable.

It is important to note that “time pressure” can be designed in different ways for a competitive video game. A timer indicating how long the game has got left is the obvious method, but having to reach a certain score is another. For example, if a player must get to 100 points to beat their opponent, they will become more anxious, aroused, and competitive as they or their opponent approaches that “deadline”. Therefore, any indication that a player is getting close to achieving or not achieving the goal of winning should be viewed as an extra pressure that may affect how competitive the game becomes.

2.3.1.7 Frequency

For video game ratings, the frequency of violent acts within the game help determine the level of violence within the game. While no studies have assessed frequency of competition, it would be logical that the amount of competitive action or gameplay within a video game would impact how competitive the game is perceived. For example, World of Warcraft™ has several competitive aspects, such as competing against other players in raids. However, there are also many aspects of the game which are not competitive, for example exploring the virtual environment and completing a story. League of Legends™ on the other hand only has competitive gameplay, there is no exploration or story, just two teams
competing within the game. The percentage of time a player spends competing within a video game should impact how competitive the game is rated overall.

2.3.1.8 Summary

There are several reasons why a competitive situation can be seen as more or less competitive (see Garcia et al., 2013, for some other examples). When focussed on video game design, score feedback, rewards, the creation of rivalry, number of competitors, group competition, and frequency appear to be key aspects that can influence the competitiveness of the game. However, research assessing the impact of these aspects within a video game on competitiveness is limited (only Eastin et al, 2007, for number of competitors). If future research can clarify what specifically makes a game more competitive it can assist developers of video games, as competition is a major motivator for people to play video games (Olson et al., 2007). In addition, it may also help identify which games are likely to increase aggression within the player, assuming competition within video games influences aggression. Other social factors may also have an impact on how competitive a video game can be, but this will be discussed in the “Multiplayer” section of this chapter.

2.3.2 Evidence for video game competition increasing aggression

The idea that competition may promote conflict, anger, and aggression is not a new concept (e.g., Deutsch, 1973, 1993). Yet while video games provide a good platform to assess competitiveness effects, competitiveness has been largely ignored compared to research on violent video games (Adahci & Willoughby, 2011b). This is surprising considering that when research into video games was relatively new, Anderson and Morrow (1995) found that participants who played a video game competitively, compared to cooperatively, displayed a higher number of aggressive acts within the video game. In the decade following this finding, only a few video game studies mentioned competition as a factor. For example, Williams and Clippinger (2002) assessed the effect of a human versus computer opponent, and Carnagey
and Anderson (2005) attempted to control for competition when assessing the effect of violence. However, it appears that no published studies assessed the effect of competition in video games on aggression until Eastin (2007), which built upon the Anderson and Morrow (1995) study. Since 2007 there have been a number of studies of competition within video games, although there are still far fewer than violent video game studies.

The most common way in which competition is assessed within experimental video game research is to compare a competitive version of a game to a cooperative version. Generally, studies require participants to either compete against a human opponent or cooperate with another player to defeat a computer opponent or conduct a task. For example, in Mihan, Anisimowicz, and Nicki (2015) participants in the cooperative condition worked in pairs to defeat waves of computer enemies in the first-person shooter game Call of Duty: Modern Warfare 2 (TM). In the competitive conditions the two participants played a one-on-one death match where the aim was to “kill” each other. When comparing competitive multiplayer modes to cooperative multiplayer modes several researchers have found increased aggression in the competitive condition (Eastin & Griffiths, 2009; Eden & Eshet-Alkalai, 2014; Schmierbach, 2010; Velez, Greitemeyer, Whitaker, Ewoldsen, & Bushman, 2016), two found mixed results (Anderson & Morrow, 1995; Velez, Manhood, Ewoldsen, & Moyer-Guse, 2014), and others found no difference at all (Charles, Baker, Hartman, Easton, & Kreuzberger, 2013; Eastin, 2007; Mihan et al., 2015; Waddell & Peng, 2014). While these studies provide some insight into the impact of competitive multiplayer games, significant differences could be due to cooperation reducing aggression (see Greitemeyer & Mugge, 2014) rather than competition increasing it. In addition, the cooperative condition still involves competing against a computer opponent in most of these studies (e.g., Mihan et al., 2015). Therefore, the cooperative condition may still be viewed as competitive which may explain why there are some differences in the results, because competition has not been
successfully manipulated and thus varies randomly. To resolve this issue a measure of
competition could have been used to make sure each condition varied appropriately.

While fewer in number, there have also been studies that have compared a single-
player mode to a competitive multiplayer mode. Again, using Mihan et al. (2015) as an
example, participants in the single-player condition attempted to defeat the waves of
computer enemies by themselves. Results for these types of studies also vary, with Eastin
(2006) and Shafer (2012) finding that aggression was higher in the competitive multiplayer
condition compared to single-player, while Eastin and Griffiths (2006), Hollingdale and
Greitemeyer (2014) and Velez et al. (2016) found no difference. Others have even found
higher levels of aggression on some measures in the single-player condition (Drummond,
2014; Mihan et al., 2015). However, once again, the single-player mode still involved
participants competing against a computer. In addition, the studies did not actually assess
whether participants view the multiplayer competitive condition as more competitive than the
single-player condition. Therefore, the single-player condition may be as competitive as the
competitive condition and this might explain the variability in the results.

A study by Adachi and Willoughby (2011a) appears to be the only experimental study
that has successfully manipulated competitiveness across conditions and provided evidence to
support the success of the manipulation. The aim of this study was to assess the impact of
both violence and competition within video games using a 2 (Violence) by 2 (Competitive)
experimental design. Each of the four conditions had a different game, but through a pilot
study and participants’ ratings of violence and competition during the main experiment, the
games being employed in the competitive conditions were found be more competitive, and
the games being employed in the violent conditions had more violence. The 60 participants
(32 males, 28 females) in the main experiment were randomly assigned to play one of the
four video games. After playing the game for 12 minutes participants’ aggressive behaviour
was measured through the Hot Sauce Paradigm (Lieberman et al., 1999) (level of hot sauce given to another supposed participant indicates level of aggression, discussed in depth during Chapter 3). The results found that competitiveness within the video games increased aggression. The effect size for competitive compared to low-competitive conditions was not given, although the partial $\eta^2$ was .31 (small effect size = .01, medium = .06, large = .14 [Green & Salkind, 2008]) for the model which included all games. That being said, violence alone did not significantly increase aggression, which indicates the effect size of the model was more closely linked to difference in competition. The fact that violence alone did not increase aggression indicates that perhaps competition has confounded the results of previous violent video game studies. The issue of competition as a confounding variable is discussed in more depth in Chapter 3. A major limitation of this study was that different games were utilised across all conditions. As will be discussed in Chapter 3 it is better to use the same game as other confounding variables may vary amongst the different games, e.g. input controls and the goal of the game.

It is also relevant to discuss studies that have assessed the impact of winning or losing a video game, as this is an important aspect of competitive play. Losing is often described as a negative outcome when playing video games and has been linked to aggression. Shafer (2012) found that participants who reported losing a video game had higher levels of state hostility (partial $\eta^2 = .05$). This was irrespective of whether the video game was a violent first-person shooter or a non-violent puzzle game. Both Breuer, Scharkow, and Quandt (2015a) and Griffiths et al. (2016) manipulated the win/lose outcome of a sports video game by using a confederate who was an experienced gamer. The confederate was informed by the experimenters to either win or lose the game on purpose, but the participants were not aware of this manipulation. In both studies the participants who lost the game reported higher levels of aggression post-gameplay compared to the participants who won ($\omega = .2$, and partial $\eta^2 =$
While not specifically addressing losing, Przybylski et al. (2014) found that when a player’s competence within the game is impeded there is an increase in aggression. This further suggests that when an individual is obstructed from winning a competitive game they will be more likely to have aggressive thoughts and feelings. Mathews (2015) also found that higher skilled players reported lower levels of state hostility and aggressive cognitions. This is most likely due to the fact that the higher skill players would win more often, as difficulty did not appear to be manipulated to match the participant. All these findings suggest that how people perform in a competitive gaming environment will affect their level of aggression after playing.

While there is a limited amount of research specifically looking at the effect of competitive gaming on aggression using experimental designs, there is even less research assessing real-life competitive gaming using quasi-experimental, cross-sectional, or longitudinal designs. A conference paper by Shores, He, Swanenburg, Kraut, and Riedl (2014) discussed quasi-experimental data from the highly popular game *League of Legends™* to assess gaming behaviour. *League of Legends™* can be played in either “ranked” mode, where winning or losing the game affects a player’s rank (type of leader board) in the game, or “unranked” mode where winning or losing does not affect the rank. As discussed previously, having a leader board and the reward of the player moving up the leader board should increase the competitive nature of the game. Indeed Shores et al. (2014) stated that the “ranked” mode is considered to be more competitive. When they compared these two game modes, they found that gamers who played in the “ranked” mode displayed more “toxic behaviour”, as reported by other gamers. Toxic behaviour can be a variety of things, and is defined in Shores et al. (2014) as behaviour that negatively impacts others’ experience, but the main aspect of it is verbal aggression towards others, e.g. cursing and yelling. Therefore, it appears that having a more competitive gaming environment, through
ranking, may produce more in-game aggression. However, as this was a quasi-experimental study it may be that people who choose to play in the ranked mode may have higher levels of trait aggression to begin with (Selection hypothesis).

Interestingly, Shores et al. (2014) also found that having toxic team mates made newer players less likely to play another game straight after that first “toxic” game. This can be a concern for game developers as they want to encourage people to play more often and not be turned off by the game when they are new to it. Therefore, *League of Legends*™ developers introduced a tribunal system where players could report others for toxic behaviour (Lin, 2015). Since the introduction of this tribunal system they observed a 40% reduction in verbal abuse. In addition, they also found that putting red highlighted pre-game messages, such as “Teammates perform worse if you harass them after a mistake”, reduced negative attitude by 8.3%, verbal abuse by 6.2%, and offensive language by 11% (Maher, 2016). An issue with these studies is that they are not published in peer-reviewed journal articles, and are instead confined to conference papers (Shore et al., 2014) and newspaper articles (Lin, 2015; Maher, 2016). This makes it difficult to assess the validity of the studies, particularly for the results printed in the newspaper articles. However, it appears that video game developers are acknowledging the negative effect of in-game aggression during competitive games, and are trying the take measures to reduce it.

Lastly, there have also been two studies assessing the long-term effects of competitive video games. Adachi and Willoughby (2013) conducted a cross-lagged panel design longitudinal study in which 1492 students (50.8% female) were assessed on their video game exposure and aggressive behaviour from grade 9 to grade 12. In grades 9 and 10 video game exposure was assessed through participants reporting if they had or had not played certain types of games (e.g., racing, sport, puzzle games). As this does not take into consideration how often they play, it does not provide a good measure of exposure. However,
in grades 11 and 12 participants were asked to rate how often they played certain games on a scale from 1 (not at all) to 5 (five or more hours a day). Competitive video game exposure was assessed via how often they played sport and racing games. These types of games are considered to be highly competitive but low on violence, which is why they were used to assess competitive video game exposure. Using this method, they found a bi-directional relationship between competitive video game exposure and aggression across grades 11 and 12 ($r = .06$ in both directions). This suggests that competitive video games can cause people to become more aggressive over time. However, a limitation of this study was the focus on sporting and racing games for competitive video game exposure. Several violent games would be considered to be competitive as well, which makes it difficult to conclude whether all competitive games are related to aggression or just sports and racing games. In addition, the effect size was very small.

To address these issues, Adachi and Willoughby (2016) reanalysed the results of their 2013 study. Instead of relying on just sports and racing games for indicators of competitive video game exposure, they also included participants’ exposure to action and fighting games. The reason for this was that action and fighting games were considered to be competitive as players usually compete to kill or harm opponents. The impact of violence within these video games was controlled for by using a latent variable that represented a propensity to play competitive video games. Action, fighting, sports, and racing games were indicators of the latent variables, therefore shared variance was explained by competition. In contrast, as sports and racing games are generally not violent, then the propensity to play violent video games did not explain the shared variance. Therefore, relationships between the latent variable of propensity to play competitive video games and aggression was due to competition and not violence. Using this method, they found that competitive video game
exposure predicted future aggressive behaviour ($r = .32$) and aggressive behaviour predicted future competitive video game exposure ($r = .12$).

In their 2016 paper, Adachi and Willoughby also reported the results for a similar study that assessed 1132 university students (70.6% female) rather than high school students. The method was the same as the 2013 study, while the analysis was the same as the reanalysis of the 2013 study in their 2016 paper. However, aggressive affect was also measured and how often participants played certain games on a scale of 1 (not at all) to 5 (five or more hours a day) was included across the entirety of the four years of the study. They again found that competitive video games exposure predicted future aggressive behaviour ($r = .10$ to $.12$). In addition, aggressive behaviour predicted competitive video game exposure ($r = .05$ to $.07$). They also found that aggressive affect was a mechanism in which competition affected aggressive behaviour in the long term, which is consistent with the frustration-aggression hypothesis mentioned previously.

A limitation with all studies in Adachi and Willoughby (2013, 2016) is that assessing how often participants play certain video games does not capture the variability in competition within these types of games. As demonstrated previously, there may be quite a few aspects that affect how competitive a game is. Therefore, for example, two participants who play action games five or more hours a day would receive the same score on competitive video game exposure even if one played the game competitively while the other played relatively non-competitively. Adachi and Willoughby (2016) even suggest that future research could include participants rating of competitiveness to enhance their findings. Using participants’ competitive ratings of video games appears to be a more valid method on face value. In addition, using participant ratings in violent video research is common and has been shown to be a valid measure of violent video game exposure (Busching et al., 2015).
2.3.2.1 Summary

Initial studies assessing a “competitive” version of a game compared to a cooperative or single-player version have provided inconsistent results. It is important to note that these studies did not assess if the competitive condition was perceived to be more competitive, which may explain why there are inconsistent results due to unforeseen variances in competition. Studies that have provided evidence of a successful manipulation of competitiveness, or that have manipulated whether the participants win or lose, have consistently found that competition and losing can increase aggression. In addition, a longitudinal study found that competitive video game exposure increased long-term aggression. Analyses into the effect of competition within video games on aggression are still very limited, especially compared to research on violent video games. At the moment, the evidence suggests competition has an impact on post-game aggression. However, given the inconsistent results and limitations in previous studies, further replication and research is needed to provide a more definitive conclusion.

2.4 Interaction between Violence and Competition within Video Games

From extensive literature searches there appear to be no studies that have specifically assessed the interaction between violence and competition within video games on aggression. However, studies by Adachi and Willoughby (2011a; 2016) may provide an insight into whether the theory of an interaction effect is supported. Adachi and Willoughby (2011a) found that competition significantly increased aggression while violence did not, but interaction results were not reported so it could be assumed that no significant interaction was found. However, by looking at the standardised results of aggressive behaviour it appears that participants in the violent and competitive condition displayed slightly higher aggressive behaviour compared to the non-violent and competitive condition. In addition, participants in the non-violent and non-competitive condition displayed slightly lower levels of aggressive
behaviour compared to people in the violent and non-competitive condition. This suggests that the results were trending towards an interaction, but further statistical evidence is required.

When Adachi and Willoughby (2016) combined both action/fighting games and sports/racing games to get a latent variable of competitive video games exposure, they were able to assess the standardized residual covariance matrix. By assessing this they were able to discover that action/fighting games did not significantly provide any unique variance that predicted aggressive behaviour. This was demonstrated for both their studies, i.e. assessing high school students and university students. If violence and competition within video games were to interact it would be expected that the action/fighting games would be a stronger predictor of aggressive behaviour, but it seems this was not the case. However, as violence ratings from participants were not taken it may be that some action/fighting games were not that violent and some sports/racing games were violent. This could mean that the standardized residual covariance matrix may not have picked up the unique variance of violence. Therefore, it appears that more research is needed to assess the interaction between violence and competition within video games.

2.5 Multiplayer Games

For this dissertation, multiplayer games are defined as a video game where two or more human players play the same game at the same time, either online or in person. The players can be working cooperatively against the computer, cooperatively against other players, competing against each other, or a combination these. Video games can have both single-player and multiplayer modes. For example, Call of Duty\textsuperscript{™} can be played in single-player “campaign” mode where one player completes missions against computer opponents, while in the multiplayer mode players can compete against multiple individual human opponents or in a human group versus another human group. The level of interactions with
other players can vary in-game as well. In World of Warcraft™, for example, players will be in a game with other players, but as the virtual world is so large a player can complete tasks and missions by themselves and have no interaction with others. Therefore, even if a video game has the ability to be multiplayer it does not necessarily mean an individual will choose to play with other people. If the individual is playing with or interacting with other human players, then they are playing “multiplayer”.

The previous section discussed how a competitive multiplayer mode can impact aggression. However, the actual impact of playing with other human players was not discussed, the focus was the impact of a competitive scenario. In addition, rivalry and number of players has been discussed as factors that may increase the competitiveness of a video game. While these factors may be linked to multiplayer games it is still possible to have rivalries with computer opponents, such as “bosses” or the main antagonist within a game, and have multiple computer players in a game. Therefore, this section will aim to address how simply having another human player in a video game may increase aggression and also the competitiveness of a video game.

2.5.1 Human compared to computer opponent: Effect on aggression

Playing a video game in single-player mode compared to a multiplayer mode has been shown to have inconsistent results. Some studies mentioned previously (Hollingdale & Greitemeyer, 2014; Mihan et al., 2015; Shafer, 2012; Velez et al., 2016) used different game modes for the single-player and multiplayer conditions, e.g. storyline for single-player compared to a “death match” for multiplayer. This makes it difficult to assess whether the differences in game modes or the presence of a competitive human opponent influenced aggression. However, some studies have used the same competitive game mode for the single-player and multiplayer condition.
Eastin (2006) had participants compete against the same computer opponent in the same level and environment for both the single-player and multiplayer condition. The only difference was that the participants in the single-player condition were told they were competing against a computer, while participants in the multiplayer condition were told they were competing against a human. Even though the participants in the multiplayer condition really competed against a computer, the researcher put in artificial online loading screens to help convince the participants they were competing against a human. Using this technique Eastin (2006) reported that players who were told they were competing against a human displayed higher levels of aggressive thoughts. However, later that year, using a similar methodology, Eastin and Griffiths (2006) found no difference between the single-player and multiplayer conditions on hostile expectations. Differences in findings could be due to the fact that the Eastin (2006) study assessed affect, while the Eastin and Griffith’s (2006) study assessed cognition. As theorised in Chapter 2, the primary route for competition to impact aggression is through affect, therefore, affect measures could be more sensitive to the impact of multiplayer competition. Even more contrary to Eastin’s (2006) findings, Williams and Clippinger (2002) found that when participants played the single-player condition they displayed higher levels of aggressive affect compared to the multiplayer condition. However, it should be noted that a limitation of this study was its repeated measure design, where all participants played the single-player condition first and then a week later played the multiplayer condition. Therefore, learning effects could have been present.

It appears there are inconsistent results from studies comparing a single-player mode to a multiplayer mode. Reasons for the inconsistent results could be the use of different measures of aggression, the difference in impact on in-group and out-group targets (e.g., Greitemeyer, 2014b), or individual differences (such as whether extraverted people are
impacted more heavily during multiplayer games). Another explanation is that the studies were conducted in a laboratory setting.

These studies were confined to a laboratory setting and therefore the level of competition and type of language used between players may not be as extreme in real life. Breuer et al. (2015a) included a confederate in their study who would actively “trash-talk” the participant to make the interaction more realistic, while in the other condition the confederate would make encouraging comments. They found no difference between the two types of social interaction in terms of their effect on aggression, but they stated that the trash-talking was quite mild, e.g. sarcastically saying “nice pass”, which may not be realistic enough to mimic real-life interactions.

In addition to the inability to replicate real-life interactions within a laboratory, participants may be inhibiting their behaviour due to observer effect, which may affect ecological validity. Observer effect is also referred to as the Hawthorne effect, named after an experiment which was initially assessing the impact of lighting on working hours and productivity at the Hawthorne plant between 1927 and 1932 (Salkind, 2014). However, during the experiment it was discovered that, regardless of lighting level, participants in the experimental group worked longer and production increased due to their awareness of the experiment and being observed by the researchers. When applied to experimental studies assessing multiplayer games, participants may attempt to reduce their aggression towards the human opponent in an attempt to look socially acceptable to observers. In support of this hypothesis, while not specifically assessing video games, Wright (2013) demonstrated that when participants believed they were anonymous online it increased cyber aggression.

Therefore, longitudinal or cross-sectional studies that assess behaviour outside the laboratory are an important adjunct to experimental findings. However, longitudinal and cross-sectional
studies assessing multiplayer games and aggression are yet to be published (this was addressed in Study 1A).

2.5.2 Potential relationship between multiplayer games and competition

The social comparison theory (Festinger, 1954) posits that humans compare their abilities to others. The comparison puts pressure on the individual to reduce the discrepancies between their ability and that of others which results in a “unidirectional push to do better and better” until the individual “is just slightly better than the others” (Festinger, 1954, p.125). Competitive behaviour is a manifestation of this social pressure to “protect one’s superiority” (Festinger, 1954, p.126). Therefore, while competition against a computer opponent is possible, the idea that humans compare themselves to others suggests that competition should be greater against a human opponent.

Building upon the social comparison theory and others’ work, Garcia et al. (2013) identified two key relational factors between opponents that can affect the competitiveness of a situation. The first is the similarity to the opponent, with more similar individuals or groups showing more competitiveness towards each other. In addition, this increase in competitiveness can lead to greater hostile attitudes towards the opposing individual or group. The second relational factor is that people will have increased competitiveness towards friends rather than strangers, demonstrating that the closeness of a relationship can affect the competitiveness of the situation (Garcia et al., 2013). When related to video games, a player may identify as being similar to computer characters or even have a sort of relationship with them, built through the story of the game. However, it is more likely that the player will identify similarities with other human players as they display human characteristics that a computer program cannot. In addition, closer relationships are more likely to develop with other humans rather than a computer program. Therefore, competing against a human, rather than a computer, should be more competitive.
To further support this, Katsyri, Hari, Ravaja, and Nummenmaa (2013) found that during their fMRI study there was a greater activation of the brain areas (such as the ventral striatum) associated with reward pathways when a participant defeated a human rather than computer player. This suggests that people are more motivated to compete and win against a human rather than a computer. In addition, Ravaja et al. (2006) found that participants who competed against a human, rather than a computer, had higher levels of arousal, perceived threat, engagement, and spatial presence. This seems to suggest that participants have a greater investment in trying to win against a human rather than computer.

While there are no published studies that have directly assessed the differences in the level of competition between human versus computer opponents in a video game, social comparison theory and other evidence suggests that a human opponent will elicit more competitiveness. Therefore, multiplayer games may impact aggression through the increase in competitiveness. However, further studies are needed to explore this as there are inconsistent results in regard to whether multiplayer games even have an impact on aggression.

2.6 Chapter Summary

The major theories of aggression explain that both violence and competition within video games will increase aggression. Violence within the game impacts aggression primarily through cognition, while competition impacts aggression primarily through affect. However, due to spreading activation, both violence and competition should affect aggressive behaviour through cognitions, affect, and arousal. On the whole, the evidence suggests that violent video games do in fact increase aggression, with large meta-analyses finding a small but meaningful average effect size. Studies also support that competition within video games increases aggression, although more research is needed as there are a limited number of studies assessing the variable of competition. In addition, while theoretically both violence
and competition should interact to cause even higher levels of aggression, there appears to be
no published studies that have been conducted to support this. Finally, there is some evidence
to suggest that playing games with others may increase the competitiveness within video
games, and thus increase aggression, although once again more research is needed to come to
a definitive conclusion. Due to the lack of research, and at times inconsistent results,
regarding the effect of competition, interaction between competition and violence, and
multiplayer gameplay, it is important for this dissertation to assess these variables and
whether they affect aggression. On the other hand, violence has been studied extensively, but,
as discussed in the next chapter, methodological issues may have confounded results which
suggests further research on violence is needed as well.
Chapter 3: Methodological Issues

Despite decades of research there are still some major methodological issues and areas of concern with violent video games research. Some of these concerns appear to be unwarranted as they are based on correlational or anecdotal evidence, rather than causative evidence. For example, an argument has been put forward that because violent crimes have decreased and video game sales have increased over the same period this provides evidence that violent video games have no real-world effects (e.g., Ferguson, 2010). However, there are so many factors that have influenced violent crime over this time, such as political and cultural changes, that this conclusion is unfounded. Publication biases towards only publishing positive results have also been raised as a concern (e.g., Ferguson, 2010), but extensive meta-analyses have sourced both published and unpublished data and found no evidence of publication bias using the trim and fill technique (Anderson et al., 2010; Greitemeyer & Mugge, 2014). However, while some arguments appear to be unfounded, there are still quite a few methodological issues that are valid. This chapter discusses some of these major issues, primarily the use of different games across conditions and the issue of in-game confounding variables, particularly competition. The potential impact of third variables and the issues with assessing aggressive behaviour are also discussed.

3.1 Games used Across Conditions in Experimental Studies

One major issue in violent video game research is the use of different games across conditions, such as the violent condition versus the non-violent condition. Just on face value, using different games across conditions poses a serious threat to validity as there are several differences between video games which could potentially confound results. Of particular interest to this dissertation is the confounding variable of competition in violent video game research. While it has not actually been assessed (this was addressed in Study 1A), violent video games are often considered to be more competitive (Carnagey & Anderson, 2005).
Therefore, if a study finds that a violent video game such as Call of Duty™ increases aggression compared to a non-violent video game such as Tetris™, it is difficult to conclude that it was the violence and not some confounding factor, such as the level of competitiveness, that caused the increase.

Adachi and Willoughby (2011b) identified three factors that should be controlled for in violent video games research: competition, pace of action, and level of difficulty. These factors are all potential predictors of aggression, but when Adachi and Willoughby (2011b) assessed the research on violent video games they concluded that these three variables were generally not controlled for. Competition, for example, was only controlled for in one study, Anderson and Carnagey (2009). However, there were some limitations with the Adachi and Willoughby (2011b) review. Firstly, only 18 studies were reviewed. In their review of the same literature Anderson et al. (2010) found 92 experimental studies for their meta-analysis; hence, it appears that the Adachi and Willoughby (2011b) review was limited. In addition, Adachi and Willoughby (2011b) did not publish inclusion criteria and search terms which makes it difficult to assess why some studies were included while others were not. Secondly, the review concentrated on research that used participants’ ratings of games, e.g. “how difficult was the video game”, to control for confounding variables. However, several studies have controlled for confounding variables by using the same game across conditions and only manipulating the relevant variables, such as violence. Lastly, in the table presented by Adachi and Willoughby (2011b), only information on whether studies had controlled for competition, pace of action, and difficulty was reported. While not a really a limitation, because their review focused on these aspects, it may be beneficial for the review in this dissertation to include information about other factors, such as level of frustration, to demonstrate what is generally controlled for.
Due to these limitations, the following literature review aimed to gather a more comprehensive view on whether competition had been controlled for in previous research. This methodological review built upon Adachi and Willoughby (2011b) by incorporating a larger number of studies, reporting both self-report measures and modification techniques to control for confounding variables, and stating all factors that were controlled for. However, as competition is an important factor of this dissertation, it was the main focus.

3.1.1 Review overview

Search terms and criteria were previously explained in Chapter 2, Section 2.2.2. As mentioned previously, 68 papers (85 unique studies) were included in this review and were compiled into Tables 2.1, 2.2, and 2.3. Each table provides information about the study’s design, variables the video games were subjectively matched on (further explanation of this in Section 3.1.2), the domain of aggression measured (cognitive, affect, behaviour, arousal, desensitisation), and the results of the studies. The design of the studies only includes experimental manipulation of game condition; therefore, quasi-experimental designs were not reported. For example, some studies may have included a high trait aggression group and compared them to a low trait aggression group. This information was not included as the purpose of this review was to assess in-game manipulation and the effect of in-game confounding variables.

Each table differs on the violent condition manipulation technique used. Table 2.1 includes all studies that used a different game in the violent condition compared to the non-violent condition. Table 2.2 comprises studies that manipulated the level of violence within one game, but the goal of the game was different in each condition. Lastly, Table 2.3 includes all studies that manipulated the level of violence within one game and each condition had the same goal. The following sections explain these violence manipulation techniques further,
their strengths and weaknesses, and results found from the different methodologies. Finally, Section 3.1 finishes with recommendations for future research.

3.1.2 Issues with using different games

It is common practice in research on violent video games to use different games across conditions, with 52 of the 68 papers (62 of 85 unique studies) reviewed in this dissertation using this method (see Table 2.1). An example of this is Hasan, Begue, and Bushman (2012) who looked at the effects of violent video games on aggression and also the mediating role of hostile expectation bias. For their study the games Condemned 2™, Call of Duty 4™, and The Club™ were used for the violent condition and S3K Superbike™, Dirt 2™, and Pure™ for the non-violent condition. The researchers used three games in each condition to increase the generalizability of the findings, but in essence all three violent games are first or third-person shooter games (i.e., player shoots others while viewing the video game from just above the in-game character) and the three non-violent video games are all racing games. The violent games all have the same sort of gameplay, i.e. the player attempts to kill enemies while trying to avoid their own death in a virtual environment, while the racing games all involve the player attempting to win a motor vehicle race. Thus, the violent video games compared to the non-violent video games used in this study vary on the games’ fundamental design. Therefore, it is inappropriate to assume that variances in aggression after playing are due to the differing levels of violence alone and not to other variances between the games. It could be argued that the differences between the games add to the error variance, which may be factored out through meta-analyses. However, some differences may systematically vary, for example competition, which is generally greater in violent video games (Carnagey & Anderson, 2005).

Researchers have attempted to control for confounding variables by matching the games on various aspects, for example frustration, difficulty, and action (see Table 2.1). The
common way to match video games is to use the Video Game Evaluation Questionnaire (VEQ), or a variant of this, which asks players to rate the game they played on certain aspects, for example frustration, on a scale of 1 = not at all to 7 = extremely (Anderson & Dill, 2000). This is not a standardised measure with researchers adding and removing items frequently. In addition, due to the major variances in items used between studies, it is often not stated as the VEQ. This is why it is referred to as “subjectively matched on” in the Tables 2.1, 2.2, and 2.3, and as demonstrated, each paper has a different set of items they matched.

Most studies match the video games during the main experiment and if the games vary on any undesired factors they are covaried out using an ANCOVA (e.g., Barlett, Branch, Rodeheffer, & Harris, 2009). However, there are some studies that examined the video games in a pilot study to confirm that the games were evenly matched on potential confounding variables, e.g. pace of action, before the main experiment.

There are a few issues with these subjective matching techniques. One issue raised by Elson and Quandt (2014) is the lack of “point of reference”. When participants play only one game and are then asked to rate difficulty for example, they are given no other game or scenario to compare it to. Therefore, if a participant is asked to rate the difficulty of a game, such as Tetris™, they may compare it to another type of Tetris game, a puzzle game, or any other game they have played. However, this game should be compared directly to the game being used in the violent condition. Elson and Quandt (2014) posed this as a speculative point that has not yet been assessed, although there may be some support for it as demonstrated by variances in participants’ ratings of games.

An example is Carnagey’s (2006) four studies which assessed violent video games using the games MLB Slugfest Baseball™ and NFL Blitz Football™ for the violent condition and MVP Baseball 2004™ and Madden Football™ for the non-violent condition. Both the violent and non-violent conditions had a baseball game and a NFL game, but in the non-
violent condition the rules that apply to the real sports also apply to the video game. By contrast, in the violent condition, players are allowed to conduct violent acts, e.g. hit the opposition and start fights. The aim of the first study was to assess whether the level of competition was consistent across all games, while the subsequent three studies assessed aggressive cognitions, affect/attitudes, and behaviour respectively. Carnagey (2006) consistently assessed variances in difficulty, enjoyment, frustration, excitement, action, ability to play the game, and perceived improvement for all four studies. All of these possible confounding variables were assessed using the VEQ. Out of the seven confounding variables assessed, the differences between the violent and non-violent condition in difficulty, frustration, action, ability to play the game, and perceived improvement were not consistent across all four studies. It could be hypothesised that this inconsistency in results is due to the lack of “point of reference” referred to by Elson and Quandt (2014). Participants are giving an opinion of how, for example, difficult the game is compared to other games they have played. This would result in some uncontrolled variance as each participant would have been exposed to different video games in their life time. Either way, the inconsistency of results shown in the Carnagey (2006) studies demonstrate that subjective measures of experience of a game do not reliably demonstrate actual differences between the games.

Counter to this argument however, is other research that has demonstrated that participants’ ratings are a valid and reliable way to assess the amount of violence within a video game (Busching et al., 2015). Unfortunately, this reliability and validity analysis has not been conducted on other factors. For example, violence is relatively easy to identify, i.e. it involves killing, blood and gore, etc. However, level of difficulty for example, might be harder for participants to analyse and is much more subjective. Another argument against “point of reference” is that individual differences in ratings should be factored out through random sampling of participants. However, if participants are consistently using a similar
puzzle game they have played to compare with Tetris™, while using a similar first-person shooting game to compare to the first-person shooting game used in the study, then the difference would be systematic rather than random.

One way to address the “point of reference” issue is to conduct pilot studies. In a pilot study, participants could play both the violent and non-violent games and compare them on a variety of different aspects, e.g. difficulty, frustration, competitiveness. Therefore, participants would have a consistent point of reference. Researchers could then use the results of the pilot study to utilise games that are equally matched in the main experiments. Unfortunately, pilot studies are not conducted often. Only 9 of the 52 papers (11 of 63 unique studies) that used different games across conditions conducted a pilot study to assess potential confounding differences between the games. Other researchers (see Table 2.1) examined the video games themselves, some extensively, but no actual data was given to support their conclusions.

One important point to note, however, is while pilot studies may provide a better understanding of the base differences between the games, participants’ subjective ratings during the main experiment are also very important to consider because a participant’s subjective experience of a game can affect aggression (e.g., Mahood, 2006; Williams, 2009). Using difficulty as an example again, a pilot study may conclude that when Game A is compared to Game B, Game A is found to be more difficult. However, in the main experiment, where participants only play one of the games and thus use their previous experiences as a point of reference, Game B may be found to be rated as being more difficult. This would be due to individual differences, with participants who played Game B being less skilled at video games in general. Identifying these individual differences could then be considered when analysing the results. In summary, a pilot study would identify base differences between the games (e.g., is Game A more difficult than Game B?), while the
participants’ subjective experience of the game during the main experiment would identify individual differences (e.g., participants who played Game B were less skilled). If two different games need to be used, a pilot study appears to be crucial, but this is not often done.

Instead, if confounding differences are seen between the violent and non-violent conditions, an ANCOVA is used to “control” for these effects. However, Adachi and Willoughby (2011b) argue that this is not a valid method. They reference Miller and Chapman (2001) who provided evidence to suggest that if the treatment group and the covariate are not independent then an ANCOVA is not suitable. A common example is comparing a clinically depressed group to a control group on some sort of task. Anxiety cannot be “controlled” for using an ANCOVA due the high co-morbidity of depression and anxiety. There is shared variance between depression and anxiety. Therefore, when anxiety is covaried out it can remove the effect of depression or lead to a spurious effect (Miller & Chapman, 2001). Therefore, Adachi and Willoughby (2011b) argue that if the two conditions (violent and non-violent) systematically vary on a confounding variable, such as competition, then an ANCOVA is not appropriate. Field (2012) also states that the two different groups should not differ on the covariate. Therefore, taking competition as an example, if a video game in the violent condition is found to be more competitive than the video game in the non-violent condition, then an ANCOVA cannot be used to “control” for the impact of competition. Despite this, ANCOVAs are often used in research on violent video games to control for a wide range of confounding variables assessed using participants’ subjective experience.

It should be noted however, that an ANCOVA could be used if the confounding variables varied randomly (Miller & Chapman, 2001). Thus, if a pilot study found that two games had the same level of competitiveness, and during the main study participants, based on their subjective experience, rate one game as being more competitive, an ANCOVA could
be used. This is because the variance in subjective competitiveness would have been due to individual differences. As participants were randomly assigned to each group, the differences between groups was random and not due to the systematic differences between the games.

Based on these arguments, it appears that if pilot studies are conducted to find games that are matched on a variety of different aspects then all issues are resolved. However, it is important to note that researchers can ask participants for their perceptions of each game on certain aspects, but there are too many variations between video games to control for every aspect. For example, Arriaga, Esteves, Carneiro, and Monteiro (2008) controlled for 14 possible confounding variables, which was the most for the studies assessed in this review, yet they still missed what may be one of the most important variables, competition. Going back to a previous example, where Hasan et al. (2012) compared violent first-person shooting games to a racing game, there are too many differences to control for using subjective ratings. For example, a first-person shooter involves the player clicking quickly and accurately on a screen while trying to avoid other players clicking on them. A racing game on the other hand involves using a keyboard to move a car around a track. The impact of these differences is unknown, and they certainly cannot be controlled for through participants’ opinions.

This section, as well as the contents of Table 2.1, highlight that the majority of studies assessing the impact of violent video games on aggression are not adequately controlling for the variations in a range of different aspects between video games, such as competition. This lack of control adds “noise” to the studies, making it very difficult to determine the independent role that violence alone has on the cause of the increase in aggression. One way to reduce this “noise” so that the impact of violence within video games can be more clearly assessed, is to use the same game across conditions. This means that the violent and non-violent condition will be exactly the same on every aspect apart from violence which will be
modified within that one game (discussed in more depth shortly). However, as discussed in the next section, caution must be taken when using the same game across conditions.

3.1.3 Issues with manipulation of the same game

As demonstrated, the next step for research into the effects of violent video games on aggression is to use the same game across all conditions while only manipulating the level of violence. However, only 16 of the 68 papers (23 of 85 unique studies) used the same game across conditions (see Tables 2.2 and 2.3). Perhaps the programing skills required to modify a video game or a failure to understand the importance of in-game confounding variables has influenced this. Also, some researchers may have opted not to manipulate video games to strengthen ecological validity. However, as video games are played in so many ways outside a laboratory setting, the added ecological validity is not strong enough to outweigh the weakness of this method listed in the previous section. While manipulating one game is a better approach, at the very least on face validity, researchers must still take care with their manipulation of the game. In this section the studies from Table 2.2, which used the same game across conditions but varied the goals of the game, are discussed. It appears that varying the goals across conditions increases the threat of confounding variables.

In some extreme cases, researchers appear to have manipulated the game and goals so much that the two conditions were basically different games. An example of this is Lin (2013b) who used the game *Grand Theft Auto 4*™ for both the violent and non-violent conditions. In the violent condition participants were required to save a person by killing opponents, while in the non-violent condition participants took a woman out on a date within the game. As the variation between the conditions is so extreme, it basically turned into two completely different games, which, as discussed previously, confounds results. This makes it very hard to conclude that violence alone was the cause for increase in aggressive affect in Lin’s (2013b) study.
However, even subtle changes to a video game can affect the probability of having confounding variables. One example is Carnagey and Anderson (2005), who utilised the same racing game across all conditions, *Carmageddon 2™*, and only varied the consequences of hitting other cars. The researchers changed the levels of violence within the game by either awarding points for destroying other vehicles (violence rewarded), deducting points for destroying other vehicles (violence punished), or not letting participants make contact with other vehicles (non-violent conditions). A limitation of this design is that in the violence rewarded condition participants have the extra goal of trying to slow down their opponents by ramming them. This adds to the competitiveness of the game as participants not only have to go as fast as they can to finish but can also slow down opponents which they may do to win rather than try to trash the car in a violent manner (Adachi & Willoughby, 2011b). Therefore, the results from this study may be confounded by the possible increase in the competitive nature of the violence rewarded condition (Adachi & Willoughby, 2011b). This limitation is a result of the manipulation of the goals of the game, which meant that participants had to complete “different” tasks.

A second example is Staude-Muller, Bliesener, and Luthman (2008) who used “freeze” weapons in the non-violent condition so that participants would not be able to kill their opponent. Participants were also able to “unfreeze” allies. Using this method, they found that participants in the violent condition, i.e. using deadly guns to kill the opponents, demonstrated desensitisation to violent aversive stimuli and greater sensitisation to aggressive cues. However, the two conditions had slightly varied goals within the game. That is, in the non-violent condition participants could now save their teammates. This could be seen as prosocial helping behaviour which has been shown to reduce aggression (Greitemeyer & Mugge, 2014). Therefore, the results could be due to decreased aggression from the non-violent condition rather than an increase from the violent condition.
Some researchers have even created their own game to control for other confounding variables, but this can also have complications. For example, in Persky and Blascovich (2007) participants in the violent condition had to shoot opponents while also hiding behind walls to avoid bullets. The non-violent condition had the same environment except that participants had to spray paint a canvas to make a piece of abstract art. The researchers suggested that they were trying to control for confounding variables as the pointing and shooting of the paint was similar to that of pointing and shooting a gun. In addition, running to different gaps in the wall meant participants could shoot a different colour which encouraged them to move about in a similar fashion to the participants trying to dodge bullets in the violent game. However, a criticism of this manipulation is that shooting paint at a large canvas involves little accuracy compared to shooting a smaller sized opponent off in the distance (e.g., difference in level of difficulty). Also, while participants were encouraged to move around in the non-violent condition they were not forced to by objects flying at them. Therefore, in the violent condition participants had the extra goals of trying to dodge bullets as well as being as accurate as possible (e.g., difference in pace of action). Again, these different goals within the game may impact how, for example, competitive the game is.

These studies highlight that when manipulating a video game to control for confounding variables, caution must be taken to avoid varying the goals. In extreme cases, such as Lin (2013b), using the same game but having different goals may increase the likelihood of the results being confounded beyond using two completely different games that have been matched on certain aspects. Therefore, the best technique is to manipulate the video games while not varying the goals or tasks, which has been done by a few researchers (See Table 2.3).
3.1.4 Studies using the same game

As demonstrated by Tables 2.1 (studies using difference games) and 2.2 (studies using the same game but with different goals), the majority of studies in this review found that violent video games increased aggression in some way, whether it is through behaviour, affect, or cognitions. However, their results have potentially been confounded due to not effectively using the same game across conditions. One technique to manipulate violence within a game while changing nothing else is to vary the level of blood and gore presented in the game. For example, Barlett, Harris and Bruey (2008a) used the game Mortal Kombat: Deadly Alliance\textsuperscript{TM}, a fighting game, across all conditions and only varied the amount of blood displayed in the game, which is an inbuilt option of the game. They found that when there was a high level of blood and gore it significantly increased participants’ aggression, suggesting that increased violence within video games impacts aggression levels. However, there are two minor limitations to this technique. Firstly, the “non-violent/low-violent” condition still has high levels of violence as participants would still fight opponents in the game by kicking and punching etc. It is unclear then whether any form of violence or just extreme violence is needed to increase aggression. Secondly, the increase in blood may serve as a visual cue demonstrating the “damage” they have caused as well as the “damage” they are receiving. This potentially adds extra visual cues which emphasise whether the participant is winning or losing. This in turn may cause an increase in competition and thus a confound (Farrar, Krčmar, & Nowak, 2006).

Other researchers have used different modification techniques. An example is a study by Elson, Breuer, Van Looy, Kneer, and Quandt (2015) which effectively manipulated one game across conditions. For this study, the game Unreal Tournament 3\textsuperscript{TM} was modified to have a violent and non-violent condition, as well as a normal-speed and high-speed version of the game. The violent condition was similar to most first-person shooting games in which the
player would move around with a gun and kill opponents before they were killed themselves. Similarly, the non-violent version of the game involved participants running around with a gun-like object, but instead of trying to kill opponents the player would just freeze them. Once the opponent froze they would turn invisible and just disappear from the game. While both versions of the game had the same goals, i.e. the player hits their opponent before they are hit, each version varied in level of violence which was supported by participant ratings. Using this method, the researchers found that violence did not increase aggressive behaviour.

Another good example is Kneer et al. (2016) who replaced a flamethrower which kills an opponent (violent condition) with a “rainbowblower” which shoots rainbows and defeats the opponent by incapacitating them as they convulse in laughter. Participants confirmed the successful manipulation with the flamethrower condition being rated as more violent than the “rainbowblower” condition. Again, using this technique, they did not find that violence within the game increased aggressive cognition and behaviour. One reason why studies that used the same game across conditions while not varying the goals, such as Elson et al. (2015) and Kneer et al. (2016), have conflicting results to the majority of research is due to confounding variables, such as competition, being adequately controlled for. This hypothesis was tested further in Studies 1A and 2.

3.1.5 Summary of results for each matching technique

Of the 52 papers (63 unique studies) that used different games across conditions, 55.77% (57.14% of unique studies) found that violent video games increased aggression, 11.54% (9.52% of unique studies) found that violent video increased aggression on some measures but not others, and 32.69% (33.33% of unique studies) found that violent video games did not increase aggression. In studies where a pilot study was conducted to match the video games before the main experiment (9 papers, 11 unique studies), 44.44% of papers (45.45% of unique studies) found violent video games increased aggression, 22.22% (9.09%
of unique studies) showed mixed results, and 33.33% (45.45% of unique studies) found no effect. The sample sizes of studies using different games can vary, and this appears to be especially true for studies finding null results. As the effect of violent video games is quite small, the limited sample sizes may be insufficient to demonstrate a significant result. Based on this and the findings from the majority of studies, it appears that playing a violent video game will increase aggression compared to playing a different non-violent video game. However, as has been discussed, with these studies it is difficult to determine whether it is the violence within the game or other confounding variables, such as competition, which is causing the increase in aggression.

Studies that used the same game across conditions but varied the goals within the game had similar findings. Of the eight papers (10 unique studies) that used this design, 62.50% (70.00% of unique studies) found that violent video games increased aggression, 12.50% (10.00% of unique studies) found mixed results, and 25.00% (20.00% of unique studies) found no effect. However, as discussed in Section 3.1.3, the variances in goals between games can increase the threat of confounding variables, once again making it difficult to conclude that violence was the sole cause of increased aggression.

When researchers used the same game across conditions and kept the goals the same (8 papers, 12 unique studies), the findings appear to conflict with studies using different games or the same game with differing goals. In contrast to the majority finding that violent video games increase aggression, 50.00% of papers (50.00% of unique studies) found null results, 25.00% (25.00% of unique studies) were mixed, and only 25.00% (25.00% of unique studies) found an effect. This finding adds support to the hypothesis that previous violent video game research may have been affected by confounding variables. If this was not the case then the tightly controlled studies, seen in Table 2.3, would have shown a similar spread of results, yet the opposite has occurred. However, caution must be taken when interpreting
these results as only eight papers (12 unique studies) have used the same game with the same goals across conditions.

Even though the studies with better methodologies are finding more null results, based on the weight of evidence, as discussed in Chapter 2, overall the research indicates that violent video games increase aggression. While using different games across conditions might not be the best experimental technique, there are a large number of studies, which often have the largest sample sizes and use different games from study to study, that still find that the violent video game increases aggression. Greitemeyer and Mugge (2014, p. 585) described this as “converging evidence from different methodologies (called triangulation)” which definitely does enhance confidence in the conclusion that violent video games increase aggression. Therefore, eight papers (12 unique studies), using better methodologies, are perhaps not enough to disregard decades of research, especially when there was still some inconsistency between those studies. However, it is important to continue to use the methodology of implementing the same game across conditions (as done in Study 2), because violence within video games may continue to have a null effect on aggression when confounding variables are adequately controlled for.

3.1.6 Competition as a confounding variable

As discussed previously, competition within video games has been shown to increase aggression (e.g., Adachi & Willoughby, 2011a; 2016). However, only three papers using different games across conditions adequately matched games on competition (Adachi & Willoughby, 2011a; Anderson & Carnagey, 2009; Carnagey, 2006). One other study covaried competition out using an ANCOVA (Jerabeck & Ferguson, 2013), but as discussed previously this is not appropriate. As only three papers matched competition (5.88%) it is apparent that competition has not been adequately controlled for or considered in violent video game research.
The three papers that did control for competition (Adachi & Willoughby, 2011a; Anderson & Carnagey, 2009; Carnagey, 2006), taken together with the studies that should have theoretically controlled for competition by using the same game with the same goal across conditions (papers in Table 2.3), provide inconsistent results. Violence was found to increase aggression in four papers (36.37%), two found mixed results (18.18%), and five (45.45%) found null results. Therefore, it is unclear at this stage if competition within video games has confounded previous violent video game research. Consequently, the aims of Studies 1A and 2 are to assess the effect of violence within video games while controlling for competition.

Competition is a very important in-game confound to assess, because violent video games are generally considered to be more competitive (Carnagey & Anderson, 2005). While other confounding variables, such as level of difficulty (Przybylski et al., 2014), may impact results, they are not variables that appear to be systematically higher in violent video games. Therefore, as the wide range of studies assessing violent video games have used different games, the confounding effect should be mitigated through meta-analyses. However, as violent video games are seen to be more competitive, then the majority of studies would have had the violent condition as being more competitive, and thus the confounding effect of competition would not have been mitigated through meta-analyses.

3.1.7 Summary

The majority of studies in violent video game research use a different game for the violent condition when comparing against a non-violent condition. There is a major flaw in this design because it becomes difficult to determine whether the violence within the game or some other confounding variable caused an increase in aggression. Attempts have been made to reduce the impact of confounding variables by matching games on a variety of aspects using assessments of participant subjective experience of the game. However, issues with
“point of reference”, the number of potential confounding variables to consider, the fact that some variables cannot be controlled for using this method, and the incorrect use of ANCOVAs to control for confounding variables suggests that using different games across conditions is less than ideal.

The best way to control for confounding variables is to use the same game across conditions and manipulate the game so that only violence varies. There are some studies that attempted to manipulate only violence but changed the game so much that other confounding variables may also have varied across conditions. When studies do successful modify one game so that only violence varies, they provide conflicting results to the majority of studies (which use poorer methodologies), with violence within the game not affecting aggression. This suggests that previous research may indeed be confounded by other differences between games. However, as only eight papers have been conducted which successfully manipulated violence within one game, more research is needed to confirm that the large amount of research conducted previously has actually been confounded. This was done in Study 2.

In regard to competition, only a few studies have controlled for it. The results have been inconsistent and thus further research is still needed to confirm if it has been a confounding variable in violent video game research (addressed in Studies 1A and 2). Competition is an important confounding variable to control for as it may systematically vary, with violent video games being considered more competitive. Therefore, meta-analyses cannot mitigate the variance as it is systematic rather than random. Future studies need to break away from the norm and use the same game across conditions and manipulate only the variables being assessed. This will help to satisfactorily control for competition, as well as other confounding variables. By doing this it will help clarify whether violent video games cause an increase in aggression because they are violent, or because they are competitive (addressed in Study 2).
3.2 External Third Variables and Individual Differences

In addition to in-game confounding variables influencing results from violent video game research, there are also external third variables or individual differences that may moderate the effect. As the GAM suggests, there are several predictors of aggression and researchers have assessed a wide range of them as moderators of violent video games. However, in this section only the main variables of concern to research on violent video games are discussed. While there is only a limited amount of research, the effect of these third variables on competitiveness results are also discussed where possible.

3.2.1 Sex differences

Males display more physical aggression (Archer, 2004; Bjorkqvist, 1994), play video games for longer (IGEA, 2016), and have a greater preference for violent video games (Gentile, Lynch, Linder, & Walsh, 2004; Olson et al., 2007). These factors make sex an important variable to consider when assessing the effect of violent video games on aggression. However, despite some concern (e.g., Ferguson, 2010), overall there appears to be no difference between males and females in terms of the effect of violent video games on aggression.

There have been studies that have found violent video games have a greater effect on males (e.g., Tian & Qian, 2014). However, when Anderson et al. (2010) conducted their meta-analysis, they found that there were no significant sex differences in effect on aggressive behaviour. In fact, females had slightly higher effect sizes for experimental and longitudinal studies, but this was not significant. This finding suggests that sex does not moderate or mediate the relationship between violent video games and aggression. Indeed, most studies that have included sex as a moderator have found that it does not have an effect (e.g., Anderson & Carnagey, 2009; Gentile et al., 2014). In addition, others have found that
after controlling for sex, violent video games still affect aggression (e.g., Anderson et al., 2008).

The limited impact of sex on the relationship between violent video games and aggression appears to also be apparent for competitive video games. Adachi and Willoughby (2011a) found in their experimental study that there was no interaction between the violent or competitive game condition and sex. In addition, their longitudinal study showed that sex did not moderate the relationship between competitive video game exposure and aggression (Adachi & Willoughby, 2013).

3.2.2 Age differences

Children and adolescents are among the most likely to play video games (IGEA, 2016). In addition, children and adolescents with higher levels of trait aggression have been reported to be drawn to violent video games (Breuer, Vogelgesang, Quandt, & Festl, 2015b; Von Salisch, Vogelgesang, Kristen, & Oppl, 2011). This suggests that a large proportion of adolescents will be drawn to violent video games because at that stage of development they will already have higher levels of aggression due to biological and psychosocial factors (see Kirsh, 2003). While adolescents may be “at risk” because of their inclination to play violent video games, there are also concerns that the effect of violent video games on aggression will be stronger in the younger population (Anderson et al., 2010).

Theoretically there is evidence to suggest that adolescents are more vulnerable to the impact of violent video games. Adolescents are more aggressive in nature, thus exposing them to violent video games should reinforce aggression (Kirsh, 2003). This may create an interaction effect when related to the GAM. Personal factors, such a biological (e.g., brain development, hormones) and psychosocial (e.g., challenges at school, changes in relationships), should interact with the situational factor of violent video games to make the adolescent more likely to behave aggressively. In addition, cognitive deficiencies related to
decision making may make young adolescents more likely to act impulsively and therefore aggressively (Kirsh, 2003). Not only will adolescents be more likely to act aggressively in the short term following violent video game play, the repeated acts of aggression should reinforce aggressive scripts and attitudes resulting in long-term effects (Kirsh, 2003). These long-term effects in adolescents should be more pronounced because they will act aggressively more often.

However, despite the strong theoretical evidence, studies assessing violent video games and aggression, on the whole, do not find that younger participants are more strongly affected. In the meta-analysis by Anderson et al. (2010), age was not significantly related to effect size in experimental, correlational, and longitudinal studies. Anderson et al. (2010) states that caution should be taken when interpreting these results as the meta-analysis process may not be the best way to assess the impact of age. This is due to comparisons of effect sizes being influenced by studies using different populations, different measures of aggression, and being conducted across historical time periods. Anderson et al. (2010) therefore conclude that further research is needed to assess different age groups in the same study, using the same measures of aggression.

A later study by Gentile et al. (2014) compared the long-term effect of violent video game play on aggression between grade 3/4 ($M_{age} = 9.20$) students and grade 7/8 ($M_{age} = 13.00$) students. Only the relationship between initial video game play and initial aggressive cognition was found to be moderated by age, with the younger children showing a greater relationship. All other paths between video game play and aggressive cognition and behaviour did not differ between age groups. Another study looked at slightly older participants and found that aggression in both adolescents aged 14-17 and young adults aged 18-21 was not impacted by violent video game play in the long term (Breuer et al., 2015b). These studies do not appear to support the proposition that the effect of violent video games
is stronger in certain age groups. However, the age differences were relatively small, and perhaps variances in effect would be more pronounced if, for example, children were compared to adults.

In regard to competition, Adachi and Willoughby (2016) reported on two cross-lagged panel design longitudinal studies. The first assessed university students ($M_{age} = 19.00$), and the second assessed high school students ($M_{age} = 15.83$). The same methodologies were used and there was a stronger effect size for the impact of competitive video games on aggression in high school ($r = .32$) compared to university students ($r$ between .10 and .12). However, this is the only study that has assessed different age groups, and they were assessed at different points in historical time (high school data between 2005 to 2008; university data between 2010 and 2013). It is also important to note that if violent video game research has been confounded by competition, and thus competition was causing the increase in aggression, age does not moderate this relationship.

Based on the weight of evidence, the impact of video games on aggression is not moderated by age. This is despite the theoretical understanding that there should be a stronger effect for adolescents. However, as the younger population are still more likely to play video games and are drawn to violent games, adolescents should still be considered as at higher risk due to their greater exposure to violent video games.

### 3.2.3 Trait aggression

While sex and age does not appear to moderate the effect of violent video games on aggression, there is some evidence to suggest that trait aggression does. Bushman (1995) found that participants with high trait aggression, compared to low trait aggression participants, felt angrier and displayed more aggression after watching a violent video. Later studies assessing violent video games further supported the moderating effect of trait aggression (e.g., Arriaga, Esteves, Carneiro, & Monteiro, 2006; Giumetti & Markey, 2007).
In addition, Arriaga et al. (2006) and Giumetti and Markey (2007) found that people with low trait aggression were not affected by violent video games at all. This suggests that only people with high levels of trait aggression are influenced by violent video games.

Others argue against this, for example, Gentile et al. (2014) suggest that the evidence is mixed. Indeed, in their study they found that trait aggression did not moderate the relationship between violent video game exposure and aggression. Also, studies have found that when they controlled for trait aggression, violent video games still increased aggression (Carnagey & Anderson, 2005; Willoughby, Adachi, & Good, 2012). Anderson and Carnagey (2009), also found that trait aggression did not moderate violent video games’ effect on aggressive affect and behaviour. However, it did moderate the effect on aggressive cognition. As only aggressive cognition was moderated they concluded the findings supported that no particular “population is wholly immune to violent media (e.g., Anderson et al., 2003, 2007)” (Anderson & Carnagey, 2009, p. 738). However, this conclusion does not suggest that people with high levels of aggression are more vulnerable to the effect of violent video games.

The GAM would support the view that people with low trait aggression are not immune, although people with high trait aggression should be affected more. As discussed previously, personal factors such as trait aggression should interact with situational factors such as playing violent video games to influence how likely a person is to act aggressively. The situational factor alone should increase the likelihood of aggression, but when coupled with personal factors the likelihood should increase further. However, as has been discussed, the evidence has not been clear cut.

As the results are inconsistent it is apparent that future research needs to further evaluate the influences of trait aggression on the strength of the relationship between video games and aggression. In addition, assessing the impact both in the short term and long term would be beneficial. As violent video games primarily affect aggressive cognition through
priming, short term effects on people with low trait aggression may not be apparent through cognitive measures. This is because the violent content may not prime many aggressive cognitions as the person does not have an aggressive personality. However, long term repeated exposure may strengthen relationships between the violence within the game and aggressive cognitions. Therefore, while violent video games may not have a detectible short term impact on people with low trait aggression, it may still have a long-term effect.

Lastly, one very important aspect to discuss in relation to the moderating effect of trait aggression is to be cautious in how it is interpreted. If people with low trait aggression are not affected by violent video games, it does not mean that the impact of violent video games is not important. The effect of violent video games would still be affecting a sizeable proportion of the population that have high or even moderate levels of trait aggression (Giumetti & Markey, 2007 found that participants with moderate trait aggression were significantly affected). Therefore, violent video games would still be having a negative impact on society as a whole.

3.2.4 Cultural differences

Aggression rates have been shown to vary across countries (Barclay & Tavares, 2003, through assessment of homicides and violent crimes). This may mean that different cultures and countries are affected differently by violent video games. Anderson et al. (2010) suggested that Eastern cultures, primarily focused on Japan, may produce lower effect sizes due to differences in how violence is contextualised in the media, attention levels to situational contexts, processing of emotions and emotion-action links, and the context in which video games are played. However, they also state that basic emotions and behaviours are universal which suggests that violent video games may affect aggression similarly across cultures.
This universal argument was supported when Anderson et al. (2010) found that culture, i.e. Eastern compared to Western, did not moderate the relationship between violent video games and aggressive behaviour, cognition, and affect for experimental studies. However, some non-experimental research on aggression and video game violence was moderated by culture; with Western cultures showing a greater effect size. However, it is not clear whether the moderation was due to differences in culture or the difference in measures used. Therefore, future studies need to assess the effect of violent video games across countries at the same time, using the same measures. Another limitation of the meta-analysis was that it focused primarily on Japanese and American studies. Therefore, it may be beneficial for future studies to analyse a wider range of nations. Despite further research being needed, the results from the large meta-analysis by Anderson et al. (2010) suggest that culture does not moderate the relationship between violent video games and aggression.

3.2.5 Other potential moderators

Mental Health Issues.

Due to indications of mental health issues in some perpetrators of shooting massacres, e.g. Sandy Hook Massacre, there have been concerns that people with mental health issues may be more vulnerable to the effects of violent video games. However, Ferguson and Olson (2014) found that children with clinically elevated depressive or attention deficit symptoms were not significantly impacted by violent video games when assessing bullying and delinquency. In addition, Engelhardt, Mazurek, Hilgard, Rouder, and Bartholow (2015) found that adults with Autism Spectrum Disorder did not differ in the effect of violent video games on aggression. These studies support that these specific disorders/mental health issues do not increase vulnerability to the impact of violent video games. However, as these appear to be the only two studies assessing mental health, further replication is needed, as well as assessments of other disorders (e.g., personality disorders).
Another potential moderator of concern for some researchers is family violence, that is, witnessing or receiving physical or verbal abuse within the family. Ferguson et al. (2008a) found that violent video game exposure was correlated with trait aggression. However, after conducting a multiple regression with other predictors of aggression, violent video game exposure was not predictive of trait aggression. Sex turned out to be strongest predictor, but receiving family physical and verbal aggression were also both significant predictors. DeCamp (2015) also conducted a multiple regression with a range of predictors of aggression, including violent video game exposure. After including the other predictors in the multiple regression, violent video game exposure did not predict hitting someone in the past year for both males and females. However, for both males and females, seeing or hearing family violence at home was the second strongest predictor. Therefore, these studies suggest that family violence may moderate the relationship between violent video games and aggression. However, due to the limited amount of research it cannot be strongly concluded as yet that family violence moderates the effect of violent video games. In addition, only correlational rather than experimental (causal) designs have been used.

### 3.2.6 Summary

Overall the evidence suggests that sex, age, culture, and mental health issues do not moderate the effect between violent video games and aggression. Research on trait aggression was inconsistent, and studies assessing family violence was very limited, indicating that more research is needed for these two variables. However, while trait aggression and family violence may have an impact on non-experimental studies, random sampling used in experimental studies still demonstrate a causal relationship between violent video games and aggression. That being said, trait aggression and family violence may still have an effect on error variance which may impact significance tests. However, as meta-
analyses of a large number of studies using correlational, longitudinal, and experimental
designs (as seen in Chapter 2) have demonstrated a relationship between violent video games
and aggression, this consistency in results across designs makes it difficult to conclude that
other external third variables or individual differences are the primary cause of the increased
aggression.

It is also important to note that if a third variable, such as trait aggression, is found to
be a moderator it does not diminish the importance of the violent video game and aggression
relationship. For example, if only people with high levels of trait aggression are impacted by
violent video games, then there is still a sizeable percentage of the population being affected.
In addition, it means that the “high risk” group of individuals, as they are already likely to
aggress, are becoming even more likely to aggress, which may lead to violent or criminal
behaviour. However, the evidence is not strong enough to indicate that a specific group, such
as people with low trait aggression, are immune to the effects of violent video games.

3.3 Assessing Aggression

Since the early publications on aggression, such as Dollard et al.’s (1939) *Frustration
and Aggression*, there have been numerous studies assessing aggression. However, despite
years of refining the methodology and implementation of different paradigms, the validity of
measures of aggression continues to be questioned (Ritter & Eslea, 2005; Tedeschi &
Quigley, 1996). This is especially true for measures of aggressive behaviour, with even
classic experiments such the “bobo doll” experiments (e.g., Bandura, 1973) having a
limitation of not assessing the motivations behind hitting the doll (Tedeschi & Quigley,
1996). The continued criticisms of measures of aggressive behaviour makes it difficult for
researchers, as while assessing aggressive cognition and affect is important, it is crucial to
assess whether it will lead to aggressive behaviour. Further, it is vital that the aggressive
behaviour assessed during research can predict real-world aggressive behaviour. This section
evaluates the more recent and commonly used measures of aggressive behaviour in violent video game research. In addition, the measures of trait aggression, cognition, affect, and arousal are discussed briefly.

3.3.1 Assessing aggressive behaviour

Some argue that laboratory measures of aggressive behaviour are valid measures (e.g., Anderson & Bushman, 1997; Giancola & Zeichner, 1995). However, Ritter and Eslea (2005) reviewed laboratory aggression paradigms, building upon Tedeschi and Quigley (1996), and concluded that no ideal paradigm currently existed. Some concerns include: poor understanding of the motivations of the aggressor; the distance between the target and aggressor; the lack of behavioural options for the participant; and, inability to generalise results to real-world aggression (Ritter & Eslea, 2005). While all measures of aggressive behaviour have their limitations, some appear to be better and more widely used in violent video games research. In this section the two most commonly used and assessed measures of aggressive behaviour in violent video game research are discussed.

3.3.1.1 Modified Taylor Competitive Reaction Time Task (TCRTT)

The TCRTT was originally constructed by Epstein & Taylor (1967). However, it was later modified by researchers due to ethical concerns (e.g., Anderson & Dill, 2000; Bushman, 1995) who replaced the use of electric shocks with auditory noise blasts. For this assessment participants are informed that they are competing in a reaction time task against a human opponent who is in another room. However, in reality they are competing against a computer program that will win 50% of the trials. Each of the 25 trials consists of the participant trying to press a button as quickly as they can after receiving a cue. If the participant presses the button faster than their “opponent” they will blast this opponent, who they believe is a human, with noise at an intensity (0-10) and duration (0-10) set by the participant. Therefore, higher intensity and duration settings selected by the participant indicates greater aggression.
levels. If the participant loses they are blasted by noise at a pre-selected intensity and duration by the computer, although they believe it is set by their human opponent. The TCRRT is widely used and held in high regard, although there are some concerns about external validity, lack of standardisation, and construct validity.

Early papers assessing the TCRRT found that it had good external validity (e.g., Anderson & Bushman, 1997; Giancola & Zeichner, 1995; also, see Carnagey & Anderson, 2005; Ferguson & Rueda, 2009, for examples). In a more recent study, Giancola and Parrott (2008) found that shock intensity, as measured by the original TCRRT (electric shocks), was correlated with self-reported measures of physical aggression, verbal aggression, anger, and hostility. In addition, giving participants alcohol, which should increase aggression, also increased the intensity of the stimuli selected by the participants. These findings suggest that the TCRRT is a valid measure of aggressive behaviour when assessed with personality and short term changes in aggression. In regard to the modified version of the TCRRT (auditory blasts), Carnagey and Anderson (2005) found that it correlated with trait aggression, further supporting that the modified version of the TCRRT is a valid measure. However, Ferguson and Rueda (2009) found conflicting results.

Ferguson and Rueda (2009) argued that most early studies assessing the validity of the TCRRT typically used indirect methodologies, i.e. effect sizes of laboratory studies were similar to those in correlation studies. As such, they are not directly assessing whether higher noise blasts are associated with an external indicator of aggression. Therefore, Ferguson and Rueda (2009) conducted two studies that correlated the TCRRT intensity and duration levels with various external measures of aggression. They found that the intensity and durations set by participants was not correlated with self-reported violent crime, physical assault, psychological abuse, or executive functioning. In addition, trait aggression did not correlate with intensity and duration in Study 1, although in Study 2 trait aggression did significantly
correlate, but only for females. Taken as a whole these results suggest that the TCRRTT is a poor predictor of external measures of aggression. However, a limitation of this study is that it did not assess whether the TCRRTT measures short term changes in aggression. In addition, as demonstrated previously, there are far more studies supporting the external validity of the TCRRTT. Therefore, based on the weight of evidence the TCRRTT has good external validity.

However, there are other major concerns raised by some researchers, such as is the lack of standardisation in the procedure and analysis for the TCRRTT (e.g., Elson, Mohseni, Breuer, Scharkow, & Quandt, 2014; Ferguson, Smith, Miller-Stratton, Fritz, & Heinrich, 2008b). Procedural differences between studies include noise intensities and durations either increasing in severity or being randomised, winning or losing the first trial and the varying severity in noise blasts in the first trial, having or not having a “zero” option, and having both noise intensity and duration or just one of these (see Elson et al., 2014, for examples of studies using different procedures). In regard to analysis, researchers can use either intensity, duration, or both; they can sum or multiply intensity or duration to get a composite score; they can sum or average the scores across trials; they can average scores across all trials or different sets of trials; and, they can include participants selecting intense noise (8-10) as a measure of aggressive behaviour (see Elson et al., 2014, for examples of studies using different analysis methods). These differences in procedures and analyses makes it difficult to compare studies. They also provide researchers with the possibility to pick and choose which methods give them a desired result. In addition, it has been shown that using different methods and analyses can produce completely different results (Elson et al., 2014). For example, Elson et al. (2014) demonstrated in one study that the sum of high intensity volume and mean volume intensity after losing a round of the TCRRTT produced significant results, while all other scores produced null results (e.g., mean duration and first trial volume). Based
on these findings it is clear that further standardisation is needed so that consistent procedures and analyses can be employed across all studies.

The construct validity (Salkind, 2014) of the TCRTT has also been a concern to some researchers (Adachi & Willoughby, 2011b; Lieberman, Soloman, Greenberg, & McGregor, 1999). The issue is that increased noise intensity and duration in the TCRTT may be due to competition rather than aggressive behaviour (Lieberman et al., 1999). It is theorised that the reason why participants punish their opponent more harshly is to slow them down in subsequent trials; therefore, the TCRTT may be assessing the participants’ competitive nature (Lieberman et al., 1999). In regard to violent video games, participants may become competitively primed while playing a violent video game, and therefore act more competitively in the TCRTT (Adachi & Willoughby, 2011b). As they are acting more competitively in the TCRTT they may “punish” their opponent with a higher noise intensity and duration (Lieberman et al., 1999).

To address this concern, some studies have tried to clarify why people aggress by using the six item TCRTT motivation questionnaire (e.g., Anderson & Carnagey, 2009). This questionnaire assesses whether revenge (e.g., “I wanted to pay back my opponent for the noise levels (s)he set”) or instrumental aggression (e.g., “I wanted to impair my opponent’s performance in order to win more”) motivated people to give the noise intensity and duration they delivered. Both forms were found to be motivators of aggression (Anderson & Carnagey, 2009), suggesting that competitiveness does have some impact on the way people behave, i.e. they wanted to impair the opponent’s performance. In addition, there are concerns regarding the validity of the motivation questionnaire as the items assessing revenge may not necessarily tap into the participant’s desire to intentionally harm their opponent (Adachi & Willoughby, 2011b). One way that may potentially reduce the possibility that competition is being assessed is to use a visual cue rather than an auditory cue (Elson et al.,
This means that participants will not think that blasting the opponent with noise will reduce their ability to react to an auditory cue.

While the TCRTT has its issues, it is still the most widely used measure of aggressive behaviour in violent video games research. Of the 38 papers reviewed in Tables 2.1, 2.2, and 2.3 that assessed aggressive behaviour, 65.79% used the TCRTT. In addition to its wide use, its validity has been assessed more frequently than others, with the majority of studies supporting its validity (see Anderson et al., 2010, for examples). However, as has been demonstrated there are still concerns in regard to the lack of standardisation and construct validity.

3.3.1.2 Hot Sauce Paradigm

The Hot Sauce Paradigm (Lieberman et al., 1999) was created partly to remove the issue of creating a potentially competitive situation as seen with the TCRTT. The Hot Sauce Paradigm is the second most popular measure of aggressive behaviour (18.42% of papers reviewed in Tables 2.1, 2.2, and 2.3 that measured aggressive behaviour). In this paradigm, after participants play the video game they are told that they are going to participate in a separate study about food preferences. Participants fill out a short food preference survey asking how much they like certain foods on a scale, e.g. spicy, sweet etc. They then receive a completed survey from another anonymous participant, which is in fact a bogus survey specifically filled out by the researcher to show that this “participant” does not like spicy foods. Participants are then given a bottle of hot sauce and they decide how much the other “participant” should have. More hot sauce given to the fake participant indicates more aggressive behaviour from the actual participant.

The validity of the Hot Sauce Paradigm has been assessed in a few studies. Lieberman et al. (1999) found that the amount of hot sauce given correlated with trait aggression. This finding was also supported by Meier and Hinsz (2004) who also found a significant
correlation. Later, Adachi and Willoughby (2011a), who were primarily assessing violent and competitive video games, found that the aggressive behaviour assessed through the Hot Sauce Paradigm correlated with trait aggression \( r = .32 \). However, this result was not significant due to the limited sample size (only 26 participants).

One criticism of the early applications of the Hot Sauce Paradigm is the lack of options (Ritter & Eslea, 2005). Participants only had the option of giving a very spicy hot sauce and no other alternatives are provided. Therefore, the researcher had no idea how the participant may react if different options were provided. Indeed, Beier (2012) found that the choice options can have an effect on aggression displayed in the Hot Sauce Paradigm. In response to this criticism, Barlett et al. (2009) added an extra dimension of level of spiciness, with four hot sauces ranging from not very spicy to very spicy being present for the participant to choose from. Therefore, aggressive behaviour was measured by the spiciness level of the hot sauce selected and the amount of hot sauce given.

This limitation in early research does bring into question the findings of validity demonstrated by Lieberman et al. (1999) and Meier and Hinsz (2004), as they did not include multiple options. Adachi and Willoughby (2011a) did include multiple options, but as mentioned previously the Hot Sauce Paradigm did not significantly correlate, despite the strength of the correlation being .32. Therefore, the evidence so far suggests that the Hot Sauce Paradigm is valid, but further research is needed to make a stronger conclusion, and this is a concern shared by other researchers (e.g., Adachi & Willoughby, 2011a; Elson et al., 2014).

**3.3.1.3 Summary of measures of aggressive behaviour**

There are several measures of aggressive behaviour (including observable measures), all of which have advantages and limitations (see Ritter & Eslea, 2005; Suris et al., 2004, for examples). Therefore, it is difficult to conclude which measure of aggressive behaviour is the
“best”. However, in violent video game research the TCRTT appears to be the most widely used and the most researched measure. Consequently, while there are still concerns about standardisation and content validity, it appears to be the most appropriate measure to use at the moment. The Hot Sauce Paradigm is an emerging measure that may address concerns about the TCRTT, but currently there does not appear to be enough research assessing its validity. In regard to all measures of aggressive behaviour, it is also important to note that while no measure is perfect, there have been relatively consistent results shown in meta-analyses on violent video games and aggression (e.g., Anderson et al., 2010; Greitemeyer & Mugge, 2014) across studies using different measures of behaviour. This demonstrates good scientific robustness which strengthens the conclusion that video games have an effect on aggressive behaviour and that the results can be generalised to the real world.

3.3.2 Measures of trait aggression, affect, cognition, and arousal

Trait aggression can be measured through standardised questionnaires, self-reports, peer reports, teacher reports, or parent reports (Anderson et al., 2010). However, the most common measure of trait aggression appears to be the Buss-Perry Aggression Questionnaire (Buss & Perry, 1992). The 29-item scale asks participants to rate how characteristic certain statements are of them on a 5-point Likert scale from 1 (Extremely uncharacteristic of me) to 5 (Extremely characteristic of me). The scale has four subscales: Physical aggression (e.g., “If someone hits me I hit back”), verbal aggression (e.g., “My friends say I am somewhat argumentative”), anger (e.g., “I have trouble controlling my temper”), and hostility (e.g., “I am suspicious of overly friendly strangers”). Males tend to score much higher on physical aggression, and slightly higher on verbal aggression and hostility (Buss & Perry, 1992). The reason it is the most commonly used is probably due to its good validity (e.g., predictive validity) and reliability (e.g., internal consistency) found across multiple studies (e.g., Gerevich, Bacskaí, & Czobor, 2007; Harris, 1997; Tremblay & Ewart, 2005). As it has been
validated extensively it is sometimes referred to as the “gold-standard” of measuring trait aggression (e.g., Gerevich et al., 2007). Perhaps the only issue with the Buss-Perry Aggression Questionnaire is it may be impacted by social desirability (Harris, 1997). This is an issue for all self-report measures as participants’ responses may be manipulated by the desire to be viewed favourably by others. However, in spite of this limitation, its reliability and validity make it the best measure of trait aggression. Unfortunately, this measure cannot assess short term changes in aggression. Also, it cannot assess aggressive affect, cognition, and arousal.

Aggressive affect is generally assessed through self-report measures of state hostility, state anger, and feelings of revenge (Anderson et al., 2010). One of the most commonly used measures is the State Hostility Scale (SHS) (Anderson, Deuser, & DeNeve, 1995). This 35-item questionnaire comprises mood statements related to aggressive affect, e.g. “I feel furious”, and asks participants to rate if they are feeling this way on a 5-point Likert scale where 1 is strongly disagree and 5 is strongly agree. The SHS has also recently been divided into four subscales (Anderson & Carnagey, 2009): Feeling unsociable (e.g., “I feel unsociable”), feeling mean (e.g., “I feel cruel”), lack of positive feelings (e.g., “I feel friendly”, reverse coded), and aggravation (e.g., “I feel frustrated”). The overall scale has consistently been found to have good reliability (e.g., Anderson et al., 1995; Barlett et al., 2009; Barlett et al., 2008a). In addition, the Cronbach alphas for three of the subscales have been good to excellent (> .9 = excellent, > .8 = good, > .7 = acceptable, > .6 questionable, > .5 poor, < .5 unacceptable [George & Mallery, 2003]), although the Cronbach alpha for the feeling unsociable subscale was only .59 (Anderson & Carnagey, 2009). As with all self-report measures, one concern with the SHS is that it could be affected by social desirability. However, apart from perhaps assessing brain regions known to be impacted by anger (Anderson et al., 2010), there appears to be no other way to assess aggressive affect.
Aggressive cognitions can be assessed in a variety of ways, for example story or word completion, Stroop interference, and facial recognition (Anderson et al., 2010). The word completion task (Anderson, Carnagey, & Eubanks, 2003) requires participants to fill in missing letters to ambiguous words. Half of the words presented can be filled in to be an aggressive or non-aggressive word, e.g. “h_t” can be “hit” or “hat”. The proportion of ambiguous words completed to be aggressive indicates the level of aggressive cognition. This task, as well as other measures of aggressive cognition, are basically assessing aggressive priming. There is a concern by some researchers that while they may validly assess aggressive priming, the priming may not result in aggressive behaviour (Elson & Ferguson, 2014; Sherry, 2001). This argument is based on the hypothesis that aggressive behaviour cannot be assessed in a laboratory setting. Therefore, studies demonstrating that aggressive priming leads to aggressive behaviour are not valid due to poor validity of the measure of aggressive behaviour. However, as previously suggested, the amount of research using different measures of aggression provide good scientific robustness for violent video games, as well as the effect of aggressive priming on aggressive behaviour.

According to the GAM, arousal levels help predict aggressive behaviour. Therefore, arousal is also measured in research on violent video games. It is usually measured using sympathetic nervous system indicators such as heart rate, blood pressure, or galvanic skin conductance (Anderson et al., 2010). The issue with arousal is that it can be affected by a variety of things. It is difficult to tell, for example, if a participant’s arousal has increased because the game is violent and they have become more aggressive or if it is just exciting. Indeed, Ballard, Visser, and Jocoy (2012) found that diastolic blood pressure was higher for participants who played a violent video game, compared to a non-violent video game. However, they suggested that this was not due to increased aggression as the violent video game was reported to be more exciting and enjoyable by participants. Another factor to
consider when interpreting arousal is whether the increase was due the participant being scared of the violence or angry about it. As such, arousal is very difficult to interpret.

3.3.3 Summary of measures of aggression

The main issue with assessing aggression is the validity of measures of aggressive behaviour as it is vital to demonstrate that cognitions and affect can lead to aggressive behaviour in the real world. Indeed, even the U.S. Supreme Court noted that aggressive priming (assessed via the word completion task) from violent video games is not a compelling “state interest”, presumably because they do not believe that it indicates an intent to be aggressive or to predict aggressive behaviour (Elson & Ferguson, 2014; Ferguson, 2013). As there is a reliance on studies assessing aggressive behaviour, debate has focussed on the validity of measures of aggressive behaviour.

The majority of studies demonstrate that the most commonly used measure of aggressive behaviour in research on violent video games, the TCRIT, has good external validity. That being said, there are serious concerns and evidence to suggest that the TCRIT has issues with standardisation and content validity. There are other measures of aggressive behaviour, but they all have limitations (see Ritter & Eslea, 2005; Suris et al., 2004), or have not been assessed extensively (e.g., Hot Sauce Paradigm [Adachi & Willoughby, 2011a; Elson et al., 2014]). However, a strength of the research into violent video games as a whole is that a large number of studies have been conducted using different measures of aggressive behaviour. Therefore, meta-analyses (Anderson et al., 2010; Greitemeyer & Mugge, 2014) have been able to synthesise the studies using different measures to find that overall the research area has concluded that violent video games increase aggressive behaviour. This provides strong scientific robustness to the area and strengthens conclusions that violent video games have an impact on real-world aggression. However, in regard to competition, there has only been one study that has assessed aggressive behaviour in an experimental
study (Adachi & Willoughby, 2011a). Therefore, in Study 2 the TCRTT was utilised in an attempt to provide more scientific robustness in competition research, i.e. providing a different measure to Adachi and Willoughby (2011a) who used the Hot Sauce Paradigm.

The most used measures of trait aggression, aggressive affect, and aggressive cognitions are valid and reliable, and there do not appear to be many concerns about these measures from researchers.

3.4 Conclusions and directions for future research

Despite concerns with external third variables and measures of aggressive behaviour, the validity of violent video game research remains strong. Large meta-analyses (e.g., Anderson et al., 2010; Greitemeyer & Mugge, 2014) have still found a relationship between violent video games and aggression after considering all published and unpublished papers using a variety of different methods and techniques. This provides good scientific robustness as multiple measures of aggressive behaviour have been utilised. In addition, random sampling of participants in experimental studies would have controlled for the potential impact of third variables. However, one aspect that may not be factored out through meta-analyses is the impact of the confounding variable of competitiveness within video games.

As demonstrated in the first section of this chapter, most studies assessing the impact of violent video games use different games across conditions. This makes it difficult to conclude that violence alone increased aggression. There are potentially several factors that differ between the video games used in the violent condition compare to the games in the non-violent condition which could confound results. However, competition is the most important variable to consider. This is because while other variables may differ randomly, e.g. difficulty, and thus may be factored out during a meta-analysis, competition will not be factored out due to violent video games being considered more competitive in general (i.e., systematically vary). Therefore, potentially every study in a meta-analysis may be
confounded with the increase in aggression being due to competitiveness rather than violence. This is why it is imperative to build upon the limited amount of research assessing the impact of competitiveness within video games to clarify why video games increase aggression.

3.5 Research Questions

There are a very limited number of studies assessing the impact of competition within video games on aggression. The studies that have researched this area found that competition does increase aggression (Adachi & Willoughby, 2011a, 2013, 2016). However, these studies have limitations such as not using the same game across conditions during the experimental study (Adachi & Willoughby, 2011a) and not considering all types of video games and variations between games within one genre of games during longitudinal research (Adachi & Willoughby, 2013, 2016). Due to these limitations and the need for further replication, the following research question was posed and assessed.

**RQ1:** Does competition within video games affect aggression?

While there has been a large amount of research assessing the effect of violent video games on aggression, there are a limited number of studies that have controlled for competition. The studies that have controlled for competition produced inconsistent results. Therefore, the following research question was posed and assessed.

**RQ2:** Does violence within video games affect aggression when competition is controlled for?

Some studies have looked at the violence versus competition hypothesis to explain increases in aggression after video gameplay. However, it appears that none have assessed whether violence and competition interact. Therefore, the following research question was posed and assessed.
**RQ3:** Does a combination of competition and violence within video games increase aggression further than one variable alone?

Results of studies assessing the impact of multiplayer games on aggression has been inconsistent. In addition, all studies assessing multiplayer games appear to be in a laboratory setting in which participants may be impacted by observer effects. Therefore, the following research question was posed and assessed.

**RQ4:** Do multiplayer games have a relationship with aggression and is this in part due to an increase in the competitive nature of the game?

Lastly, there appears to be no extensive model that demonstrates how multiple factors within a video game can impact aggression. For example, as demonstrated in Chapter 2, studies have assessed the impact of violence, competition, and multiplayer factors on aggression but these factors have not been combined to create a model of how video games impact aggression. Therefore, the following research question was posed.

**RQ5:** Can a more comprehensive model of how video games impact aggression be created?

The following chapter aims to partially address these research questions by assessing the relationship violence, competition, and multiplayer games have with trait aggression using a cross-sectional design.
Chapter 4: Study 1A: Relationship that Violent, Competitive, and Multiplayer Video Games have with Trait Aggression

4.1 Introduction

As discussed in Chapter 1, the influence of media on aggression has been a concern for the public and researchers for many years. Video games have become the latest focus of media and aggression research with so many in the population playing video games and sales of $22.41 billion in the US alone (ESA, 2015). Of particular concern are violent video games as they have been shown by the majority of research studies to increase aggression (e.g., Anderson et al., 2010; Greitemeyer & Mugge, 2014). While the effect of violent video games has been extensively assessed, research assessing the cause of this effect is incomplete, mainly because the impact of competition within video games on aggression is limited. That is, violent video game research often does not control for the effect of competition. Furthermore, with 56% of frequent gamers playing with other people (ESA, 2015), the impact of multiplayer games is becoming an important factor that needs to be evaluated. Therefore, this study addressed the relationship exposure to and preference for violent, competitive, and multiplayer video games has with trait aggression.

The impact of competitive video games on aggression has been assessed by a few experimental studies (e.g., Adachi & Willoughby, 2011a; Eastin & Griffiths, 2009; Mihan et al., 2015; Schmierbach, 2010). However, the majority of these studies manipulated the social situation of the game rather than the level of competition within the game itself, i.e. cooperative multiplayer, competitive multiplayer, or single-player. In each of these three conditions participants still competed against an opponent (human or computer) and competitive ratings of the games were not assessed. Therefore, it is difficult to conclude whether the social context or level of competitiveness was affecting aggression. That being said, one study (Adachi & Willoughby, 2011a) used participants’ ratings to confirm that
levels of competition within each video game utilised had been successfully controlled and found that competition increased aggressive behaviour (using the Hot Sauce Paradigm) while violence did not.

However, as discussed in Chapter 3, laboratory measures of aggression have been questioned on their ability to predict real world aggression (e.g., Ritter & Eslea, 2005). Therefore, it is important to support results of experimental studies (e.g., Adachi & Willoughby, 2011a) with correlational and longitudinal research as they can use self-report measures of real-world aggression. In addition, the impact of real-world video game play can be assessed. The combination of experimental, correlational, and longitudinal studies assessing the impact of competitive video game play is important to provide robust scientific evidence.

It appears that only Adachi and Willoughby (2013, 2016) have conducted longitudinal studies assessing the impact of competitive video game exposure in the real world. Competitive video game exposure was found to predict later aggression for both adolescents and young adults. However, participants only stated how often they played action, fighting, sports, and racing video games. While these games may generally be competitive, there will be variances in how competitive, and also how violent, every game will be. Therefore, having participants rate how competitive and violent each game they play is appears to be a more valid measure of competitive and violent video game exposure. In addition, using participants’ ratings in violent video game research is common and has been shown to be a valid measure of violent video game exposure (Busching et al., 2015).

Calculating an overall competitive video game exposure score should use methods previously applied in violent video game research. In violent video game research, a common approach is to multiply time spent playing a game by a violence rating provided by the participant, then sum all the games played by that participant to provide an overall score.
(Anderson et al., 2010). This calculation can be easily applied to competitiveness within video games, i.e. replace violence ratings with competitiveness ratings. A limitation of this statistical approach is that results will be skewed by time spent playing any video game, regardless of the game’s competitiveness. For example, if Participant One gave a score of seven (on a 1-7 scale) for time spent playing the game, and then a three (1-7 scale) on the competitiveness of the game, they will still score a total of 21 despite the game being not very competitive. In comparison, if Participant Two does not play as often (scores a three), but the game is highly competitive (scores a seven) this will also produce a score of 21. The limitation is that if exposure to “competitive” games is being measured then arguably the second participant should be getting a higher score because they are playing highly competitive games, while Participant One is not. Another method that addresses this issue is to ask participants if they have played violent or M rated games at all, but not how often (e.g., DeCamp, 2015; Willoughby et al., 2012). This provides information on whether the participant prefers to play violent or non-violent games. Preference for competitive video games could easily be identified by asking participants how competitive they consider each of the video games they play. A limitation of this method is that it does not take into consideration how often people play. However, including both a measure that includes time (exposure) and one that does not (preference) may provide a better understanding of the relationship between video games and trait aggression.

Another interesting finding from Adachi and Willoughby (2016) was that the action and fighting games provided no unique variance above the latent variable of competitive video game exposure. This suggests that violence alone does not predict aggression, and that there appears to be no interaction between violent and competitive video games. This does not support previous research that found violent video game exposure predicts future aggression (e.g., Anderson et al., 2010), or the theoretical argument of an interaction effect as
both violence and competition have been shown to increase aggression (see Chapter 2). One potential reason for the contradictory results is that previous studies assessing violence have been confounded because violent video games are considered to be more competitive (Carnagey & Anderson, 2005). However, it is important to note that it appears no study has assessed whether violent video games are generally more competitive. Therefore, it will be assessed in this study. Another potential reason for the null finding by Adachi and Willoughby (2016), which is also a limitation of the study, is that participants did not rate how violent the games were. Therefore, it may be that some action/fighting games were not violent and some sports/racing games were violent. As such, they would have shared some violence variance which may have affected results. Further research measuring both violence and competition within video games is needed to assess the true relationship violence and competition have on aggression.

The effect of playing multiplayer games has also become an important factor to consider with online gaming becoming so popular. From the evidence discussed in Chapter 3 (e.g., Festinger, 1954; Katsyri et al., 2013), it appears that multiplayer games increase competition. Therefore, as competitive video games increase aggression, multiplayer games should also increase aggression. However, experimental research assessing the effect of multiplayer games on aggression has so far been inconsistent (e.g., Eastin, 2006; Eastin & Griffiths, 2006; Williams & Clippinger, 2002). One possible explanation for this could be the impact of observer effects in a laboratory setting (also known has the Hawthorne effect; Salkind, 2014). Some participants may inhibit their aggressive behaviour toward another human opponent to appear socially acceptable to observers. Indeed, Wright (2013) found that people displayed more cyber aggression when they believed they were anonymous. Therefore, it is important to conduct correlational and/or longitudinal studies to assess the effect of multiplayer games outside a laboratory setting.
Other factors to consider are individual differences, such as sex and age of the participants (see Chapter 3). There are some concerns about whether sex moderates the effect of video games on aggression (e.g., Ferguson, 2010). However, research has demonstrated that video games influence males and females equally (Anderson et al., 2010). There are also concerns that adolescents are more vulnerable to violent video games. Media coverage of teenage violence in recent years has put a focus on violent video games and how they may be having a greater effect on young people, yet the meta-analysis by Anderson et al. (2010) did not support this. However, theoretically, as adolescents are still developing and they are generally more aggressive at that stage, video games may have an impact on attitudes and beliefs about when aggression is acceptable (Kirsh, 2003). Therefore, assessing violent, competitive, and multiplayer video game exposure and preference in high school may be useful in understanding its relationship to aggression in later years.

4.1.1 Overview and hypotheses

As demonstrated, there is a limited amount of research assessing the relationship between competitive video game exposure and aggression, especially outside of a laboratory setting. Therefore, the primary aim of this study was to address this issue by conducting a survey study that assessed real-world competitive video game exposure and how it relates to trait aggression. To build upon Adachi and Willoughby (2013, 2016), participants reported the competitiveness of the games they play to give a more accurate measure of competitive video game exposure. In addition, violence ratings were taken to assess the relationship between violent video game exposure and trait aggression, and to assess the interaction between violence and competition within video games. While the amount of time exposed to competitive and violent games was the main focus, preference for competitive and violent games was also analysed to provide a measure that was not skewed by the amount of time playing video games overall. It was hypothesised that exposure and preference for both
competitive and violent games in the last year would be positively correlated with trait aggression. As both competition and violence have been shown to have a relationship with aggression, it was hypothesised that there would be an interaction between violence and competition, producing a stronger correlation with trait aggression than either variable independently.

The secondary aim was to assess the relationship multiplayer game preference has with competition and trait aggression as previous research has not been conducted outside a laboratory setting. The results from experimental research on multiplayer games and trait aggression has been inconsistent. However, this survey based study was not in a laboratory and thus was not impacted as heavily by observer effects. In addition, playing against another human should increase competitiveness. Therefore, it was hypothesised that playing video games with humans, compared to playing in single-player mode with computers, would be correlated with competition and thus trait aggression.

As there are concerns that adolescents are vulnerable to the effects of video games, the participants’ exposure to and preference for violent, competitive, and multiplayer games in high school was also assessed. It was hypothesised that the strength of the correlation between exposure or preference in high school and current trait aggression would be the same as the correlation between exposure or preference in the last year and trait aggression.

The moderating effect of sex was also assessed. Despite it being expected that males would play video games more often, it was hypothesised that sex would not moderate the effect of exposure or preference on trait aggression.

Lastly, the relationship between violence ratings and competitiveness ratings of the video games was also explored. This is due to the fact that no study has actually assessed whether violent video games are generally more competitive. However, as experts are of the
opinion that they are more competitive, it is hypothesised that the violence ratings of video games would have a positive correlation with competitive ratings.

4.2 Method

4.2.1 Participants

The sample consisted of 99 participants (51 males, 48 females) with an age range of 18 to 64 ($M = 23.45$, $SD = 6.50$). Participants were either recruited through an advertisement displayed at the end of a first-year psychology lecture, or through an event posted on the researcher’s Facebook page. The only criteria for inclusion in the study were that participants be over the age of 18 and have no prior knowledge of the study. For highest level of education completed, 57% had completed high school, 15% a technical college degree, 26% an undergraduate university degree, and 2% a postgraduate degree. In addition, 17% were not currently studying, 2% were currently in a technical college course, 73% were currently in an undergraduate course, and 8% were currently in a postgraduate course. The study was approved by the University ethics committee (RMIT CHEAN reference number: ASEHAPP 46-13).

4.2.2 Materials

*Video Game Definition.* Participants were informed that for the survey “video games” are considered to be all games on an electronic device, e.g. Facebook games, mobile phone games, computer games, console games etc.

*Video Game Exposure (VGE).* This questionnaire was designed to assess violent VGE and competitive VGE in the last year and during high school. Participants were asked to state how many hours a week they played video games on average in the last year and during high school (13 to 18 years old). They then stated up to 10 games they played most frequently in the last year and in high school, and the percentage of time playing each game compared to the others. This percentage was used in conjunction with the number of hours played each
week to give an hourly score for each game on average in a week. Participants also rated each game for competitiveness and violence on a scale of 0 (not at all) to 6 (extremely). The score for each game was multiplied by the amount of time spent playing that game. All games were then summed to give an overall competitive VGE score and a violent VGE score for both the last year and in high school.

*Video Game Preference (VGP).* VGP scores for each participant were calculated by multiplying the decimal percentage amount of time playing each game with its corresponding violence and competitive ratings by the participant. This was done for each game and then summed to give an overall competitive VGP and overall violent VGP score for both the last year and in high school. These overall scores could range from 0 (Prefer not to play competitive/violent video games at all) to 6 (Prefer to play extremely competitive/violent video games).

*Multiplayer Video Game Preference.* This was assessed by asking participants to state the percentage of time spent playing multiplayer games compared to single-player games for both the last year and in high school. Therefore, multiplayer preference could range from 0 (prefer not to play multiplayer games) to 100 (prefer to play only multiplayer video games).

*Trait Aggression.* The Buss-Perry Aggression Questionnaire (BPAQ) (Buss & Perry, 1992) was used to assess trait aggression. The 29-item scale asked participants to rate how characteristic of themselves certain descriptions are (e.g., “If someone hits me, I hit back”). Items were rated on a scale of 1 (extremely uncharacteristic) to 7 (extremely characteristic). As well as providing an overall score of trait aggression items were also classified into four subscales: physical aggression, verbal aggression, anger, and hostility. This scale has been widely used and found to have good validity (e.g., Gerevich et al., 2007; Harris, 1997; Tremblay & Ewart, 2005), and it was found to have excellent internal consistency for this
study ($\alpha = .90$). The physical, verbal, anger, and hostility subscales were also found to have good internal consistency with a Cronbach’s alpha of .82, .84, .82, and .86, respectively.

### 4.2.3 Procedure

Participants received a link to the Qualtrics (Qualtrics, 2014) online survey which they could complete in their own time. Participants were informed that the survey was assessing video game habits and personality. Participants were also informed about what they would be required to do, that participation was completely voluntary, and that all data would be anonymous. No incentives were given and consent was implied through completion of the survey. Participants could quit the survey at any time and come back later to complete it. The anonymous data was transferred into SPSS 20.

### 4.2.4 Data analysis

**Cleaning.**

Three participants stated that they played 80 hours a week (one for the last year, two for high school). As this translates to 11.43 hours per day, it was deemed unrealistic and these outliers were removed from the analyses that involved that data. Participants who did not play video games at all in the last year were not included in the video game preference or multiplayer preference data for the last year as they would record no preference or multiplayer score. This resulted in 89 participants (49 males, 40 females) for preference and multiplayer data for the last year. For the same reason, participants who did not play video games in high school were not included in preference or multiplayer data for high school resulting in 90 participants (51 males, 39 females) for high school data.

**Assumption tests.**

All analyses and assumption testing was conducted following the guidelines of Field (2009). In each of the correlation analyses at least one variable was found to be not normally distributed according to the Shapiro-Wilk test. This was mainly due to a proportion of
participants playing little to no video games, resulting in game exposure and preference data being binomially distributed or heavily skewed. Steps were taken to rectify this issue, for example log10, square root, and other transformations were implemented, but no techniques were sufficient to normalise the distributions. As this assumption was not fulfilled, the non-parametric correlation analysis Spearman’s rho was implemented as it does not require the data to be normally distributed.

For all regression analyses a log10 transformation for trait aggression was implemented to rectify normality issues with the residuals (errors) of the model. In addition, to resolve issues of multicollinearity the independent variables were centred. After these corrections, the assumptions of normally distributed errors, linearity, homoscedasticity, multicollinearity, and independent errors were met for the regressions analysing video game preference data. However, regressions analysing exposure had some assumption issues. This is most likely due to the competitive video game exposure and violent video game exposure score not being completely independent (they both included number of hours playing video games). Multicollinearity was an issue as the average VIF across variables was between 2 and 3. In addition, by assessing the collinearity diagnostics it appeared that the variance proportions of two or more variables fell onto the same dimension. Homoscedasticity was also an issue as the standardised residual/predicted values plots appeared to be funnel shaped. Therefore, these issues with multicollinearity and homoscedasticity limited the generalisability of the regression analyses for exposure data.

4.3 Results

4.3.1 Descriptive statistics

Descriptive statistics are summarised in Tables 4.1 and 4.2. These two tables also demonstrate sex differences assessed using a series of MANOVAs. In both the last year and in high school, males reported significantly higher hourly amounts of video game play,
violent VGE, competitive VGE, competitive VGP, violent VGP, and percentage of multiplayer games. There were no significant sex differences for overall trait aggression (BPAQ), although males reported higher scores on the verbal aggression subscale.

Table 4.1

*Descriptives and Sex Differences for Hours Playing Video Games, Exposure and Preference for Competitive and Violent Video Games, and Preference for Multiplayer Video Games (N*= 99, Male = 51, Female = 48)*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overall</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>10.15</td>
<td>11.76</td>
<td>14.10</td>
</tr>
<tr>
<td>High</td>
<td>11.08</td>
<td>10.63</td>
<td>15.52</td>
</tr>
<tr>
<td>CVGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>30.78</td>
<td>45.04</td>
<td>46.76</td>
</tr>
<tr>
<td>High</td>
<td>31.33</td>
<td>42.98</td>
<td>51.82</td>
</tr>
<tr>
<td>VVGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>21.24</td>
<td>34.44</td>
<td>30.27</td>
</tr>
<tr>
<td>High</td>
<td>22.85</td>
<td>30.07</td>
<td>37.80</td>
</tr>
<tr>
<td>CVGP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>2.73</td>
<td>1.66</td>
<td>3.20</td>
</tr>
<tr>
<td>High</td>
<td>2.79</td>
<td>1.81</td>
<td>3.23</td>
</tr>
<tr>
<td>VVGP</td>
<td></td>
<td></td>
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<tr>
<td>Year</td>
<td>1.92</td>
<td>1.62</td>
<td>2.35</td>
</tr>
<tr>
<td>High</td>
<td>1.90</td>
<td>1.42</td>
<td>2.43</td>
</tr>
<tr>
<td>MP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>42.83</td>
<td>34.31</td>
<td>55.61</td>
</tr>
<tr>
<td>High</td>
<td>41.28</td>
<td>32.47</td>
<td>52.75</td>
</tr>
</tbody>
</table>

*Note.* Hours = Total hours playing video games a week; CVGE = Competitive video game exposure; VVGE = Violent video game exposure; CVGP = Competitive video game preference; VVGP = violent video game preference; MP = Multiplayer preference; Year = Games played in the last year; High = Games played in high school

* n for Hours, CVGE, and VVGE = 98 for year (51 males, 47 females), 97 for high (50 males, 47 females)

* n for CVGP, VVGP, and MP: 89 for year (49 males, 40 females), 90 for high (51 males, 39 females)
Table 4.2

*Descriptives and Sex Differences for the BPAQ and Subscales (N = 99, Male = 51, Female = 48)*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overall</th>
<th></th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td>$F$</td>
<td>$p$</td>
</tr>
<tr>
<td>Overall</td>
<td>78.90</td>
<td>23.99</td>
<td>81.51</td>
<td>24.23</td>
<td>76.13</td>
<td>23.67</td>
<td>1.25</td>
<td>.27</td>
</tr>
<tr>
<td>Physical</td>
<td>22.49</td>
<td>9.13</td>
<td>23.90</td>
<td>9.29</td>
<td>21.00</td>
<td>8.81</td>
<td>2.54</td>
<td>.11</td>
</tr>
<tr>
<td>Verbal</td>
<td>17.12</td>
<td>6.37</td>
<td>18.57</td>
<td>5.99</td>
<td>15.58</td>
<td>6.45</td>
<td>5.70</td>
<td>.019</td>
</tr>
<tr>
<td>Anger</td>
<td>17.82</td>
<td>7.15</td>
<td>16.88</td>
<td>7.29</td>
<td>18.81</td>
<td>6.94</td>
<td>1.81</td>
<td>.18</td>
</tr>
<tr>
<td>Hostility</td>
<td>21.46</td>
<td>9.87</td>
<td>22.16</td>
<td>10.41</td>
<td>20.73</td>
<td>9.30</td>
<td>.52</td>
<td>.48</td>
</tr>
</tbody>
</table>

*Note.* BPAQ = Buss-Perry Aggression Questionnaire. Variables below Overall BPAQ are its subscales.

### 4.3.2 Main analyses

#### 4.3.2.1 Video game exposure

As summarised in Table 4.3, a Spearman’s rho correlation analysis was conducted to assess the relationship between competitive VGE, violent VGE, and the BPAQ. Competitive VGE in the last year and in high school had a significant positive correlation with the BPAQ, as well as with the physical aggression subscale. However, only competitive VGE in the last year had a significant correlation with the verbal aggression subscale. Violent VGE in high school did have a significant positive correlation with the physical aggression subscale. However, violent VGE both in the last year and in high school were not significantly correlated with the BPAQ overall or any other subscale.

Competitive VGE and violent VGE scores were summed to provide a combined violent and competitive VGE score. As seen in Table 4.3, violent and competitive VGE had a significant positive correlation with the BPAQ in both the last year and in high school. The combination of violent and competitive VGE also had a significant positive correlation with
the verbal aggression subscales for exposure in the last year, as well as with the physical and verbal subscales for exposure in high school.

It is also important to note that there was a significant correlation between exposure in the last year and exposure in high school for both competition $r_s (94) = .64, p < .001$, and violence $r_s (94) = .72, p < .001$. Therefore, exposure in the last year and high school was summed. As seen in Table 4.3, the combination of competitive VGE in the last year and high school had a significant positive correlation with the BPAQ and the physical and verbal subscales. However, the combination of violent VGE in the last year and high school provided a significant positive correlation with only the physical aggression subscale.

Table 4.3

*Exposure to Violent, Competitive, and Multiplayer Games and Spearman’s Rho Correlation with the BPAQ and its Subscales*

<table>
<thead>
<tr>
<th>Variable (n)</th>
<th>Overall</th>
<th>Physical</th>
<th>Verbal</th>
<th>Anger</th>
<th>Hostility</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVGE Year (98)</td>
<td>.26**</td>
<td>.23*</td>
<td>.31**</td>
<td>.10</td>
<td>.17</td>
</tr>
<tr>
<td>CVGE High (97)</td>
<td>.25*</td>
<td>.34**</td>
<td>.19</td>
<td>.08</td>
<td>.12</td>
</tr>
<tr>
<td>VVGE Year (98)</td>
<td>.07</td>
<td>.13</td>
<td>.05</td>
<td>-.07</td>
<td>.11</td>
</tr>
<tr>
<td>VVGE High (97)</td>
<td>.17</td>
<td>.25*</td>
<td>.15</td>
<td>-.04</td>
<td>.11</td>
</tr>
<tr>
<td>VCVGE Year (98)</td>
<td>.21*</td>
<td>.19</td>
<td>.27**</td>
<td>.05</td>
<td>.14</td>
</tr>
<tr>
<td>VCVGE High (97)</td>
<td>.22*</td>
<td>.31**</td>
<td>.20*</td>
<td>.02</td>
<td>.11</td>
</tr>
<tr>
<td>CVGE YearHigh (96)</td>
<td>.27**</td>
<td>.30**</td>
<td>.28**</td>
<td>.11</td>
<td>.13</td>
</tr>
<tr>
<td>VVGE YearHigh (96)</td>
<td>.15</td>
<td>.22*</td>
<td>.13</td>
<td>-.05</td>
<td>.13</td>
</tr>
<tr>
<td>MP Year (89)</td>
<td>.24*</td>
<td>.19</td>
<td>.19</td>
<td>.16</td>
<td>.15</td>
</tr>
<tr>
<td>MP High (90)</td>
<td>.29**</td>
<td>.22*</td>
<td>.16</td>
<td>.23*</td>
<td>.23*</td>
</tr>
</tbody>
</table>

Note. CVGE = Competitive video game exposure; VVGE = Violent video game exposure; VCVGE = Violent and competitive video game exposure; MP = Multiplayer preference; Year = Exposure in the last year; High = Exposure in high school; YearHigh = Exposure in the last year and high school

* $p < .05$; ** $p < .01$
4.3.2.2 Video game preference

A Spearman’s rho correlation was also used to assess the BPAQ’s relationship with competitive and violent VGP. As seen in Table 4.4, competitive VGP in the last year had a significant positive correlation with the BPAQ and all its subscales. Competitive VGP in high school also had a significant correlation with the BPAQ, although it only significantly correlated with the physical aggression and anger subscales. Violent VGP in both the last year and in high school had no significant correlation with the BPAQ or its subscales.

As seen in Table 4.4, the summed combination of violent and competitive VGP had a significant positive correlation with the BPAQ and the physical subscale for preferences in both the last year and high school. However, it was not significant for the other subscales.

It is also important to note that there was a significant correlation between preference in the last year and exposure in high school for both competition $r_s (80) = .64, p < .001$, and violence $r_s (80) = .66, p < .001$. Therefore, preference in the last year and high school were summed. As seen in Table 4.4, the summed combination for competitive VGP in the last year and high school had a significant positive correlation with the BPAQ and all its subscales. However, the summed combination for violent VGP in the last year and high school did not significantly correlate with the BPAQ or its subscales.
Table 4.4

Preference for Violent and Competitive Games and Spearman’s Rho Correlation with the BPAQ and its Subscales

<table>
<thead>
<tr>
<th>Variable (n)</th>
<th>Overall</th>
<th>Physical</th>
<th>Verbal</th>
<th>Anger</th>
<th>Hostility</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVGP Year (89)</td>
<td>.38**</td>
<td>.36**</td>
<td>.29**</td>
<td>.22*</td>
<td>.25*</td>
</tr>
<tr>
<td>CVGP High (90)</td>
<td>.34**</td>
<td>.34**</td>
<td>.18</td>
<td>.22*</td>
<td>.18</td>
</tr>
<tr>
<td>VVGP Year (89)</td>
<td>.03</td>
<td>.11</td>
<td>-.10</td>
<td>-.02</td>
<td>.11</td>
</tr>
<tr>
<td>VVGP High (90)</td>
<td>.19</td>
<td>.19</td>
<td>.07</td>
<td>.05</td>
<td>.13</td>
</tr>
<tr>
<td>VCVGP Year (89)</td>
<td>.27*</td>
<td>.31**</td>
<td>.14</td>
<td>.14</td>
<td>.20</td>
</tr>
<tr>
<td>VCVGP High (90)</td>
<td>.32**</td>
<td>.31**</td>
<td>.16</td>
<td>.17</td>
<td>.18</td>
</tr>
<tr>
<td>CVGP YearHigh (82)</td>
<td>.45**</td>
<td>.38**</td>
<td>.34**</td>
<td>.28*</td>
<td>.27*</td>
</tr>
<tr>
<td>VVGP YearHigh (82)</td>
<td>.14</td>
<td>.17</td>
<td>.02</td>
<td>.05</td>
<td>.12</td>
</tr>
</tbody>
</table>

Note. CVGP = Competitive video game preference; VVGE = Violent video game preference; VCVGP = Violent and competitive video game preference; Year = Preference in the last year; High = Preference in high school; YearHigh = Preference in the last year and high school.

* $p < .05$; ** $p < .01$

4.3.2.3 Interactions

Two forced entry regression analyses were used to assess the interactions between competitive VGP and violent VGP for both the last year and high school. When competitive VGP, violent VGP, and competitive/violent VGP interactions for the last year were entered into a regression, the overall model was found to be a significant predictor of the BPAQ, $R^2 = .15$, adjusted $R^2 = .12$, $F(3,85) = 4.93$, $p = .003$. Competitive VGP was found to be a unique predictor of the BPAQ, $\beta = .38$, $t(84) = 3.65$, $p < .001$. However, violent VGP and the interaction effect were not significant predictors. The same analysis was conducted for VGP in high school and the overall model was found to be significant, $R^2 = .11$, adjusted $R^2 = .08$, $F(3,86) = 3.53$, $p = .018$. Again, competitive VGP was found to be a unique predictor of the BPAQ, $\beta = .29$, $t(85) = 2.51$, $p = .014$, while violent VGP and the interaction effect were not.
Using the same method, two more forced entry regression analyses were conducted to assess the interaction between competitive VGE and violent VGE. The overall model of competitive VGE, violent VGE, and interaction effect were found to be significant for exposure in the last year, $R^2 = .10$, adjusted $R^2 = .07$, $F(3,94) = 3.29, p = .024$. However, for exposure in high school the overall model was found to be not significant, $R^2 = .07$, adjusted $R^2 = .04$, $F(3,93) = 2.26, p = .087$. Once again, competitive VGE was found to be a unique predictor of the BPAQ in both the last year, $beta = .32, t(93) = 2.67, p = .009$, and high school, $beta = .37, t(85) = 2.01, p = .047$. However, violent VGE and the interaction effect in both the last year and high school were not found to be significant predictors.

### 4.3.2.4 Multiplayer analysis

As seen in Table 4.3, in both the last year and high school there was a significant positive correlation between percentage of time playing multiplayer games and the BPAQ overall. However, only multiplayer preference in high school was found to have a significant positive correlation with the BPAQ subscales of physical aggression, anger, and hostility. Multiplayer preference was found to have a significant positive correlation with competitive VGP in both the last year $r_s (87) = .52, p < .001$, and in high school $r_s (88) = .43, p < .001$. However, multiplayer preference had no significant correlation with violent VGP in the last year, $r_s (87) = .11, p = .30$, and or in high school, $r_s (88) = .13, p = .21$.

### 4.3.2.5 Competitive and violent game ratings

In relation to whether violent video games tend to be more competitive, there was a significant positive correlation between violence ratings and competitive ratings across all games played by participants. This was observed for games in the last year, $r_s (525) = .17, p < .001$, as well as in high school $r_s (461) = .21, p < .001$. 
4.3.2.6 Sex moderation

Sex moderation was assessed using a series of multiple regressions looking at the interaction sex may have with VGE, VGP, or multiplayer preference in both the last year and in high school. Sex did not moderate any relationship with the BPAQ or any other relationships ($ps > .05$).

4.3 Discussion

The primary aim of this study was to assess trait aggression and its relationship with violent and competitive VGE and VGP, as well as the interaction between violence and competition. As hypothesised, competitive VGE and VGP in both the last year and in high school was significantly correlated with trait aggression. As hypothesised, competitive VGE and VGP in both the last year and in high school were significantly correlated with trait aggression. However, violent VGE and VGP did not significantly correlate with trait aggression, which does not support the hypothesis. In addition, unexpectedly violence and competition did not interact. In regard to the secondary aim, as hypothesised, preference for playing multiplayer was significantly correlated with competition and trait aggression. Also, as hypothesised, age of exposure and preference, as well as sex, did not moderate any relationships between video games and aggression. It was also found, as hypothesised, that violent video games were generally more competitive.

Due to the limited amount of research in the area, the relationship between competition and aggression was one of the primary aims of this study. It was demonstrated that exposure to and preference for competitive video games was correlated with trait aggression. This supports previous findings from Adachi and Willoughby (2013, 2016), which appear to be the only other published studies that have addressed the correlation between real-life competitive VGE and aggression. Building upon Adachi and Willoughby (2013, 2016), this study highlighted that when all games are considered, not just specific
genres, and participants’ ratings of competitiveness are used, exposure to competitive video games is still related to trait aggression. Also, when focussing on which games participants play, rather than how often they play them, preference for competitive video games is related to trait aggression. As trait aggression was not assessed at two time points, it is unclear from this study the direction of the relationship (selection or socialisation [Moller & Krahe, 2009]). However, Adachi and Willoughby (2013, 2016) found a bi-directional a relationship between competitive VGE and aggression using a cross-lagged panel design. There were limitations with Adachi and Willoughby (2013, 2016), i.e. competitive ratings for each game played by participants were not taken, thus future longitudinal studies assessing all video games and their competitiveness levels are needed. Preference could also be assessed in future longitudinal research as at this stage it is unclear whether the participants preferred to play competitive video games because they are aggressive (selection), or whether their preference for competitive video games made them more aggressive (socialisation).

While competition was significantly correlated, violent VGE was only correlated with the physical aggression subscale of the BPAQ and only for exposure in high school. Contrary to the hypothesis, no other correlations between violent VGE/VGP and the BPAQ were significant. This is not consistent with the majority of previous empirical research or theories of aggression (Anderson & Bushman, 2002; Anderson et al., 2010; Greitemeyer & Mugge, 2014). However, there are some other studies that have also reported null results (e.g., Adachi & Willoughby, 2016; Breuer et al., 2015a; Ferguson, San Miguel, & Hartley, 2009). The primary reason for the contrary findings to the majority of previous research is that competition within video games was not analysed in previous research. As hypothesised, this study found that violent video games tend to be more competitive than non-violent video games. This finding, taken together with the fact that violent VGE did not correlate with aggression while competitive VGE did, suggests that previous cross-sectional or longitudinal
A few potential reasons could explain why studies may have been confounded by the variable of competitiveness. Another reason could be that participants in this study were aware of research surrounding the effect of violent video games. This is discussed in more detail in Chapter 7, as well as other limitations that may have affected results.

An important aspect of this study was the assessment of the interaction between competitive and violent video games. For both exposure and preference, no interaction was found using regression analyses and a combination of competitive and violent VGE/VGP did not have a stronger correlation with trait aggression over competition alone. These findings do not support the theoretical argument discussed in Chapter 2. That is, as violence and competition have been shown in previous research to increase aggression and theoretically impact aggression through different routes, then a combination of the two should increase aggression further. However, these null findings do appear to support Adachi and Willoughby (2016) who found that violent video games did not provide further unique predictive ability of aggression above competition alone. The findings from this study and Adachi and Willoughby (2016) can be explained by competition rather than violence within video games causing an increase in aggression. However, there are a few theoretical explanations as to why no interaction has occurred, such as a ceiling effect and individual difference (see Section 7.3). It is also important to note that as competitive and violent video game exposure both shared the same variable of hours played per week, the analysis assessing the interaction between the two exposure scores failed some assumption tests. Therefore, the generalisability of exposure scores is limited. However, the analysis assessing the interactions for preferences met all assumptions.

In addition to competitiveness and violence within video games, multiplayer games were also explored. The results showed that the percentage of time playing multiplayer games compared to single-player games was positively correlated with trait aggression. These
findings support some previous studies (Eastin, 2006; Shafer, 2012). However, the results do not support other experimental studies which found that single-player games resulted in higher or similar levels of aggression/hostility when compared to a multiplayer game that was competitive and not cooperative (Mihan et al., 2015; Schmierbach, 2010; Velez et al., 2016). This could be due to methodological limitations in previous research. That is, as participants were observed by the experimenter and potentially the other players, they may have changed their behaviour to be more socially acceptable (Hawthorne effect, see Salkind, 2014). Many current games are now played online and players have a mask of anonymity and separation from their opponent which was not the case in a controlled laboratory environment. Therefore, this may be affecting the ecological validity of previous studies as anonymity has been shown to increase cyber aggression (Wright, 2013). Thus, further experimental research is needed in this area with more realistic gaming environments. However, it should be noted that differences in results could be due to a limitation in this study. That is the amount of time playing multiplayer or single-player games was not taken into consideration, only the percentage of time playing multiplayer games compared to single-player games.

The relationship between percentage of time playing multiplayer games and competitive VGP was also explored with the results demonstrating a significant positive correlation. Therefore, multiplayer games appear to be more competitive than single-player games. This offers further insight into why multiplayer games were positively correlated with trait aggression in this study. Perhaps anonymous multiplayer games increase the competitiveness of the game which in turn increases aggression. As this study was correlational in nature, further experimental studies are needed to assess this hypothesis as this was not addressed in this dissertation.

There were some concerns and theoretical evidence to suggest that video games have a stronger effect on males and adolescents. However, it was demonstrated in a meta-analysis
that males and adolescents were no more vulnerable to the effects of violent video games than others (Anderson et al., 2010). In support of this meta-analysis, the results from this study demonstrated that sex did not moderate any relationship between video games and trait aggression.

Age of participants during exposure was also a variable that did not impact the relationships. High school competitive VGE and VGP did not differ in the strength of correlation with trait aggression compared to exposure and preference in the last year. However, the strength of correlation with trait aggression for violent VGE and VGP did increase for high school, which does not support previous research that found no difference in effect size amongst age groups (e.g., Anderson et al., 2010). The increase in strength of correlation for violent video games may indicate that adolescents are more vulnerable to the impact that violent video games may have on aggression. Alternatively, it could indicate that violent video games have long-term effects rather than short term effects. However, as the high school results were still not significant, longitudinal data was not provided (no trait aggression scores for time 1 [high school]), and previous research does not appear to support this relationship (Anderson et al., 2010), it limited the ability to generalise these conclusions.

There were also some limitations with assessing VGE and VGP in high school, primarily the issue with relying on participants to recall specific hours per week that they played video games in high school. This is because the ability to accurately recall information reduces over time (Burton et al., 2012). This limitation, as well as other limitations, are discussed in depth during Chapter 7.

However, one potential limitation that needs to be discussed now is the reliance on participants to accurately rate the competitiveness of video games. While research has shown that participants’ rating of violence is a valid measure (Busching et al., 2015), there are no studies specifically assessing the ability of participants to rate competitiveness (and because
of this, it was addressed in Study 1B). It could be more difficult for participants to rate the competitiveness of a game, compared to violence, for a number of reasons. Firstly, it is reasonably clear what makes a game violent, e.g. extreme amounts and/or realistic and graphic depictions of blood, gore, weapons, human injury, or death, but it might be less clear to participants as to whether the game is competitive. For example, what is perceived to make a game competitive may change between individuals and people may have different “points of reference” (Elson & Quandt, 2014; also, see Chapter 2). Secondly, individual differences in how participants play a certain game may impact ratings. Some participants may play a video game in the more competitive modes, or just act more competitively within the game compared to, for example, a casual gamer who just wants to have some fun. These individual differences may make it difficult to determine how competitive the game is in general. However, the level of competitiveness felt by the individual participant, rather than how competitive the game is in general, may be more useful to researchers in some studies. For example, in this study it was appropriate to gather participants’ ratings of competitiveness because it would indicate whether playing competitively is related to trait aggression. Nevertheless, it is still important to assess whether games that are designed to be more competitive overall are significantly related to aggression. Therefore, future research should assess whether participants’ competitive ratings are a valid measure of the overall competitiveness of the game by design, and Study 1B aimed to address this.

A suggestion for future research, which was not addressed in this dissertation, is to look at the relative weight given to hours playing video games compared to the competitiveness or violence of the games when assessing exposure to competitive or violent video games. This study demonstrated that both exposure to and preference for competitive video games was related to trait aggression. However, preference for competitive video games, which did not include hours playing video games, had a stronger relationship with
trait aggression. Therefore, future studies may want reduce the weighting given to hours played to create a more sensitive measure of competitive or violent video game exposure.

In summary, trait aggression was linked to competitive video games but not violent ones. In addition, preference for multiplayer games correlated with competition preference, which may explain why preference for multiplayer games also correlated with trait aggression. Also, there was no interaction between violent and competitive video games and their relationship with trait aggression. These findings provided information about the relevant relationships to design the model in Section 7.5, although as this study was correlational in nature a further study was needed to assess the causal impact of violence and competition. However, before moving on to Study 2 it is important to note that the reliability and validity of the measure of competition (participants’ subjective ratings) has not been quantified. Therefore, Study 1B assessed the reliability and validity of participants’ ratings, as well as creating a new scale that categorised in-game elements which influence the competitiveness of a game by design.
Chapter 5: Study 1B: Assessment of Level of Competitiveness within Video Games

5.1 Introduction

Study 1A demonstrated that competitive video game exposure and preference were related to trait aggression. However, there was a concern about how the level of competition within the video games was measured. One broad question answered by the participants was used to assess whether the games played by participants were competitive or violent, i.e. “How competitive was the video game” on a scale of zero to six. Participants’ ratings of violence have been shown to be a valid measure (Busching et al., 2015). However, asking participants to rate the games’ competitiveness has not been assessed in terms of validity and reliability. It may be difficult for participants to rate how competitive a video game is because competition is less definable than violence. Indeed, there are official rating systems which are openly available for people to view, such as the ESRB, that define what makes a video game violent, but they do not include competition. Also, the competitiveness of a game varies depending on how the participant interacts with the game, what modes or sections of the video game the participants’ play, and individual differences in what constitutes high and low levels of competition. Therefore, this study addressed the validity and reliability of a one-item participant rating that measures the competitiveness of video games with a multi-item scale. As such, a new measure of competition intended for experts was designed (as there appeared to be no other suitable measure) and the reliability and validity of this new measure was assessed. This new measure may have further uses, for example, if competition is found to increase aggression, then the official video game ratings systems, such as the ESRB, could use the scale to build a competition factor into the ratings for video games.

It was discussed in Chapter 3 that using participants’ opinion of a game may have poor inter-rated reliability. Across four studies by Carnagey (2006), participants rated the game they played on difficulty, enjoyment, frustration, excitement, action, ability to play the
The ability of participants to accurately report on the competitiveness of a game by its design has not been assessed specifically, but there are some studies that demonstrate positive findings (Adachi & Willoughby, 2011a; Anderson & Carnagey, 2009). While Carnagey (2006), and then later published in Anderson and Carnagey (2009), assessed several aspects across four studies, competition was only assessed in their first study as a control for competition in the subsequent studies. In that first study, it was predicted by the researchers that the games used would not significantly differ in terms of competition. Participants were asked to rate the competitiveness of the games using a four-item scale: “to what extent did you feel like you were competing with the other team,” “how hard were you trying to win the game,” “how competitive was this video game,” and “to what extent did this video game involve competition”. From the participants’ ratings, it was found, as predicted, that the games were evenly matched on competition, which provides evidence of predictive validity (Salkind, 2014). In addition, the scale was found to have good internal consistency ($\alpha = .84$).

Later Adachi and Willoughby (2011a) also used this scale but removed “how hard were you trying to win the game/match/contest” and “how competitive was this video game” during their second study as they claimed these items did not differentiate competition. It
appears logical to remove “how hard were you trying to win the game/match/contest”, as Adachi and Willoughby (2011a) rightly point out that players can try hard to win a non-competitive game. For example, a participant might try very hard to complete/win a puzzle game, but as defined in Chapter 2 this is not competition as two entities are not competing for the same goal. As such, it may be that the results from the Anderson and Carnagey (2009) study were influenced by this poor item. However, it does not seem logical to remove the second item mentioned by Adachi and Willoughby (2011a), i.e. “how competitive was this video game”. On face validity alone it appears this item would measure differences in competition between games. It is unclear why this item was removed, and no further explanation was given by the researchers as to why this item did not differentiate between competitive and non-competitive video games.

Despite removing two items from Anderson and Carnagey’s (2009) original scale, Adachi and Willoughby (2011a) still used it to assess differences in competition between video games. They hypothesised that two games would be low on competitiveness, while the other two would be high. This hypothesis was mostly supported with all but one game falling into the high or low category as predicted. However, one of the games (Left 4 Dead 2<sup>TM</sup>) utilised for the low-competitive condition was significantly more competitive than the other low-competitive game, but still less competitive than the highly competitive games. This suggests that it had a moderate level of competitiveness. Based on the description of Left 4 Dead 2<sup>TM</sup> in Adachi and Willoughby (2011a), and the mode used, it is unclear what specific competitive aspects were apparent, but it had some level of competition as participants had to fight/compete against zombies. However, the other game utilized for the low-competitive condition had no competition as defined in this thesis as it was a puzzle game. Despite this slight deviation from the hypothesis, the Adachi and Willoughby (2011a) study did provide
evidence that participants’ competitive rating of a game has good predictive validity of the base competitiveness of a video game.

However, as both these studies were experimental they only required participants to play a certain level or mode of a video game. Therefore, it is unclear whether other video games that can be played in a variety of ways can still be reliably and validly assessed for competition by untrained participants. For example, in Study 1A it may still be unclear whether people who play video games competitively or games that are designed to be more competitive influence how aggressive players become. It may also be a combination of both. Therefore, this study assessed whether participants’ ratings of video games, not played in an experimental environment but in real-life, can reliably and validly measure how competitive the games are by design.

Another factor worth considering is what items are best to assess competition. Anderson and Carnagey (2009) used four items, but Adachi and Willoughby (2011a) pointed out that at least one of these items may be removed due to poor face validity. The other three items appear very similar, indicating good internal consistency for the scale. However, as they are so similar, just asking one question, “how competitive was the video game”, may be enough to be a valid measure of competition. Indeed, Busching et al. (2015) found that a broad question on the level of violence in a game was more reliable than specific questions, e.g. “how often do you shoot or kill”. Therefore, this study assessed the inter-rater reliability (Salkind, 2014) and predictive validity of one broad question assessing the level of competition within the video games.

To assess the predictive validity of participants’ ratings of competition, it must be compared to another measure of competition. The one broad item question could be compared to Anderson and Carnagey’s (2009) four-item measure (and this was done in Study 2). However, this is just another measure of participants’ ratings, thus comparing it to another
measure that uses experts to analyse the level of competitiveness within the game by design would be more beneficial. Anderson and Carnagey (2009) and Adachi and Willoughby (2011a) used their expertise in the field to choose games they believed would be competitive or not, but no formal measure was used. In addition, they only had to assess games they were specifically choosing for their experimental study and would thus have an intimate knowledge of the games chosen. However, in cross-sectional and longitudinal research, the games played by the participants are not chosen by the researchers. Therefore, the researchers may not have an intimate knowledge of the games played by the participants and there may be a large variety of games to assess. Therefore, it would be beneficial for a new measure of competition to be developed so that experts can more easily assess the games’ competitiveness by design. In addition, it may have a secondary use by assisting official video game rating systems, such as the ESRB, to determine a games competitiveness if they deem competition to factor worth adding to their rating system (discussed in more depth during Section 5.4 and Chapter 7).

To create a new measure of competition an understanding of what makes a video game competitive must be determined. As was discussed in Chapter 2, there may be several design aspects of a video game that influence level of competitiveness. These factors include having score feedback for the player’s opponent, rivalries, rewards, competing as a team, time pressure, and frequency of competitive events. It was also discussed that the number of competitors may have an influence the competitiveness, but there was inconsistent evidence for this (e.g., Eastin, 2007; Ku et al., 2005). Having multiplayer aspects or modes is another potential factor that may impact how competitive a video game is. Previous researchers found inconsistent results in regard to its impact on aggression (Eastin, 2006; Eastin & Griffiths, 2006; Williams & Clippinger, 2002) (see Chapter 2), but Study 1A demonstrated a relationship between multiplayer game preference and competitive video game exposure.
This suggests that multiplayer games may be more competitive. Therefore, having multiplayer aspects as a factor may help identify which video games are more competitive. Therefore, this study used the most suitable aspects mentioned to create the criteria of the measure assessing how competitive a video game is at a design level. As it assesses the design of the game, it removes the impact of individual differences and difference in gameplay styles.

The first aim of this study was to develop a new measure of competition (Expert Competitive Video Game Rating Scale), designed for experts, that implemented specific factors that influence the competitiveness of a video game. Internal reliability (Salkind, 2014) of the new measure was assessed through a reliability analysis, while predictive validity was assessed through a correlation between participants’ competitive ratings and the new measure of competition. The second aim of was to use the new measure of competition to assess the predictive validity of the one-item participant rating of competition. In addition, the variance in participants’ ratings was used to assess inter-rater reliability. The third aim was to evaluate participants’ violence ratings and official ESRB ratings to further assess the predictive validity and inter-rater reliability (for participant ratings only) of these two measures of violence. Based on the findings from Bushing et al. (2015), it was hypothesised that participants’ violence ratings and ESRB ratings would correlate, thus demonstrating good predictive validity. In addition, participants’ ratings of violence would display little variance, thus demonstrating good inter-rater reliability.

5.2 Method

5.2.1 Participants

This study used a sub-set of the same participants from Study 1A. As only the most popular video games were assessed (as discussed in the Materials section), the total sample
for this study was reduced to 60 (36 males, 24 females) with an age range of 18 to 39 ($M = 22.38, SD = 3.80$).

5.2.2 Materials

*Video games chosen for analysis.* As there were so many different types of games played by participants, only the most popular were chosen for this analysis. Seven games were selected as they were played by 10 or more participants. These games were *Call of Duty* (TM), *Candy Crush* (TM), *DOTA 2* (TM), *FIFA* (TM), *Grand Theft Auto* (TM), *Pokémon* (TM), and *Skyrim* (TM). As only these games were being analysed, participants who had not played this game in the last year were not included.

Some of these games have multiple titles in a series, for example the *Pokémon* (TM) series includes titles such as *Pokémon Yellow* (TM), *Pokémon White* (TM), and *Pokémon Silver* (TM). For this study the different titles of the games were combined and analysed as one game. This was because while the graphics and story line may change between games, they are all fundamentally the same game and the tasks in the game are the same. Therefore, the level of competitiveness and violence should not differ between the different titles. This was supported by participants’ ratings with all titles within any video game series receiving the same violence and competitive scores per participant.

5.2.3 Procedure

Only the participants’ violent and competitive ratings of the seven games played by 10 or more participants were used. Data was collected in the same manner described in Study 1A.

5.2.4 Development of expert competitive video game rating scale

The original purpose of the Expert Competitive Video Game Rating Scale (ECS) was to assess the predictive validity of the one-item participant rating of competition. The reason for “expert” in the name is discussed in more detail in the discussion section. However,
briefly, it is due to the setting in which the scale is most likely to be applicable. That is, for
experts to use, rather than participants in a study. This section outlines how the ECS was
designed with the following section demonstrating the application of the scale.

The factors outlined in Chapter 2 (expect rivalry, number of competitors, and
rewards) were used to form the scale. As rivalry within a video game is quite broad and may
be achieved in several different ways, this specific factor was not used. Instead, the
appearance of leader boards was used as it encourages a rivalry as players aim to beat others
close to them on the leader board. Also, the number of competitors within the game was not
considered as a factor due to the research being inconsistent on whether more competitors
increases competitiveness (e.g., Eastin, 2007; Ku et al., 2005). However, playing as a team
where it is one team versus another appears to be a factor that can increase competitiveness
(McCallum et al., 1984), therefore it was included. Lastly, “rewards” was not included as the
importance of each reward will vary greatly from one player to the next. Overall there were
six factors developed to predict competitiveness: frequency of competitive events, clear
opponent’s score feedback, leader boards, team gameplay, time pressure, multiplayer. Each
factor was scored on a scale of 1 to 7. These scores were then averaged to give an overall
predicted competitive rating.

Generally, the scores for each factor were based on the frequency, e.g. the percentage
of time the opponent’s score is visible to the player. However, there are also some other
specific considerations for some factors and these are listed below:

1. **Frequency of competitive event:** Based on how often the player competes against
   another computer or human player.

2. **Opponent’s score:** Based on frequency, as well as simplicity of the score being displayed

3. **Leader boards:** Based on the frequency of leader boards being used within the game.

4. **Team gameplay:** Based on frequency of team gameplay
5. **Time Pressure**: Based on the frequency and simplicity of time pressure in a competitive event.

6. **Multiplayer**: The frequency that the player competes against human opponents.

### 5.2.5 Predictions

Using the ECS, the researcher created a predicted competitive rating for each of the seven games. Violence was rated based on the ESRB rating for video games as the level of violence within the game is a major factor of the rating. There are five categories in the ESRB, not including the childhood development rating. Therefore, the video games were rated from 1 (Everyone) to 5 (Adult 18+). Some games do not have ESRB ratings and therefore the researcher rated these games based on the criteria set out on the ESRB website.

For all seven games, the competitive ratings for each factor, overall competitive rating (mean of factors ratings), violence rating, and rationale for each rating can be seen in Tables 5.1 through to 5.7. Table 5.8 provides a summary of all competitive and violence ratings, as well as a categorisation of each game into high, moderate, or low competitiveness and violence based on the ratings. These ratings were used to assess the predictive validity of participants’ ratings of competitiveness and violence. In addition, the predictive validity of the ECS and ESRB ratings was assessed when compared to the participants’ ratings.
Table 5.1

*Call of Duty*® (*ECS*) and *Violence* (*ESRB*) Ratings

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>7</td>
<td>Players are constantly in an environment where they compete against a computer or human player by killing their opponent before they are killed.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>4</td>
<td>Opponent’s score is clearly displayed in a simple numerical value for multiplayer modes. However, there is no score in the single-player modes hence the moderate rating.</td>
</tr>
<tr>
<td>Leader board</td>
<td>4</td>
<td>There is a leader board and ranking system in the multiplayer mode, but none in the single-player mode.</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>5</td>
<td>It is common to play in a team during the multiplayer modes, and in the single-player mode the player is often with a computer controlled squad. However, the computer controlled squads’ actions rarely affect the actions of the actual player, hence the more moderate score.</td>
</tr>
<tr>
<td>Time pressure</td>
<td>6</td>
<td>In the multiplayer modes there is always a time pressure. In addition, the single-player condition has time pressure at times.</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>4</td>
<td><em>Call of Duty</em>® has both single-player and multiplayer modes.</td>
</tr>
<tr>
<td>Competition rating</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Violence rating</td>
<td>4</td>
<td><em>ESRB</em> rating of M 17+.</td>
</tr>
</tbody>
</table>
Table 5.2

*Candy Crush*™: Competition (ECS) and Violence (ESRB) Ratings

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>4</td>
<td>Players generally just complete the puzzle task of the game and is therefore not competitive. However, players can compare scores with other human players which makes it competitive at times.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>1</td>
<td>While completing the task there is no opponent’s scoreboard. Players can look at other players scores, but this is part of leader boards.</td>
</tr>
<tr>
<td>Leader board</td>
<td>4</td>
<td>If the player is playing while comparing with friends, leader boards are available.</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>1</td>
<td>There is no team play in <em>Candy Crush</em>™.</td>
</tr>
<tr>
<td>Time pressure</td>
<td>1</td>
<td>There is a time pressure within the game, but this time pressure is not related to the competitive event of comparing scores to opponents.</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>3</td>
<td><em>Candy Crush</em>™ is generally a single-player game. However, there are social elements to the game which make it somewhat multiplayer.</td>
</tr>
</tbody>
</table>

| Competition rating   | 2.33   |                                                                                                                                               |
| Violence rating      | 1      | No ESRB rating but it has no violence at all.                                                                                                 |
Table 5.3

**DOTA 2™: Competition (ECS) and Violence (ESRB) Ratings**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>7</td>
<td>The game only involves competing against other players.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>5</td>
<td>The opposing team’s kill score is always displayed, as well as other scores related to each player on the opposing team. Therefore, the frequency of the opponent’s score is high. However, while the scoreboard is in simple numerical values, it does not always indicate who is winning hence the more moderate score on this factor.</td>
</tr>
<tr>
<td>Leader board</td>
<td>5</td>
<td>A ranking leader board is a major part of DOTA 2™. However, it is possible to play a game mode which does not impact the players ranking, hence the more moderate score.</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>7</td>
<td>DOTA 2™ always has one team of five versus another team of five.</td>
</tr>
<tr>
<td>Time pressure</td>
<td>5</td>
<td>There is no time pressure in terms of a clock counting down. However, in every game each team must destroy the opponent’s base before their base is destroyed. This creates a time pressure; the player will feel more pressure the closer someone gets to destroying a base. However, it is less clear than a clock time pressure hence the more moderate score.</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>7</td>
<td>DOTA 2™ is nearly always a multiplayer game.</td>
</tr>
<tr>
<td>Competition rating</td>
<td>6</td>
<td>No ESRB rating, but it has mild cartoonish violence, a little blood, and fighting is a major part of the game.</td>
</tr>
<tr>
<td>Violence rating</td>
<td>3</td>
<td>No ESRB rating, but it has mild cartoonish violence, a little blood, and fighting is a major part of the game.</td>
</tr>
</tbody>
</table>
Table 5.4

\textit{FIFA}^{(TM)}: Competition (ECS) and Violence (ESRB) Ratings

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>7</td>
<td>Players are constantly competing against a computer or human opponent in a soccer match.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>7</td>
<td>The opponent’s score is always displayed in a clear and simple numerical value.</td>
</tr>
<tr>
<td>Leader board</td>
<td>6</td>
<td>Apart from some occasional matches, each game contributes to a ranking on a leader board.</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>3</td>
<td>While soccer is a team game, generally one player controls all the soccer players in the game. However, there are occasions where the player will be in an actual team with other human players, but this is less common.</td>
</tr>
<tr>
<td>Time pressure</td>
<td>7</td>
<td>There is always a clear and simple time pressure displayed as a clock.</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>4</td>
<td>\textit{FIFA}^{(TM)} has both single-player and multiplayer modes.</td>
</tr>
</tbody>
</table>

| Competition rating      | 5.67   |
| Violence rating         | 1      | ESRB rating of E                                                          |
Table 5.5

*Grand Theft Auto™: Competition (ECS) and Violence (ESRB) Ratings*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>3</td>
<td>The majority of the game involves exploring and interacting within a virtual world. Most situations are not competitive, but there are occasions where it is.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>3</td>
<td>The majority of the time there is no scoreboard. However, occasionally there is.</td>
</tr>
<tr>
<td>Leader board</td>
<td>1</td>
<td>There is no leader board.</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>1</td>
<td>When competitive situations arise, the player is acting alone.</td>
</tr>
<tr>
<td>Time pressure</td>
<td>3</td>
<td>Generally, there is no time pressure, but occasionally there is.</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>2</td>
<td><em>Grand Theft Auto™</em> is generally a single-player game. It can be played multiplayer but this is rare.</td>
</tr>
<tr>
<td>Competition rating</td>
<td>2.17</td>
<td></td>
</tr>
<tr>
<td>Violence rating</td>
<td>4</td>
<td>ESRB rating of M 17+</td>
</tr>
</tbody>
</table>
Table 5.6

*Pokémon*(TM): *Competition (ECS) and Violence (ESRB) Ratings*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>5</td>
<td>Most of the game involves battling <em>Pokémon</em>(TM), which is competitive. However, there are other aspects to the game such as exploring the world and completing the story line which is not competitive.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>5</td>
<td>There is an indication of the opponent’s score. This is indicated by how many <em>Pokémon</em>(TM) are left and the health of the current <em>Pokémon</em>(TM) available. However, as <em>Pokémon</em>(TM) can heal and perform other actions that do not just take away the opponent’s health it is not as clear an indicator of who is winning as a simple numerical system.</td>
</tr>
<tr>
<td>Leader board</td>
<td>5</td>
<td>There are some modes within the game that give clear rankings, but this is not very common. However, there is the levelling system within the game which provides a leader board of sorts, though it is not a clear ranking system.</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>2</td>
<td><em>Pokémon</em>(TM) is generally played one versus one.</td>
</tr>
<tr>
<td>Time pressure</td>
<td>1</td>
<td>There is no time pressure in <em>Pokémon</em>(TM).</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>4</td>
<td><em>Pokémon</em>(TM) has both single-player and multiplayer modes.</td>
</tr>
<tr>
<td>Competition rating</td>
<td>3.67</td>
<td></td>
</tr>
<tr>
<td>Violence rating</td>
<td>1</td>
<td>ESRB rating of E</td>
</tr>
</tbody>
</table>
Table 5.7

Skyrim™: Competition (ECS) and Violence (ESRB) Ratings

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>5</td>
<td>The majority of the game is competing against computer opponents. However, players can still explore a virtual world and complete other tasks which are not competitive.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>4</td>
<td>The opponent’s score is given through health bars. However, as players can heal their health, hide, or run away amongst other actions it is not necessarily a clear indicator of who is winning.</td>
</tr>
<tr>
<td>Leader board</td>
<td>1</td>
<td>There is no leader board.</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>1</td>
<td>Skyrim™ is played individually.</td>
</tr>
<tr>
<td>Time pressure</td>
<td>1</td>
<td>There is no time pressure.</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>1</td>
<td>Skyrim™ is a single-player game.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Competition rating</th>
<th>Violence rating</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Competition rating</td>
<td>2.17</td>
<td>4</td>
<td>ESRB rating of M 17 +</td>
</tr>
</tbody>
</table>

Table 5.8

Competition (ECS) and Violence (ESRB) Ratings for All Games

<table>
<thead>
<tr>
<th>Video Game</th>
<th>Competition Rating</th>
<th>Competition Category</th>
<th>Violence Rating</th>
<th>Violence Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call of Duty™</td>
<td>5.00</td>
<td>High</td>
<td>4</td>
<td>High</td>
</tr>
<tr>
<td>Candy Crush™</td>
<td>2.33</td>
<td>Low</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>DOTA 2™</td>
<td>6.00</td>
<td>High</td>
<td>3</td>
<td>Moderate</td>
</tr>
<tr>
<td>FIFA™</td>
<td>5.67</td>
<td>High</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>GTA™</td>
<td>2.17</td>
<td>Low</td>
<td>4</td>
<td>High</td>
</tr>
<tr>
<td>Pokémon™</td>
<td>3.67</td>
<td>Moderate</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>Skyrim™</td>
<td>2.17</td>
<td>Low</td>
<td>4</td>
<td>High</td>
</tr>
</tbody>
</table>

Note. GTA = Grand Theft Auto
5.2.6 Data analysis

Correlational analyses were used to assess the predictive validity of participants’ competitive and violence ratings, the ECS, and ESRB. Two approaches were taken when conducting these analyses. Firstly, each of the participant competitive ratings across the seven games were correlated with the ECS. This resulted in the competitive rating predicted by the ECS being replicated to match the games played by each participant. For example, 11 participants played Call of Duty™, thus the ECS score of five was matched to each of those 11 participants’ competitive ratings. This method was done for the correlation between participants’ violence rating and ESRB as well. This approach was taken to assess the predictive validity of each participant’s subjective view on the competitiveness of the game, which is influenced by individual differences and differences in how the game is played between individuals. The second approach was to correlate the ECS or ESRB rating with the average participant rating for competitiveness or violence. This approach was taken to assess the predictive validity of a more objective participant rating of competition and violence. As several participants’ scores were averaged it reduced the impact of individual and gameplay differences.

Cleaning and Assumption Tests.

Once the seven games had been identified, the only data that was maintained for this study was the competitive and violent ratings given by participants for each of the seven popular games. If there was a game where the participant had played multiple versions, for example Pokémon Soul Silver™ and Pokémon White™, the ratings for the two games were converted into one rating of competitiveness and one rating of violence for Pokémon™. This was done to keep the opinion of each participant equal, i.e. one participant did not end up having two ratings for Pokémon™. Once this cleaning was completed there were a total of 88
participant competitive ratings, as well as violence ratings. This was spread across 60 participants and the number of responses for each video game can be seen in Table 5.9.

Correlation analyses were used to assess the similarities between the ECS or ESRB ratings and the participants’ ratings of competition and violence. The normality assumption was not violated for competition when average participant ratings for each game were analysed; therefore, Pearson’s correlation was used. However, there were normality issues for participants’ average violence rating which could not be resolved through transformations. Therefore, Spearman’s Rho was used instead for the violence analysis. The ECS and ESRB scores were also correlated with all 88 participants’ ratings for each game. The normality assumption was violated for both competition and violence, thus Spearman’s Rho was used.

ANOVAs with post hoc analyses were used to assess differences between the video games in terms of participants’ competitiveness and violence ratings. Due to differences in variance, skewed data (that could not be addressed through transformation techniques), and unequal sample sizes, Gabriel’s pairwise test was used. This test deals well with unequal variance, non-normal data, and unequal sample sizes (Field, 2009).

5.3 Results

5.3.1 Inter-rater reliability of participants’ ratings

To assess the inter-rater reliability of participants’ ratings of competition and violence, the variance amongst ratings was assessed. As seen in Table 5.9, the descriptive statistics indicate that the standard deviations for each game were small. In addition, the average standard deviation for participants’ competitive ratings was 1.65. The average standard deviation for violence ratings was .92 when the zero standard deviation games were included and 1.28 when they were not. Therefore, while participants’ ratings of violence were more consistent than competition, it was not by a large amount, and competition was still consistent and reliable.
Table 5.9

Means, Standard Deviation, and Subsets for Participants’ Competitive and Violence Ratings

<table>
<thead>
<tr>
<th>Game</th>
<th>n</th>
<th>Competitive Rating</th>
<th>Violence Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Call of Duty(TM)</td>
<td>11</td>
<td>6.36</td>
<td>1.12</td>
</tr>
<tr>
<td>Candy Crush(TM)</td>
<td>20</td>
<td>2.85</td>
<td>1.90</td>
</tr>
<tr>
<td>DOTA (TM)</td>
<td>10</td>
<td>5.80</td>
<td>1.93</td>
</tr>
<tr>
<td>FIFA(TM)</td>
<td>14</td>
<td>5.93</td>
<td>1.49</td>
</tr>
<tr>
<td>GTA(TM)</td>
<td>12</td>
<td>2.83</td>
<td>1.85</td>
</tr>
<tr>
<td>Pokémon(TM)</td>
<td>10</td>
<td>3.90</td>
<td>1.91</td>
</tr>
<tr>
<td>Skyrim(TM)</td>
<td>11</td>
<td>2.73</td>
<td>1.35</td>
</tr>
</tbody>
</table>

Note. GTA = Grand Theft Auto

* Subset 1 = Low Competitiveness or Violence, Subset 2 = Moderate Competitiveness or Violence, Subset 3 = High Competitiveness or Violence. Subset 1 is significantly different from Subset 2 and 3, and Subset 2 is significantly different from Subset 3. However, if a video game falls into multiple Subsets then it is not significantly different from any other game in either of those Subsets.

5.3.2 Internal reliability of ECS

Internal reliability of the ECS was conducted through a reliability analysis on the six factors of the scale. The Cronbach alpha for the ECS was .90, with no item increasing the alpha if it was removed (see Table 5.10).

Table 5.10

Internal Reliability and Predictive Validity of Each Factor in the ECS

<table>
<thead>
<tr>
<th>Criterion</th>
<th>α if Deleted</th>
<th>( r_s ) with Participant Competition Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>.87</td>
<td>.61**</td>
</tr>
<tr>
<td>Scoreboard</td>
<td>.90</td>
<td>.48**</td>
</tr>
<tr>
<td>Leader board</td>
<td>.89</td>
<td>.46**</td>
</tr>
<tr>
<td>Teams</td>
<td>.87</td>
<td>.64**</td>
</tr>
<tr>
<td>Time Pressure</td>
<td>.89</td>
<td>.58**</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>.88</td>
<td>.56**</td>
</tr>
</tbody>
</table>

Note. ** \( p < .001 \)
5.3.3 Predictive validity ECS and participants’ competition ratings

A correlation analysis was used to assess the predictive validity of the ECS and participants’ competition ratings. When assessing the correlation between the ECS and each of the 88 participants’ subjective competitive ratings, a significant, strong, positive correlation was found, \( r_s (86) = .60, p < .001 \). Each of the six factors of the ECS were also correlated with the 88 participants’ subjective competitive video game ratings, with all having a significant relationship (see Table 5.10). When the participants’ competitive ratings were averaged to give a more objective competitive rating, it was found to have a significant, very strong, positive relationship with the ECS, \( r (6) = .96, p = .001 \).

An ANOVA with Post Hoc Analyses was completed to further assess the predictive validity of the ECS and participants’ competition ratings. This was done through analysing how the participants, on average, categorised the video games into high, moderate, or low competition, compared to the ECS categories. The ANOVA found a significant difference between the games on participants’ competitiveness ratings, \( F(6, 81) = 11.77, p < .001 \), partial \( \eta^2 = .47 \). Post Hoc Analyses revealed three subsets: subset one being low competitiveness \( p = .86 \), subset 2 moderate \( p = .087 \), and subset 3 high \( p = 1.00 \). The subset that each video game fell into can be seen in Table 5.9. *Skyrim™*, *Grand Theft Auto™*, and *Candy Crush™* were found have significantly lower competition ratings than *DOTA 2™*, *FIFA™*, and *Call of Duty™* \( (ps < .01) \). However, *Pokémon™*, which was rated around the middle of the 1 to 7 competitiveness scale, only significantly differed from *Call of Duty™*, \( p = .027 \). Therefore, *Pokémon™* fell into both the low and moderate subset. In addition, it pulled *DOTA 2™* and *FIFA™* into the moderate subset. When comparing these subsets to the categories predicted by the ECS (Table 5.8), it can be seen that they are very similar.
5.3.4 Predictive validity of ESRB as a violence predictor and participants’ violence ratings

A correlation analysis was used to assess the predictive validity of the ESRB ratings and participants’ violence ratings. When assessing the correlation between the ESRB ratings and each of the 88 participants’ subjective violence ratings, a significant, very strong, positive correlation was found $r_s (86) = .91, p < .001$. When the participants’ violence ratings were averaged to give a more objective violence rating, it was found to have a significant, very strong, positive relationship with the ESRB ratings $r_s (6) = .93, p = .002$.

An ANOVA with Post Hoc Analyses was completed to further assess the predictive validity of the ESRB and participants’ violence ratings. This was done through analysing how the participants, on average, categorised the video games into high, moderate, or low violence, compared to the ESRB categories. The ANOVA found a significant difference between the games on violence ratings, $F(6, 81) = 73.41, p < .001$, partial $\eta^2 = .85$. Post Hoc Analyses revealed three subsets: subset one being low violence ($p = .163$), subset 2 moderate ($p = .086$), and subset 3 high ($p = .84$). The subset that each video game fell into can be seen in Table 5.9. *Skyrim* (TM), *Call of Duty* (TM), and *Grand Theft Auto* (TM) were found to have significantly higher violence ratings than all other games ($ps < .001$). *DOTA 2* (TM), which fell in the moderate subset significantly differed from all other games ($ps < .001$) apart from *Pokémon* (TM), *Pokémon* (TM) also did not significantly differ from *Candy Crush* (TM) and *FIFA* (TM). When comparing these subsets to the categories predicted using the ESRB rating (Table 5.8), it can be seen that they are very similar.

5.4 Discussion

The overall aim of this study was to assess the reliability and validity of the ECS ratings of video games competition levels, participants’ ratings of competition and violence for video games, and the validity of ESRB ratings. Competition rated through the ECS was
found to have excellent internal reliability and predictive validity. Also, participants’ ratings of competition were found to have good inter-rater reliability and predictive validity. As hypothesised, participants’ ratings of violence had good inter-rater reliability and predictive validity with the ESRB.

The first aim, and perhaps the most important aspect of this study, was the development and use of the ECS to predict the level of competition within a video game. The ECS was found to have excellent internal reliability. Furthermore, the removal of any factor of the ECS did not increase the alpha and each significantly correlated with participants’ competition ratings which indicates that all factors contribute to the concept of competition. This supports the studies (e.g., Ku et al., 2005; Malhorta, 2010; McCallum et al., 1984; McClintock & McNeel, 1966; McClintock & Nuttin, 1969) and ideas discussed in Chapter 2 which suggested that frequent competitive events, clear opponent score feedback, leaderboards, team gameplay, and time pressure are all factors that make a video game more competitive. In addition, multiplayer gameplay was also a predictor suggesting that multiplayer games are more competitive, supporting the results from Study 1A. As all these factors were predictors of competition within the video games, any of them could be used in an experimental study to manipulate the level of competition within one game, and this was done in Study 2. The ECS was also found to have good predictive validity as it had a strong correlation with participants’ ratings of competition. In addition, the fact that there was a stronger correlation with the average of participants’ scores, compared to each of the 88 participants’ subjective competitive ratings, indicates that the ECS predicts the overall competitiveness of the game by design. That is, it predicts the average level of competitiveness the player will experience within the game.

As discussed in the ECS development section, the original purpose of this scale was to assess the predictive validity of participants’ competitiveness ratings. However, it could be
utilised in video game research, and potentially official video game rating organisations, such as the ESRB. Researchers of previous studies have used their expertise to decide whether the games they were utilising were competitive or not (e.g., Anderson & Carnagey, 2009; Adachi & Willoughby, 2011a). While their opinion on the level of competitiveness within the games was validated by participants’ ratings, it is beneficial for researchers to use the more structured ECS, rather than their opinion, to choose games that are suitable for the study. This would hopefully increase the likelihood of successfully manipulating or controlling for competition. The other potential use of the ECS is that with competition being demonstrated to increase aggression (Adachi & Willoughby, 2011a), policy makers may want to have competition as a factor when considering the rating of a video game. While the ESRB, for example, has factors such as level of blood, gore, and realism of violence, they could also use the six factors laid out in the ECS to determine the level of competitiveness. The use of the ECS and official video game ratings are discussed in more depth during the implication section (7.8) of Chapter 7.

This newly developed competitiveness scale for video games is prefixed with “Expert” due to its predicted primary use. As suggested the ECS should be used by researchers and official rating organisations, thus it would be expected that these people would have training (expertise) in identifying the six factors of the ECS within a video game. The ECS could also be given to participants of video game studies to measure the competitiveness of the video game but this may not be a reliable measure. As has been discussed, participants’ ratings for violence are more reliable when a broad question is asked rather than specific ones (Busching et al., 2015). This is expected to be the same for competition and asking specific questions such as “is there a time pressure and is it simplistic” would be quite hard for someone who is not trained to evaluate the level of time pressure. Therefore, it is advised that the ECS only be used by researchers and experts who
have been trained to evaluate each of the six factors. However, future research should assess whether participants can reliably identify the level of competition within a video game using the ECS.

The second aim of this study was to examine the use of a one-item participant rating to measure the level of competition within a video game. With Study 1A appearing to be the first study asking participants to rate the competitiveness of the video games they play at home, there was a concern as to whether a single question asking “how competitive was the video game” was reliable and valid. The fact that this study (Study 1B) demonstrated that there was very little variation between participants on competitive ratings indicates that participants’ competition ratings using one item does have good inter-rater reliability. In addition, with participants’ average competitive ratings having a very strong correlation with the ECS, it also demonstrated good predictive validity. However, the correlation was weaker using each participant’s competitive rating, compared to the average of participants’ competitive rating. This suggests that individual differences in how people identify competitiveness and how competitively they play the game impacts results. That being said, the correlation between the 88 participants’ subjective competitive ratings and the ECS was still strong, and as previously mentioned variability was still low. This indicates that participants’ subjective rankings of competition within video games is valid and reliable.

Good predictive validity was further supported by participants’ competitive rankings of the games matching the ECS. The ECS predictions for each game into the high, moderate, or low competition category were extremely similar to the competitive subsets extracted from the participants’ ratings.

These findings of reliability and validity support previous research that also demonstrated little variance between participants’ ratings of competitiveness, and the predictive validity of participants’ ratings when matched to the researchers’ predictions
(Anderson & Carnagey, 2009; Adachi & Willoughby, 2011a). However, the findings from this study build on previous research. Firstly, previous research (Anderson & Carnagey, 2009; Adachi & Willoughby, 2011a) only used participants’ ratings of a game in an experimental study. This meant that all participants played the same level or mode of the game, which would have increased consistency in the competition ratings. However, the current study demonstrated that regardless of what level or mode participants play the game in the real world, their rating of the games’ competitiveness by design was still reliable and valid. Secondly, this study also built on previous research by demonstrating that one broad item assessing competition, as opposed to the four-item measure (Anderson & Carnagey, 2009) or two item measure (Adachi & Willoughby, 2011a) in previous studies, is reliable and valid. From a practical standpoint, one item appears to be better as it is reliable and valid and only requires the participant to answer one question rather than several. In addition, Busching et al. (2015) found that participant violence ratings were more reliable when a broad statement was presented (i.e., “how violent was the game?”), rather than specific questions about the game (i.e., “how often did the character in the game get hurt?”). It was suggested that the greater reliability from the broad question was due to it reducing the impact of individual differences (Busching et al., 2015). While the Busching et al. (2015) study was related to violence, it does suggest that a broad question may be better for competition ratings as well.

The above findings regarding reliability and validity of participants’ competition ratings minimises the argument associated with lack of point of reference as discussed in Chapter 3 (Elson & Quandt, 2014). A viable explanation for why “point of reference” may not be required centres around it being random error rather than a systematic error. While participants’ responses may vary depending on differences in points of reference, these variations will be averaged out. This provides support for the view that in experimental
studies it is acceptable to control for competition using participants’ subjective ratings. However, it is important to realise that the best method is to use the same game across conditions (Elson & Quandt, 2014). This is due to the other issues raised in Chapter 2. For example, it would be near impossible to control for all potential differences between games using participants’ ratings. In addition, if differences are found then an ANCOVA would not be suitable in controlling for the difference statistically (Adachi & Willoughby, 2011b).

The violence within video games was also assessed and as expected participants’ ratings matched the ESRB ratings. In addition, the standard deviations for each of the games were small suggesting little variation in responses between participants. The variance in violence ratings was also smaller than the variance in competitive ratings. This suggests that it may be easier for participants to identify violence within a game than competitiveness. Perhaps this is due to the fact that violence rating systems, such as the ESRB, have been in the public domain for a long time. Therefore, participants would be more familiar with how violence is assessed. Overall, the findings suggest that asking participants to rate the violence within a video game is a valid and reliable measure of the level of violence in the game, which supports previous research (Busching et al., 2015).

A limitation of this study is that the inter-rater reliability of the ECS was not assessed. Only the researchers’ opinion of the games on each of the factors was used to form the ECS ratings. Future research may want to evaluate the ECS ratings of several trained assistants who are not involved in the study.

Future research may also want to further develop the scale by assessing other aspects that make video games competitive, evaluating the factors of the ECS using an experimental design, and creating normative data. A panel of experts (Delphi panel) could discuss the ECS and evaluate whether there may be other factors that need to be added to the scale. However, as mentioned in Chapter 2, there appears to be very little research evaluating what makes a
video game competitive. Therefore, any suggestions for additional factors would have to be researched and validated. This could be done by manipulating these aspects within a video game and assessing how it affects participants’ ratings of competition.

In addition, the factors already in the ECS need to be assessed in video game research using an experimental design. While there is evidence that these factors impact level of competition, they have not been tested within video games. For example, time pressure has only been assessed within an auction environment (Ku et al., 2005; Malhorta, 2010). Therefore, these factors need to be manipulated within one game (thus controlling for confounding variables) to assess whether participants rate either version of the game as being more competitive. Measures of aggression could also be implemented to assess whether the factors of the ECS impact aggression. As such, Study 2 manipulated the presence of a scoreboard and time pressure within one game to assess its impact on participants’ ratings of competition and participants’ aggression.

Another suggestion for future research is to create normative data for participants’ ratings of competition. As the sample size was only 10 to 20 participants per video game, there was not enough power to analyse differences between individuals. For example, people who play competitive video games more often may rate a game as being less competitive than those who rarely play competitive games. Other potential differences could occur between sexes, cultures, and age groups. If a study with a large sample size could assess differences between certain groups, and found that there were significant differences, this information could be used to weight participants’ responses. For example, if males are found to rate games as being less competitive than females on average, then males’ competition ratings could be weighted to match females.

Overall it was found that participants’ ratings of competition and violence for video games are a reliable and valid measure of assessing the competitiveness and violence of the
game by design. Further, the newly developed experts’ measure of level of competitiveness within a video game, the ECS, was found to be reliable and valid. The ECS also demonstrated that frequency of competitive events, clear opponent’s score feedback, leader boards, team gameplay, time pressure, and multiplayer gameplay are factors that predict the level of competition within a video game. This provides valuable information to help build the model in Section 7.5 by indicating what aspects of a video game may impact aggression through competition. In addition, researchers can modify these factors within a video game to manipulate the level of competition. As such, Study 2 modified score feedback and time pressure within a video game to manipulate competition and thus assess the effect of competitiveness on aggression using an experimental design. The major implication of this study is the potential use of the ECS in official video game ratings, such as the ESRB. With evidence suggesting that competition within video games influences aggression, official rating systems may want to incorporate the ECS. It would help rating systems, such as the ESRB, identify which games are designed to be competitive and thus warn people of the potential negative effects and who the game is appropriate for.
Chapter 6: Study 2: Causal Impact of Violence and Competitiveness within Video Games on Aggression

6.1 Introduction

Some politicians have stated (or implied) that certain shooting massacres, such as the one at Virginia Tech in 2007 or Sandy Hook Elementary in 2012, were a result of the perpetrator playing violent video games (Benedetti, 2007; Sandoval et al., 2013). However, if the perpetrator did play violent video games it is unclear whether these video games increased the likelihood of the perpetrators acting aggressively, or that the perpetrator was drawn to these video games due to their already developed aggressive tendencies. As such, this study assessed the potential causal impact that video games have on aggression.

As discussed in Chapter 3, the majority of studies do not adequately control for all possible factors that may influence aggression (see Tables 2.1, 2.2, and 2.3). Therefore, this study utilised the same game across conditions while manipulating only competition and violence to assess their effect on aggression without being influenced by other variables (Elson & Quandt, 2014). Previous studies have found that losing increases aggression as well (e.g., Breuer et al., 2015a; Griffiths et al., 2016), but they did not assess whether this effect only occurred during competitive gameplay. As such, this second study assessed the impact of losing in both a competitive condition and low-competitive condition. In addition, despite the non-significant results from Study 1A, the interaction between competition and violence was assessed due to the strong theoretical argument for an interaction (see Chapter 2). To help explain how competition, losing, and violence may impact aggression, theoretical pathways describing how each variable impacts on aggressive affect and aggressive behaviour were also assessed.
6.1.1 Competition

It was demonstrated in Study 1A that exposure to and preference for competitive video games have a relationship with aggression, although causality was not assessed. In an experimental study by Adachi and Willoughby (2011a) it was found that competition has a causal impact on aggression, but they used different games across conditions. As discussed in Chapter 3, the best methodology in video game research is to use the same game across conditions while manipulating the game to vary only the variables being assessed (Elson & Quandt, 2014). This ensures that there are no unforeseen differences between the games, such as differences in the game’s goals or the game’s input controls, that may confound results. However, as of yet there appears to be no published studies that have manipulated competition within one video game.

A way to manipulate competitiveness within one video game is to use modification techniques (Elson & Quandt, 2014). Modification techniques involve changing certain aspects of a video game. An example is Kneer et al. (2016) who replaced the guns in a first-person shooting game with non-harmful “rainbowblowers” that made the opponent convulse in laughter for the non-violent condition. These types of modification techniques have been suggested for violent video game research (Elson & Quandt, 2014) and have been implemented by some researchers (e.g., Elson et al., 2015; Kneer et al., 2016). However, modification techniques have yet to be utilised in competitive video game research. This may be due to limited research demonstrating the factors that can be manipulated to influence the competitiveness of a video game. However, results from Study 1B indicated that frequency of competitive events, clear opponent score feedback, leader boards, team gameplay, time pressure, and multiplayer gameplay appear to influence how competitive a video game is. Therefore, one or more of these aspects could be manipulated within a video game to vary the level of competition.
Caution must be taken when manipulating the video game so that other aspects do not vary. For example, if the frequency of competition varies between conditions then other parts of the game may change as well. For example, if one group plays a video game exploring a virtual world without competing against computer opponents and then another group plays the same game but competes all the time, then other aspects, such as pace of action, may vary. An example of this is Lin (2013b) where one condition involved competing against computer opponents, while in the other condition the participant took a woman out on a date in the virtual world. These two versions of the game end up being different in multiple ways. There are also other competitive factors that may have unforeseen implications. For example, implementing a multiplayer compared to single-player condition, as players may inhibit their aggression while in the presence of other people.

In contrast, manipulating the presence of a scoreboard and time pressure appear to be suitable ways to vary the level of competitiveness within a game. If the scoreboard and time pressure are removed, then everything else in the game should stay the same. For example, the pace of action and the tasks needed to be completed in the game would not vary. Another strength of manipulating the presence of the scoreboard and time pressure is that previous studies have demonstrated that they can increase competitive behaviour while completing a non-video game task. McClintock and McNeel (1966) and McClintock and Nuttin (1969) found that when the participants were made aware of their opponent’s score, it increased competitive behaviour. In regard to time pressure, it has been demonstrated during auctions that competitive behaviour increased amongst individuals when the time for bidding was nearly over (Ku et al., 2005; Malhorta, 2010). This suggests that time pressure within games should increase competition. As such, the appearance of a scoreboard and time pressure was manipulated in this study.
When performing these types of manipulations, it is important to confirm that the manipulations were successful, and this can be done through participants’ subjective ratings. Most studies assessing violent video games use this technique to ensure that the violence between the two conditions varies (e.g., Adachi & Willoughby, 2011a; Anderson & Carnagey, 2009; Elson et al., 2015; Kneer et al., 2016). As discussed previously, using participants’ subjective ratings has its limitations in controlling for confounding variables, for example, there are too many differences between games to assess all of them and the inability of an ANCOVA to control for any differences found (see Chapter 3). However, if the same game is being used and thus no other difference should occur, then participants’ subjective ratings can be used to assess a successful manipulation. In addition, as found in Study 1B, an average of participants’ ratings does not appear to be influenced by a “lack of point of reference” (Elson & Quandt, 2014). Nevertheless, ways to measure participants’ experience of competitiveness within a video game are still relatively new. Some researchers have used multiple items to measure competitiveness (Anderson & Carnagey, 2009; Adachi & Willoughby, 2011a), but Study 1B demonstrated that a one-item question asking “how competitive was the video game” was reliable and valid. However, it is unclear whether one of these methods, multiple items compared to one item, is more reliable. Therefore, this study compared a broad one-item measure of competition to a four-item measure of competition (Anderson & Carnagey, 2009) in terms of inter-rater reliability. A broad one-item measure of violence was also compared to a four-item measure of violence. It was expected that the broad question would have better inter-rater reliability (Busching et al., 2015).

**Competition: Theoretical affect pathway to aggression.**

In addition to discovering whether competitive video games increase aggression, it is important to assess how it increases aggression. Berkowitz (1989) developed the frustration-aggression hypothesis which predicts that competition impacts aggression through the
frustration of being actively blocked by the opponent. However, there appears to be little research assessing whether this is true for competition within video games. Adachi and Willoughby (2011a), which is the only published experimental study assessing competition, did not assess frustration. This could be done through measuring participant’s aggressive affect. One measure used to assess aggressive affect is the State Hostility Scale (SHS) which was described in Chapter 3. This scale also has four subscales, one being aggravation. This subscale includes the item “frustration” and thus the other items in the scale are related to this construct. Therefore, as the frustration-aggression hypothesis predicts, it would be expected that this subscale would be affected the most by competition, but little research has been done to support this. Breuer et al., (2015a) found that while losing a video game directly increased aggression, losing also increased frustration which in turn increased aggression. This supports the frustration-aggression hypothesis, however, Breuer et al. (2015a) assessed winning compared to losing, rather than variances in competitiveness. It is also important to assess the impact of competition on overall aggressive affect. As discussed in Chapter 3, the theory suggests that competition impacts aggressive behaviour through the route of affect. Therefore, the current study assessed the impact of competition within a video game on aggressive affect while also assessing whether competition has the strongest effect on the aggravation subscale of the SHS.

6.1.2 Losing

Another important factor of competitive games worth assessing is the impact of losing on aggression. As discussed previously, studies have found that losing a video game can increase aggression (e.g., Breuer et al., 2015a; Griffiths et al., 2016). However, these studies have not assessed whether losing only has an effect in a competitive video game, or whether losing in a low-competitive video game still increases aggression. For example, if a person loses a game that they do not really care about, such as a friendly soccer game in \textit{FIFA}^{TM}
where there is no reward for winning and is thus not very competitive, it may not increase the likelihood of aggression. However, if a game of soccer in *FIFA*\(^{(TM)}\) is against another opponent close to them on a leader board (increased rivalry), and winning the game results in going to the top of the leader board (greater reward), the game becomes more competitive and losing the game may have a greater effect on aggression.

**6.1.3 Violence**

In regard to violence, Study 1A found that violent video games did not have a relationship with trait aggression. This correlational study was contrary to the majority of previous research (e.g., Anderson et al., 2010; Greitemeyer & Mugge, 2014), but did support some studies (e.g., Adachi & Willoughby, 2016; Breuer et al., 2015a; Ferguson et al., 2009). Therefore, this experimental study (Study 2) assessed the impact of violence within a video game on aggression to clarify the somewhat conflicting findings from Study 1A. In addition, the impact of violent video games was assessed while controlling for competition. As discussed in Chapter 3, previous researchers have generally not controlled for competition within their research design. However, the few that have controlled for competition, through either using the same game or participants’ subjective experience, have found inconsistent results. Therefore, this study aimed to bring greater clarity to whether violence in video games impacts aggression when competition is controlled for.

*Violence: Theoretical affect pathway to aggression.*

When assessing the impact of violence within video games it is also important to assess how it impacts aggressive behaviour. Cognition is theorised to be the primary route, but cognition will interact with affect (GAM; Anderson & Bushman, 2002) (see Chapter 2). However, it is still somewhat unclear what aspects of affect are impacted by violent video games. The subscales of the SHS have been utilised in a couple of studies assessing violent video games, although the results have been inconsistent. Anderson and Carnagey (2009)
found that violent video games increased the aggravation subscale only. However, Saleem, Anderson, and Gentile (2012) found that aggravation did not significantly increase after violent video game play compared to a neutral game, but the mean subscale and lack of positive feelings subscale did. It is unclear why the results of these two studies were completely different. It could be due to the different games implemented in each study or the fact that they did not use the same game across conditions. In any case, due to the limited amount of research and inconsistency in results, the current study utilised the subscales of the SHS to assess which factors of aggressive affect were impacted.

6.1.4 Interaction effect

The theory discussed in Chapter 2 suggested that as violence and competition are theorised to independently impact aggression through different routes, cognition and affect respectively, then a combination of violence and competition should have an additive effect. However, Study 1A did not support this, with no interaction effect being found. That being said, the results from Study 1A did support the findings from Adachi and Willoughby (2016), who found that violence within video games did not provide further power in predicting aggression above competition alone. A limitation of Study 1B though was that competitive and violence exposure scores were not completely independent as they both involved overall number of hours playing video games in their scale. Therefore, this violated the assumption of independent variables which made it difficult to generalise the results. As such Study 2 assessed the interaction between violence and competition within a video game. In addition, no published study has assessed the interaction effect between violence and competition within a video game using an experimental design. Therefore, while Adachi and Willoughby (2016) demonstrated that there is no interaction for long-term effects, Study 2 assessed whether violence and competition within video games interact in the short term.
6.1.5 Aims and hypotheses

The first aim of this study was to assess the impact that violence and competition within video games have on aggressive affect, aggressive behaviour, and arousal. To limit the effect of in-game confounding variables the same game was used for all conditions while using modification techniques to manipulate violence and competition. It was hypothesised that both violence and competition would increase aggressive affect, aggressive behaviour, and arousal. In regard to affect, the subscales of the SHS were used to explore which aspects of aggressive affect violence and competition impact; and it was hypothesised that competition would have the strongest effect on the aggravation subscale. In addition, the impact of losing was also assessed with it being hypothesised to increase aggressive affect (strongest effect on aggravation), aggressive behaviour, and arousal. Furthermore, it was hypothesised that losing would have a stronger effect when the video game was more competitive.

The second aim was to explore the interaction between violent and competitive video games. Despite the previous correlational study and Adachi and Willoughby (2016) not finding an interaction, the theory still suggests an interaction effect should occur. Therefore, it was hypothesised that there would be an interaction between violence and competition within the video game.

Due to the limited research in the area, differences between the four-item measure of competition (Anderson & Carnagey, 2009) and the broad one-item measure of competition were explored in terms of inter-rater reliability. In addition, a four-item violence measure (Elson et al., 2015) was compared to one broad violence item. It was hypothesised that the one broad item of competition and violence would have better inter-rater reliability compared to the respective four-item scales.
6.2 Method

6.2.1 Participants

The sample consists of 64 participants (40 male, 24 female) who were either third year Psychology students from RMIT University or were acquaintances of these students. Participants’ age ranged between 18 and 53, with a mean age of 21.58 (SD = 4.62). Inclusion criteria included being 18 or over and having no prior knowledge of the experiment. The study was approved by the RMIT ethics committee (HREC project number: 39/14)

6.2.2 Materials

Demographics. Participants were asked to rate on a 7-point Likert scale (1 = not at all, 7 = extremely) how experienced they were at video games overall and first-person shooting games, as well as how skilled they were at first-person shooting games (which was used to set the difficulty of the video game).

Video Game. The game *Unreal Tournament 3: Black Edition* (TM) was used for this study. It is a first-person shooter game where the player must kill their opponent before they are killed. For all conditions the participants played the game for 10 minutes against one computer opponent.

Violence Modification/Manipulation. For the violent condition participants used a weapon called the *Bio Rifle*, which shoots blobs of toxic waste, to kill their opponent. In addition, a modification called *Gibalicious* (Asvachin, 2008) was used to increase the amount of blood and gore in the game. The ESRB rated *Unreal Tournament 3* (TM) as M17+ (Mature) (4 on a 5-point scale), and while the *Gibalicious* modification increased the violence further, it was unlikely to affect the ESRB rating. Figure 6.1 shows the violent condition.
Note that the yellow box on the left-hand side was not visible to participants.

In the low-violent condition, a modification called Battle Team/Freezetag Arena (de Vries, 2014) was used. This modification includes an option to have players freeze in a light blue colour when they are defeated, rather than die and explode in blood and gore. In the low-violent condition, the “Bio Rifle” was described to participants as a paintball gun which would freeze the opponent when hit enough times. In addition, when a player hit their opponent a “ping” noise would be made rather than pain noises. Also, any text which stated that the player had “killed” their opponent was changed to “defeated” their opponent. Using the ESRB rating guide, it is predicted that this condition of Unreal Tournament 3 (TM) would receive a rating of E (Everyone) (1 on a 5-point scale) as it contained very mild violence. Figure 6.2 and 6.3 show the low-violent condition.
Figure 6.2. Low-violent, competitive condition of Unreal Tournament 3: Black Edition™.

Note that the yellow box on the left-hand side was not visible to participants.

Figure 6.3. Low-violent and low-competitive condition of Unreal Tournament 3: Black Edition™.
Competitive Modification/Manipulation. For the competitive condition, each time a player killed or froze their opponent they would get one point which would be displayed on the scoreboard. Each time a player was killed or frozen a new round would begin with both players respawning. If the participant got more points than their computer opponent after 10 minutes they would win the game, or lose the game if they got less. It was clearly stated to participants in this condition that the game would only last 10 minutes, but to create a more visible time-pressure the game warned players when there was 30 seconds left and when there was five seconds left. The level of competition in this condition was assessed using the ECS and it received a competition rating of 3.5 out of 7, as seen in Table 6.1. Figures 6.1 and 6.2 show the competitive condition.

Table 6.1

*High Competition Condition: ECS Rating*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>7</td>
<td>The game only involved competing against another player.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>7</td>
<td>Opponent’s score was visible and clearly identified who is winning using an easy to understand numerical system</td>
</tr>
<tr>
<td>Leader board</td>
<td>1</td>
<td>There was no leader board</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>1</td>
<td>The game was one player versus one computer player</td>
</tr>
<tr>
<td>Time pressure</td>
<td>4</td>
<td>Participants were told the game would only last 10 minutes, and a warning was given at 30 seconds and five seconds. However, a clock was not displayed the whole time.</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>1</td>
<td>It was a single-player game</td>
</tr>
<tr>
<td>Competition rating</td>
<td>3.5</td>
<td></td>
</tr>
</tbody>
</table>
For the low-competitive condition, the game would still reset if a player was killed or frozen but no points were awarded. Therefore, there was no scoreboard displayed and all messages of “you defeated your opponent” were removed. This meant that participants had no indication of whether they were winning or losing. In addition, before playing, participants in the low-competitive condition were informed that there was no winning or losing. No time pressure was displayed and the video game did not end after 10 minutes, rather the researcher came into the room and informed the participant to stop. The level of competition in this condition was assessed using the ECS and it received a competition rating of 2 out of 7, as seen in Table 6.2. Figure 6.3 shows the low-competitive condition.

Table 6.2

*Low Competition Condition: ECS Rating*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of competition</td>
<td>7</td>
<td>The game only involved competing against another player.</td>
</tr>
<tr>
<td>Opponent’s score</td>
<td>1</td>
<td>Opponent’s score was not visible</td>
</tr>
<tr>
<td>Leader board</td>
<td>1</td>
<td>There was no leader board</td>
</tr>
<tr>
<td>Team gameplay</td>
<td>1</td>
<td>The game was one player versus one computer player</td>
</tr>
<tr>
<td>Time pressure</td>
<td>1</td>
<td>The was no time pressure</td>
</tr>
<tr>
<td>Multiplayer</td>
<td>1</td>
<td>It was a single-player game</td>
</tr>
<tr>
<td>Competition rating</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Win/Lose result. To assess the effect of losing on aggression, the researcher took note at the end of the game what the final score was. This was done for both the competitive and low-competitive conditions.
Arousal. The Polar RC3 GPS was used to measure the heart rate of the participants. This heart rate monitor required a strap to be fitted around the chest with sensors touching the skin. The heart rate was then wirelessly sent to a watch which recorded the information. The watch could also be set to record different time frames, and this feature was utilized to measure pre, during, and post gameplay heart rates. The watch was placed in a position where the participants could not see what was displayed. Once the participant’s heart rate data was recorded, it was uploaded anonymously to the researcher’s polar web account. Average heart rate per minute for pre, during, and post gameplay was taken and transferred to SPSS.

Aggressive Affect. The State Hostility Scale (SHS) (Anderson et al., 1995) was used to assess participants’ aggressive affect post gameplay. This 35-item questionnaire comprises of mood statements, e.g. “I feel furious”, and asks participants to rate if they are feeling this way on a 5-point Likert scale where 1 is strongly disagree and 5 is strongly agree. Questions that relate to positive or nice feelings, e.g. “I feel friendly”, were reverse coded. The SHS has been used by several researchers and has been found to be a reliable measure (e.g., Anderson et al, 1995; Barlett et al., 2009; Barlett et al., 2008a). For this study, the initial reliability analysis had a high Cronbach’s alpha of .91, although the questions I feel “tender”, “amiable”, and “sympathetic” were removed as all increased the alpha and were either not significantly correlated or negatively correlated with the total SHS score. Therefore, only 32 items were used in this study with a Cronbach’s alpha of .93.

Aggressive Affect Subscales. The SHS comprises of four subscales (Anderson & Carnagey, 2009): Feeling unsociable, feeling mean, lack of positive feelings, and aggravation. The items “tender”, “amiable”, and “sympathetic” were removed from the subscales due to them not positively correlating with the SHS overall. Feeling mean, lack of positive feelings, and aggravation had good to excellent alphas of .92, .85, and .88.
respectively. However, feeling unsociable had a poor Cronbach’s alpha (.51) and thus was not used in this study.

Aggressive Behaviour. The modified Taylor Competitive Reaction Time Task (TCRTT), originally constructed by Epstein and Taylor (1967) and later modified by other researchers (e.g., Anderson & Dill, 2000; Bushman, 1995), was used to assess post gameplay aggressive behaviour. This study used a procedure very similar to what was used in the original studies (Anderson & Dill, 2000; Bushman, 1995). Firstly, the participants were informed that they were competing against a human opponent in another room, but it was actually a computer program. The aim was to press the mouse button as quickly as possible when a visual cue was given. The loser of this reaction time task was then blasted with white noise set at an intensity and duration chosen by their opponent before each trial. Noise intensity was set on a scale of 0 (0 decibels, no noise) to 10 (100 decibels, very loud) and duration on a scale of 0 (0 seconds, thus no noise) to 10 (2 seconds of noise). The task involved 25 trials in which the computer program, in a semi random pattern, sets the intensity and duration to blast the participant with between 1 and 4 for the first nine trials. In the subsequent eight trials the computer program set the intensity and duration between 4 and 7, and for the last eight trials it was between 7 and 10. Participants always lost the first trial and then 50% of the subsequent trials spread evenly across the three blocks of eight trials. Participants could select any intensity and duration level to give to their opponent before each trial. The levels selected by the participant across the 25 trials gave a mean score for both intensity and duration. Higher mean scores indicated higher levels of aggressive behaviour. Intensity was recorded on the scale of 0 to 10, while duration was recorded by the number of seconds, from 0 up to 2.

The TCRTT appears to be the most commonly used measure of aggressive behaviour and has been shown to have good external validity by some (e.g., Anderson & Bushman,
However, as discussed in Chapter 3 there are still some concerns about its validity and standardisation (Elson et al., 2014; Ferguson & Rueda, 2009).

**Subjective Gaming Experience.** Participants were also asked to rate how enjoyable, frustrating, fast-paced, exciting, and difficult the game was on a scale of 1 (not at all) to 7 (extremely). These questions were used to assess whether participants in different conditions were having varying experiences outside the manipulated variables of violence and competition. There are no psychometrics for this measure as each item was just one standalone question.

**Video Game Manipulation Assessment.** A four-item scale (Elson et al., 2015) was used to assess if the violence manipulation was successful. The items are: “You had to use physical violence in this game”, “The characters in this game were hurt”, “Physical damage was inflicted on the characters in the game”, “You had to kill humans in this game”. Responses ranged on a 7-point Likert scale from 1 (not at all) to 7 (extremely) and then all four items were averaged to give an overall violence score. The internal reliability of the four-item scale was good ($\alpha = .86$). A broad one-item question was also used to assess violence manipulation on a 7-point Likert scale from 1 (not at all) to 7 (extremely). This item was “how violent was the video game?”.

The competitive manipulation was also assessed using four items that related to the competitiveness of the game (Anderson & Carnagey, 2009). These items are: “to what extent did you feel like you were competing with the other team”, “how hard were you trying to win the game”, “how competitive was this video game”, and “to what extent did this video game involve competition”. A 7-point Likert scale from 1 (not at all) to 7 (extremely) was used and the items were averaged to give an overall competitive rating. It was found to have good
internal reliability (α = .87). The item “how competitive was this video game” was used as the broad one-item measure of competition.

6.2.3 Procedure

Participants were randomly allocated into one of the four video game conditions (n = 16 per condition), i.e. violent/competitive, low-violent/competitive, violent/low-competitive, low-violent/low-competitive. The random allocation was done separately for males and females so that there was an equal number of males and females every group. Participants were briefed about the study but they were told the study was assessing the effect of video games on reaction time skills. They were also informed that participation was completely voluntary, they could leave at any time, and that all data was anonymous. Once they had read the participant information sheet, participants signed the consent form if they wished to participate. Participants were then left in a private room to fit themselves with the heart rate monitor and a base reading was taken up until they started playing the video game, roughly 2 minutes. Demographic questions were asked and then participants were given a brief tutorial on how to play the game. Once confident, participants were left alone in a room to play the video game against the computer for 10 minutes. This room had a one way tinted window so the researcher could observe the participant to make sure nothing went wrong. After playing the video game, participants were required to fill in the SHS, which took no longer than five minutes. Postgame heart rate was also monitored during this time. Once the SHS was completed the participants engaged in the TCRRT which took approximately 10 minutes. Participants were then probed to see if they were aware of the true nature of the study or the deception involved in the TCRRT. Participants were then fully debriefed, informed that the results could be removed if they were unhappy with the deception, and given university contact details if they were concerned about any aspects. The whole experiment took around 30 minutes.
6.2.4 Data analysis

The data from the demographics and SHS were recorded using Qualtrics (Qualtrics, 2014), an online survey tool, and these results were transferred to SPSS. The raw data from the TCRTT was also transferred to SPSS, as well as the researcher’s record of which participants had won and lost. No identifiable information was recorded so the results remained anonymous and confidential.

Assumption tests.

Following the directions in Field (2009), analyses of Levene’s tests revealed that the assumption of homogeneity of variances was not violated in all ANOVAs conducted. This was the same for the MANOVAs conducted, although enjoyment in the violence analysis and experience with first-person shooters in the competition analysis violated the assumption of homogeneity of variance. However, MANOVAs are quite robust when there are equal sample sizes (Field, 2009), which was the case in these analyses. In addition, the homogeneity of covariance matrices was not violated for the MANOVAs.

In regard to the normality assumption, most dependent variables in the main analyses were normally distributed. However, three groups of data were not normally distributed and could not be resolved through transformation. Therefore, given the F statistic is robust and the sample sizes were equal (Field, 2009), the data was kept in its original form.

While the sample sizes were equal for competitive and violent analyses, win-lose analyses were not equal. This was due to participants not being assigned to a win or loss group, instead it was random. As a result, 37 participants won and 26 lost. Therefore, violation of assumptions may have an impact on the results due to the unequal sample sizes (Field, 2009). The assumption of homogeneity of variance was not violated for all win-lose ANOVAs, although there were some issues with normality. Most issues were resolved using a square root transformation, although some groups of data for the mean subscale could not
be resolved. Therefore, the generalisability of the win-lose results in relation the mean subscale was reduced.

6.3 Results

6.3.1 Descriptive statistics and missing data

Descriptive statistics are summarised in Table 6.3. It should be noted that due to technical issues four participants’ four-item violence ratings were not recorded. In addition, one participant’s win/lose and one participant’s heart rate were not recorded. Also, four participants had their TCRTT scores removed from the analyses as they were aware of the deception. Participants who had missing or removed data were not included in the analyses that involved those variables; however, their data was used for all other analyses.
### Table 6.3

**Descriptive Statistics for Violent and Low-Violent condition, Competitive and Low-Competitive Condition, and Overall (N = 64, 40 Male, 24 Female)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Violence</th>
<th>Competition</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Exp Overall</td>
<td>4.31</td>
<td>1.64</td>
<td>4.78</td>
</tr>
<tr>
<td>Exp FPS</td>
<td>3.78</td>
<td>1.85</td>
<td>4.22</td>
</tr>
<tr>
<td>Skill FPS</td>
<td>3.47</td>
<td>1.74</td>
<td>3.81</td>
</tr>
<tr>
<td>Enjoying</td>
<td>5.03</td>
<td>1.20</td>
<td>4.97</td>
</tr>
<tr>
<td>Frustrating</td>
<td>3.31</td>
<td>1.40</td>
<td>3.00</td>
</tr>
<tr>
<td>Pace</td>
<td>4.91</td>
<td>1.75</td>
<td>4.91</td>
</tr>
<tr>
<td>Exciting</td>
<td>4.88</td>
<td>1.40</td>
<td>4.63</td>
</tr>
<tr>
<td>Difficult</td>
<td>3.56</td>
<td>1.48</td>
<td>3.66</td>
</tr>
<tr>
<td>1 Item Violence</td>
<td>3.69</td>
<td>1.51</td>
<td>2.28</td>
</tr>
<tr>
<td>4 Item Violence</td>
<td>4.81</td>
<td>1.60</td>
<td>2.87</td>
</tr>
<tr>
<td>1 Item Comp</td>
<td>4.91</td>
<td>1.33</td>
<td>5.31</td>
</tr>
<tr>
<td>4 Item Comp</td>
<td>5.28</td>
<td>1.10</td>
<td>5.52</td>
</tr>
<tr>
<td>HR Pre</td>
<td>93.71</td>
<td>12.39</td>
<td>94.50</td>
</tr>
<tr>
<td>HR During</td>
<td>89.19</td>
<td>10.77</td>
<td>90.53</td>
</tr>
<tr>
<td>HR Post</td>
<td>86.29</td>
<td>9.19</td>
<td>86.50</td>
</tr>
<tr>
<td>SHS Overall</td>
<td>70.44</td>
<td>16.31</td>
<td>67.19</td>
</tr>
<tr>
<td>SHS Aggravated</td>
<td>14.34</td>
<td>5.18</td>
<td>14.72</td>
</tr>
<tr>
<td>TCRTT Intensity</td>
<td>5.28</td>
<td>2.41</td>
<td>5.62</td>
</tr>
<tr>
<td>TCRTT Duration</td>
<td>1.16</td>
<td>.43</td>
<td>1.20</td>
</tr>
</tbody>
</table>

**Note.** Exp = Experience, FPS = First-Person Shooter, Comp = Competition, HR = Heart Rate, SHS = State Hostility Scale, Unpositive = Lack of Positive Feelings, TCRTT = Taylor Competitive Reaction Time Task.

**Note.** Some difference in n: 4 Item Violence and TCRTT Intensity/Duration = 60, HR Pre, During, Post = 63.
6.3.2 Manipulation checks and subjective experience

To confirm that violence and competition were successfully manipulated across conditions while keeping all other variables the same a series of MANOVAs were conducted. Violence ratings were expected to be higher in the violent condition while competition ratings were expected to be higher in the competitive condition. All other variables, i.e. subjective experience variables, competition when assessing the violence manipulation, and violence when assessing the competition manipulation, where expected to not significantly differ across conditions. Also, differences between winning and losing on violence, competition, and the subjective experience questions were explored.

A MANOVA found that violence was successfully manipulated with the violent condition demonstrating a significantly higher score on the four-item violence scale, \( F(1, 58) = 24.40, p < .001 \), and the one-item violence scale, \( F(1, 62) = 15.65, p < .001 \), than the low-violent condition. Competition and the subjective experience variables were successfully controlled for with no significant difference between the violent and low-violent condition.

Participants reported no significant difference between the competitive and low-competitive condition on the four-item competitiveness scale, \( F(1, 62) = .18, p = .68 \), and one-item competitiveness scale, \( F(1, 62) = 1.42, p = .24 \). Violence and the subjective experience variables were successfully controlled for with no significant differences between the competitive and low-competitive condition.

Differences in subjective experience between participants who had won or lost was also explored. Participants who lost reported the game as being significantly more frustrating, \( F(1, 61) = 7.13, p = .010 \) and difficult, \( F(1, 61) = 6.81, p = .011 \). There were no other significant differences between participants who won or lost on the other subjective experience variables, violence, or competition.
6.3.3 Main analyses

6.3.3.1 Aggressive affect (SHS)

A series of ANOVAs were conducted to assess the effect of competition, violence, and losing on aggressive affect (measured through the SHS). It was hypothesised that competition and violence would both independently impact aggressive affect. In addition, an interaction effect between competition and violence would occur. Also, it was hypothesised that losing would impact aggressive affect, with losing in the competitive condition having a stronger effect.

A Two-Way ANOVA showed a significant main effect for competition, \( F(1, 60) = 4.56, p = .037, \) partial \( \eta^2 = .07, \) with participants in the competitive condition demonstrating greater aggressive affect. No significant main effect was found for violence, \( F(1, 60) = .61, p = .44, \) partial \( \eta^2 = .01. \) There was also no significant interaction between the competitive and violent condition, \( F(1, 60) = 3.83, p = .055, \) partial \( \eta^2 = .06. \)

A One-Way ANOVA indicated no significant main effect for losing, \( F(1, 61) = 3.71, p = .059, \) partial \( \eta^2 = .06. \) However, when analysing participants in the competitive group alone, losing did show a significant main effect, \( F(1, 30) = 4.87, p = .035, \) partial \( \eta^2 = .14, \) with participants who lost having a higher aggressive affect. No significant main effect was found for participants in the low-competitive condition.

6.3.3.2 SHS subscales

A series of ANOVAs were conducted to assess the effect of competition, violence, and losing on the subscales of the SHS. This was done to clarify how each of the variables (competition, violence, and losing) influenced aggressive affect. While it was unclear if competition would significantly affect all subscales, it was hypothesised that it would have the strongest effect on aggravation. Due to previous research finding inconsistent results, it was unclear which subscales violence would affect and which subscale it would have the
strongest effect on. Interaction effect between competition and violence was also explored. As with competition, it was hypothesised that losing would have the strongest effect on aggravation. This effect would be even stronger for participants in the competitive condition.

*Feeling Mean.* A Two-Way ANOVA found no significant main effect for competition, $F(1, 60) = 3.36, p = .072$, partial $\eta^2 = .05$, or violence, $F(1, 60) = .004, p = .95$, partial $\eta^2 < .001$. In addition, there was no significant interaction between violence and competition, $F(1, 60) = 3.36, p = .072$, partial $\eta^2 = .05$. A One-Way ANOVA found no significant effect for losing, $F(1, 61) = 3.58, p = .063$, partial $\eta^2 = .06$. When analysing participants in the competitive group alone, losing also had no significant effect, $F(1, 30) = 4.01, p = .054$, partial $\eta^2 = .12$. No significant main effect was found for participants in the low-competitive condition, $F(1, 29) = .61, p = .44$, partial $\eta^2 = .02$.

*Lack of Positive Feelings.* A Two-Way ANOVA found no significant main effect for competition, $F(1, 60) = 2.13, p = .15$, partial $\eta^2 = .03$. However, a significant main effect for violence was found, $F(1, 60) = .553, p = .022$, partial $\eta^2 = .08$, with participants in the violent condition reporting a higher lack of positive feelings. Also, there was no significant interaction between violence and competition, $F(1, 60) = 3.54, p = .065$, partial $\eta^2 = .06$. A One-Way ANOVA found no significant effect for losing, $F(1, 61) = .30, p = .59$, partial $\eta^2 = .005$. When analysing participants in the competitive group alone, losing also had no significant effect, $F(1, 30) = 1.75, p = .20$, partial $\eta^2 = .06$. No significant main effect was found for participants in the low-competitive condition, $F(1, 29) = .53, p = .47$, partial $\eta^2 = .02$.

*Aggravation.* A Two-Way ANOVA found a significant main effect for competition, $F(1, 60) = 4.44, p = .039$, partial $\eta^2 = .07$, with participants in the competitive condition reporting more aggravation. However, there was no significant main effect for violence, $F(1, 60) = .08, p = .78$, partial $\eta^2 = .001$. Also, there was no significant interaction between
violence and competition, $F(1, 60) = .76, p = .39$, partial $\eta^2 = .012$. A One-Way ANOVA found a significant main effect for losing, $F(1, 61) = 5.32, p = .025$, partial $\eta^2 = .08$, with participants who had lost reporting higher levels of aggravation. However, when analysing participants in the competitive group alone, losing had no significant effect, $F(1, 30) = 4.12, p = .051$, partial $\eta^2 = .12$. No significant main effect was found for participants in the low-competitive condition, $F(1, 29) = 2.05, p = .16$, partial $\eta^2 = .07$.

### 6.3.3.3 Aggressive behaviour (TCRTT)

A series of ANOVAs were conducted to assess the effect that competition, violence, and losing had on aggressive behaviour (measured by TCRTT noise intensity and duration). It was hypothesised that competition and violence within the video game would increase participants’ intensity and duration settings during the TCRTT. In addition, it was hypothesised that an interaction effect between violence and competition would occur for both intensity and duration. Losing during the video game was also hypothesised to increase participants’ intensity and duration settings during the TCRTT, with losing in the competitive condition having a greater effect.

For intensity, there was no significant main effect for competition, $F(1, 56) = 1.31, p = .26$, partial $\eta^2 = .02$, or violence $F(1, 56) = .29, p = .59$, partial $\eta^2 = .01$. There was also no significant interaction between competition and violence, $F(1, 56) = .06, p = .81$, partial $\eta^2 = .001$.

For duration, there was no significant main effect for competition, $F(1, 56) = 2.00, p = .16$, partial $\eta^2 = .04$, or violence $F(1, 56) = .19, p = .74$, partial $\eta^2 = .002$. There was also no significant interaction between the competitive and violent condition, $F(1, 56) = .48, p = .49$, partial $\eta^2 = .01$.

Separate AONVA’s found that losing did not have a significant main effect with intensity, $F(1, 57) = 1.74, p = .19$, partial $\eta^2 = .03$, or duration, $F(1, 57) = 3.45, p = .067$, with partial $\eta^2 = .06$. 
Partial $\eta^2 = .06$. When assessing the competitive group alone, there was still no significant main effect for intensity and duration.

6.3.3.4 Arousal (Heart rate)

A series of mixed design ANOVAs were used to assess the interactions between heart rate at the three time points and competitive conditions, violent conditions, and win or lose groups. All interactions were found to be not significant ($ps < .05$) which indicated that competition, violence, and losing did not increase arousal. However, when a repeated measures ANOVA was conducted for all participants’ across pre, during and post gameplay, heart rate was found to significantly decrease from pre-game baseline to during gameplay, $F(1, 62) = 25.13, p < .001$, partial $\eta^2 = .29$, and significantly decreased from during gameplay to post-game baseline, $F(1, 62) = 39.12, p < .001$, partial $\eta^2 = .39$.

6.3.3.5 Reliability of violence and competitiveness scales

Inter-rater reliability (through evaluation of standard deviations) of the measures of competition and violence was assessed. This was done to determine which type of scale, four specific items or one broad item, was more reliable at identifying which conditions were competitive or violent. It was hypothesised that one broad item would have greater inter-rater reliability for both competition and violence. Differences between the scale ratings were also explored to see if one scale produced different results in assessing game manipulation. The internal reliability of the four-item scales was also assessed.

Competition Scales. For competition, as can be seen in Table 6.3, the four-item competition scale was found to have less variation compared to the one-item competition scale when assessing the competitiveness in the high competition and low competition conditions. This suggests that the four-item competition scale has greater inter-rater reliability.
The four-item competition scale had a Cronbach’s alpha of .87. The removal of any items did not improve the alpha. However, the item “how hard were you trying to win the game” had the weakest correlation with the one-item competitiveness scale, $r(62) = .55, p < .001$, compared to the other two items on the three-item competitiveness scale (.66 for compete with opponent, .73 for involve competition).

**Violence Scales.** In contrast to competition, as can be seen in Table 6.3, the one-item violence scale was found to have less variation compared to the four-item violence scale when assessing the violence in the high violence and low violence conditions. This suggests that the one-item violence scale has greater inter-rater reliability. The internal reliability of the four-item scale was good ($\alpha = .86$).

### 6.3.4 Secondary analyses

#### 6.3.4.1 Sex moderation

To assess differences between males and females, and the possible moderating effect of sex, a MANVOA and a series of interaction effects were analysed. Sex was found to not significantly interact with the competitive, violence, or losing results on the SHS, TCRTT, or heart rate. In assessing general differences, MANOVAs revealed that males reported higher levels of experience with video games overall, more experience with first-person shooters, and greater skill with first-person shooters ($p < .05$). Females reported higher levels of frustration with the video game ($p < .05$). No other significant differences were found between males and females for subjective experience, SHS, or TCRTT.

#### 6.3.4.2 Predictive validity and internal reliability of the TCRRT

To assess the predictive validity of the TCRRT a correlation between the SHS and TCRRT was conducted. There was no significant correlation between the SHS and TCRRT intensity, $r(58) = .09, p = .49$, or SHS and TCRRT duration $r(58) = .12, p = .37$. 
Intensity and duration of the TCRTT were significantly correlated, $r(58) = .95, p < .001$. This indicates excellent internal reliability between the two measures of aggressive behaviour within the TCRTT.

6.4 Discussion

The overall aim of this study was to assess the effect of competition, violence and losing within a video game on aggressive affect, aggressive behaviour, and arousal. As hypothesised, competition had a significant impact on aggressive affect, primarily due to an increase in aggravation. Losing was also found to increase aggressive affect, primarily through aggravation, but this was only for participants in the competitive condition. This supports the hypothesis that losing would have a stronger effect if the video game was competitive, but does not support that losing in any condition would have an effect. Violence was found to not increase aggressive affect which does not support the hypothesis. However, it was found to affect “lack of positive feeling”. Neither competition, violence, nor losing were found to influence aggressive behaviour or arousal, which does not support the hypotheses. In addition, the hypothesis that violence and competition would interact was not supported. Also discussed throughout this section is the finding that the four-item competition scale was more reliable, compared to the one-item competition scale, while the one-item violence scale was more reliable than four-item violence scale. Limitations and suggestions for future research are discussed during each subsection.

6.4.1 Competition and aggressive affect

The impact of competition within video games on aggressive affect had yet to be assessed in an experimental study. With competition being theorised to primarily impact aggressive behaviour through affect (see Chapter 2), it was important for the current study to address this gap in the literature. Results showed that a more competitive version of a video game increased aggressive affect, which supports the hypothesis. In addition, it supports
previous research that has found that competition within video games impacts other aspects of aggression, such as aggressive behaviour (Adachi & Willoughby, 2011a, 2013, 2016). Furthermore, the current study supports the findings from Study 1A which found competitive video game exposure and preference to be related to trait aggression. Building on Study 1A, Study 2 also demonstrated a causal relationship. This supports the socialisation hypothesis (Moller & Krahe, 2009), that is, playing competitive video games will lead to an increase in aggression. While Study 2 did not assess the selection hypothesis, Adachi and Willoughby (2013, 2016) found a bi-directional relationship using a cross-lagged panel design. Therefore, while competitive video games increase aggression, aggressive people will also choose to play more competitive video games. This results in a continuous cycle, also known as a downward spiral (Slater et al., 2003).

With competition being found to increase aggressive affect overall, it was important to discover how this effect had occurred. The results indicated, as hypothesised, that the primary reason why aggressive affect had increased after competitive video game play was due to aggravation. The aggravation subscale of the SHS has several items that relate to frustration, thus the results support the frustration-aggression hypothesis. As discussed in Chapter 2, the frustration-aggression hypothesis states that competition involves the opponents actively attempting to block the players’ goal of winning. This, by definition, is a frustrating event and thus would increase the likelihood of aggression. There are three reasons why the competitive condition, compared to the low-competitive condition, would have been found to be more aggravating. Firstly, the frustration-aggression hypothesis indicates that there must be a goal being blocked. In the competitive condition participants were told their goal was to win and their opponent actively tried to block this goal. In contrast, participants in the low-competitive condition were told to just have fun, thus they were not given a specific goal that could be blocked by their opponent. The second reason for
increased aggravation is the appearance of a scoreboard. The scoreboard in the competitive condition provides a clear indicator of what the goal is (to get more points than the opposition). Also, it clearly identifies how well the opponent is doing at blocking the player’s goal. The clarity of the goal that needs to be achieved and how close the player is to achieving it would create more aggravation when this goal was blocked, compared to a player in the low-competitive condition who had no displayed goal. Thirdly, the presence of a time pressure would increase the level of aggravation felt during the final stages of the game. With participants in the competitive condition having a time pressure, it indicated how long they had to achieve their goal. This would mean, if the scores are close, the opponent blocking the goal of winning, by receiving a point, would be more aggravating as the participant would have less time to overcome this blockage and achieve the goal of winning.

However, despite these competitive factors increasing aggravation and aggressive affect overall, as well as previous research (including Study 1B) indicating that a scoreboard (McClintock & McNeel, 1966; McClintock & Nuttin, 1969) and time pressure (Ku et al., 2005; Malhorta, 2010) increases competitive behaviour, participants did not rate the competitive condition higher on competition, compared to the low-competitive condition. In Study 1B it was found that participants are generally quite good at identifying differences in competition between video games. However, perhaps the results from this study suggest that if the changes are subtle, such as the scoreboard being removed, they might not be able to accurately identify a difference. This brings back into question the critique of Elson and Quandt (2014), that participants may not validly and reliably be able to identify differences if they only play one of the games because there is no point of reference. Therefore, it would be beneficial for participants to play both games in a pilot study to assess whether they would rate a video game differently if one has a scoreboard and time pressure while another did not.
An alternative explanation as to why participants did not perceive a difference in competitiveness between the competitive and low-competitive conditions is that the removal of a scoreboard and time pressure alone may not be enough to manipulate competitiveness. Indeed, the ECS only found the more competitive version of the game to be rated 3.5 compared to 2 for the low-competitive condition. It may be that a scoreboard and time pressure only increase competitiveness when other factors, such as a leader board or team gameplay are also present. However, it is important to reiterate that participants in the competitive condition did report higher levels of aggressive affect and aggravation post gameplay. The only aspects that changed in the game were the presence of a scoreboard and time pressure, thus these aspects did increase aggressive affect. This makes it more likely that participants were just not able to identify the subtle differences between the games, without playing both versions of the video game in a pilot study.

It is also important to discuss how participants’ ratings of competition were measured, as there has not been any published study that had compared measures of competition ratings in an experimental study. Contrary to the hypothesis, the four more specific items assessing competition (Anderson & Carnagey, 2009) had greater inter-rater reliability (less in-group variance) than one broad item. This does not support Busching et al. (2015) who found that broad questions were more reliable than specific ones when assessing violence. Perhaps it is better to be more specific when it comes to measuring competition or it may be that the four-item scale of competition (Anderson & Carnagey, 2009) is broad enough.

As has been discussed previously, rating the level of violence within a video game may be easier for participants compared to rating competition due to the presence of official rating systems that clearly identify what makes a video game violent. There is no such rating system for competition and thus participants may have varying views on what makes a game competitive. Therefore, as the four-item scale asked more specific questions about
competition it may have been easier for participants to provide consistent responses hence the greater inter-rater reliability. This suggests that the ECS may be a reliable and valid measure of measuring participants’ ratings of competition as it clearly identifies what aspects influence the competitiveness of the video game. However, this hypothesis needs to be researched further as untrained participants may find the ECS more confusing due to its very specific nature (see Chapter 5).

Alternatively, the four-item competition scale may have been more reliable because it did not rely on one question and was not that specific. For example, “to what extent did this video game involve competition” from the four-item competition scale is much broader than “how often do you shoot and kill” which was in the Busching et al. (2015) study. Therefore, the Anderson and Carnagey (2009) four-item competitiveness scale may be broad enough, but also has a series of questions relating to competition that makes it more reliable than one item asking “how competitive was the video game”.

6.4.2 Losing and aggressive affect

Another aspect of competitive gameplay is the result of the competition, i.e. winning or losing. When assessing all participants across conditions, losing did not have a significant effect on aggressive affect which does not support the hypothesis or previous research (Breuer et al., 2015a; Shafer, 2012). However, in support of the hypothesis, when only participants in the competitive condition were assessed, losing did increase aggressive affect. On the other hand, participants in the low-competitive condition who performed poorly did not show an increase in aggression. This suggests that a video game must be high on competitiveness for the impact of losing to have an effect. This would make sense, as in a competitive environment there is a clear goal to win the game. However, in a low-competitive environment there is no clear goal to win. Indeed, participants in the low-competitive condition were told to just have fun. In addition, the removal of the scoreboard
would have made it difficult for participants to keep track of whether they were winning. Therefore, it may be beneficial for future research to ask participants if they had won or lost to assess their perceived performance and how that impacts aggression. In summary, when the participant does not have a goal of winning, or is not motivated as strongly to win due to the game not being competitive, then attempts to block the participant from winning do not increase aggression.

Once again, as with competition, it is important to understand how losing increased aggressive affect. Aggravation was found to be the only subscale of the SHS that was affected by losing. This supports the hypothesis and indicates that frustration is the cause of increased aggression after losing. This make sense as an opponent has successfully blocked the goal of winning which is a frustrating event, as suggested by the frustration-aggression hypothesis. These findings also support Breuer et al. (2015a), who found that frustration had a mediating effect on losing.

6.4.3 Violence and aggressive affect

The impact of violence within video games on aggression has been a societal concern for a long period. However, contrary to the majority of previous research (Anderson et al., 2010; Greitemeyer & Mugge, 2014) and the hypothesis, violence within a video game did not increase aggressive affect. This finding supports the results from Study 1A and there are other studies that have also reported null results (e.g., Elson et al., 2015; Kneer et al., 2016; Przybylski et al., 2014). Researchers have discussed various reasons as to why there may be differences in results across studies, e.g. poor measure of aggression and the moderating effect of third variables (Elson & Ferguson, 2014). However, findings from this study support that a lack of control over confounding variables, chiefly competition, is the primary cause.

Previous studies have generally used different games across violent and non-violent conditions which meant that each condition would vary on more than just violence (Elson &
Quandt, 2014). However, this study used the same game for each condition which meant that violence would be the only aspect of the game which was different. Other research that has used the same method has found similar results to this study (e.g., Elson et al., 2015; Kneer et al., 2016). In addition, Study 1A demonstrated that violent video games tend to be more competitive, therefore, as results from this study show that competition has an impact on aggressive affect, then previous studies have been confounded by the competitive nature of violent video games.

It is important to note that both the one-item measure and four-item measure of violence within the game found the violent condition to be significantly more violent compared to the low-violent condition. This dispels any arguments that the violence did not differ sufficiently. In regard to the reliability of the measures of violence, both were found to have good inter-rater reliability, although the one broad item assessing violence had greater inter-rater reliability than the specific questions on the four-item scale. This supports previous research that broad questions assessing violence are more reliable (Busching et al., 2015).

While violent video games did not affect the SHS overall, it did influence the lack of positive feelings subscale. This supports research by Saleem et al. (2012) who also found “lack of positive feeling” to be impacted by violence, although they also found that the mean subscale was influenced which was not the case in this study. Anderson and Carnagey (2009) on the other hand only found that the aggravation subscale was affected, which was not found to be affected in this study. It may be that the difference in results was caused by this study using the same game across conditions and thus controlled for in-game confounding variables, such as competition. It is also important to note that this result (increased lack of positive feeling) appears to support previous research demonstrating that violent video games reduce prosocial helping behaviour and empathy (Anderson et al., 2010; Greitemeyer & Mugge, 2014). This is because the lack of positive feelings subscale includes items such as “I
feel sympathetic”, “I feel cooperative”, and “I feel understanding”. On face value these items appear to predict the participants’ empathy and willingness to be prosocial. Therefore, violent video games may be increasing aggression through a decrease in empathy and prosocial feelings. Indeed, as discussed in Chapter 2, the GAM predicts that due to desensitisation, violence within video games will reduce a person’s empathy towards victims of aggression. Therefore, they will be less likely to help victims of aggression and also be more likely to commit aggressive acts as they do not understand the extent of the harm they are inflicting. Indeed, studies have shown that desensitisation from video games, and thus a reduction in empathy, can lead to more aggressive behaviour (e.g., Engelhardt et al., 2011a).

**6.4.4 The effect of video games on aggressive behaviour**

It was important to assess the effect that video games have on aggressive behaviour to demonstrate that increases in aggressive affect can lead to real-life aggressive actions. However, contrary to the hypotheses, aggressive behaviour, measured through the TCRRT, was not affected by competition, violence, or losing. This does not support previous violent or competitive video game research (Adachi & Willoughby, 2011a; Anderson et al., 2010; Greitemeyer & Mugge, 2014). In addition, it does not support the frustration-aggression hypothesis or GAM, as they would predict that the increased aggressive affect from competition and losing would increase aggressive behaviour. There are three potential reasons why aggressive behaviour was not impacted in this study; the length of time video games have an effect on aggression, the poor validity of the TCRRT, and the lack of standardisation in the procedure used for TCRRT.

Firstly, the null results may have not been because of issues with the TCRRT itself, but rather the delay between participants completing the video game and starting the TCRRT due to the implementation of the SHS. Unfortunately, the SHS could not be implemented after the TCRRT as the competitive and aggressive nature of the TCRRT may have
influenced answers on the SHS. Therefore, participants experienced up to five minutes of delay before starting the TCR TT after playing the video game. Barlett et al. (2009) used the Hot Sauce Paradigm to measure aggressive behaviour after violent video game play and found that the impact on aggression was still apparent after a five-minute delay but had dissipated after a ten-minute delay. Therefore, any effect that the video game play in this study (Study 2) had on aggressive behaviour may have dissipated during the beginning of TCR TT. Future research may want to consider only using one measure of aggression after video game play, as multiple measures may not be able to be employed before the effects of video games dissipate.

The second potential reason for the null results for aggressive behaviour are the questions regarding the validity of the TCR TT. Ferguson and Rueda (2009) found that the TCR TT was not correlated with criminal behaviour, executive functioning related to aggression, or to an extent trait aggression or domestic violence. Findings from this study (Study 2) also found that noise intensity and noise duration were not correlated with the SHS which assesses aggressive affect. It would be expected that aggressive affect would correlate with aggressive behaviour, as the GAM predicts, but it did not (poor predictive validity). This suggests that the TCR TT is not a valid measure of aggressive behaviour. The TCR TT was used in this study because it is the most widely used and other measures of aggressive behaviour have limitations of their own (Ritter & Eslea, 2005).

Thirdly, null results may have been due to a limitation in the procedure used for the TCR TT. Previous studies have noise blasted participants with the maximum amount in the first round to “provoke” participants (e.g., Ferguson & Rueda, 2009). Others have also had the levels of noise blasts vary randomly (e.g., Anderson & Carnagey, 2009), rather than having noise blast levels steadily increase in a semi random pattern as in this study. These other techniques may increase the sensitivity of the TCR TT (Anderson & Carnagey, 2009).
Future studies should consider using these patterns for the TCRRT, but more importantly a consensus in the procedure utilised should be reached amongst researchers and then be consistently employed (Elson et al., 2014; Ferguson et al., 2008b). Indeed, as no consensus had been reached it was difficult to determine which other more recent procedures worked most effectively, thus the original procedure (e.g., Anderson & Dill, 2000; Bushman, 1995) was used in this study.

With the continued issues surrounding the TCRRT, such as poor validity and problems with standardisation, it would be beneficial for future research to improve existing measures of aggression or develop new ones. As discussed in Chapter 3, the Hot Sauce Paradigm (Lieberman et al., 1999) is suggested by some to be a better measure of aggression, although further research assessing its validity and reliability are needed (Adachi & Willoughby, 2011a; Elson et al., 2014). Perhaps researchers should employ a more natural observational measure of aggression. For example, online verbal aggression is so frequent that some video game companies have developed tools to reduce it (Lin, 2015; Maher, 2016). Therefore, a new and authentic measure of aggression could put participants in a realistic gaming environment and observe their natural level of verbal aggression towards other players.

**6.4.5 Arousal**

Arousal was also found to not significantly differ between conditions which does not support the hypothesis or previous findings (e.g., Adachi & Willoughby, 2011a; Anderson et al., 2010). Potential reasons for the conflicting results include the control over confounding variables in this study and procedure used to measure the participants’ baseline heart rate.

As other variables were kept consistent across conditions, and at quite a high level, it may have resulted in a ceiling effect when it came to the video game’s impact on arousal. For example, all conditions of the video game were found to have the same level of excitement
and pace of action. It would be expected that these factors would have some level of influence over heart rate (e.g., Adachi & Willoughby, 2011b). Therefore, it may be that as these factors were kept the same, plus they were rated highly in each condition, that any aggression felt by the participant was not able to increase their heart rate over the excitement and pace of action felt (ceiling effect).

Alternatively, it may have been a limitation with the procedure used to measure the pre-game baseline of participants’ heart rate that caused the null results in regard to arousal. At the start of the study when pre-game heart rate was recorded, participants came into an unfamiliar environment, met a new person (the researcher), and were being briefed on an experiment they were going to undertake. This potentially would have created a somewhat stressful environment that may have increased participants’ heart rate. Therefore, once they started playing the video game in a room by themselves for a period of 10 minutes, they may have felt more comfortable. Indeed, it was found that participants’ heart rate reduced from pre-gameplay to during gameplay regardless of what condition they were in. Participants’ heart rate fell even further after gameplay but this may have been a result of the participants becoming more comfortable with being in the experimental environment. It may be then that any aggression felt while playing the game did not affect arousal due to the already high levels of arousal felt by the stress of the experiment. As discussed in Chapter 3, it is often quite difficult to evaluate what is causing fluctuations in heart rate, and it appears to be the case in this study. Therefore, future studies should require participants to sit in a room by themselves for a period of time, perhaps while completing a controlled task to take the participants’ mind off the experiment. This would deliver a more reliable baseline measure of arousal.
6.4.6 Interaction between violence and competition

Some of the most popular video games are both violent and competitive, e.g. *Call of Duty: Black Ops III*™ and *Star Wars: Battlefront*™ (Grubb, 2016). Therefore, it was important to assess whether the combination of violence and competition had an even greater effect on aggression. Contrary to the hypothesis, results from this study found no significant interaction between violent and competitive video games on aggressive affect, aggressive behaviour, or arousal. This does not support the interaction theory raised in Chapter 2. That is, as both violence and competition within video games increase aggression, and they are theorised to impact aggression through different routes (cognition and affect respectively), then a combination of the two should have an even greater effect. While the results did not support this theory, it did support the results from Study 1A and Adachi and Willoughby (2016), as these studies also found that violence did not increase the predictive power of aggression over competition alone. Some theories as to why no interaction has occurred could be due to violence not having an effect at all, the influence of spreading activation, video games only being able to influence aggression to a certain degree (ceiling effect), and motivations for playing video games influencing how players are affected. These theories are described in detail during Chapter 7.

6.4.7 Summary

In summary, the competitive condition of a video game was found to increase aggressive affect. In addition, participants in the competitive condition had even higher levels of aggressive affect. These increases in aggressive affect were due to increased feelings of aggravation. On the other hand, it was found that when competition and other potential confounding variables were controlled for by using the same game across all conditions, violence did not influence aggressive affect. However, the violent video game condition did increase participants’ “lack of positive feelings”, suggesting that it may impact aggressive
behaviour through decreased empathy, prosocial feelings, and desensitisation. Despite strong theoretical and previous empirical evidence, competition, losing, and violence were not found to increase aggressive behaviour. This is most likely due to the measure of aggressive behaviour, TCRIT, being found to have poor predictive validity, or limitations in the procedures used. Arousal was also not influenced by competition, losing, or violence, but this was most likely due to other factors influencing arousal, such as the pace of action of the game and stress of the experimental environment. Contrary to the interaction theory discussed in Chapter 2, but in support of the findings from Study 1A, there was no interaction between violence and competition. In conclusion, it appears that competition and losing impact aggression, and when competition is controlled for, violence does not have an effect. This will be further discussed and evaluated in the following chapter, with a model summarising the findings being presented in section 7.5. The following chapter also details the limitations of the studies, suggestions for future research, and implications of the findings.
Chapter 7: General Discussion

Concerns about the negative effects of violent media, in a broad sense, date back to the Roman Gladiatorial era (Tertullian, 200). In the modern era, these concerns have taken a new platform; the impact of violence within video games. The majority of research has found that violence within video games affects aggression (Anderson et al., 2010; Greitemeyer & Mugge, 2014). However, the focus on violence within video games appears to have led to a limited amount of research assessing other aspects of video games and how they might affect aggression. Competition and social gameplay appear to be factors that have an impact on aggression as well, but the research surrounding these aspects is limited and competition has rarely been controlled for in violent video game studies. This led to the broad aim in this dissertation to assess the effect of violence and competition within video games, both independently and combined, on aggression. In addition, the effect of multiplayer games was explored. More specifically, based on previous research, five research questions were formed:

RQ1: Does competition within video games affect aggression?

RQ2: Does violence within video games affect aggression when competition is controlled for?

RQ3: Does a combination of competition and violence within video games increase aggression further than one variable alone?

RQ4: Do multiplayer games have a relationship with aggression and is this in part due to an increase in the competitive nature of the game?

RQ5: Can a more comprehensive model of how video games impact aggression be created?

This final chapter explores each of these research questions and how they were addressed by each study while also relating the results to previous research. In addition, the development of the model will be discussed. Limitations will be summarized, followed by
directions for future research. Lastly, the implications of this dissertation will be discussed before an overall summary and conclusion are presented.

7.1 RQ1: Competition within Video Games

The first step in addressing RQ1 was to assess whether there was any relationship at all between competition within video games and aggression. Study 1A explored this and demonstrated that exposure to and preference for competitive video games was correlated with trait aggression. The effect sizes ranged between .24 and .38 (5.76% to 14.44% variance explained), which is comparable to the impact of violence on aggression in previous video game research (Anderson et al., 2010). This indicates that competitive video games have a relationship with aggression and this relationship is of practical significance (as discussed in Chapter 2). This supports previous longitudinal research that had also found that competitive video game exposure predicted future trait aggression (Adachi & Willoughby, 2013, 2016). However, Adachi and Willoughby (2013, 2016) only demonstrated that exposure to action, fighting, sports, and racing games had a relationship with trait aggression. These games were assumed to involve intense competition, but the level of competitiveness within these games can vary and there are other game genres that involve intense competition. Indeed, in Study 1B it was found that *Skyrim™*, an action game, was perceived to have low levels of competitiveness by both the participants and researcher. As such, Study 1A considered all video games and used participants’ ratings of competitiveness thus demonstrating that regardless of the genre of the video game, exposure to and preference for competitive video games have a positive relationship with trait aggression.

However, a potential issue with Study 1A is that competition may be harder for participants to classify compared to violence. Violence guideline systems for media have been around since 1922 (Trend, 2007), thus society is far more aware of what makes media violent compared to competitive. In addition, the level of competition rated by the player may
be influenced by individual differences in what constitutes competition and differences in how competitively the game is played. Therefore, there was a concern as to whether participants could accurately rate how competitive the game is by design. Study 1B addressed this by developing a new measure of the level of competitiveness within video games by design and assessing participants’ subjective competition ratings of video games they play. Study 1B found that participants were able to reliably rate competition (inter-rater reliability) and accurately rate competition when compared to the new competition measure created by the researcher (predictive validity). This indicates participants’ ability to rate the competitiveness of games by design is valid. This supports the results from Study 1A, that exposure to and preference for video games designed to be competitive are related to trait aggression.

While the cross-sectional study provided valuable information about the relationship that competitive video games played in the real world have with trait aggression, it did not provide any evidence of the direction and causality of the relationship. Therefore, Study 2 employed an experimental design and built upon previous research (Adachi & Willoughby, 2011a) by using the same game across conditions. As discussed in Chapter 3, using the same game across conditions controls for all differences between games that may confound results, such as the goals of the game, the controls used, and how exciting the game is by design. Using this technique, it was found that participants in the competitive video game condition displayed higher levels of aggressive affect. In addition, the effect size indicated that seven percent of the variance was explained by competitiveness, which again indicates practical significance (see Chapter 2). This suggests that competition within video games has a causal effect on aggression (socialisation hypothesis [Moller & Krahe, 2009]). This also supports previous studies by Adachi and Willoughby (2011a, 2013, 2016) which appear to be the only
other research to successfully assess the impact of competitiveness within video games on aggression.

Adachi and Willoughby (2013, 2016) also found a bi-directional relationship between competitive video games and aggression in their longitudinal studies using a cross-lagged panel design. Therefore, not only do competitive video games increase aggression but people who are aggressive are drawn to competitive games. This bi-directional relationship indicates that players of competitive video games may be in a downward spiral (Slater et al., 2003). That is, people with aggressive tendencies will be drawn to competitive video games, which will in turn make them more aggressive and thus even more likely to play competitive video games. As this cycle continues it increases the impact of competitive games in the long term.

The findings from Study 2 also support the frustration-aggression hypothesis which suggests that competitive video games increase aggression due to the frustrating nature of the games. Participants in the competitive condition had higher scores on the aggravation subscale of the SHS, which included the item “frustration”. No other subscales of the SHS were found to be significantly influenced by the competition within the video game which indicates that aggravation and frustration are the primary factors that lead to an aggressive affect. Losing in the video game was also found to increase the aggravation subscale of the SHS, but none of the other subscales. This further supports the frustration-aggression hypothesis as the goal of winning had been successfully blocked, which is frustrating/aggravating.

Interestingly though, losing only had a significant impact on aggressive affect overall if the participants were in the competitive condition rather than the low-competitive condition. Previous research has found that losing increased aggression, but these studies only assessed losing in a competitive condition (Breuer et al. 2015a; Shafer, 2012). Therefore, the results from this study have built upon previous findings by demonstrating that
losing in a low-competitive setting does not impact aggression. This does not appear to support the Self Determination Theory (Deci & Ryan, 1985; Deci & Ryan, 2000; Ryan & Deci, 2000), which suggests that players will strive to be competent at a video game, and if that need is not fulfilled it may lead to aggression (Przybylski et al., 2014). Regardless of whether the video game is competitive or not, if the participant was performing poorly in the game (i.e., lost even though it was not competitive), the player would not be competent at the game. However, a theory as to why participants who lost in the low-competitive condition did not have increased levels of aggression is because the lack of competition reduced the need to be competent. If the game was not competitive, participants may not have a desire to perform well. Instead they would just play the game for other motives including to have fun. In addition, with the scoreboard being removed it would have made it more difficult for the participants to identify that they were performing poorly, which may mean the need to be competent was not threatened. In any case, the results from this study demonstrate that performing worse than an opponent (i.e. losing), will only impact aggression if the video game is also highly competitive.

Competition and losing in a competitive environment increased aggression, thus, according to the GAM, this should lead to an increase in aggressive behaviour. However, in Study 2, aggressive behaviour, measured using the TCRRT, was not affected by competitiveness or losing. This may indicate that while competition and losing impacts aggressive affect, it would not necessarily be able to increase aggressive behaviour. However, some researchers have been concerned about the validity of the TCRRT (e.g., Ferguson & Rueda, 2009) (see Chapter 3 for more detail), and this may have had an effect on the results. Indeed, the SHS which assesses aggressive affect was found not to significantly correlate with the TCRRT. This does not support the GAM which states that increases in aggressive affect should lead to an increase in aggressive behaviour. Based on this lack of predictive
validity, as well as the concerns and findings from other researchers (e.g., Adachi & Willoughby, 2011b; Elson et al., 2014; Ferguson & Rueda, 2009), the TCRTT does not appear to be a valid measure of short term aggressive behaviour. In addition, limitations with the procedure used in Study 2 may have impacted results (see Limitations in Chapter 7).

Therefore, it is difficult to conclude that the results from this study demonstrated that competitive video games do not have an effect on short term aggressive behaviour. Adachi and Willoughby (2011a) found that competition did impact aggression using the Hot Sauce Paradigm. However, the validity of the Hot Sauce Paradigm has not been extensively assessed which means caution must be taken when interpreting results. Issues with assessing aggressive behaviour are common in violent video game research, although researchers have overcome this issue, to an extent, by conducting multiple studies using different designs and different measures to create scientific robustness. As only a few studies have assessed competition, including this one, future research is needed to provide scientific robustness in this area to confidently conclude that competitive video games impact or do not impact aggressive behaviour.

As the GAM predicts that arousal is linked with aggressive affect and aggressive behaviour, the impact on heart rate from competition and losing was also assessed. However, Study 2 found that participants’ heart rate did not significantly differ between the competitive and low-competitive group, or between participants who won or lost. The issue with assessing arousal is that it can be unclear what is influencing it. For example, a reason why both the competitive and low-competitive conditions did not significantly differ in heart rate may be because participants rated them equally on excitement and pace of action. Both these factors were rated quite highly by participants, so perhaps competition would not have been able to impact arousal beyond the influence of excitement and pace of action.
Overall, the studies in this dissertation found that competition within video games has a causal relationship with aggression. In addition, this relationship appears to be in part a result of the frustration and aggravation felt while playing competitive video games. Losing, but only in a competitive video game, also had a causal relationship with aggression due to the frustration and aggravation. There could be arguments against these conclusions as the TCRTT and heart rate were not affected. However, as the more valid and reliable measures of aggression (SHS and Buss-Perry aggression questionnaire) found an effect or relationship, there is stronger evidence suggesting that competition within video games has an impact on aggression.

7.2 RQ2: Violence within Video Games

There is a concern within society that violent video games impact aggression. However, in the cross-sectional study (Study 1A) violent video games were not found to correlate with trait aggression. Despite the cross-sectional study not being able to conclude a causal relationship, if violent video games did in fact cause aggression a relationship between violent video game exposure or preference and trait aggression would still be expected. Further still, Study 2 supported the results from Study 1A by finding, using an experimental design, that violent video games did not cause an increase in aggressive affect or behaviour, or an increase in heart rate. These findings do not support the majority of previous research (Anderson et al., 2010; Greitemeyer & Mugge, 2014). The lack of the aggressive behaviour and increase in heart rate could be due to issues mentioned previously, such as the validity of the TCRTT and the constant levels of excitement and pace of action. However, even the SHS in the experimental study and the Buss-Perry aggression questionnaire in the cross-sectional study did not show a significant effect.

One reason why violence may not have had an effect on aggressive affect is that violence is theorised to primarily impact aggression through cognition, e.g. through priming.
Therefore, it may have been that participants’ aggressive cognitions had increased, but no measure of aggressive cognition was utilised in Study 2. However, the GAM theorises that increases in aggressive cognition should interact with affect. Indeed, previous studies have shown that violent video games impact aggressive cognition and affect to a similar strength (Anderson et al., 2010). Therefore, violent video games should still increase aggressive affect.

The primary argument of this dissertation that explains the null findings in relation to violence is that competition rather than violence caused an increase in aggression. As demonstrated in Chapter 3, previous studies of violent video games have rarely controlled for competition. In addition, the few studies that did attempt to control for competition, by either using competitive ratings from participants or using the same game across conditions, demonstrated inconsistent results. Further, the majority of studies that have employed better methodology of using the same video game across conditions have found that violent video games did not affect aggression (e.g., Elson, 2015; Kneer, 2016). This is supported by the null results found in Study 2, in which the same game was utilised across conditions while only modifying competition and violence.

It is important to control for competition in violent video game research because violent video games tend to be more competitive. This was demonstrated in Study 1A. Therefore, the results of previous research which found that violent video games produce more post game aggression compared to different non-violent video games may be due to the competitive nature of the violent video game rather than violence itself. It is important to note that some video games are violent but not competitive, and some non-violent games are competitive. For example, in Study 1B it was demonstrated that both Grand Theft Auto(TM) and Skyrim(TM) were rated as being low on competitiveness but high on violence. FIFA(TM) on the other hand was rated as being high on competition but low on violence. Therefore, these
types of games utilised in experimental research could have controlled for competition. However, the issue with this is that there are a wide range of other factors that may differ between the games. For example, the tasks that need to be completed in FIFA(TM) compared to Grand Theft Auto(TM) are very different, and it is still unclear whether the differences in tasks have an effect on aggression. Therefore, it is important to use the same game across conditions as done in this dissertation.

From a theoretical perspective, the catalyst model (Ferguson et al., 2008a) may explain why violent video games did not increase aggression in this dissertation, although there are still some major issues with this model that need to be resolved. The catalyst model suggests that the violence within the video game would only style how the aggression is displayed rather than increase the likelihood of aggression. This theory would explain why participants did not show an increase in the mild forms of aggression assessed in this dissertation, e.g., blasting a person with noise is quite mild aggression. However, if players are styling their aggression based on violent video games then there may be an increase in the extreme forms of aggression and violence. For example, a violent video game may not increase the likelihood of yelling at someone, as this mild form of aggression would have been displayed anyway. However, according to the catalyst model, it may increase the chances of the player shooting a real person because instead of displaying aggression through yelling they have styled their aggression based on a violent first-person shooting game. However, there does not appear to be any evidence that extremely violent actions within violent video games are mimicked that closely. Also, based on the readings of Ferguson’s papers, it is unlikely the authors of the catalyst model would agree with the conclusions raised here. A re-evaluation and further assessment of the catalyst model may be needed to more clearly explain how aggression may be styled by violent video games, as well as why violence does not impact aggression.
There was one area in which violent video games did have an impact, and that was on the lack of positive feelings subscale of the SHS. This subscale includes items that surround the concept of empathy. Therefore, it appears that playing a violent video game lowers the empathy of a player. This may relate to desensitisation and reductions in prosocial helping behaviour displayed by previous research (Anderson et al., 2010; Greitemeyer & Mugge, 2014). It also relates to GAM theory that violent video games desensitise people to aggression, resulting in an increase in aggressive behaviour. If a player’s empathy has been reduced they may have less concern for victims of aggressive behaviour. Therefore, the lack of empathy towards the victim may desensitise the player to the negative effects of aggressive behaviour, increasing the likelihood of aggression and reducing prosocial helping behaviour.

Despite evidence of violent video games affecting empathy, no other measures of aggression were significantly impacted by playing violent video games. Therefore, in regard to RQ2, when all confounding variables, including competition, are controlled for within the video game violence did not have a significant impact on aggression. This finding does not support the majority of previous research (Anderson et al., 2010). In addition, this dissertation indicates that violent video game research is not as scientifically robust as previously thought (Greitemeyer & Mugge, 2014). This is due to the fact that competition has not been controlled for by the vast majority of previous studies despite violent video games tending to be more competitive. Future research should consistently include competition in their analyses during cross-sectional, longitudinal, and experimental studies. This will create scientific robustness in the competitiveness field, as well as provide more clarity and support as to whether the impact of violence has been confounded by competition.

7.3 RQ3: Interaction between Violence and Competition

While the impact of violence and competition within video games have been assessed independently, there appeared to be no published paper that had specifically looked at an
interaction effect. With several popular video games being both violent and competitive such as *Call of Duty: Black Ops III*™ and *Star Wars: Battlefront*™ (Grubb, 2016) it was important to assess this interaction. In both Study 1A and 2 there was no interaction between violence and competitiveness. This supports Adachi and Willoughby (2016) who found violent and competitive video games did not provide any further predictive power of aggression compared to competition alone. However, it does not support the theory outlined in Chapter 2. That is, violent video games prime aggressive cognitions, while competitive video games increase aggressive affect. Therefore, if both these pathways of the GAM are being activated simultaneously then it should increase the likelihood of aggression further than any one variable only. Reasons why no interaction occurred include violence not having an effect at all, the spreading activation of aggressive affect to cognitions, a ceiling effect occurring, and differences in motivations to play video games.

The lack of an interaction could simply be due to the fact that violence did not have an effect on aggression independently. If violence does not have an independent effect, then it would not increase the level of aggression over competition alone. However, if violence has an effect independent of competition, then other theoretical explanations are needed for the lack of interaction.

It may be that no interaction occurred because of the impact of spreading activation on the present internal state (route to aggressive behaviour) of the GAM. Spreading activation suggests that affect will impact on cognitions and vice versa. Therefore, when competition is involved in a violent video game, the aggressive affect caused by the competition will influence aggressive cognitions which may cancel out the effect of violence.

This theory of the spreading activation cancelling out the impact of violence is also related to the ceiling effect. Video games in general can only increase the likelihood of aggression so far with effect sizes demonstrated in previous research (Anderson et al., 2010;
Greitemeyer & Mugge, 2014), as well as in this dissertation, indicating that video games only have a small influence. Therefore, the combination of both violence and competition may not have a greater effect because one variable alone is sufficient to reach the maximum impact video games can have on aggression.

The lack of an interaction may also be due to differences in type of gamers. Kahn et al. (2015) developed a new scale to measure what motivated people to play video games. Participants were asked to agree or disagree, on a five-point Likert scale, with 20 statements about why they play video games, e.g. “I play to win”. Using this scale the researchers were able to identify six types of gamers: competitor, completionist, socializer, escapist, story-driven, and smarty-pants (Kahn et al., 2015). As there are several different types of gamers, it may be that certain people are affected differently by different games. For example, competitors may become more aggressive after playing a competitive game, but not be affected by the violence. Story gamers on the other hand may not be affected by the competitiveness, but possibly would be affected by the violence. Therefore, a combination of both violence and competitiveness may not increase aggression further because each type of gamer is only affected by one aspect. Further research is recommended as there appears to be no published study that has explored these possible connections.

In summary, the results from the studies in this dissertation, as well as the Adachi and Willoughby (2016) study, indicate that there is no interaction between competition and violence within video games on aggression. Nevertheless, research in this area is still limited and theoretically it is predicated that an interaction should occur. Therefore, future research should continue to evaluate the interaction between violence and competitiveness within video games.
7.4 RQ4: Multiplayer

Competing against a human opponent is very popular (Weibel et al., 2008), thus it was important to evaluate whether multiplayer games are related to aggression, as well as competition. Study 1A demonstrated that the percentage of time that people play multiplayer games compared to single-player games is correlated with trait aggression. Firstly, this indicates that playing with other human players is linked with aggression. This supports some research (Eastin, 2006; Shafer, 2012), but not others (e.g., Mihan et al., 2015; Williams & Clippinger, 2002), with the research in this area being quite inconsistent and relatively limited. Previous research assessing the effect of multiplayer games had only been conducted in a laboratory setting using an experimental design. This meant that participants would not be anonymous while playing the video game and would be vulnerable to observer effects (Hawthorne effect [see Salkind, 2014]) and the influence of social desirability (Harris, 1997). Therefore, players may inhibit their aggressive behaviour which in turn may also influence aggressive affect and cognition. Indeed, Wright (2013) found that participants who were anonymous online acted more aggressively in terms of cyber bullying. As video games are often played from the seclusion of the player’s home against other anonymous players online it was important to address the impact of anonymous multiplayer gaming.

As Study 1A was survey based and recorded real-life gaming behaviour, the findings suggest that multiplayer gaming outside of a laboratory setting is linked with aggression. However, from the data recorded in Study 1A it is hard to conclude whether the anonymity of online gaming is the reason a relationship was found. This is because only the percentage of multiplayer gaming was recorded, not what type of multiplayer gaming. Therefore, future research should include different subsections of multiplayer gaming. This could include playing with friends online, playing with random people online (anonymous), playing with friends in the same room, or playing with strangers in the same room. This would help clarify
the relationship different types of multiplayer gaming have with aggression, especially with online gaming.

Unfortunately, Study 2 did not incorporate a multiplayer condition. Therefore, the causal effect of multiplayer gaming on aggression could not be analysed. It may be that aggressive people play more multiplayer games (selection hypothesis), perhaps so they can take their aggression out on random anonymous online people. Future research could assess the causal effect, but it may be difficult as experimental studies are impacted by observer effects. However, there may be some ways to overcome this issue including having participants play at home and gathering gameplay data from gaming companies.

Having participants play the game by themselves at home would create a more realistic gaming environment not impacted by observer effects. In this design three conditions could then be employed: participants play the game by themselves against computers, play the game online against other participants that are anonymous, play against participants that are not anonymous. Participants could also be measured on their level of aggression at home, after gameplay, through online implementation of the measures of aggression. However, there are some issues with this technique. Firstly, it would be left up to the participant to follow the instructions and not deviate from the process. Secondly, the online social environment that the participants experience may vary, which would impact the results. To address this issue, instead of having other participants in the game, there could be trained confederates who are disguised as other participants and thus have control over the types of communication within the game. This technique has been used before in a laboratory setting (Breuer et al., 2015a). It would also solve issues with having participants with different skill levels in the game. The confederates could vary their ability so that it matches that of the participant.
Another method that would use a quasi-experimental approach would be to use data collected by gaming companies. For example, *Riot Games*, who developed *League of Legends*™, collected data from their players and have used this to create a tribunal system and pre-game messages to reduce toxic behaviour within the game (Lin, 2015; Maher, 2016). This type of data could potentially be employed to assess aggressive social behaviour online. That is, comparing people who play the game with friends, to those who play the game with random (anonymous) people. An issue with this quasi-experimental approach is that participants would not be randomly assigned to a group, and thus a causal relationship may be difficult to prove. In addition, aggressive behaviour would be measured through in-game aggressive social interactions. This may mean that the player's true level of aggression may not be measured, as some may be behaving aggressively at home, e.g. hitting the desk, but not display the aggression online. However, this type of research would give an important insight into the aggressive behaviour of players in a natural online multiplayer environment where they would feel truly anonymous and uninhibited.

While there is plenty of room for future research in the area of multiplayer games, there was also another important finding from Study 1A. The percentage of time playing multiplayer games was correlated with competitive video game preference. This indicates that multiplayer games may be more competitive. However, the percentage of time playing multiplayer games was not specifically linked to each game. This makes it difficult to link multiplayer gameplay to the specific games that were competitive. However, as the correlation between competitive video game preference and multiplayer preference was medium to strong, it provides evidence to suggest that there is a link. In addition, Study 1B demonstrated that games which were rated as being highly competitive were all either played solely online or had a strong online platform for which players can play against other people. Also, the games that were rated low on competition could either not be played online, or are
games that do not have a strong multiplayer mode. This highlights that in highly competitive games participants will generally be playing against other human players. As multiplayer games appear to be more competitive, the reason why multiplayer games are related to aggression could be due to their competitiveness. However, further evidence is required to support this hypothesis.

Future studies could include a measure of competitiveness in the experimental study described previously, i.e. playing the game at home. This would help to clarify whether the players become more competitive in the multiplayer video games, compared to the single-player games. There may also be differences in the level of competitiveness between strangers and friends. If competitiveness is measured, modelling techniques could be utilized to assess whether competition is having a moderating or mediating effect on the relationship between multiplayer games and aggression.

Overall, the results from Study 1A and Study 1B indicate that multiplayer games have a relationship with trait aggression and it may be due to an increase in competition. However, future research is needed to assess whether multiplayer games have a causal effect on aggression. In addition, more research is needed to assess whether competition is moderating or mediating that effect.

7.5 Model Summarising this Dissertation

As discussed in Chapter 2 the GAM (Anderson & Bushman, 2002) is the most comprehensive and cited model in video game research on aggression. The impact of violence and competition within video games on aggression does fit into this model well, however, as it is a general model of aggression it is difficult at times to conceptualise how specific factors of video games influence aggression. Therefore, a new model (Figure 7.1) was developed as an extension of the GAM, focusing on the specific situational factors associated with playing a video game assessed in this study (e.g., competition, violence,
losing, multiplayer) and how each of these factors influence aggressive affect and thus aggressive behaviour. It is important to note that video game factors such as competition and violence may impact aggressive behaviour through cognition and arousal, but these were not included as they were not a focus of this dissertation. Future researchers are encouraged to add cognition and arousal to this model. In addition, other factors which are deemed important to explaining how video games impact aggression, such as pace of action and difficulty (Adachi & Willoughby, 2011b), should also be added in the future. Furthermore, personality and biological factors, as well as a feedback loop/downward spiral (Slater et al., 2003), could also be added in future research. This model, and the further development of this model, will help to provide a more comprehensive view of how video games impact aggression. In addition, it will identify what other factors of video games need to be controlled for in future video game research.
Figure 7.1. Model summarising this dissertation. Note that broken lines indicate that further evidence is needed to confirm the effect.
7.5.1 Model description

Figure 7.1 provides a model of the findings from this dissertation. Broadly, this model describes the effect competition and violence within video games have on aggressive affect and thus aggressive behaviour. It should be noted that quite a few causal relationships in this model were not supported in this thesis or were not assessed. However, this dissertation has discussed that there is empirical evidence from other studies and/or strong theoretical explanations for an effect in regard to these relationships. As such, they are included in this model to demonstrate the importance of considering a large range of factors when conducting research in this area, which has been an issue in the past, i.e. not considering competition. Each of the components of the model are explained in detail below.

Influence of aggressive affect on behaviour.

Both the GAM and the frustration-aggression hypothesis posit that aggressive affect will lead to aggressive behaviour and this has been supported by research (Anderson & Bushman, 2002; Anderson et al., 2010; Berkowitz, 1989; Greitemeyer & Mugge, 2014). While Study 2 did not find that aggressive affect was related to aggressive behaviour, this was most likely due to the limitations with the TCRIT, thus the impact of aggressive affect on behaviour was given a solid arrow line in the model.

The effect of competition on aggressive affect.

Aggressive affect was found to be impacted by video game competition in Study 2, and this was in part explained by an increase in aggravation/frustration. Losing in the competitive condition increased aggressive affect even further, and once again this was in part due to aggravation/frustration. Due to these findings, this part of the model has been given solid arrow lines. However, aggravation/frustration may not be the only factor that explains how competition impacts aggressive affect. For example, future research may want
to explore whether dominance plays a role. Therefore, a broken arrow directly from competition to aggressive affect was added.

Aspects of competition.

An important feature of this dissertation was the creation of the ECS which identified specific factors that make a video game competitive. As such, the model included frequency, scoreboard, leader board, team gameplay, time pressure, and multiplayer aspects as factors that influence how competitive a video game is. Therefore, these specific factors should impact aggressive affect through their influence on the level of competition within a video game. However, as discussed previously more experimental video game research is needed to confirm that they do impact competition, hence the broken arrow lines.

The effect of violence on aggressive affect.

While the majority of previous research has found that violence within video games impacts aggressive affect (Anderson et al., 2010), this dissertation did not, most likely due to competition being controlled for. Therefore, a broken arrow line between violence and aggressive affect was given in the model. However, a solid arrow line was given between violence and lack of positive feelings/empathy as Study 2 demonstrated this effect. That being said, as the SHS as a whole was not impacted by violence the line between lack of positive feelings/empathy and aggressive affect is a broken arrow line. Once again it is important to note here that violence may still impact aggressive behaviour through cognitions as this was not assessed in this dissertation.

Competition and violence interaction effect.

Finally, the model indicates that there may be an interaction between competition and violence within video games that may cause even greater aggression. The theory discussed in Chapter 2 suggested that as competition and violence are hypothesised to impact aggression through different routes, affect and cognition respectively, a combination of the two should
increase aggression further. However, Studies 1A and 2 did not show a significant interaction between competition and violence. However, as there is very limited research assessing this interaction, and the theory suggests an interaction should occur, further research is required.

7.6 Limitations

There has already been some discussion about how the studies in this dissertation could be improved. In this section, the limitations are summarized and discussed in more depth. Some limitations impact on the ability to generalise results, while others may explain why some unexpected results were found. The limitations include participants’ awareness of violent video game research, ability of participants to recall video game exposure, measuring aggressive behaviour, participants’ ability to identify competition manipulation, and sample sizes.

*Participants awareness of violent video game research.*

The impact of violent video games is a topic that has been a concern of the public for a long time, especially for parents. Therefore, it is often discussed in the media. In addition, shooting sprees get media attention with the inevitable media discussion around the impact of violent video games. As a result of media coverage and the long-held concerns about violent video games’ effects, awareness of the topic may be quite high and this can be an issue for studies. For example, Bender, Rothmund, and Gollwitzer (2013) found that people who identified highly with video games reported less aggression on a transparent compared to a non-transparent measure of aggression. This indicates that people who identify highly with video games, and thus, most likely, do not agree with the perceived negative effects of violent video games, will reduce their aggression scores when they are aware of what is being measured. Therefore, it is important to hide the true nature of the study, although participants may still be aware. Indeed, it has been found that cover stories may not be enough to reduce participants’ awareness of the hypothesis (Bender et al., 2013). Therefore, it is important to
ask whether participants were aware of the true nature of the experiment. This was done for Study 2, but not for Study 1.

In contrast, the effect of competition within video games on aggression is a relatively new topic and does not appear to be a common topic of discussion in society. In addition, it may be difficult for participants to realise that they are playing either a competitive or low-competitive game in an experimental study. Therefore, their awareness of the topic would be relatively low and thus they would be less likely to manipulate responses or behaviour based on their own opinions.

While competition’s effect would not have been impacted by participants’ prior knowledge or opinion, the high awareness of the issue of violence within video games may have impacted the effect of violence within video games on aggression.

*Ability for participant to recall exposure.*

A limitation of Study 1A was that participants had to rely on their memory to specify how often they played video games in high school. The ability to recall information deteriorates over time, especially when that information is not rehearsed (Burton et al., 2012). While participants may have played video games since high school, they would not have specifically rehearsed how long they played for in high school. With the mean age of participants being 23 years, many participants had to recall specific gameplay hours from five or more years ago. Future longitudinal studies could track participants from adolescence into adulthood, a design that would enhance understanding of the long-term impacts of competitive and violent video game exposure.

In addition, participants being able to accurately recall how often they played in the last year was also an issue. The fact that three participants stated they played 80 hours a week, which appears unrealistic, suggests that participants may have trouble accurately stating video game exposure. Generally, previous studies asked participants to rate their
gameplay on a scale which may make it easier for participants. However, this method can have issues of its own as participants may have differing views on what high or low levels of video game exposure is. Perhaps future studies could come to a consensus as to what specific hours relate to low video game use up to high video game use on a scale. Alternatively, participants could record in a diary exactly how often they play over a certain period of time.

*Measuring aggressive behaviour.*

It has already been discussed that the measure used to assess aggressive behaviour (TCRTT) in Study 2 appears to have poor predictive validity as it did not correlate with the SHS. In addition, there does not appear to be a consensus on the best procedure for the TCRTT (Elson et al., 2014; Ferguson et al., 2008b), thus the procedure used in Study 2 may have been less sensitive to measuring aggression. Future research is needed to further standardise and validate measures of aggression, such as the TCRTT and the Hot Sauce Paradigm. Alternatively, it may be necessary, as suggested in Section 6.4.4, for researchers to employ a more simplistic technique by directly observing participants’ aggressive behaviour while playing the video game, e.g. aggressive use of equipment and/or verbal aggression towards other players.

*Participants’ ability to identify competition manipulation.*

Another limitation of Study 2 was that participants scored competition equally between the competitive and low-competitive conditions. This was most likely due to the subtle differences between the conditions, i.e. no scoreboard or time pressure for the low-competitive condition. However, even with these subtle differences, the participants in the competitive condition reported higher levels of aggressive affect. If future studies could modify one game to differ greatly on competition, then perhaps even stronger effect sizes for competitions’ impact on aggression could be seen. An example of how to modify competition successfully could be to have participants play a racing game where they either compete
against an opponent or just race against time to try to be as quick as possible. This means that the same game is used and there is the same goal within the game; get around the track as fast as possible. However, in the competitive condition they would have an opponent and in the non-competitive condition they would not have an opponent at all.

Sample sizes.

It could be argued that a potential criticism of this dissertation was the small sample sizes, which may have resulted in type 2 errors. However, given the effect of competition was still significant while violence was not indicates that competition has a stronger effect on aggression. In addition, in Study 1A the correlation strength for exposure to (.07) and preference for (.03) violent video games in the last year on aggression was so low that adding more participants would not have pushed it to significance. Further, the effect size of violence on aggressive affect and behaviour in Study 2 was .01. Having more participants was unlikely to have influenced the significance of the result.

7.7 Future Directions

Despite decades of studies into video games and aggression there are still several avenues researchers can explore in the future. These include addressing the limitations presented in this dissertation and the suggestions made previously in this discussion section, including building a more comprehensive model of how video games impact aggression and further assessment of multiplayer video games outside the laboratory. Other avenues include collaborating with video game companies to assess the impact of video games in a different way, more consistency within the research area, the continued inclusion of competition within studies, further evaluation of the long-term effects of competition and violence, and further development of the ECS.
Collaborating with video game companies.

It has already been discussed that the video game company Riot Games analysed data within their game League of Legends™ to reduce levels of aggression (toxic behaviour) (Lin, 2015; Maher, 2016). A potential reason why they conducted this research was for commercial purposes, with new players being less likely to play again if they were abused by other players in the game (Shores, 2014). In addition, the amount of time spent playing the game during one session was reduced when players participated in a toxic gaming environment. Therefore, Riot Games created a tribunal system and pre-game messages to reduce the amount of toxic behaviour so new players would be more likely to continue, and so that all players would play for longer (Lin, 2015; Maher, 2016). These types of findings provide a unique opportunity for psychologists to investigate the impact of real games in real gaming environments, while also benefiting the gaming company financially.

Collaboration with video game companies is important because these companies may be averse to research done by academic psychologists who are outside the video game industry. For example, video game companies that produce violent games may try to contest findings that suggest that violent video games increase aggression as it may reduce the sales of their games or increase legislative restrictions. This could lead to video game companies using financial means to manipulate research so that violent video games do not demonstrate a relationship with aggression, although this is only speculative. Therefore, researchers could work with video game companies to provide important academic knowledge, while helping the video game company themselves. However, it must be noted that caution must be taken when video game companies are funding research due to their vested interest in the outcome of the studies.
Consistency within the research.

Elson et al. (2014) and Ferguson et al. (2008b) have argued that consistency is needed when using the TCRIT, but consistency is also needed in the research area as a whole. For example, Greitemeyer and Mugge (2014) found that one group of researchers find null results in relation violent video games, while the majority of others find significant results. These differences suggest there may be biases involved, although it could also be due to differences in methodologies, games used, and the research questions posed. While employing different techniques and styles can increase the scientific robustness in an area of research, it can also add quite a lot of variability in results, which can make it difficult to conclude whether violent video games actually increase aggression. Consistency may also help explain why some researchers find significant results while others do not.

An example of poor consistency is the use of different games or modifications in each study. Using different sets of games in each study does provide scientific robustness and does help generalise results, but when there are inconsistencies in findings there needs to be consistency in the games used. If researchers used the same modified version of a game with the same procedures, then there may be less room for errors/biases. The modification of the Team Fortress 2™ by Kneer et al. (2016), which implemented the “rainbowblower” for the non-violent condition, appears to be the best design conceptually. While it was not used in this study due to Kneer et al. (2016) being published after Study 2 began, future researchers may want to consider using this design. If other researchers find similar results to Kneer et al. (2016), that violence within video games does not increase aggression, then it would suggest that using this design produces conflicting results to the majority of previous studies. This would further discussions about how video games effect aggression as findings and methods used at the moment appear to be so inconsistent that no progress is being made in terms of coming to a consensus.
Inclusion of competition in violent video game research.

The most important aspect that needs to be consistently included in future aggression and video game research, either as an independent variable or at least controlled for, is competition. As has been discussed and demonstrated by this dissertation, and by Adachi and Willoughby (2011a, 2013, 2016), competition within video games is related to increased aggression. Additionally, based on the evidence so far, competition moderates the effect of violence, potentially to the point that violence does not have a significant effect on aggression. Therefore, previous research has been confounded by differences in competitiveness between the games used in experimental studies or the games reported by participants in cross-sectional and longitudinal studies. However, as the research into the effect of competitive video games is very limited, especially when looking at the interaction between competition and violence, more studies are needed to support the findings from this study. Therefore, it is advised that future studies attempt to control or test for competition in their study design, preferable by manipulating the violence and competition within the same game to reduce the impact of other confounding variables.

An issue with assessing competition and violence in one experimental study is how to manipulate both variables within one video game. Study 2 attempted to do this and while there was a significant effect between level of competition and aggression, participants did not rate the level of competitiveness as being any different. It has already been discussed that a racing game could be used to further accentuate differences in competitiveness, but it may be difficult to include a manipulation of violence into the game as well. For example, it has been argued that being able to destroy other vehicles (violent condition) adds another competitive element to the game, as participants will hit other vehicles in an attempt to slow them down and stop them from winning (Adachi & Willoughby, 2011b). In addition, if
competitiveness needed to be manipulated it makes it difficult for violence to still be included. Therefore, a different approach to manipulating competition and violence is needed.

Instead of competing within the video game, e.g. trying to kill an opponent before they are killed, participants could compete by trying to the complete a task within the game at the same time as an opponent. An example of how this could be done is by having a training drill of a first-person shooting game where the targets can either be inanimate objects or virtual humans. Therefore, when the participants play the game they are either shooting objects (possibly with a non-violent projectile device), or humans which will die while having blood and gore displayed. Competition could be varied by either having the participants complete the task as fast as they can (or just in their own time), or faster than an opponent. For the competitive condition, another player would be in the “training drill” actively trying to hit more targets than the participant (actively blocking the participant to cause more frustration and thus aggression [Berkowitz, 1989]). A scoreboard would then be displayed so the participant can track how their opponent is progressing (score feedback [e.g., McClintock & McNeel, 1966]). A trained confederate could be the opponent to manipulate the level of difficulty and make sure that the participant feels that the competition is close (time pressure [e.g., Maule et al., 2000]). In addition, the participant could be told they are competing against a computer or human to assess the impact of multiplayer gameplay. Furthermore, the effect of winning and losing could be assessed, as well as the impact of social interaction between players if it was a multiplayer game.

A potential issue is that there is most likely no game currently available that fits the criteria of the study design described. However, this does not mean it cannot be created easily. Elson and Quandt (2014) suggest a variety of tools that can be used to create a modified version of a game, such as *Garry’s Mod™* (Facepunch Studios, 2006) and *Source SDK™* (Valve, 2004). As these tools are relatively easy to learn, researchers could create the
game to fit their research design. However, they could also collaborate with game designers, or even game design students at universities. Using these modification tools would provide researchers with the ability to have games that completely match their research design, such as the one mentioned above.

*Long-term effects.*

The long-term effects of competition and violence need to be explored further in future research. Study 1A found that exposure to and preference for competitive video games in high school was significantly correlated to post high school trait aggression. However, as trait aggression was not measured in high school the causality of that relationship cannot be determined. Adachi and Willoughby (2013, 2016) appear to be the only studies assessing the long-term effects of competition but they did not take into consideration all video games played by participants. There have been multiple studies assessing the long-term effects of violence within video games (Anderson et al., 2010; Greitemeyer & Mugge, 2014) but they have not controlled for competition. Therefore, future research assessing the long-term effects of both competitive and violent video game exposure on aggression is needed.

From a theoretical perspective, future research may find that competition within video games has a stronger short term effect than violence, but violence may have a strong long-term effect. Competition influences affect (Berkowitz, 1989) and these feelings may have a quick effect on aggressive behaviour. On the other hand, the impact of violence may take multiple sessions of exposure as the priming effects would slowly result in connections between video games and aggression becoming stronger, causing more automatic aggressive knowledge structures, beliefs, attitudes, schemas, and scripts, resulting in long-term effects on aggressive behaviour (Anderson & Bushman, 2002).
Further development of the ECS.

Future research should consider using the ECS to confirm that video games are equal on levels of competition, although further development the scale is needed. Firstly, there needs to be further discussion within the research community (Delphi panel) as to what other factors influence the competitiveness of a video game. These additional variables can then be manipulated within one video game to assess whether they influence participants’ ratings of competition. Further evaluation using the aforementioned method is needed for the aspects already in the ECS as well to confirm that they do influence competition. It is important to note that participants should play each version of the game and assess its competitiveness so they have a “point of reference” (Elson & Quandt, 2014). Depending on how strongly each variable influences competition, certain factors of the ECS could be weighted to provide a more accurate measure of competition. For example, scoreboards may have a stronger influence over the competitiveness of a video game compared to team gameplay and thus should be weighted accordingly.

Future research should also assess whether certain factors of the ECS influence aggression. Study 2 demonstrated that a combination of a scoreboard and time pressure increases aggressive affect, but the other factors have yet to be assessed in video game research. This future research could be used to inform official rating boards (e.g., ESRB) as to what specific aspects of competition within video games they should be aware of.

7.8 Implications

As discussed, the results from this dissertation have implications for the direction of future research in this area, but there are also implications for society. This section will firstly discuss the possibility of competitive and multiplayer aspects being considered in official video game ratings. Secondly, the role of parents and education in reducing the negative impact of competitive video games and competition within society generally will be
discussed. Lastly, it is argued that violence within video games should not be ignored despite the null findings in this dissertation.

Based on the findings of this dissertation it is clear that concerns people have about the impact of video games on aggression should not be confined to just the violence within them. Competition should also be considered. This could have ramifications for video game rating systems, as competition is currently not part of this process. Therefore, some video games may be available to children that are highly competitive but not violent, e.g. \textit{FIFA}^{(TM)} which is rated G in Australia. With competition affecting aggression, as found in this dissertation, then information about the negative effects of competitive gaming should be available. Study 1B demonstrated several factors of competition that should be considered by the rating boards. Indeed, the ECS developed during Study 1B could be used to help rating boards, such as the ESRB, to identify whether a video game, by its base design, is competitive or not. The only issue with this is that video games often involve competitive and low-competitive modes, which may make it difficult for the rating boards to give an overall rating. However, this does not stop the rating boards from providing some information about the competitiveness of the video game.

In addition to providing information about competitiveness, there should be information about how online games may involve toxic behaviour between human players. At the present moment, the ESRB warns that “Online interactions [are] not rated by the ESRB” (as seen on the ESEB website). This does not provide any information to parents about what can be expected in online gameplay. Parents should be warned about the aggressive social contexts that their children may be involved in. These types of warnings could enable parents to decide whether they want their child to play only the single-player version of the game, or whether the online multiplayer environment is acceptable.
However, as with all warning and rating systems, ultimately it is up to the parent to decide whether their child can play the video game. As both competition and violence appear to have such a low effect size, the potential risk of playing the game may be acceptable when weighed against the positives. For example, there is evidence suggesting that video games have a positive effect on visual spatial cognition, problem-solving, and creativity (see Granic, Lobel, & Engels, 2014 for a review). In addition, competition is one of the main reasons why people are entertained by video games (Greenberg et al., 2010; Olson et al., 2007). People often participate in activities that are entertaining but provide an element of risk or harm. One relevant example is children playing sports games where there is the possibility of them getting injured. Competitive video games are fun, and beyond the potential positive effects, it provides a form of entertainment. Society needs to decide whether this form of entertainment, which is utilized by millions of people, needs to be further regulated or even banned to stop the very small impact that competitive video games have on aggression. Nevertheless, it does not mean that small steps cannot be taken to mitigate the negative effects of competitive video games.

It is likely that the most effective way to reduce the impact of competitive video games on aggression is education. This is not just applicable to video games but also to competition within life as a whole. Parents should be encouraged to model and discuss how to behave appropriately and non-aggressively in a competitive situation (see Bandura, 1977 for review on modelling behaviour). Indeed, it has been shown in a sporting environment that positive behaviour displayed by spectators and coaches increases the positive behaviour of children during a game (Arthur-Banning, Wells, Baker, & Hegreness, 2009). The issue with competitive video game play is that children are often not supervised by adults. For example, Olson et al. (2007) found that 79.5% of boys and 77.8% of girls played with a parent rarely or never. Therefore, this lack of parental involvement may lead to the children acting
aggressively when they become frustrated by a competitive game as they do not know any other way to deal with that emotion. Online multiplayer games may be even more dangerous as children are potentially taught inappropriate or aggressive behaviour from other players. While coaches or parents are educating about good behaviour at competitive sporting events, this level of education may be diminished for competitive video game play. Therefore, it is important for parents to be involved in their child’s video gameplay, as parental involvement has been demonstrated in violent video game research to help reduce aggression (e.g., Anderson, Gentile, & Buckley, 2007, as cited in Anderson et al., 2010).

Minimising the impact of competitive video games on aggression can be generalised to the wider society. Competition is rife within society and if competition within a video game can impact aggression, then competition outside the virtual world will most likely have an effect on aggression as well. Deutsch (e.g., 1973, 1993) produced several papers arguing for a more peaceful world where competition was replaced by cooperation, so the idea of reducing competition within society to reduce aggression is not a new one. Therefore, if action is taken to reduce or regulate competition within video games, there should also be discussions about how to reduce competition within other facets of life. However, video games could be used as a tool to reduce the negative effects of competition outside of video games. Much like the promotion of sportsmanlike behaviour in sport, competitive video games could be used to teach children how to deal with competition appropriately. As suggested previously, parents have a big role in this, although gaming companies could also play a part, such as reducing toxic behaviour in online multiplayer games. If game companies encourage sportsmanlike behaviour in video games they will not only educate people on how to behave appropriately in a competitive environment, they will also have more people playing their games. Competitive video games could reduce aggression in the long term, rather than increasing it. However, there appears to be no research assessing this. Therefore,
future studies could create a study where a child plays a competitive video game and is then encouraged in some way to act in an appropriate, non-aggressive, manner. It would be very interesting to see if this education could actually reduce the amount of aggressive behaviour displayed during a later competitive event that is not part of a video game.

Some may argue that a potential implication of this dissertation is that, due to the null effects related to violence within video games, perhaps violence should not be a factor of video game ratings, but this is highly illogical, unethical, and politically unpalatable. To be clear, the majority of studies in this area find that violence within video games does have an impact on aggression (Anderson et al., 2010; Greitemeyer & Mugge, 2014). In addition, there is strong theoretical evidence to support that violence within video games will increase aggression (e.g., GAM), while theories that would suggest that violence would not have an effect have been widely disproven (catharsis model), or have not been assessed in enough depth (catalyst model). The null findings from this dissertation, regardless of the level of control over competition, does not provide enough evidence to disregard all previous studies. In fact, studies that have controlled for competition, either through participants’ ratings or by using the same game, have been inconsistent when it comes to the effect of violence within the video game. However, what this study does highlight is that more research is needed to assess the effect of violence and competition within video games and how they interact both empirically and theoretically.

7.9 Summary and Conclusions

In summary, competition within video games had a significant positive correlation with trait aggression and was shown to have a causal effect on aggressive affect, primarily through aggravation/frustration, supporting previous research and the frustration-aggression hypothesis. Losing in a competitive video game increased the level of participants’ aggressive affect further, again primarily through an increase in aggravation/frustration. In
addition, frequency of competitive events, scoreboard, leader board, team gameplay, and time pressure were found to be predictors of competition within a video game suggesting that they would increase aggression through an increase in competition. Indeed, having a scoreboard and time pressure present within a video game increased participants’ aggressive affect. Multiplayer video games were also related to trait aggression, and this is probably due to the fact that multiplayer games are more competitive. Competition, losing, or violence within a video game were not found to effect aggressive behaviour or arousal but this is most likely due to the limitations of the measures and procedures used. While violence did significantly impact “lack of positive feelings” and thus empathy, it was not related to trait aggression and did not impact aggressive affect overall. This is most likely due to the fact that competition was adequately controlled for in this dissertation meaning that previous studies have been confounded to some degree as violent video games were found to generally be more competitive. It is expected that the null findings for violence also explain why no interaction between competition and violence within video games on aggression was found. The null findings on violence within video games contradict the majority of previous research and the GAM. However, it does support the majority of previous studies that have successfully controlled for competition by using the same game across conditions. This demonstrates that the impact of violence within video games on aggression is still unclear. Therefore, further research assessing violence in video games, while controlling for competition, is needed. This will provide further clarity as to whether violence within video games influences aggression, or whether it is just the competitiveness of the games.

In conclusion, violence within video games should not be the only concern when it comes to the effect of video games on aggression. As visually presented by the model in this dissertation, competition and losing in a competitive game must be considered. As such, rating boards (e.g., ESRB) should include information about the competitiveness of a video
game using the ECS developed in Study 1B. Parents could use this warning and be made aware that supervising their children while they play the competitive video game is recommended. Education of children on how to deal appropriately with the frustration of competing and losing a video game may reduce future aggressive behaviour.
References


Bushman, B. J., & Gibson, B. (2011). Violent video games cause an increase in aggression long after the game has been turned off. *Social Psychological and Personality Science, 2*(1), 29-32. doi: 10.1177/1948550610379506


Engelhardt, C. R., Bartholow, B. D., Kerr, G. T., & Bushman, B. J. (2011a). This is your brain on violent video games: Neural desensitization to violence predicts increased aggression following violent video game exposure. Journal of Experimental Social Psychology, 47, 1033-1036. doi:10.1016/j.jesp.2011.03.027


video game play motivations. *Computers in Human Behavior, 49*, 354-361. doi: 10.1016/j.chb.2015.03.018


