

Long Versus Short Violent Videogame Play: Do Players Habituate?

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## Abstract

Numerous studies have found evidence that after playing violent videogames for 20 minutes, people experience short term increases in aggression, hostility, and anger. The current study used 62 males and 36 females from different backgrounds, aged 18-31 years, to investigate whether or not players habituate during longer, more realistic lengths of play. Participants were randomly assigned to play the first-person-shooter (FPS) game *Quake III* for either 20 or 60 minutes. State anger was measured pre-game and post-game using the State-Trait Anger Expression Inventory (STAXI). Participants in the long condition showed a smaller change in state anger (CSA) from pre-game to post-game than those in the short condition. This difference was however, not statistically significant. Results suggest that at some point between 20 and 60 minutes, players' affective response begins to attenuate. Gaming habits were also investigated and it was found that on average gamers play for 106 minutes in one sitting. In addition, desensitization effects were investigated. Results supported the hypotheses that females would show a significantly larger CSA than males and that participants unexposed to violent videogames would show a significantly larger CSA than exposed participants. The current research suggests 106 minutes of game-play in future research will provide more representative results of the 'real world', in turn, helping future researchers predict the types of people who may be negatively affected by violent videogames in both the short-term and long-term.

## Declaration of Authorship

I declare that this report does not incorporate without acknowledgement and material previously submitted for a degree in any University, College of Advanced Education, or other educational institution, and that to the best of my knowledge and belief does not contain any material previously published or written by another person except where due reference is made in the text.

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

12 September 2006

## Acronym List

IMP	– Immersive Media Prediction Model
SLT	– Social Learning Theory
GAM	– General Aggression Model
CSA	– Change in State Anger
VVE	– Videogame Violence Exposure
OFLC	– Office of Film and Literature Classification
EPQ	– Eysenck Personality Questionnaire
STAXI	– State-Trait Anger Expression Inventory
STAI	– State-Trait Anxiety Inventory

## Introduction

### *Importance of the Current Research*

In recent years experimental, correlational and descriptive studies have investigated the effects of violent videogames on people's aggression, hostility and anger, and whether or not these effects pose a threat to society. Much of the research has been conducted in America (e.g. Anderson & Dill, 2000; Bartholow, Sestir & Davis, 2005; Deselms & Altman, 2003; Fulgham, 2003; Knapp, 2002, Sheese & Purdue , 2005). Many researchers have introduced articles with anecdotes of high school mass murders linked to the use of violent videogames. (e.g. Anderson & Murphy, 2004; Bushman & Anderson, 2002; Krahe & Moller, 2003; Muir, 2004; Olson, 2004). Based on their findings, researchers have claimed gamers become more aggressive after playing a violent videogame (e.g. Anderson & Dill, 2000). When authors make such claims, their research must represent gaming outside the laboratory. The most notable shortcoming of the experimental research, has involved participants playing for periods unrepresentative of what gamers play in the 'real world'. This is particularly important because, if results vary with length of play, conclusions drawn from previous research may be inaccurate. This is the third experimental study from Australia to investigate the effects of violent videogames and is the first to investigate short versus long game-play. As such, results will provide a new framework for future experimental investigators to conduct research that is more representative of the 'real world'.

### *Overview*

In the short-term, violent videogames can increase laboratory measures of aggression, however these changes do not necessarily equate to a threat to society



(Unsworth, 2004). Regardless, the most published researcher in the field, Craig Anderson, claims that the debate is “essentially over” (Anderson et al., 2003, p.81) due to the findings of several studies that suggest violent videogames ‘make’ people aggressive (Anderson & Bushman, 2001; Anderson & Dill, 2000; Anderson & Murphy, 2003; Bushman & Anderson, 2002).

As initially suggested by Sherry (2001), length of game-play in laboratory settings needs to be explored in order to validate or seriously question past research. On average, experimenters have participants play violent videogames for approximately 20 minutes, which can be seen as enough time for the participants to become sufficiently immersed in the game. Yet it is questionable that people play violent videogames until they are sufficiently immersed and then walk away. As there is no available data to suggest for how long the average gaming session lasts, it is important for different lengths of play (long versus short) be investigated, in addition to establishing how long gamers do play for.

An additional shortcoming of past research has been the analysis of general group trends only. Consequently, if research is to be effective in its purpose, it must address the issue of individual difference and establish which individuals are likely to show an increase in aggression and what variables might be at play in ‘at-risk’ groups, as most people in the short-term, are not affected by violent videogames (Unsworth, 2004).

This *Introduction* will provide insight into exactly what a violent videogame is, why they are so popular, and how they affect the people who play them. Explanations of theoretical models relevant to violent videogame research will be explored. Finally, a

review is provided of the relevant literature and the moderating and mediating variables that led to the formulation of the aims and hypotheses of the current research.

### *The Explosion of Violent Videogames*

In the current paper, the term 'videogame' encompasses computer games, console games and hand-held games. Globally, videogames are a \$40 billion a year industry (Hill, 2006) and have surpassed the motion picture industry in sales (Williams, 2002). In Australia, software sales alone netted \$535 million dollars in 2004 (Keene, 2005).

Videogame graphics have improved exponentially, resulting in more realistic and captivating game-play. The interactive nature of games requires more involvement by a player than a movie does of a viewer. Violent videogames also appeal to a wider age-range than traditionally thought. Interestingly, of 542 self-selected volunteers from the online game *Everquest*, 84% of Griffiths, Davies and Chappell's (2004) sample were adults, with a mean age of 30 years.

Games have also been made more accessible with the introduction of hand held games, enabling them to be played anywhere and at any time. Most publicity regarding violent videogames has been negative, however studies have also shown increased mental-rotation abilities/spatial abilities (Quaiser-Pohl, Geiser, & Lehmann, 2006), increased positive socio-emotional communication in team games, regardless of the games violent content (Pena & Hancock, 2006), and even links between game performance and novice surgeons' hand-eye coordination (Rosenberg, Landsittel, & Averch, 2005).

### *What is a Violent Videogame?*

Definitions of violence are generally agreed upon in the literature, for example ‘marked by or using great physical force’ from the Collins English Dictionary (1981). This definition is used in the current study (see Appendix A). There is, however, little agreement as to which games are considered violent. Muir (2004) states “around a quarter” (p.26) of all videogames released in America contain ‘some’ violence. Smith, Lachlan and Tamborini (2003) report 68% of the 50 most popular games contain violence, while Anderson and colleagues (2004) reference a study claiming 89% of games contain “some violent content” (p.101).

Early research may have been confounded by poor computer graphics and abstract concepts of violence. Sherry’s (2001) meta-analysis found newer studies reported greater effect sizes of violent videogames on aggression. Although there may be discrepancies in whether or not some games contain ‘violence’, there is little doubt that games used in recent research, such as various versions of *Doom* (Sheese & Granziano, 2005), *Quake II* (Unsworth, Devilly & Ward, In Press), *Mortal Kombat II* (Deselms & Altman, 2003), *Wolfenstein 3D* (Anderson & Dill, 2000), and *Carmageddon II* (Carnagey & Anderson, 2005), are ‘violent’.

### *Anger, Hostility, and Aggression*

Much of previous research has been confounded by varying definitions of dependent measures. It has been noted that researchers investigating anger often differentiate unsuccessfully between *hostility*, *anger* and *aggression* and often use them interchangeably (Spielberger, 1991). *Aggression* has been described as “behaviour intended to harm another individual who is motivated to avoid that harm” (Anderson &

Bushman, 2001, p.354) and has been measured through affect, cognitions, and behaviour (Carnagey & Anderson, 2005). Buss's (1961) definition of *hostility* describes the construct as an attitude that involves the dislike and negative evaluation of others and this definition is currently used in the literature (e.g. Eckhardt, Norlander, & Deffenbacher, 2004).

The current study will use Spielberger's (1991) definition of *anger* as being "an emotional state that comprises feelings that vary in intensity from mild annoyance or aggravation to fury or rage, and are accompanied by arousal of the autonomic nervous system" (p.6). Spielberger suggests that "...anger is a necessary, but not a sufficient, condition for the development of hostile attitudes and the manifestation of aggressive behaviour" (p.6). Buss and Perry (1992) constructed The Aggression Questionnaire and noted that anger was the bridge between both physical and verbal aggression and hostility. Although we can differentiate between aggression, anger and hostility and they can occur interdependently, they are all intrinsically linked (Spielberger, 1991).

### *Violent Videogame Effects*

Research into the effects of violent videogames intensified when it was found that several perpetrators of high school shooting in America were players of violent videogames (e.g. Eric Harris and Dylan Klebold, perpetrators of the Columbine High School massacre, 1999). While Grossman (2005) has suggested violent videogames train kids to kill, there is little evidence to suggest violent videogames *cause* people to start fights or randomly kill their peers. Research has, however, shown an overall increase in various laboratory measures of aggression (e.g. Anderson & Dill, 2000), hostility (Arriaga, Esteves, Carneiro, & Monteiro, 2006), and anger (e.g Unsworth, 2004), as well

as changes in attitudes towards violence, desensitisation (Knapp, 2001), physiological arousal of the brain (Weber, Ritterfeld, & Mathiak, 2006) and cardiovascular arousal (Panee & Ballard, 2002).

In 1999 the US House of Representatives ordered the US Department of Education to study rampage shootings in schools. The result was ‘Rampage: The social roots of school shootings’ (2004). Violent media receives barely a mention in the 400 page report. Two of the three young murderers the book is written about did not even own videogames. Rather, the book addresses the greater social issues of cliques and bullying in school and family structure and upbringing. While it is true that violent videogame research needs to establish who is at risk of being subject to potential deleterious effects of violent video games and why these effects occur, research to date has only analysed ‘general group trends’ and as a consequence ‘at-risk’ gamers are not able to be identified. Being able to predict at-risk gamers involves extensive theoretical consideration however, only one theoretical model, the Immersive Media Prediction model (IMP), has begun to consider individual differences in the effects of playing violent video games (Unsworth et al., In Press).

### *Theoretical Models in Violent Videogame Research*

#### *General Theories*

While each of the following theories regarding behaviour, cognitions and affect, have their own basis, they are not mutually exclusive.

*Social learning theory.* Bandura’s (1986) Social Learning Theory (SLT) is prevalent throughout the violent videogame literature and suggests that people acquire aggressive behaviour via direct experience or observing others. Behaviour that is

observed and understood is transformed into imitative response patterns and given the right circumstances are reproduced. Thus, increased violence-viewing promotes greater usage of violence even without direct experience.

*The Cognitive Neoassociational Model.* The Cognitive Neoassociational Model (Berkowitz, 1984) proposes that events such as frustration, provocation, and loud noises produce negative affect. According to this theory, playing a violent videogame should create or reactivate aggressive thoughts, feelings, memories, beliefs (Kirsh, 2003) and associated physiological change (Berkowitz, 1990).

*Script Theory.* Script Theory (Berkowitz, 1988) suggests behaviour is guided by scripts (facts, knowledge or beliefs about a topic), otherwise known as ‘knowledge structures’ or ‘schemas’. Script Theory is relevant to both the short-term and long-term effects violent videogames may have on aggression. It is theorised that short-term exposure promotes aggressive beliefs and aggressive schemas/scripts, in turn making them more accessible, as well as desensitising the individual to the violence (Kirsh, 2003). The theory suggests long-term exposure to violent videogames would lead to the strengthening of aggressive scripts and increased likelihood they would be used during problem solving in social situations.

*Arousal theories.* Arousal theories suggest that feelings or actions are amplified when the body is aroused. Anderson and Bushman (2001) suggest that viewing violent media may result in aggression because of increased arousal. Supporting this contention, Zillmann’s (1971) excitation transfer theory states that heightened arousal after an initial stimulus, does not fade immediately after the removal the stimulus and consequently

attribution of arousal is non-specific. This increases the possibility of amplified responses to secondary stimuli after violent videogame exposure.

*Catharsis and mood management.* First proposed by Aristotle and later popularised by Freud (Wegman, 1985) catharsis explains how future aggressive impulses can be reduced by watching, playing out or reading about anger or aggression (Anderson, Carnagey, & Eubanks, 2003) in turn improving one's psychological state (Bushman, Baumeister, & Phillips, 2001). Some people use violent videogames as an outlet for built up aggression or stress (Unsworth et al., In Press). As such, it is possible that violent videogames may actually serve a positive, cathartic function. Similarly, mood management refers to the assumption that, by adapting their environment, people are motivated to reduce negative stimuli and increase positive experiential states (Zillmann, 1988). Therefore, people experiencing positive affect after playing violent videogames may choose to play them when they wish to alleviate negative affect.

#### *Theoretical Models Derived from Violent Videogame Research*

##### *General (Affective) Aggression Model*

By integrating cognitive processing models with SLT, script theory and arousal theory, Anderson and colleagues (Anderson & Bushman, 2001; Anderson & Dill, 2000; Carnagey & Anderson, 2004) have developed the general aggression model (GAM) in an attempt to explain both the short-term and long-term effects of violent videogames on aggression. With reference to short-term effects, the GAM "...describes a multistage process by which personological (e.g., aggressive personality) and situational (e.g., videogame play provocation) input variables lead to aggressive behaviour" (Anderson & Dill, 2000, p.773). As shown in Figure 1, in the short-term model, both 'person' and

‘situation’ factors affect an internal state and the outcome can be thoughtful action or impulsive action depending on ‘scripts’ activated. If aggressive scripts are activated during exposure to violent videogames then it is expected that the individual will behave more aggressively in the short-term.

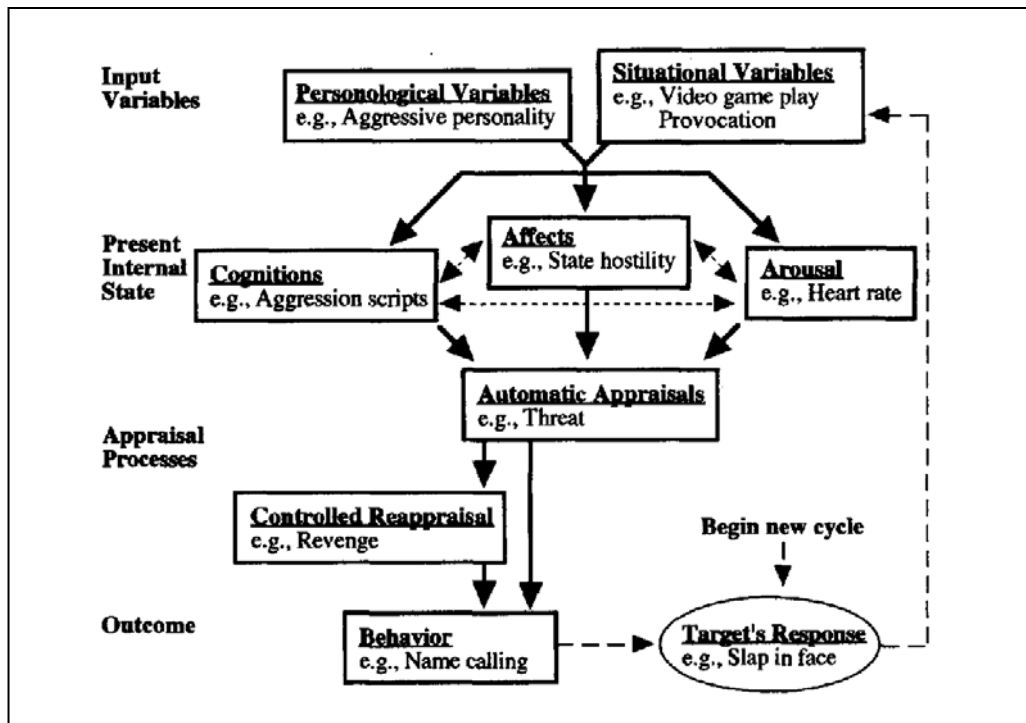


Figure 1. General Aggression Model for short-term effects of violent videogames (Source: Anderson and Dill, 2000).

The GAM also provides an explanation for the theorised long-term effects violent videogames may have on aggression. The theory refers to knowledge structures that become strengthened and reinforced in response to repeated exposure to aggressive scripts, which in turn makes the structures ‘chronically’ accessible. These knowledge structures include a hostile attribution bias, aggressive beliefs and attitudes, ‘aggressive expectation’ schemata, and aggressive behavioural scripts (Anderson & Bushman, 2002).



Under this model, long-term exposure can cause players to be more aggressive in outlook and propensity (Anderson & Dill, 2000).

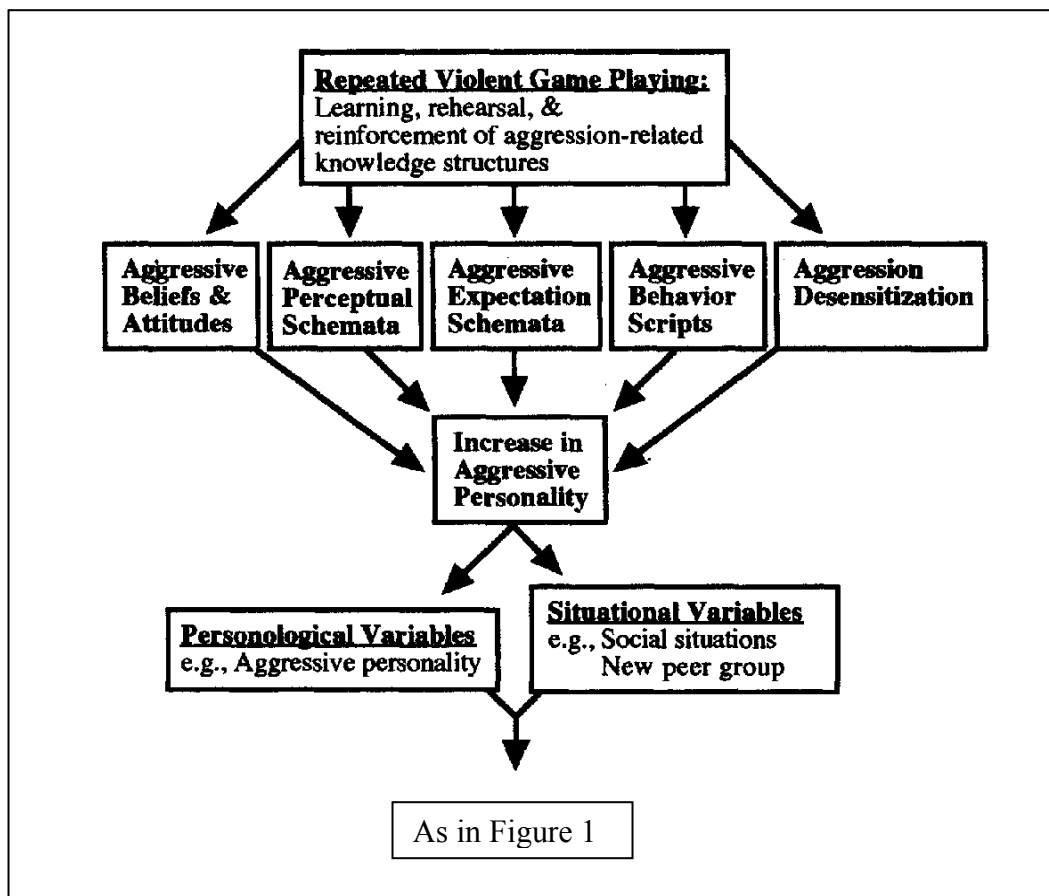


Figure 2. Long-term effects of violent videogames according to the General Aggression Model (Source: Anderson and Dill, 2000).

The GAM is extensive and highly referenced in the violent videogame literature, yet it focuses purely on the negative aspects of gaming and fails to recognise the positive influences games have, both during and outside the game. For example, some gamers play because they enjoy the socialisation (Griffiths et al., 2004) and others play specifically for cathartic purposes and to escape reality (Unsworth et al., 2004). Additionally, gamers may choose to play to alleviate built up aggression. Everything we

do influences the way we think and feel about everything else. The GAM fails to portray a regular gamer, but rather, represents the gamer who only sleeps and plays violent videogames, consequently overlooking the various positive influences of violent videogames. The most crucial flaw, however, is that the GAM describes the short-term effects as situational (i.e. after a gamer has finished playing a game), yet the use of 20 minutes as a representative period of time is without justification. As there is no available data that states for how long gamers play in one sitting, the GAM cannot be considered representative of short-term change outside the laboratory.

#### *Immersive Media Prediction Model*

Zillmann, Weaver and James (1997) urged the consideration of individual-difference variables in subsequent examinations of the effects of media violence. In addition, Reichardt (2003) noted the need for a convergence of views in the violent videogame debate. Unsworth et al. (In Press) addressed this issue and were able to account for individual differences with regard to change in state anger (CSA). Cluster analysis was used to assess the prediction that, after playing a violent videogame, adolescents naturally fell into one of three hypothesised groups; (i) Increase (ii) Decrease and (iii) No Change in State Anger. Results supported this hypothesis. Anderson (2002) suggested that results of some studies showing no change in affect may be due to imprecise measuring instruments. In contrast, using the Reliable Change Index (RCI; Jacobson, & Truax, 1991), Unsworth et al. were able to classify participants based on a reliable change in state anger, as opposed to change due to measurement error.

Unsworth et al. (In Press) showed the direction of change of the player's mood was to some extent mediated by the player's feelings prior to playing the game. This

coupled with an aggressive temperament (as measured by high scores on Psychoticism, Neuroticism, Trait Anxiety, Trait Anger, Anger Expression, and Aggressive Cognitions) predicted short-term CSA with an average 73% concordance rate. Discriminant function analysis revealed that the above six predictor variables had loadings in excess of .33 on one function, which separated players whose State Anger increased from those whose did not change. The other discriminant function suggested State Anger pre-game-play best distinguished between the Decrease group and the other two groups, whereby high pre-game anger levels correlated with a decrease in anger at post-game.

These results produced the IMP and showed that an aggressive temperament predicted short-term change in state-anger after playing a violent videogame and that the direction of change was dependent on the player's affect immediately prior to playing the game. As shown in Figure 3, for those recording high levels of anger pre-game-play (termed the '*Manager*'), playing a violent videogame in the short-term, had a cathartic effect on anger post-game-play. Conversely, if the player was not angry pre-game-play they are classified as a '*Hood*' and experienced an increase in angry affect at post-game-play. The *Player* did not have an aggressive temperament and experienced less aggressive cognitions during play and predictably showed no change in state anger at post-game.

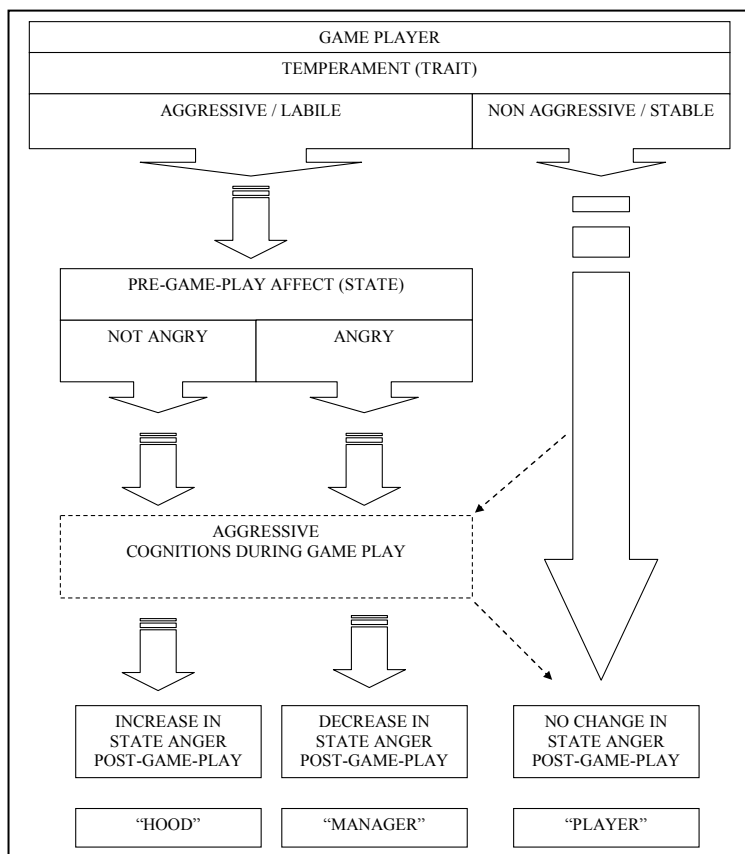


Figure 3. Immersive Media Prediction Model. Adapted from Unsworth et al. (In Press).

While Funk et al. (2004) argue that violent videogames do not assist in decreasing aggression, the IMP suggests that for some individuals, playing violent videogames has a positive, cathartic effect. Although many researchers have made links between high school mass murders and violent videogames, they have neglected to investigate the possibility of positive effects of violent videogames that may prevent such atrocities occurring. Although such factors are difficult to measure, the positive effects of violent videogames should be acknowledged.

#### *Review of the Effects of Violent Videogames*

As shown by Bensley and Van Eenwyk (2001), results of the effects of violent videogames are most conclusive for young children, while research on middle and high

schoolers and young adults are inconclusive. When the literature is reviewed, a similar pattern to the IMP emerges. That is, some studies show an increase in measures of aggression, many show no-change and some have shown a decrease. The following section will outline the remaining research that has contributed to the development of the aims and hypotheses for the current research.

### *Physiological Arousal*

It has been proposed that physiological arousal, affect and cognitions are interconnected, creating an internal state, in which activation of one state tends to activate the other two (Anderson & Dill, 2000). A recent study (Baldaro et al., 2004) found significant differences in systolic blood pressure at three time points; pre-game, during and post-game in a violent videogame condition but not in a non-violent condition. Although there was a significant increase in blood pressure during the violent condition, of note in this study was that researchers found a "...rapid return to pre-game values once the game was over" (p.207). Contrary to the arousal theory and the GAM, which suggest residual arousal after game-play may cause people to act more aggressively, these results suggest that residual arousal is very short-lived. The researchers however, failed to specify the amount of time it took for blood pressure to return to basal levels, a figure that could be highly useful in establishing the potential effect of residual arousal. Another short-coming was that Baldaro et al., (2006) did not control for immersion, enjoyment, or adverse effects such as nausea or dizziness that may have influenced participants' physiological measurements.

*Desensitisation and Prosocial Behaviour*

It has been argued that when desensitisation occurs, actions may be taken without consideration of their moral implications (Funk, Baldacci, Pasold, & Baumgardner, 2004). Desensitisation occurs when cognitive (reduced neurological activity in response to violence), emotional (reduced sympathy for victims and lenient punishment of perpetrators), and eventually, behavioural responses (e.g. point at which an individual intervenes in a fight) to stimuli are attenuated. Anderson and Dill (2000) found that, after playing violent videogames, women were more likely to behave aggressively, providing the assumptive rationale that reduced familiarity with violent videogames causes a larger effect.

Deselms and Altman (2003) have investigated desensitisation after playing a violent (*Mortal Kombat II*) or a non-violent videogame (*NBA Jam*). They found that males were desensitised after playing a violent videogame while females were conversely, sensitised to the violence as shown in assigning harsher hypothetical prison sentences to violent criminals portrayed in vignettes. However, the researchers noted that females may have perceived higher levels of violence in the *NBA Jam* condition, given their unfamiliarity with it. Similarly, Knapp (2002) had subjects play violent and non-violent videogames and subsequently had them press an intercom button that allowed an adult to intervene in a confrontation between two young males. Their results showed participants in the violent condition pressed the button, on average, significantly later (18 seconds) than individuals in the non-violent condition. He concluded that this may serve as a disinhibitory function that may, in turn, propagate an elevated potential for real life violence.

Bartholow, Sestir, and Davis (2005) showed that individuals low on 'videogame violence exposure' (VVE = violence rating of favourite games multiplied by frequency of play) behaved more aggressively after playing a violent videogame than a non-violent videogame. Likewise, Bartholow, Bushman and Sestir (2005) used an EEG to analyse P300 event-related brain potentials, which have typically been associated with the processing of stimuli that "...are evaluatively inconsistent with a preceding context" (p.1575). It was hypothesised that for individuals high on VVE, when faced with a series of neutral images followed by a violent image, the response elicited would be smaller than that for individuals low on VVE. As expected, results found desensitisation by a P300 amplitude decreased as a function of VVE, showing reduced brain activity in a system associated with aversive motivation. However, the studies showing desensitisation do not purport that violent videogames cause people to aggress but rather that there is a numbing of reactions to violent stimuli. While desensitisation-related research has presented some strong arguments, the direct effects on aggression, hostility and affect are not as compelling.

#### *Varying Effects of Violent Videogames*

*Increase effects.* Bartholow et al. (2005) found that participants with high VVE (and low on P300 ERPs) showed more aggressive behaviour (in the form of blasting variable levels of computerised white-noise at an opponent) in a competitive task. The researchers failed however, to acknowledge that the gaming experience of the 'high VVE' participants may make them more competition primed (see Anderson & Morrow, 1994) and may have a larger drive to win, as opposed to being purely aggressive.

To test the GAM, Anderson and Dill (2000) conducted two experiments on undergraduate psychology students. The first, a correlational study, found a positive relationship between aggressive personality, delinquency, and exposure to violent videogames. They concluded that exposure to violent videogames, in the long-term, “contributes to the creation of an aggressive personality” (p.783). Due to properties inherent in correlation, it can not be ruled out that aggressive personalities are attracted to violent videogames. In the second experiment, Anderson and Dill selected two games that evoked equal levels of arousal (as measured post-game-play) and frustration (self-reported) from the player. In support of the GAM, accessibility to aggressive thoughts and aggressive behaviour increased post-game-play, however state hostility did not. They concluded that violent videogames increase aggression through cognitive paths not affective paths.

Despite Anderson’s (2004) inclusion of Anderson and Dill’s (2000) research in his meta-analysis as a ‘best practice’ (methodologically strong) study, Anderson and Dill’s (2000) research was not free of methodological shortcomings. In their second study, measures of aggressive behaviour and state hostility were only measured post-game-play, therefore they could not use it as a measure of change caused by the violent videogame. Furthermore, these variables were measured after different testing sessions and the influence of the previous sessions were not considered. Additionally, no rationale was provided for their 15 minutes of game-play.

*No effect.* Anderson (2002) suggests that research reporting no effect or even positive effects can be attributed to chance. If violent videogame research is to advance researchers must be open to both positive and null results, as some research has produced



null results. For instance, contrary to his hypothesis, Scott (1995) found no relationship between varying levels of violence of three games and increases in aggressive affect of university students. This study was limited, in that levels of difficulty or enjoyment of the three games played were not controlled for. As such, Scott's results may have arisen because violence levels of the games may have been inversely related to game difficulty, which may have counteracted the change in affect due to violent content. Fleming and Rickwood (2001) did control for game difficulty and enjoyment levels across their games. Although they reported variation in physiological arousal, no significant differences were found in aggressive or positive mood between participants who played a violent videogame, non-violent videogame or paper-pencil game. These two experiments, however, had participants play games for less than 10 minutes, which questions the applicability of the results to the 'real world'.

*Decrease effects.* Unsworth et al. (In Press) were able to reliably group participants in terms of an (i) increase ( $n=22$ ), (ii) decrease ( $n=8$ ), and (iii) no change in state anger ( $n=77$ ). Given analytical approaches have looked primarily at group trends, they decided to analyse their data as previous researchers would have by conducting a repeated measures ANOVA on state anger pre- and post-game-play. They found a significant main effect for time, indicating an overall increase in anger. For this reason it is surprising that any research looking at group trends has shown an overall decrease in the dependent measure.

Egli and Meyers (1984) had participants (151 arcade patrons) answer a questionnaire that investigated possible calming effects of videogames. They found a moderate calming effect when participants were upset. This research was purely

questionnaire-based and the measure of the calming effect was not validated, nor was it objective, and hence, should be interpreted with caution.

After playing a violent videogame, Brusa (1987) found that boys' aggression levels decreased to the level of girls' aggression, which did not change. However, the choice of games with differing violent game content was poor, give the 'violent' game had been rated in a previous study (Anderson & Ford, 1986) as containing only mild violence. Comparing these two conditions does not provide clear distinction between the violent and non-violent conditions.

### *Moderating and Mediating Variables*

While divergence in findings of previous research may be in part due to methodological issues (see meta-analytical criticisms in; Anderson, 2004; Bensley and Van Eenwyk, 2001; Griffiths, 1999; Sherry, 2001), there are many moderating and mediating variables that may also affect results. These variables may assist us in establishing 'at risk' groups.

#### *Moderating Variables*

Moderating variables can affect the magnitude and direction of an independent-dependent variable relationship. The moderator divides the independent variable into subgroups which vary in their effectiveness on the dependent variable (Baron & Kenny, 1986). For example, (Bartholow et al., 2005) showed that individuals low on exposure to violent videogames behaved more aggressively after playing a violent videogame than a non-violent videogame.

*Gender.* Research has shown females to be more effected by violent content than males (Deselms & Altman, 2003). Arriaga et al. (2006) found that whilst playing violent

videogames females had a greater skin conductance (physiological arousal) than males. Males are more likely to choose games with violent content (Griffiths, 1997), and spend more time playing violent games (Durkin and Aisbett, 1999; Funk, 1993). During free-play observations, Cooper and Mackie (1986) found that only girls showed a relationship between selecting aggressive toys and the level of violence in the games they played. They noted that boys showed a higher preference for aggressive toys, yet their preference did not change as a function of the game condition.

*Game and player context.* Anderson and Morrow (1995) tested the playing styles of undergraduate students who were competition primed versus those who were non-competition primed. Players who were competition primed killed more opponents during game-play than those who were non-competition primed. Williams and Clippinger (2002) investigated differences between human and computer opponents. Although the game was a non-violent game (Monopoly), they found that those playing against human opponents reported lower levels of state anger post-game-play than those who played against the computer. They inferred that humanising computers may reduce the level of aggression shown by players. The context of the violence also appears to moderate aggression. Sherry's (2001) meta-analysis noted that games containing any sort of human and fantasy characters engaging in violence produced larger effect sizes than games that were sports related.

*Videogame violence exposure.* Over-exposure to repeated violence can cause desensitisation and can lead to the viewer becoming more tolerant and less inhibited in the use of violence (Smith & Donnerstein, 1998). Given the number of research studies on desensitisation, it appears that the amount of exposure to violent videogames

moderates the effect that the game has on subsequent aggression/affect. As noted by Bartholow et al. (2005), people with high VVE displayed less aggressive behaviour than did participants with low VVE.

### *Mediating Variables*

A mediator variable creates an indirect effect between a dependent variable and an independent variable, by influencing the independent variable and hence the outcome of the dependent variable (Baron & Kenny, 1986).

*Personality.* The GAM suggests that violent videogames create an aggressive personality. Furthermore, Anderson and Dill (2000) suggest that the aggressive personality mediates the effect that playing violent videogames has on subsequent aggression. Anderson et al. (2004) found a correlational link between repeated exposure to violent videogames and trait aggressiveness. Unsworth et al. (In Press) created a comprehensive model (IMP) based on personality factors that reliably separated those who showed an increase in anger, with those who showed no change in anger at post-game-play.

*Affect.* Affect has also been well investigated as a mediator. In particular the effects of violent videogames on state-anger (e.g. Abel-Cooper, 2001) and state-hostility (e.g. Arriaga et al., 2006) have been well documented. The IMP shows that aggressive personality (trait characteristics) predicts CSA, however that change is dependent on state anger pre-game-play.

*Length of Play.* Sherry (2001) wrote “one of the most intriguing findings of the meta-analysis is that effect size was negatively related to playing time...” (p.424). He highlighted two studies that anchored the negative slope. The studies (Ballard and Weist,

1995; Hoffman, 1995) were conducted independently of one another, using undergraduate university students, the same outcome measures and the same game (Mortal Kombat). Vastly different playing times of 10 and 75 minutes (Ballard and Weist, 1995, and Hoffman, 1995, respectively) yielded vastly different effect sizes of  $r=.90$  and  $r=.05$  respectively. Sherry suggests that studies using a short game-play condition may simply be measuring an initial arousal effect. Similarly, Unsworth et al. (in Press) noted the need for a single study to compare long and short game-play and suggest that longer game-play may have a cathartic effect once initial arousal has depleted.

Participants of experimental research have played for between ‘several minutes’ (Kirsh, 1998) and 30 minutes (Deselms & Altman, 2003) and everything in between; six minutes (Silvern & Williamson, 1987), 10 minutes (Scott, 1995), 13 minutes (Kirsh, 1998), 15 minutes (Funk et al., 2003; Knapp, 2002), 20 minutes (Anderson & Murphy, 2003; Carnagey et al., 2006, Unsworth et al., In Press), and 25 minutes (Sheese & Graziano, 2005). Although there is no available data for how long gamers play in single sittings (a figure that would vary greatly), Gentile et al. (2004) found that adolescents play for an average of 77 minutes per day. This suggests past research has underrepresented the amount of time people play games for and hence, as Sherry (2001) suggested, may have been examining various dependent measures at a point of heightened arousal. In ‘real life’ situations, people may play to a point of habituation and attenuation of physiological arousal. If longer game-play conditions produce smaller changes in affect, previous research using short game-play conditions may not be representative of gaming and its effects outside the laboratory. Bartholow and Anderson

(2002) stated that their 10 minute game-play might not have been long enough for the violent game to produce a large effect. This comment highlights that the desire to find an effect may override the importance of representative research for some investigators.

*Number of players.* Past research has tended to ignore the intensity of the game as a possible mediating factor. While this is usually controlled for within experiments (e.g. playing single player with individual testing sessions), there are no experiments that investigate vastly different group sizes. Unsworth et al. (In Press) had groups of 8 to 10 participants playing either multi-player or single-player. Other studies (e.g. Uhlmann & Swanson, 2005) do not even state if the game is played against the computer, one-on-one, or on multiplayer. Given the latest gaming experience is an online-only role play game where up to 2,000 people can be playing at any one time (M. Griffiths, Davies, & Chappell, 2004), it appears that playing single player against the computer is a thing of the past. This gap in the literature needs to be explored so future research can either control for intensity, or be confident that the number of players does not influence the dependent measure.

#### *Aims and Hypotheses*

As discussed, there is a substantial line of research that has explored the effects of violent videogames relating to anger, aggressive behaviour/cognitions, physiological arousal, catharsis, desensitisation, changes in attitudes and their association to real life violence. As has been identified, several important aspects of the past research need to be clarified in order to produce a framework for future research that more realistically represents gaming outside the laboratory. Firstly, there is no research investigating differences in violent videogame effects between short periods of play and long periods

of play. Given this gap in the literature, the current study was the first to investigate any differences in CSA between people who played for a short period of 20 minutes versus people who played for a longer period of 60 minutes. It was predicted that, after the initial arousal and possible change in affect caused by the game, participants in the long condition would habituate and there would be attenuation of the initial affective response. It was therefore hypothesised that:

- (a) Participants in the short condition would show a significantly larger CSA than participants in the long condition.

To further clarify an appropriate length of play for long conditions in future research, the current study aimed to establish how long gamers play for in single sittings.

Given the extensive reports regarding desensitisation this study also aimed to investigate differences in change in CSA due to gender- and experience-differences.

Specifically, due to males' greater general exposure to violence, it was hypothesised that:

- (b) Females would be sensitised to, and more affected by the videogame violence and therefore show a significantly larger CSA than males, regardless of length of play.

Furthermore, it was predicted that:

- (c) Participants unexposed to violent videogames would show a significantly larger CSA than participants exposed to violent videogames.

The current study also sought to replicate the IMP with a new sample. It was hypothesised that:

- (c) Participants would fall reliably in to one of three groups; (i) increase in State Anger (ii) decrease in State Anger, and (iii) no-change in State Anger.

Furthermore, it was predicted that:

(d) State anger at pre-game-play in addition to five temperament variables (Psychoticism, Neuroticism, Trait Anger, Anger Expression, and Trait Anxiety) could be used to predict the above group membership.

Finally, given the lack of published research regarding game intensity (number of players) and relative player skill, the current research investigated any associations they may have with player's change in state anger. No directional hypotheses were propositioned for these exploratory observations.



## Method

### *Participants*

Participants were recruited through advertising in gaming centres, word-of-mouth and twenty participants were undergraduate students who participated for course credit. The current sample comprised 62 male ( $M=23.9$  years,  $SD=3.02$ ) and 36 female ( $M=21.4$  years,  $SD=2.65$ ) volunteers aged between 18-31 years with an overall mean age of 23.0 years ( $SD=3.11$ ). The gender imbalance may be explained by the nature of the game, *Quake III*, which was selected for its high-violence rating given by the Office of Film and Literature Classification (OFLC). Violent videogames have been shown to be more popular with males than females (Durkin & Aisbet, 1999). Forty three participants had prior experience with First Person Shooter (FPS) games, while 55 were novice players. More detailed analysis of gaming habits is presented in the results.

### *Experimental Materials*

#### *Testing Equipment*

*Quake III* has an MA15+ rating (OFLC) for its high-level animated violence. There is no 18+ rating for videogames in Australia, which makes this the highest violence rating possible. *Quake III* is a popular FPS game released in 2000. In FPS games the player takes the role of the shooter with a 'first person' visual perspective. The screen shows only the arms of the character and the weapon they are carrying. The graphics on *Quake III* are currently considered advanced and remains a popular game amongst gamers, yet is able to be run on standard university computers. A computer laboratory was used during five weeks of University holidays and three weeks of semester for data collection. Thirteen copies of *Quake III* were manually installed on 13 computers,

separated by one computer not used in experimentation. The copies of *Quake III* were bought directly from the makers (Id Software) at an educational, bulk rate.

### *Gaming Questionnaire*

This questionnaire contained 12 questions directed at participants' gaming habits, including general videogame information such as "...how many hours do you spend playing videogames per week?" and violent videogame-specific information such as "how much of this time is spent playing games that are violent in nature?" Questions regarding participants' favourite games, how old they were when they first played a violent videogame, why they do or do not enjoy playing violent videogames and how the games make them feel during play were also asked. As recommended by Unsworth et al. (In Press), questions focused on violent videogames in addition to videogames in general. See Appendix A for the full Gaming Questionnaire.

### *Eysenck Personality Questionnaire*

The Eysenck Personality Questionnaire (EPQ, Eysenck & Eysenck, 1975) was administered to gather information on personality characteristics of the participants. The EPQ predominantly measures three dimensions of personality, Psychoticism (P), Extraversion (E), and Neuroticism (N). Factor analytical research of the 90-item scale by Eysenck and Eysenck (1971) provided a group of items which discriminated between a criminal population (N=934) and an age/class matched non-criminal population (N=189). Eysenck and Eysenck (1975) suggest this scale may be useful as a predictor of delinquency or of recidivism. The EPQ was used, as opposed to other popular personality measures, in order to replicate the IMP.

The EPQ has good reliability for Extraversion (.82), and Neuroticism (.83) scales and moderate reliability for the Psychoticism scale (.66; Caruso, Witkie, Belcourt-Dittloff & Gotlieb, 2001). Individuals scoring high on E are typically sociable, have many friends, and do not like studying on their own. They crave excitement, they are impulsive and can be aggressive. Conversely, low scorers are introspective, quiet, reserved, distant, ordered and keep their feelings under control (Eysenck & Eysenck, 1975).

“The typical high N scorer is an anxious, worrying individual, moody and frequently depressed” (p.9; Eysenck & Eysenck, 1975). They are overly emotional and find it difficult to return to an even keel after an emotional experience. If combined with a high E, individuals are likely to be touchy and restless, easily excitable and possibly aggressive (Eysenck & Eysenck, 1975).

Eysenck and Eysenck (1975) describe individuals scoring high on P as odd, isolated and troublesome. Such individuals lack empathy for humans or animals and are often hostile and aggressive, even to individuals close to them. High scorers frequently engage in sensation-seeking behaviour as a means to compensate for low levels of human emotion/feeling.

#### *State-Trait Anger Expression Inventory*

The State-Trait Anger Expression Inventory (STAXI; Spielberger, 1991) was used to measure Anger Expression pre-game-play and State and Trait Anger at pre- and post-game-play. State and Trait Anger and Anger Expression scores are calculated from 40 independent items in a question booklet. The more recent STAXI-2 was not used in order to replicate the IMP as accurately as possible.

Although much research has focused on the effects of violent videogames on various measures of aggression, the presence of state anger is often necessary for the behavioural act of aggression to occur (Spielberger, 1991). Additionally, Buss and Perry (1992) demonstrated that anger is the bridge between both physical and verbal aggression and hostility. For this reason, the current measure of change in anger is considered pertinent to the current debate regarding the effects of violent videogames.

Spielberger (1991) defines trait anger as:

Individual differences in the frequency that state anger [is] experienced over time. ... Individuals high in trait anger [are] more likely to perceive a wide range of situations as anger provoking (i.e. annoying, irritating, frustrating), and to respond to such situations with elevations in state anger (p.6).

State anger is defined as:

An emotional state or condition that consists of subjective feelings of tension, annoyance, irritation, fury and rage, with concomitant activation or arousal of the autonomic nervous system. ... State anger varies in intensity and fluctuates over time as a function of perceived injustice or frustration resulting from the blocking of goal directed behaviour (Spielberger, 1991, p.6).

The anger expression score is collated from three separate scores: (i) Anger-In (suppression); (ii) Anger-Out (towards other people/objects); and (iii) Anger-Control (attempts to control anger expression) and refers to the frequency that an individual expresses anger, regardless of whether it is expressed in or out.

The STAXI has good divergent and convergent validity and strong concurrent validity for trait anger (Spielberger, 1991). A two week test-retest study yielded reliability coefficients of .74 and .88 for trait anger and anger expression, respectively, while state anger was very low (.01; Bishop & Quah, 1998). With high relevance to the current research, as may be expected, Cahill (2003) found the reliability of state anger to improve over a shorter period of time, with a test-retest reliability coefficient of .77 over 20 minutes. This coefficient will be operational in the computation of short term 'reliable change' for replication of the IMP.

#### *State-Trait Anxiety Inventory*

State and trait anxiety were measured by Spielberger's (1983) State-Trait Anxiety Inventory (STAI). The STAI is a self-rating 40-item questionnaire appropriate for the current young adult sample. Spielberger (1983) reports good concurrent validity and reliability for Trait Anxiety, with a test-retest coefficient of .73. State Anxiety has good reliability (mean alpha is .93) and validity (Spielberger, 1983).

#### *Post-Gaming Questionnaire*

This was designed to elicit information regarding how the participants felt about playing *Quake III*. This information was designed to further explain any anger change with questions directed at frustration, enjoyment, self-reported physiological arousal, immersion in the game, perceived realism of the portrayed violence, and how disturbing participants found the violence. All questions used a Likert-type scale response (1 = strongly agree; 5 = strongly disagree). See Appendix B for full questionnaire.

### *Independent Measures*

*Exposure.* Exposure to violent videogames (Exposure) was calculated by multiplying the average number of hours spent playing videogames per week by the self reported percentage of that time playing games that are violent in nature. For example: If participant X played 10 hours of videogames per week and three quarters of this time was spent playing violent games, the Exposure score was:  $10 \times .75 = 7.5$ .

*Temperament.* Temperament in the IMP is made up of Psychoticism, Neuroticism, Trait Anxiety, Trait Anger, and Anger Expression. Cumulative high scores represented an aggressive temperament.

*Self-Regulation.* Self-Regulation refers to the reasons why participants play violent videogames. Appendix C provides an explanation approach used to classify open responses into mutually exclusive categories.

### *Dependent Measure*

*Change in state anger.* State anger was measured by the STAXI at pre- and post-game-play. Based on past research an increase in anger was expected, so pre-game-play scores were subtracted from post-game-scores to create CSA.

### *Experimental Design and Procedure*

#### *Design*

The current experiment was a between and within subjects mixed design. The between subjects factors were; Length of play, Exposure, and Gender. The within subjects factor was time, taking repeated measures at pre-game-play and post-game-play.

### *Procedure*

Between three and thirteen participants came to each session, meeting at a computer laboratory with *Quake III* installed on the computers. During recruitment, all participants were told the session would take between one and two hours and were not informed of the different time conditions so as to avoid specific requests from participants.

Participants read a Plain Language Statement before providing signed consent. Participants were not misled regarding the purpose of the experiment but were not told specifically what was being investigated, in order to avoid any personal views regarding the effects of violent videogames affecting these responses. Participants were told:

In this study, I am looking into the gaming habits of young adult Australians. I am interested in the differences between players and non-players, why people do or do not enjoy playing violent videogames, and how they feel about playing them. I will also be looking at what personality factors are associated with the way people play violent videogames.

All participants subsequently completed the Gaming Questionnaire, EPQ, STAXI and the STAI, in that order. Default controls were written on a board visible to all players. Some players changed the controls to preferred settings. In such cases, controls were returned to default settings at completion of the session.

After brief instructions and a three minute warm-up, a server was set up to enable all players to join a multiplayer game in which they played against one another. To provide a comfortable environment food and drinks were also provided. The server was

set up to create a log file from which game statistics, such as number of kills, deaths and ‘suicides’, could be extracted. Players were instructed to leave the generic player names to avoid any effects of pre-existing group dynamics.

Participants were informed in the Plain Language Statement, and again verbally, that they were free to leave at any point during the experiment. This was stressed given the nature of the game may have been disturbing for some. Each computer station had an identification number and participants were instructed not to write their name anywhere on the questionnaires or consent form. Reference was only made to identification numbers to preserve anonymity.

For the short condition, map *q3m3* (level name within *Quake III*) was played for 20 minutes. The long condition played map *q3m3* followed by *q3m17*, for 30 minutes each. At completion of the game players were asked to record their ‘score’ provided by the game summary. The ‘score’ confirmed that data from the log file was correct, as it was also accessible through the server.

Once the post-game questionnaires were completed, participants were given an opportunity to ask questions before leaving. The log file was subsequently analysed predominantly for the breakdown of the number of deaths, kills and suicides for each player. These statistics were used to create a ‘skill’ level for each player (kills / (deaths + suicides)).



## Results

This section provides statistical analyses of the Long versus Short game-play hypothesis. This hypothesis was also run only for participants with videogame experience. Desensitisation hypotheses are explored as a function of Gender, followed by Exposure. Investigations are made into the limiting factors of the current data for replication of the full IMP, however analyses are provided differentiating participants whose CSA increased from those whose did not change. Finally, subsidiary analyses provide additional information to the main hypotheses and explore the gaming habits and preferences of the current sample.

### *Assumption Testing*

SPSS 14.0 (LEAD technologies, 2005) was used for data screening, Statistica (Statsoft, 2005) was used for parametric testing and graphs, and Clintools (Deville, 2005) was used for effect sizes and power analysis. All analyses were tested for significance at the  $\alpha=.05$  level.

### *Data Screening*

Prior to analysis, the demographic variables of age, gender and handedness were inspected. All variables were within range and the means and standard deviations were plausible. No missing values were detected.

*Univariate outliers.* The predictor variables for the IMP were screened for missing values and univariate outliers. Two cases for State Anger (Pre-game-play) showed out of range values due to data entry errors. Cases were amended after consultation with original questionnaires.

Three cases on Trait Anger were extreme outliers. Given this was a trait measure, several participants were likely to fall into the high range and data were left in place. The only remaining extreme outlier was in State Anger Post-Game-Play. This participant responded on their final question (see Appendix B) “I felt fired up and aggressive, but that’s because I lost” and responded ‘strongly agree’ to the statement ‘I was frustrated because I was unable to play the game’. With an overall mean for CSA of 1.92 (SD = 3.75), this participant’s score of 23 placed them five standard deviations above the mean and heavily influenced other data. Based on the available information, it was decided that the CSA was not due to the violent content of the game, but rather, due to frustration and losing. This data was removed for parametric testing, yet maintained for replication of the IMP.

*Normality of Distributions.* Critical  $z$  scores were created (Skew/SE Skew) to evaluate whether variables were significantly skewed. Appropriate transformations were made where necessary and transformed data were used for subsequent analyses. The distribution of Extraversion was negatively skewed ( $z=-3.72$ ). A sin transformation reduced skewness close to zero ( $z=-0.54$ ). State Anger, at both pre- and post-game-play, was skewed ( $z=9.53$  and  $6.20$  respectively). Inverse transformations reduced skewness marginally ( $z=6.23$  and  $2.50$ , respectively). Similarly, the skew of Trait Anger pre- and post-game-play ( $z=4.67$  and  $3.86$ , respectively) were suitably reduced with a natural-logarithmic transformation ( $z=1.39$  and  $0.94$ , respectively). Anger Expression and State Anxiety were significantly skewed at  $p<.05$  level but not at  $p<.001$  level ( $z=3.25$  and  $2.60$  respectively) and no transformations were made.

*Methodology check on dependent measure.* Change in State Anger (CSA) was significantly skewed ( $z=5.47$ ). A natural-logarithmic transformation made it appropriate for further analysis ( $z=.31$ ). Trait Anger was also measured at pre-game and post-game. A repeated measures ANOVA was conducted on Trait Anger to ensure there was no short-term change. There was no main effect of time on Trait Anger ( $F(1,97) = ns$ ) which suggested the STAXI was being completed in a reliable manner.

*Multivariate outliers.* A linear regression with all metric predictor variables revealed two multivariate outlier with a Mahalanobis distance greater than the critical chi-square value ( $\chi^2(5)=20.52, p=.001$ ). These cases were removed leaving a total of 95 valid cases.

*Multicollinearity.* A bivariate correlation was run on all metric variables to check for multicollinearity. No correlations warranted serious concern by exceeding  $r=.90$  (Tabachnick & Fidell, 2001).

#### *Possible Covariates*

##### *Age*

The age-range of the current sample was 18-31 years. Age did not need to be used as a covariate in the main analyses, as it correlated only slightly ( $r=.11$ ) with CSA.

##### *Number of Players*

In order to fill a gap in the literature, the current study used a range of group sizes ( $n=3$  to  $n=13$ ) across experimental conditions to investigate if the number of players in the game had an effect on CSA. number of players only had a small correlation with CSA ( $r=.18$ ).

A one-way between groups ANOVA was conducted to investigate if the Number of Players affected CSA. There were no significant differences across group sizes ( $F(7,94) = ns, \eta^2 = .059$ ). Tukey Honestly Significant Difference test was run post-hoc and no significant differences were found of CSA between any groups.

### *Skill*

Relevant data was not available for one group due to logging problems, leaving  $n = 88$ . A relationship barely existed between CSA and Skill ( $r = -.06$ ). The main hypotheses were analysed without covariates.

### *Means of Sample Variables*

As shown in Table 1, the means for State Anger Pre-game were significantly lower than means provided in the STAXI manual. Trait Anger for males was also significantly lower than norms, indicating the current sample was less angry than the general population. Conversely, females scored significantly higher than the provided population means on Psychoticism and Extraversion.

Table 1

*Difference Between Means for Test Sample and Means for Manual Norms on EPQ,*

*STAXI and STAI*

Test Instrument	Subscale	Gender	Norm Mean	Norm Age	Study Sample Mean	Difference Between Means
EPQ	Psychoticism	Male	4.19 (n=768)	20 - 29 Years	4.88 (n=60, SD=2.42)	ns
		Female	2.79 (n=1366)	20 - 29 Years	4.28 (n=36, SD=2.24)	p<.001**
	Extraversion	Male	13.72	20 - 29 Years	14.96 (4.33)	p=.026*
		Female	12.89	20 - 29 Years	14.86 (4.65)	p=.013*
	Neuroticism	Male	9.81	20 - 29 Years	9.59 (5.56)	ns
		Female	12.87	20 - 29 Years	12.81 (6.41)	ns
	Lie	Male	6.50	20 - 29 Years	5.87 (3.24)	ns
		Female	7.17	20 - 29 Years	6.22 (3.70)	ns
	Criminality	Overall	9.01	20 - 29 Years	12.24 (4.81)	p<.001**
	STAXI	State Anger	Male	14.10 (n=381)	18 - 30 Years	10.81 (1.39)
Female			13.34 (n=558)	18 - 30 Years	11.25 (1.56)	p=.018*
Trait Anger		Male	19.88	18 - 30 Years	17.29 (3.33)	p<.001**
		Female	20.00	18 - 30 Years	18.58 (5.03)	ns
Anger Expression		Male	26.65	M=19.95 Years	27.31(10.51)	Ns
		Female	27.14	M=19.65 Years	26.08 (8.96)	Ns

Note. At the  $\alpha = .05$  level \* =  $p < .05$ , \*\* =  $p < .001$

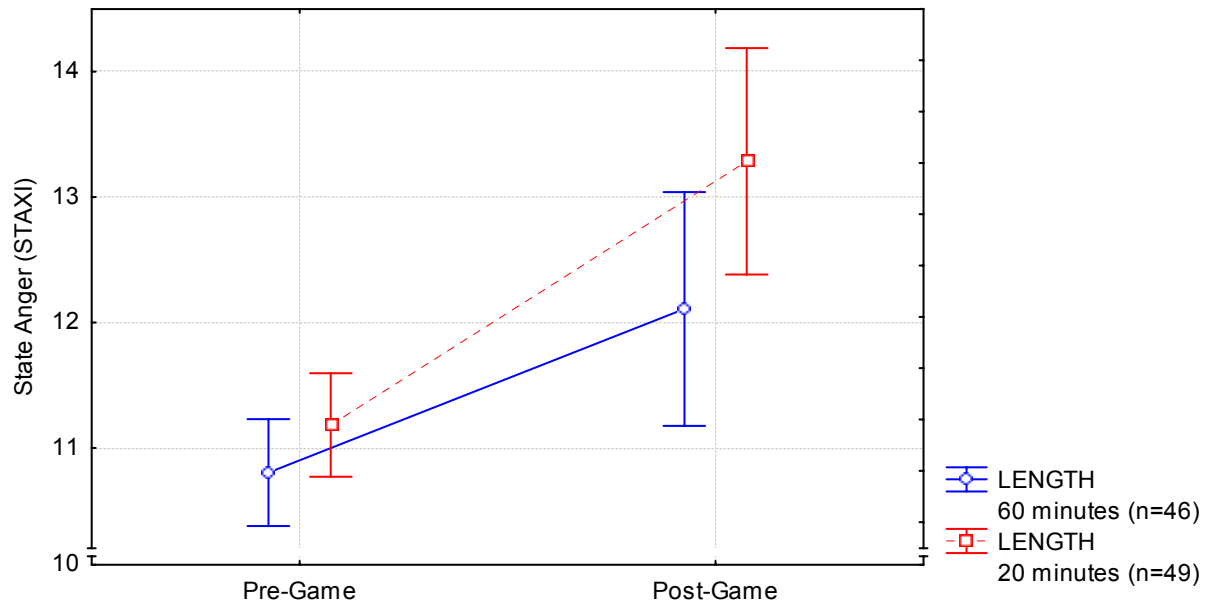
### *Single-Sitting Violent Videogame Play in the Real World*

To establish whether 60 minutes for the Long condition was representative of usual gamer play, two average scores were taken from a question asking “for how long would you normally play a game like this for, in one sitting?” (see Appendix B). The average for all participants was 63.6 minutes. Given some participants responded with 0 minutes, an average was created as a function of Exposed participants (those with experience playing violent videogames). For Exposed participants, the average was 106 minutes.

### *Long Versus Short Violent Videogame Play*

#### *Total Sample*

The main hypothesis of this study purported that participants who played *Quake III* for 20 minutes would have a significantly larger CSA than participants who played for 60 minutes. This was investigating the main effect of length of play. In order to test this hypothesis, a 2 (State Anger Pre- and Post-Game-Play) x 2 (Long and Short) ANOVA was run. Although the test was not statistically significant ( $F(1,93) = 1.56, ns$ ), in a graphical representation (Figure 4), there is a difference between the conditions in the direction hypothesised. A small effect size was found for Length on CSA (Hedge’s  $g=.26, 95\% CI=.66, -.15$ ).



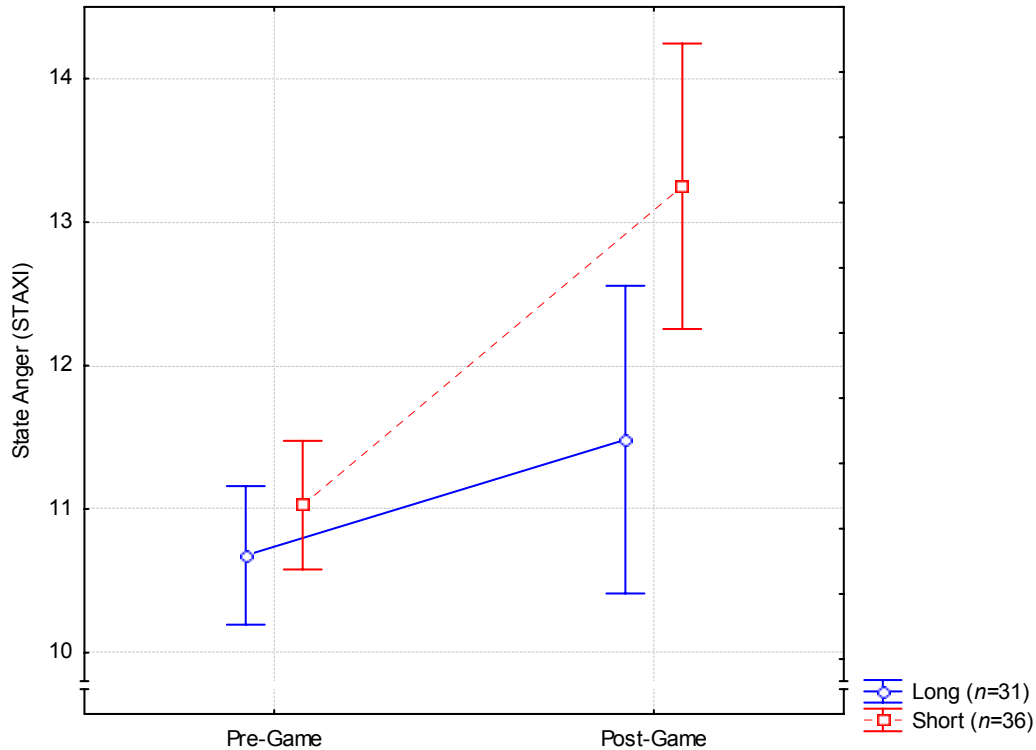
Note. Vertical bars denote 95% confidence intervals.

Figure 4. Change in state anger for long versus short conditions.

Further analysis showed that if the current study was replicated and the effect size of .26 were true, 185 participants would be needed in each group to have 95% confidence, where one-tailed analyses (theoretical justification of direction, as in the current study) were applied and a power level of .80 was desired

#### *Participants who Play Videogames*

The current data did not allow replication of the above 2x2 ANOVA for Exposed participants only. In order to test Long versus Short gaming in a way that more accurately represented the general gaming population, a 2x2 ANOVA was run for participants who had experience playing videogames. Presented graphically in Table 5, the analysis came very close to statistical significance ( $F(1,65)=3.77, p=.056$ ) and a medium effect size was found (Hedges  $g=.47, CI=-.95, .016$ ).



Note. Vertical bars denote 95% confidence intervals

Figure 5. Change in state anger for long versus short conditions for gamers only.

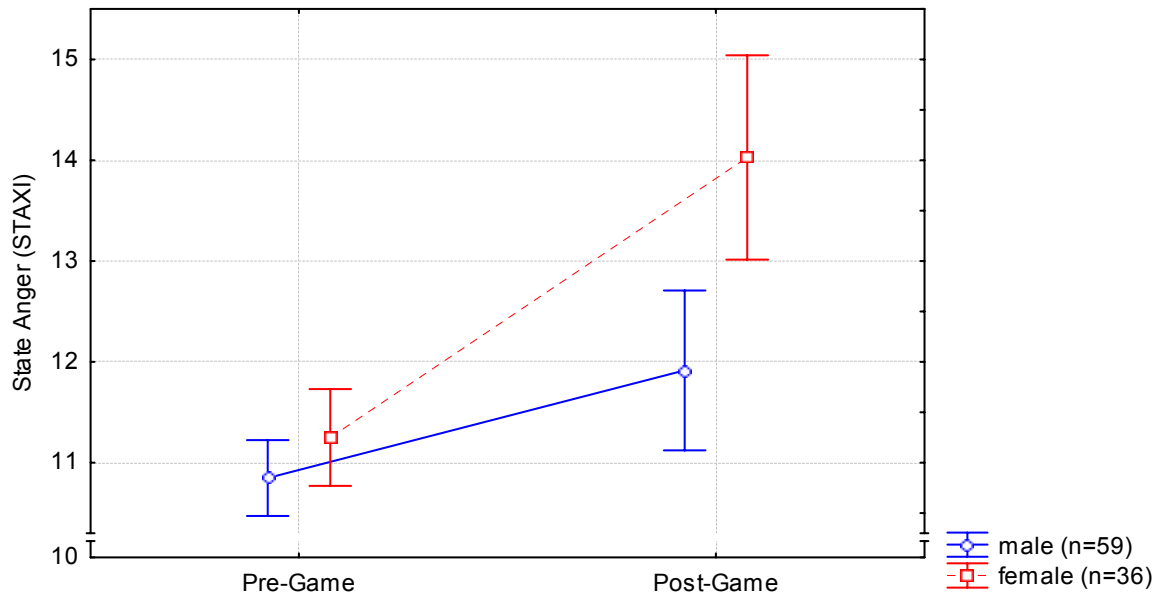
Replication of the current study using only participants who played videogames would only require 53 participants in each Length condition, if the current effect size ( $g = .47$ ) were correct and power of .80 were desired.

### *Desensitisation Hypotheses*

#### *Gender*

A 2x2 ANOVA was run to compare CSA over time for males and females, regardless of length of play. Results supported the hypothesis. There was a significant main effect of gender, with females ( $M=2.78, SD=3.26$ ) showing a larger CSA than males ( $M=1.07, SD=2.86, F(1,93)=7.17, p=.005$ ). An effect size of  $g=.56$  was found. Figure 6 provides a visual explanation of these results.





Note. Vertical bars denote 95% confidence intervals

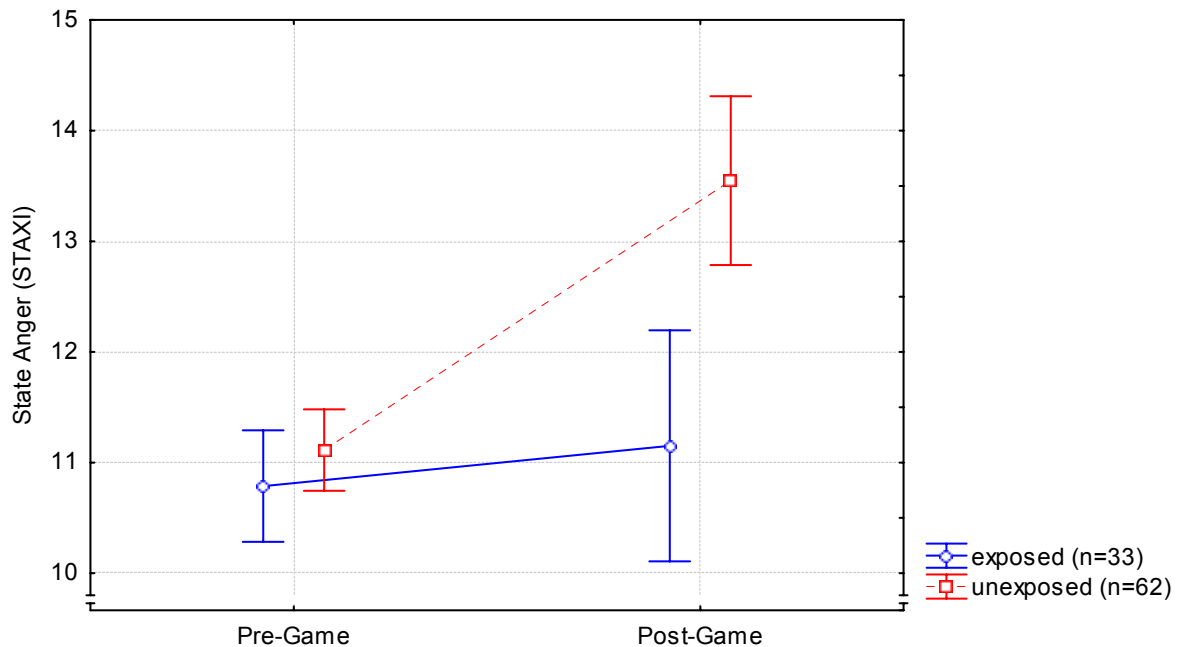
Figure 6. Change in State Anger by Gender.

An independent samples t-test for gender at pre-game-play, revealed initial state anger scores were not significantly different ( $t(93)=1.46, ns$ ). Additionally, males enjoyed playing the game significantly more than females ( $t(93)=4.25, p<.001$ ).

Although not significant, females reported feeling more physiological arousal than males ( $t(93)=-.52, ns$ ).

### Exposure

This hypothesis was tested as a function of the Exposure variable. Participants with a score greater than zero were considered Exposed to violent videogames. A 2 (pre-game and post-game state anger) x 2 (Exposed and Unexposed participants) ANOVA was run and revealed a significant effect of Exposure ( $F(1,93)=10.48, p<.05$ ), whereby Unexposed participants ( $M=2.44, SD=3.37$ ) CSA score was higher than Exposed participants ( $M=.36, SD=1.99, g=.70$ ). Figure 7 shows this desensitisation effect.



Note. Vertical bars denote 95% confidence intervals

Figure 7. Change in State Anger by Exposure

In addition, an independent samples t-test was run comparing pre-game and post-game State Anger for the Exposed group. The result was non-significant ( $t(64)=-.98, ns$ ), suggesting participants with exposure to violent videogames do not show a significant increase in State Anger when they play a violent videogame, regardless of Length of play.

#### *Immersive Media Prediction Model*

From the original sample of 98 participants, only the two multivariate outliers were removed for the following analyses, leaving a total of 96 participants.

#### *Cluster Analysis*

In order to replicate the IMP, CSA must have reliably fallen in to three groups: (i) Increase; (ii) Decrease; and (iii) No-Change. To first assess if these three groups did in fact exist, a *k*-means cluster analysis was conducted on CSA. The analytic procedure was

instructed to cluster three groups. Results in Table 2 below, indicate that CSA can be clustered in to three groups.

Table 2

*K-Means Cluster Analysis of Change in State Anger*

Change in State Anger	
Mean 1	7.04 ( <i>SD</i> =2.44)
Mean 2	0.72 ( <i>SD</i> =.95)
Mean 3	-1.72 ( <i>SD</i> =.99)
ANOVA: $F(2,95) = 92.27, p < .001$	

After establishing that CSA could be clustered in to; Increase (Mean 1); No-Change (Mean 2); and Decrease (Mean 3), a Reliable Change (RC) Index (Jacobson & Traux, 1991) was calculated to group CSA according to reliable change, as opposed to change that may be due to measurement error.

An RC Index of 4.53 ( $p < .05$ ) was obtained (see Appendix D for full calculations). Therefore, it can be said with 95% confidence that, if a player's CSA score is  $\pm$  five points it is not due to measurement error. A summary of results of is provided in Table 3 below.

Table 3

*Summary of Participants' State Anger Pre- and Post-Game-Play by Derived Group After Application of Reliable Change Index*

State Anger	Group		
	Increase (n = 20)	No Change (n = 76)	Decrease (n = 0)
Pre-Game-Play			
M	10.75	11.04	N/A
SD	0.68	1.61	N/A
Post-Game-Play			
M	17.79	11.29	N/A
SD	4.13	1.79	N/A
Change			
M	7.65	0.45	N/A
SD	4.31	1.56	N/A

When the RC Index is applied to CSA scores, there is no longer any representation in the Decrease group. Only 3 participants (pre-game State Anger scores; 15; 16; and 18) could have potentially shown a reliable decrease (i.e. five point drop). Given none did, this floor effect prevented replication of the full IMP.

*Differentiating Increase Group from No-Change Group*

Unsworth et al. (In Press) ran a discriminant function analysis on three groups (increase, decrease, and no-change) and predictor variables, however the current data separated dichotomously. For two groups (i.e. one possible discriminant function),

multiple regression results are analogous to those obtained in a discriminant function analysis (StatSoft, 2003). The two groups were coded with values ‘1’ (Increase) and ‘2’ (No-Change) and the new variable was used in a multiple regression analysis. The coded variable was regressed on to the five predictor variables (Psychoticism, Neuroticism, Trait Anger, Anger Expression, and Trait Anxiety) which differentiated Increase from No-Change groups in the IMP.

All variables entered simultaneously did not differentiate the Increase from No-Change group ( $F(5,95)=1.30, ns$ ). To investigate if any of these predictor variables differed significantly in value between the Increase- and No-Change groups a series of independent samples t-tests were run. As illustrated in Table 4, the Increase group showed significantly higher scores than the No-Change group for three temperament variables.

Table 4

*T-Test Results for Significant Differences of Predictor Variables by Change in State Anger (CSA) Groups*

Predictor Variable	CSA		Significance
	Increase ( <i>n</i> = 20)	No Change ( <i>n</i> = 76)	
Psychoticism ( <i>SD</i> )	4.30 (2.24)	4.74 (2.40)	<i>p</i> = .48
Neuroticism ( <i>SD</i> )	13.15 (6.87)	10.19 (5.74)	<i>p</i> = .048*
Trait Anxiety ( <i>SD</i> )	43.30 (11.72)	37.68 (10.97)	<i>p</i> = .036*
Trait Anger ( <i>SD</i> )	19.35 (4.37)	17.20 (3.92)	<i>p</i> = .026*
Anger Expression ( <i>SD</i> )	29.35 (10.57)	25.29 (9.68)	<i>p</i> = .10

Note.  $\alpha = .05$ , \* =  $p < .05$

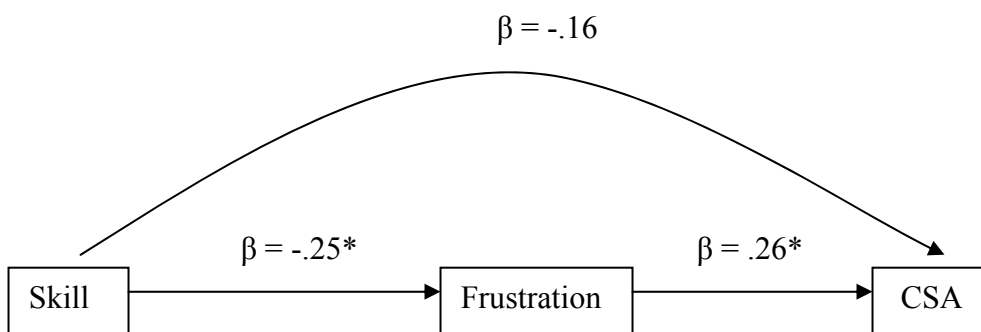
For the Increase group, Anger Expression was also higher, however not to statistical significance.

*Participants whose state anger decreased*

Although no to a ‘reliable change’ level, 14 participants did show a decrease in state anger. Of these 14 participants, nine decreased to the minimum possible score (10) on the state measure of the STAXI .

*Indirect Effect of Skill*

While the direct effect of Skill on CSA was not significant, a simple regression showed that player’s frustration due to an inability to play was a significant predictor of CSA ( $F(1,93)=6.59, \beta=.26, p=.011$ ). Additionally, Skill was a significant predictor of Frustration ( $F(1,86)=-5.91, \beta=-.25, p=.017$ ). Figure 8 below shows the beta coefficients for each direct effect. The indirect effect of Skill of CSA was  $-.25 \times .26 = -.065$ , indicating part of the Frustration – CSA relationship is due to Skill.



Note. \* =  $p < .05$

Figure 8. Indirect Relationship of Skill on Change in State Anger (CSA), through Frustration.

### *Subsidiary Analyses*

#### *Additional Predictor Variables*

*Criminality.* The items purported to measure Criminal Propensity (C) from the EPQ Manual (Eysenck & Eysenck, 1975) were analysed to create a new variable, C. As with analysis of previous predictor variables, an independent samples t-test was run to assess differences between the Increase and No- groups. No significant difference was found ( $t(94)=2.03, ns$ ).

*Exposure.* Unsworth et al. (In Press) found that their exposure variable had no differentiating power between any of the groups. Another independent samples t-test was run to establish if Exposure scores were significantly different for the Increase versus No Change groups. Exposure was significantly skewed ( $z=15.52$ ), however a natural-logarithmic transformation reduced skewness ( $z=.99$ ). The transformed Exposure variable was significantly higher for participants in the No Change group compared to the Increase group ( $t(94)=2.30, p=.011$ ). Interestingly, Exposure had a significant negative correlation with CSA ( $r=-.42, p<.05$ ).

The Exposure dichotomy was explored to assess if the aggression predictor variables in the IMP differed between the Exposed and Unexposed groups. The six variables together did not significantly differentiate the two groups, so independent t-tests were run. As can be seen in Table 5, only two variables showed statistically significant differences. It should be highlighted that Psychoticism was significantly higher for the Unexposed group.

Table 5

*T-test Results for Aggression Variables as a Function of Exposure Dichotomy*

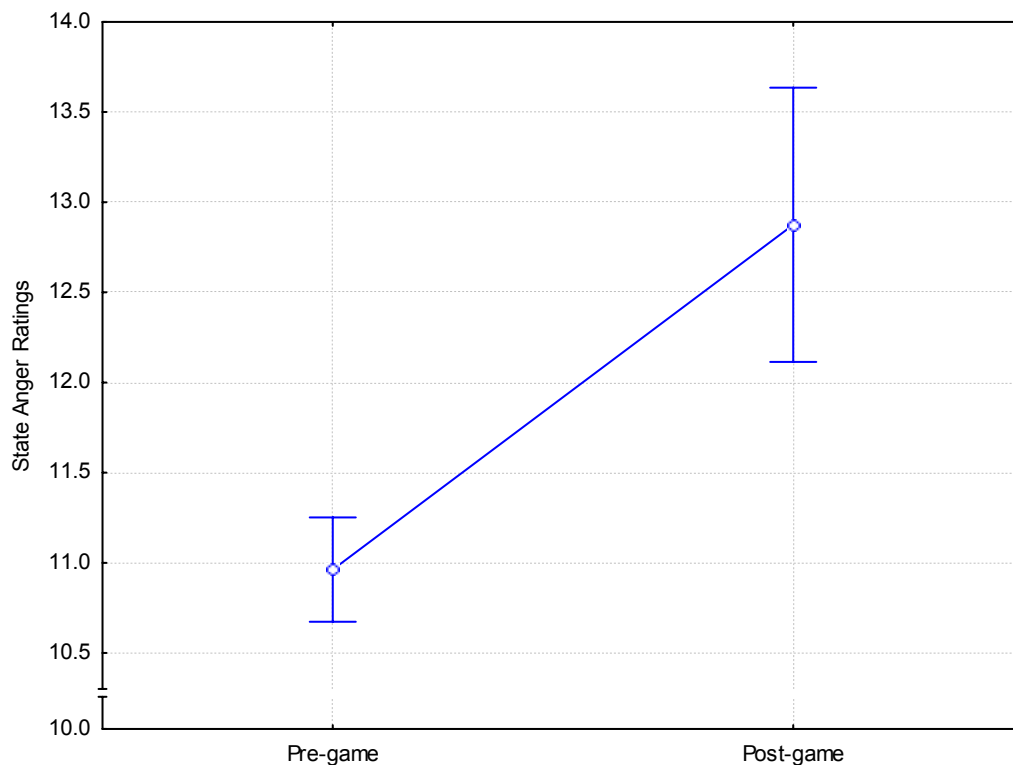
Predictor Variable	Exposure		Significance
	Exposed ( <i>n</i> =33)	Unexposed ( <i>n</i> =63)	
Psychoticism ( <i>SD</i> )	3.94 (2.25)	5.03 (2.53)	<i>P</i> =.03*
Extraversion ( <i>SD</i> )	13.40 (4.03)	15.74 (4.45)	<i>P</i> =.013*
Neuroticism ( <i>SD</i> )	9.94 (5.60)	11.27 (6.30)	<i>p</i> =.31
Trait Anxiety ( <i>SD</i> )	38.45 (8.89)	39.02 (11.48)	<i>p</i> =.81
Trait Anger ( <i>SD</i> )	16.88 (5.33)	18.08 (4.24)	<i>p</i> =.17
Anger Expression ( <i>SD</i> )	26.15 (10.91)	26.11 (9.49)	<i>p</i> =.98

*Note.*  $\alpha=.05$ , \* =  $p<.05$

#### *Main Effect of Time*

In line with previous research, a repeated measures ANOVA was conducted on pre-game-play to post-game-play. The Within-Subjects Effect was highly significant ( $F(1,94) = 30.31, p<.001$ ) as shown graphically in Figure 9 below. A large effect size (Cohen's  $d = .69$ ) was found.





*Note.* Vertical bars denote 95% confidence intervals

*Figure 9.* Overall anger ratings pre- and post-game-play, regardless of length of play.

### *Gaming Habits*

The mean age of when participants first played a violent videogame was 11.60 years ( $SD=2.88$ ,  $n=83$ ). The favourite game of the majority of participants was violent (excluded games with ‘low level animated violence’ contained in General 7+ rating games, as rated by the OFLC). Most participants owned less than 10 violent games with one participant owning 100. More detailed information of participants’ gaming habits are provided in Figures 10-13.

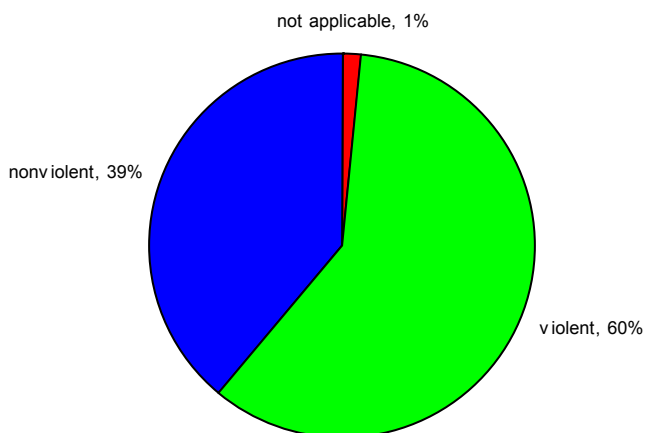


Figure 10. Favourite game type.

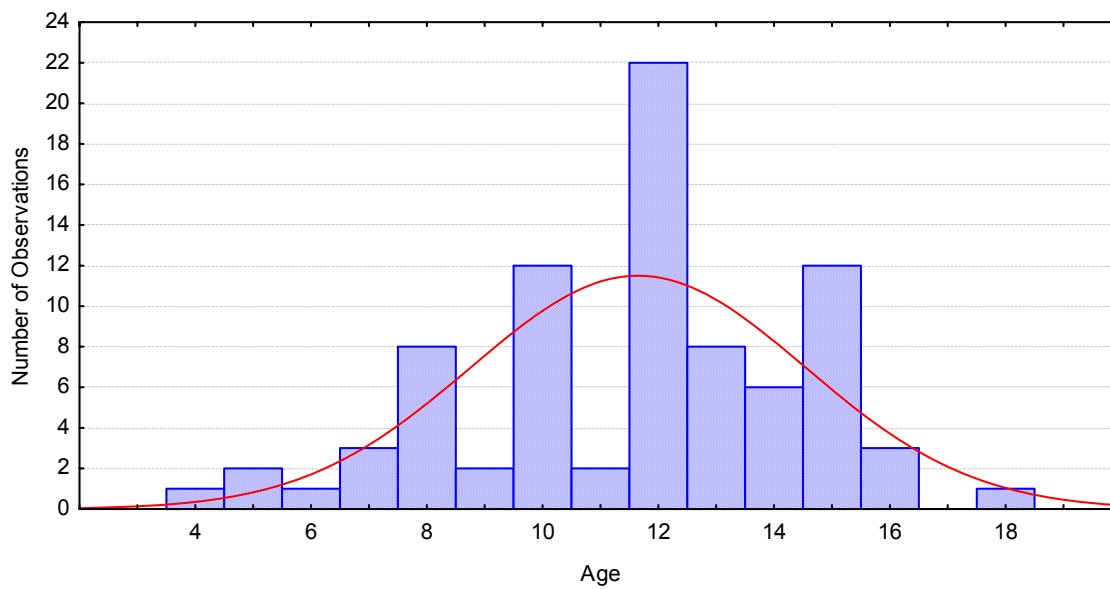


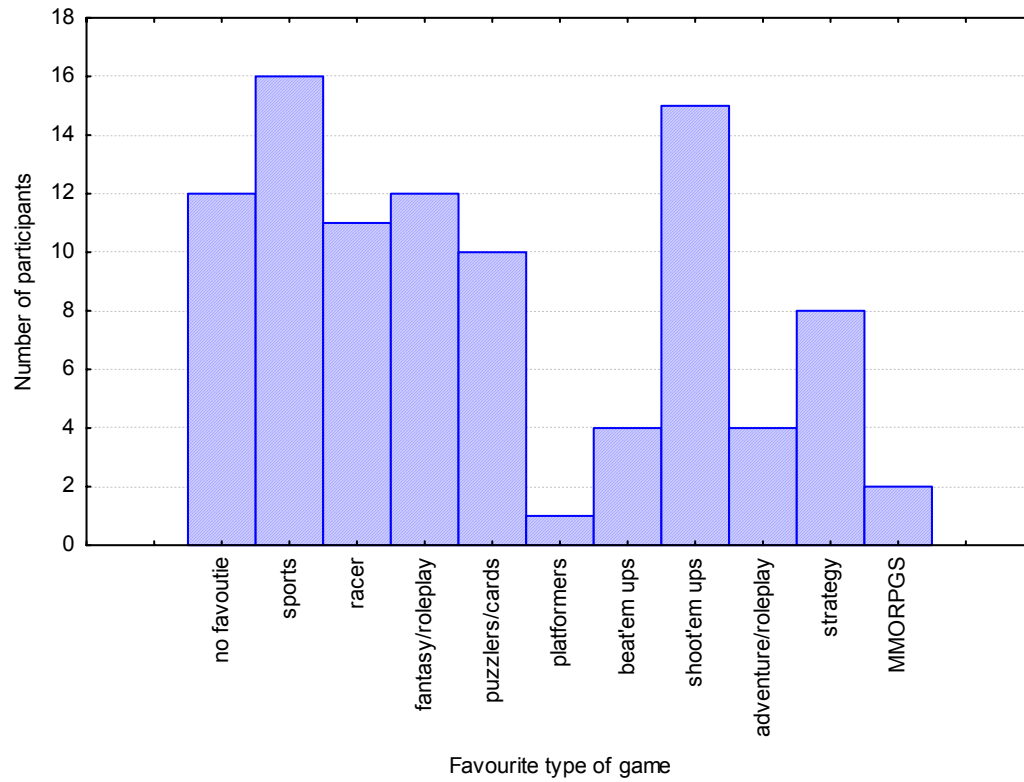
Figure 11. Age at which participants first played a violent videogame.

Participants were also asked questions regarding when they played videogames, where they played them, and on what they played. Details are provided in Table 6 below.

Table 6

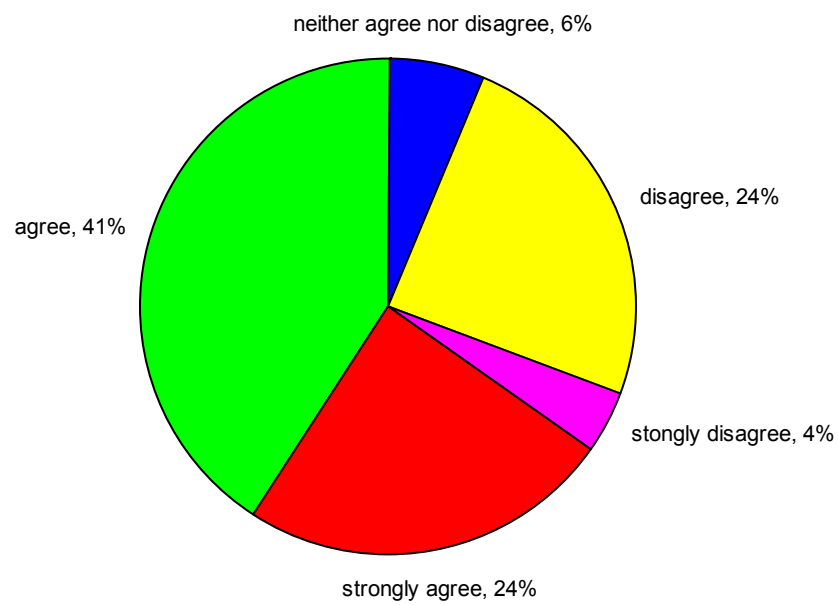
*Summary of When, Where and On What Gamers Play Videogames*

Category	Percentage of Participants ( <i>n</i> = 96)
<b>When Videogames are Played</b>	
Weekends	67%
Before School/Work	6%
During School/Work	24%
After School/Work	70%
Holidays	70%
<b>Where Videogames are Played</b>	
Home	88%
Work	15%
Friend's House	59%
Gaming Centre	10%
<b>What Videogames are Played on</b>	
Computer	85%
Playstation	54%
Nintendo	23%
Arcade Machine	9%
Xbox	42%



*Figure 12.* Favourite type of videogame.

Participants were asked if they would have played for longer if they were not asked to stop. Figure 13 shows these results.



*Figure 13.* Desire to play longer for participants in the 20 minute condition.

## Discussion

This section will provide an overview of the aims and hypotheses followed by discussion of each outcome. Interpretation and meaning of the results will be discussed with relation to previous research. The impact of the current results on future research will also be explored. Limitations will be highlighted and suggestions for future research will be recommended.

### *Aims and Hypotheses*

In order to fill a major gap in the literature, this study investigated differences in Change in State Anger (CSA) between participants who played for 20 minutes versus participants who played for 60 minutes. Participants in the short condition did show a larger CSA than participants in the long condition, however contrary to hypothesis, this difference was not significant.

The current research also aimed to clarify the desensitisation debate by hypothesising that both females and participants Unexposed to violent videogames would show a larger CSA than males and Exposed participants, respectively. Both hypotheses were supported with statistical significance and demonstrated medium (Gender) and large (Exposure) effect sizes (Tabachnick & Fidell, 2001).

The current study was also set up to replicate Unsworth et al.'s (In Press) Immersive Media Prediction model (IMP). Extremely low State Anger scores prior to experimentation did not permit full replication of the model, as will subsequently be discussed. However enough data was present to investigate whether the five predictor variables reliably separated participants in the Increase group from the No Change group as they could in the Unsworth et al. study.

### *Relevance to Past Research*

#### *Long Versus Short Violent Videogame Play*

With the exception of Unsworth et al. (In Press), who justified using 20 minutes game-play because of time limitations of the participants, no research has justified the amount of time for which participants have played. In his meta-analysis, Sherry (2001) highlighted a trend that suggests longer playing time results in less aggression and pointed out the need for a single study to explore different time exposures. Five years after Sherry's suggestions, this crucial piece of research had not been investigated. In light of the current research, implications drawn from previous research examining the short-term effects of violent videogames may need to be reviewed. The current results provide a solid framework for future research in the area.

In order to establish a more accurate length of play for future research, participants were asked, for how long they would normally play a game like *Quake III* in one sitting. While the overall average was 63.6 minutes, participants who do play violent videogames enjoy playing, on average, for 106 minutes. This alone suggests that past researchers may be misguided in believing their findings from experiments using 5 to 30 minutes of game play can be applied to real life situations.

Given this was the first research of its kind, no effect size was available to help establish the required sample size prior to testing. With 185 participants in each of the long and short conditions, the effect size obtained in this research ( $g=.26$ ) would have reached significance at the .95 confidence level with power of .80. While the current data alone cannot refute past research investigating the short term effects of violent videogames, the pattern in the data suggests participants do habituate with time.

Subsequent analysis of the same hypothesis, using only participants who played videogames, came very close to statistical significance ( $p=.056$ ). Insufficient data points prevented a 2 (length) x 2 (CSA) ANOVA for Exposed participants being run. As argued in the Introduction, individuals' interpretations of 'violence' vary. Although a definition was provided (see Appendix A), participants may misinterpret possible violent content of the games they play, hence, believing they do not play violent videogames. This provided justification for analysing only the gamers within the sample. Analysis of gamers suggested only 53 participants would be required to reach statistical significance suggesting, the current design may have reached significance if novice players were not recruited.

The GAM and Zillman's (1971) excitation transfer theory propose that, after playing a violent videogame, the player is likely to interpret physiological arousal as hostility and behave in an aggressive manner. Baldaro et al. (2004) showed that participants' physiological arousal returned to basal levels 'rapidly' after 20 minutes of violent videogame play. In addition, the current results suggest that, during game-play, affective response (accompanied by arousal; Spielberger, 1991) begins to drop off some time after 20 minutes. Having established gamers' average length of play is 106 minutes, it is highly likely that gamers play until habituation of the stimulus and attenuation of the affective and/or physiological response.

In light of the current results, the purpose of this discussion is to clarify how research can be conducted that is representative of the 'real-world'. The results of previous research has led to calls for the reduction of violence in interactive media (Carll



et al., 2005), yet it is questionable that previous research accurately portrays the real-world gaming experience.

The GAM suggests that exposure to violent videogames increases aggression in the short term (20 minutes). While there is some evidence to support this claim (e.g. Anderson & Dill, 2000; Uhlman & Swanson, 2004), the current results suggest that these studies may have inflated the short-term effects of violent videogames as a result of using unrepresentative lengths of game-play. While Anderson and Dill's GAM has been prolifically referenced throughout the literature, the model does not account for habituation and attenuation of initial affective responses. Yet it is likely that this occurs outside the laboratory. It appears that some researchers are not focused on representing the real world, but rather, are focused on finding hypothesised effects. For example, Bartholow and Anderson (2002) state that, 10 minutes game-play might not have been long enough to have a large effect. Conversely, the current research has attempted to find an accurate length of game-play rather than just finding an effect.

Anderson and Dill argue that increases in short-term aggression are expected when violent videogames prime aggressive thoughts, increase hostile feelings, or increase physiological arousal. While this may hold true for extremely short durations of game-play, the current data suggests the GAM has failed to consider two important factors. First, at some point after 20 minutes and before 60 minutes, participants' affective responses begin to attenuate. Second, during their own time, gamers choose to play for extensively longer periods than have been used in research to date. While this attenuation of affective response may represent short-term desensitisation, the current research also investigated possible long-term desensitisation caused by violent videogames.

### *Desensitisation*

One possible explanation for potential long-term increases in aggression is that exposure leads to desensitisation by reducing normal inhibitions against aggression (Bartholow et al., 2006). Desensitisation has been shown to have negative effects. One negative impact can be a reduction in the responsiveness to victims of violence (Funk et al., 2004).

*Gender.* It has been suggested that gender differences in the effects of violent videogames may be a result of level of enjoyment (Anderson & Dill, 2000). In support of this idea, males in the current study enjoyed playing *Quake III* significantly more than females. Females were affected more than males on self reported physiological arousal, a result consistent with previous findings measuring skin conductance (Arriaga et al., 2006). This gender effect may be associated with exposure: Females spend less time playing videogames (Gentile et al., 2004) and are generally less interested in playing violent games (Anderson & Murphy, 2003). The effect may also be due to more worldly experiences: Males have more physical fights, play more violent sports and watch more violent movies (Sargent et al., 2002). In this regard, males have been more exposed to violence, which may account for the gender differences found in this study, as some of the male participants were unexposed to violent videogames and conversely some females were exposed. This raises some questions regarding the causality of violent videogames on physiological desensitisation. It is possible that the gender differences found in the current study may be the result of males having greater general exposure to violence in addition to greater exposure to violent videogames. Deselms and Altman (2003) provide a similar explanation for their gender effect findings, suggesting gender

differences were a function of ‘acculturation’, and not exclusively exposure to violent videogames.

*Exposure.* Bartholow, Sestir, and Davis (2005) showed that participants low on exposure behaved more aggressively after playing a violent game than a non violent game. They also found highly exposed participants displayed high levels of aggression regardless of the game type. From the current sample, Unexposed participants showed a significantly larger CSA than Exposed participants. Additionally, regardless of length condition, Exposed participants did not show a significant CSA. Carnagey et al. (in Press) suggest that repeated exposure leads to long term desensitisation which decreases perceived injury from violence, attention to violence, sympathy towards victims, and negative attitudes towards violence. Causation cannot be shown in the current results. To the contrary, proponents of violent videogames suggest that individuals with aggressive personalities are attracted to violent videogames in the first place, an argument acknowledged by opponents of violent videogames (e.g. Anderson & Dill, 2000; Carnagey et al., In Press).

To further explore this idea, aggression variables were tested for difference between Exposed and Unexposed participants. Only two variables separated the Exposed and Unexposed participants. Both Psychoticism and Extraversion were significantly higher for the Unexposed participants. This suggests that the contention of aggressive personalities being attracted to violent videogames may be false. These findings suggest differences between Exposed and Unexposed participants may be due to long-term violent videogame exposure. Coupled with the possible negative effects of desensitisation, chronic over-exposure to violent videogames may have deleterious

effects. These results strengthen the line of research suggesting exposure to violent videogames leads to desensitisation. While the negative impact of such effects should be highlighted, generalisations should not extend to all gamers, as individual differences are becoming increasingly relevant to the effects of violent videogames.

#### *Immersive Media Prediction Model*

Past research has not established what types of people are at risk of showing levels of violent videogame-induced aggression that warrants concern. Certain researchers (in particular Anderson) have published papers repeatedly, claiming violent videogames make people aggressive, while others (e.g. Fleming & Rickwood, 2001; Scott, 1995) have reported no such findings. Anderson et al. (2003) have even gone as far as to say the debate is “essentially over” (p.81). This should not be seen as a debate, but rather the progression of understanding. Unsworth et al.’s (In Press) research was the first to integrate opposing theories and acknowledge the importance of individual difference in this debate, by grouping participants according to the direction of CSA. The current study sought to replicate this model. Unfortunately, participants in the current study reported exceptionally low state anger pre-game play which prevented full replication of the model.

As Table 2 indicates, participants were able to be grouped according to an increase, decrease, and no change in State Anger. Grouping participants accordingly, as emphasised by Unsworth et al. (In Press), is integral to beginning to understand what type of people are likely to be at risk of being largely affected by violent videogames.

With  $M=10.97$  ( $SD=1.45$ ) and the lowest possible score of State Anger on the STAXI of 10, there was little opportunity for participants to show a reliable decrease

once the RC Index was applied. Only three participants had pre-game scores with potential to reliably decrease. Interestingly, there were a total of 14 participants whose State Anger score decreased after playing *Quake III*. Of these 14 participants, nine obtained the lowest possible score on State Anger at post game. It is possible that, given these participants' scores dropped to the lowest possible score, they might have dropped further if the scale allowed it, or they were in an angrier state prior to testing. The mean score of participants whose State Anger reliably decreased in Unsworth et al.'s (In Press) research was 22.5, allowing greater opportunity for a reliable decrease in anger.

In the absence of a 'decrease' group, an attempt was made to differentiate between the Increase group and the No Change group. Three of the five temperament variables (Neuroticism, Trait Anger, and Trait Anxiety) were significantly higher for the Increase group, as suggested by the IMP. While these results lend credence to the IMP, no decisive statements should be made in complete support or confirmation due to extremely variable samples.

#### *Skill and Game Intensity*

To reiterate, the current research aimed to clarify previous research in order to assist in more productive future research. Previous research has conducted experiments with varying lengths of play and setups. Some experimenters have used single player (e.g. Arriaga et al., 2006), while others have used multiplayer (e.g. Unsworth et al., In Press). However, unfortunately most published papers have given no indication of the player/game setup they used and have not acknowledged the possible influence these factors may have had on outcome variables.

In the current experiment, groups of between 3 and 13 participants played the same level of *Quake III* in order to establish if various levels of intensity affected participants' CSA scores. Strong arguments could have been made either way. Surprisingly, there was no relationship between Number of Players and CSA. This result provides additional support to previous research that has used varying number of players (e.g. Unsworth et al., In Press).

Whilst it would be reasonable to suggest that the skill of the player may be linked to their exposure to the game, this does not account for non-players with high aptitude for such games. While skill was found to be correlated with CSA, the result was not significant. Not surprisingly, there was a significant negative correlation between Skill and Frustration, showing unskilled players were more frustrated. Past research has controlled for frustration by having games independently rated for frustration and selecting a violent and non-violent game with similar ratings. This does not, however, account for individuals' frustration during experimentation. The current study used individuals' self-ratings of frustration. Frustration was a significant predictor of CSA, whereby high frustration predicted high CSA. As such, Skill had an indirect relationship on CSA. Habitual playing should increase a player's skill, in turn allowing them to enjoy the game more. According to the SLT of aggression (Bandura, 1973), the positive feelings associated with high skills act as positive reinforcement of the aggressive content. Skill may therefore be associated with positive (lower CSA) and negative (desensitisation) effects associated with violent videogames. Future model-building research should explore the role of skill within the context of aggression and violent videogames.

### *Implications of Subsidiary Analyses*

A Criminalty score was calculated for each participant, however this score did not differ significantly between the Increase and No Change groups. Anderson and Dill (2000) used the Delinquency Scale that has been frequently linked to criminal behaviour (e.g. Thornberry & Krohn, 2000). They found that delinquency correlated with exposure to violent videogames, however, the current results showed a negative correlation (-.22) between Exposure and Criminalty score. It is possible that because the mean age was higher in the current study, participants may have been more desensitised, in turn affecting their own perceptions of criminal-like activity.

Further support for the main hypothesis was found in that 65% of participants wanted to continue playing at the completion of the 20 minute condition (Figure 13). It should be noted that participants who had never played violent videogames before and participants who did not enjoy playing them were included in these statistics. Combined with the average amount of time participants play for, these statistics suggest future research should allow participants to play for longer than 20 minutes, if results are to be considered relevant beyond the laboratory.

Seven mutually exclusive categories were derived for 'reasons for enjoying violent videogames'. It was interesting to note that 28 % of participants reported that their primary reason for playing violent videogames was for cathartic or mood management purposes (see Figure A14). In addition, participants were asked if they thought violent videogames made people aggressive. Many responded with comments such as "No, to most it's a form of stress relief", "It's very cathartic after a big day...", "Not really, they serve as an outlet for feelings of anger" or "...it makes it easy for people

to vent their aggression”, indicating people feel they use them as an outlet for aggression, anger, or stress. This further suggests the absence of a decrease in State Anger group was confounded by the dependent measure and supports Unsworth et al.’s (In Press) evidence of violent videogames cathartic effects on some players.

#### *Limitations of the Current Study*

Although the interconnectedness of aggression, anger, and hostility were explored in the introduction as a means to justify the use of anger as the dependent measure, a more pure measure of aggression would be desirable. The use of the STAXI proved to be a limitation because extremely low pre-game scores prevented reliable decreases in anger from occurring.

The current study successfully found differences between participants with exposure to violent videogames and those without. While these findings are an important addition to the long-term desensitisation effects of violent videogames, using Exposed and Unexposed participants together evidently limited the main hypothesis. Additionally, Unexposed participants showed a larger increase in anger which lessened the likelihood of participants showing a decrease in anger, as required for replication of the IMP. Unsworth et al. (In Press) only used participants who had experience playing *Quake II*, providing a more accurate representation of the gaming population. Frustration was shown to contribute to CSA, although this relationship may have been vastly different if it were only experienced players who participated.

#### *Suggestions for Future Research*

There are several ways in which future research can build on the present research. Assuming that the derived effect sizes were true, 185 participants from the general



population in the long and the short groups would be sufficient to reach significance yet, recruitment of only gamers would require less than a third of that number to reach significance. The current participants were recruited from a wide range of backgrounds in an attempt to represent the general population, however future research would benefit from recruiting gamers only.

Another way to clarify the habituation effect is to have the long condition play for the period of time gamers stated they played for. If the long condition played for 106 minutes it is predicted that state anger would continue to drop off. Researchers could have participants mark on scale of 1-100 how angry (or aggressive, depending on the choice of dependent measure) they felt at 10 minute intervals throughout testing. This would provide a better understanding of where the peak effect is and at what rate the dependent measure drops off. Ideally, participants would be asked, and allowed, to play for as long as they wanted. Given appropriate experimental design, this would provide very representative data of the way gamers behave outside the laboratory. Future research should probe further into why and when gamers stop playing in their own time. This would contribute to a better understanding of the mental and physiological state gamers are in when they choose to stop playing. If gamers stop playing when they habituate, then it is unlikely that gamers would have potentially harmful residual arousal.

Anderson and Dill (2000) suggest violent videogames increase aggression via a cognitive rather than an affective route. Researchers using measures of aggression and anger concurrently could establish if the two are associated in the context of violent videogames. Results may provide support for anger being an appropriate measure of aggression.

Given that some researchers have attempted to neutralise participants' feelings prior to playing (Williams and Clippinger, 2002), future researchers should investigate the cathartic role of violent videogames by angering or aggressing participants prior to playing. Cathartic and mood-management (anger, aggression or stress relief) reasons were the most popular reason for enjoying violent videogames. In-depth analysis of this might provide support for some positive outcomes associated with violent videogames.

### *Conclusions*

Although Sherry (2001) recommended a single study to investigate varying lengths of play, such a study has not been conducted until now. A wide range of participants were recruited, however, statistically significant differences were not found between long and short game-play. Results indicated that repetition of this study using a representative gaming sample (Exposed participants only) would most likely show significant differences. The difference between length conditions may be further clarified by lengthening the long condition. It is suggested that future research should focus on a length of game-play with greatest relevance to the 'real world'.

Possible long-term desensitisation effects were also presented. Whilst reluctant to claim causation, aggressive personality factors did not separate the Exposed and Unexposed groups suggesting it may not be aggressive personality types that are initially attracted to violent videogames. If the negative effects associated with desensitisation (e.g. decreases in perceived injury, sympathy for victims, and helping behaviour) are true, this may be the most dangerous effect of violent videogames.

## References

- Abel-Cooper, T. B. (2001). *The association between video game playing, religiosity, parental guidance and aggression, in sixth through eighth grade students attending Seventh-Day Adventist Schools.*, Univ Microfilms International.  
[Abstract only]
- Anderson, C. A. (2004). An update on the effects of playing violent video games. *Journal of Adolescence*, 27(1), 113-122.
- Anderson, C. A., & Bushman, B. J. (2001). Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science*, 12(5), 353-359.
- Anderson, C. A., & Bushman, B. J. (2002). Human Aggression. *Annual Review of Psychology*, 53, 27-51.
- Anderson, C. A., Carnagey, N. L., & Eubanks, J. (2003). Exposure to Violent Media: The Effects of Songs with Violent Lyrics on Aggressive Thoughts and Feelings. *Journal of Personality and Social Psychology*, 84(5), 960-971.
- Anderson, C. A., Carnagey, N. L., Flanagan, M., Benjamin, A. J. J., Eubanks, J., & Valentine, J. C. (2004). *Violent Video Games: Specific Effects of Violent Content on Aggressive Thoughts and Behavior.*: Elsevier Academic Press.
- Anderson, C. A., & Dill, K. E. (2000). Video Games and Aggressive Thoughts, Feelings, and Behavior in the Laboratory and in Life. *Journal of Personality and Social Psychology*, 78(4), 772-790.

- Anderson, C. A., & Murphy, C. R. (2003). Violent Video Games and Aggressive Behavior in Young Women. *Aggressive Behavior, 29*(5), 423-429.
- Arriaga, P., Esteves, F., Carneiro, P., & Monteiro, M. B. (2006). Violent computer games and their effects on state hostility and physiological arousal. *Aggressive Behavior, 32*(2), 146-158.
- Atkins, E., Nixon, K., Fling, S., Smith, L., Rodriguez, T., & Thornton, D. (1992). Videogames, Aggression, and Self-Esteem: A Survey. *Social Behavior & Personality: An International Journal, 20*(1), 39-38.
- Baldaro, B., Tuozzi, G., Codispoti, M., Montebanocci, O., Barbagli, F., Trombini, E., et al. (2004). Aggressive and non-violent videogames: Short-term psychological and cardiovascular effects on habitual players. *Stress and Health, 20*, 203-208.
- Ballard, M. E., & Lineberger, R. (1999). Video game violence and confederate gender: Effects on reward and punishment given by college males. *Sex Roles, 41*(7/8), 541.
- Ballard, M. E., & Weist, J. R. (1996). Mortal Kombat: The effects of violent videogame play on males' hostility and cardiovascular responding. *Journal of Applied Social Psychology, 26*, 717-730.
- Bandura, A. (1973). *Aggression: A social learning analysis*. Eaglewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (1986). *Social foundation of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.
- Bartholow, B. D., & Anderson, C. A. (2002). Effects of Violent Video Games on Aggressive Behavior: Potential Sex Differences. *Journal of Experimental Social Psychology, 38*(3), 283-290.
- Bartholow, B. D., Bushman, B. J., & Sestir, M. A. (2005). Chronic violent video game exposure and desensitization to violence: Behavioral and event-related brain potential data. *Journal of Experimental Social Psychology, In Press, Corrected Proof*.
- Bartholow, B. D., Sestir, M. A., & Davis, E. B. (2005). Correlates and Consequences of Exposure to Video Game Violence: Hostile Personality, Empathy, and Aggressive Behavior. *Personality and Social Psychology Bulletin, 31*(11), 1573-1586.
- Bensley, L., & Van Eenwyk, J. (2001). Video games and real-life aggression: Review of the literature. *Journal of Adolescent Health, 29*(4), 244-257.
- Berkowitz, L. (1984). Some effects of thoughts on anti- and prosocial influences of media events: A cognitive neoassociationistic analysis. *Psychological Bulletin, 95*, 410-427.
- Berkowitz, L. (1990). On the Formation and Regulation of Anger and Aggression : A Cognitive Neoassociationistic Analysis. *American Psychologist, 45*(4), 494-503.
- Bishop, G. D., & Quah, S.-H. (1998). Reliability and validity of measures of anger/hostility in Singapore: Cook & Medley Ho Scale, STAXI and Buss-Durkee Hostility Inventory. *Personality and Individual Differences, 24*(6), 867-878.

- Brooks, M. C. (2000). *Press start: Exploring the effects of violent video games on boys*. Univ Microfilms International. [Abstract only]
- Bruggemann, J. M., & Barry, R. J. (2002). Eysenck's P as a modulator of affective and electrodermal responses to violent and comic film. *Personality and Individual Differences, 32*(6), 1029-1048.
- Brusa, J. A. (1987). Effects of video game play on children's social behavior (aggression, cooperation). *Abstracts International-B, 48/10*, 3127.
- Bushman, B. J. (1995). The moderating role of trait aggressiveness in the effects of violent media on aggression. *Journal of Personality and Social Psychology, 69*(5), 950-960.
- Bushman, B. J., & Anderson, C. A. (2002). Violent video games and hostile expectations: A test of the general aggression model. *Personality and Social Psychology Bulletin, 28*(12), 1679-1686.
- Bushman, B. J., Baumeister, R. F., & Phillips, C. M. (2001). Do People Aggress to Improve Their Mood? Catharsis Beliefs, Affect Regulation Opportunity, and Aggressive Responding. *Journal of Personality and Social Psychology, 81*(1), 17-32.
- Buss, A. H. (1961). *The psychology of aggression*. New York: Wiley.
- Cahill, S. (2003, 11 February). *Personal Communication*.
- Carll, E., Singer, D., Anderson, C. A., Bushman, B. J., Dill, J. C., & Friedland, L. (2005). APA calls for reduction of violence in interactive media used by children and adolescents. Retrieved 10 July, 2006, from <http://www.apa.org/releases/videoviolence05.html>

- Carnagey, N. L., & Anderson, C. A. (2004). Violent video game exposure and aggression: A literature review. *Minerva Psichiatrica*, *45*(1), 1-18.
- Carnagey, N. L., & Anderson, C. A. (2005). The Effects of Reward and Punishment in Violent Video Games on Aggressive Affect, Cognition, and Behavior. *Psychological Science*, *16*(11), 882-889.
- Carnagey, N. L., Anderson, C. A., & Bushman, B. J. The effect of video game violence on physiological desensitization to real-life violence. *Journal of Experimental Social Psychology*, *In Press, Corrected Proof*.
- Caruso, J. C., Witkiewitz, K., Belcourt-Dittloff, A., & Gotlieb, J. D. (2001). Reliability of Scores from the Eysenck Personality Questionnaire: A Reliability Generalization Study. *Educational and Psychological Measurement*, *61*(4), 675-689.
- Cooper, J., & Mackie, D. (1986). Video games and aggression in children. *Journal of Applied Social Psychology*, *16*, 226-244.
- Deadening the heart. Killer video games are no 'safety valve' - quite the opposite. (2005). *Christianity Today*, *October*, 31.
- Deselms, J. L., & Altman, J. D. (2003). Immediate and Prolonged Effects of Videogame Violence. *Journal of Applied Social Psychology*, *33*(8), 1553-1563.
- Devilley, G. J. (2005). ClinTools Software for Windows: Version 3.5. Melbourne.
- Dietz, T. L. (1998). An examination of violence and gender role portrayals in video games: Implications for gender socialization and aggressive behavior. *Sex Roles*, *38*(5/6), 425.
- Dill, K. E., & Dill, J. C. (1998). Video game violence: A review of the empirical literature. *Aggression and Violent Behavior*, *3*(4), 407-428.

- Durkin, K., & Asbeitt, K. (1999). *Computer games and Australians today*. Sydney: Office of Film and Literature Classification.
- Durkin, K., & Barber, B. (2002). Not so doomed: computer game play and positive adolescent development. *Journal of Applied Developmental Psychology, 23*(4), 373-392.
- Eckhardt, C., Norlander, B., & Deffenbacher, J. (2004). The assessment of anger and hostility: a critical review. *Aggression and Violent Behavior, 9*(1), 17-43.
- Egli, E. A., & Meyers, L. S. (1984). The role of video game playing in adolescent life: Is there reason to be concerned? *Bulletin of the Psychonomic Society, 22*, 309-312.
- Eysenck, H. J., & Eysenck, S. G. B. (1975). *Manual of the Eysenck Personality Questionnaire (Junior & Adult)*. San Diego: Educational and Industrial Testing Service Inc.
- Eysenck, S. G. B., & Eysenck, H. J. (1971). A comparative study of criminals and matched controls on three dimensions of personality. *British Journal of Social and Clinical Psychology, 10*, 362-366.
- Fleming, M. J., & Rickwood, D. J. (2001). Effects of violent versus nonviolent video games on children's arousal, aggressive mood, and positive mood. *Journal of Applied Social Psychology, 31*, 2047-2071.
- Funk, J. B. (2005). Children's Exposure to Violent Video Games and Desensitization to Violence. *Child and Adolescent Psychiatric Clinics of North America, 14*(3), 387-404.
- Funk, J. B., Baldacci, H. B., Pasold, T., & Baumgardner, J. (2004). Violence exposure in real-life, video games, television, movies, and the internet: is there



- desensitization? *Journal of Adolescence Video Games and Public Health*, 27(1), 23-39.
- Funk, J. B., & Buchman, D. D. (1996). Playing violent video and computer games and adolescent self-concept. *Journal of Communication*, 46(2), 19-32.
- Funk, J. B., Buchman, D. D., Jenks, J., & Bechtoldt, H. (2003). Playing violent video games, desensitization, and moral evaluation in children. *Journal of Applied Developmental Psychology*, 24(4), 413-436.
- Funk, J. B., Hagan, J., Schimming, J., Bullock, W. A., Buchman, D. D., & Myers, M. (2002). Aggression and psychopathology in adolescents with a preference for violent electronic games. *Aggressive Behavior*, 28(2), 134-144.
- Gentile, D. A., Lynch, P. J., Linder, J. R., & Walsh, D. A. (2004). The effects of violent video game habits on adolescent hostility, aggressive behaviors, and school performance. *Journal of Adolescence Video Games and Public Health*, 27(1), 5-22.
- Graybill, D., Strawniak, M., Hunter, T., & O'leary, M. (1987). Effects of play versus observing violent versus nonviolent videogames on children's aggression. *Psychology, A Quarterly Journal of Human Behavior*, 24, 1-8.
- Griffiths, M. (1997). Computer game playing in early adolescence. *Youth & Society*, 29(2), 223-237.
- Griffiths, M. (1999). Violent video games and aggression: A review of the literature. *Aggression and Violent Behavior*, 4(2), 203-212.
- Griffiths, M., Davies, M. O., & Chappell, D. (2004). Online computer gaming: A comparison of adolescent and adult gamers. *Journal of Adolescence*, 27, 87-96.

- Gross, E. F. (2004). Adolescent Internet use: What we expect, what teens report. *Journal of Applied Developmental Psychology, 25*(6), 633-649.
- Grossman, D. (2005). Teaching kids to kill. *Killology Research Group: The Psychological Cost of Learning to Kill*. Available:  
[http://www.killology.com/article\\_teachkid.htm](http://www.killology.com/article_teachkid.htm)
- Hill, J. (2006, 10 August). Adults only. *The Age*, pp. 6-7.
- Howell, D.C. (1997). *Statistical Methods for Psychology*. Belmont: Wadsworth Publishing Company.
- Irwin, A.R., & Gross, A.M. (1995). Cognitive tempo, violent video games, and aggressive behavior in young boys. *Journal of Family Violence, 10*, 337-350.
- Jacobson, N.S., & Traux. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59*, 12-19.
- Keene, N. (2005). The games people play. *The Newcastle Herald, 28*.
- Kirsh, S.J. (1998). Seeing the world through Mortal Kombat-colored glasses: Violent video games and the development of a short-term hostile attribution bias. *Childhood: A Global Journal of Child Research, 5*(2), 177-184.
- Kirsh, S.J. (2003). The effects of violent video games on adolescents: The overlooked influence of development. *Aggression and Violent Behavior, 8*(4), 377-389.
- Kirsh, S.J., Olczak, P.V., & Mounts, J.R.W. (2005). Violent Video Games Induce an Affect Processing Bias. *Media Psychology, 7*(3), 239-250.
- Knapp, H.E. (2001). Desensitization after effects of playing violent videogames. *Digital Dissertations* Retrieved 20 May, 2006

- Krahe, B., & Moller, I. (2004). Playing violent electronic games, hostile attributional style, and aggression-related norms in German children. *Journal of Adolescence*, 27, 53-69.
- Kuntsche, E.N. (2004). Hostility among adolescents in Switzerland? Multivariate relations between excessive media use and forms of violence. *Journal of Adolescent Health*, 34(3), 230-236.
- Larkin, M. (2000). Violent video games increase aggression. *The Lancet*, 355(9214), 1525.
- LEAD Technologies Inc. (2005). SPSS 14.0.
- Meyers, K.S. (2003). *Television and video game violence: Age differences and the combined effects of passive and interactive violent media.*, Univ Microfilms International. [Abstract only]
- Muir, H. (2004). The violent games people play. *New Scientist*, 184(2470), 26-26.
- Newman, K.S., Foc, C., Harding, D., Mehta, J., & Roth, W. (2004). *RAMPAGE: The social roots of school shootings*. New York: Basic Books.
- Office of Film and Literature Classification (2006). *Classification database*. Sydney: Office of Film and Literature Classification.
- Olson, C.K. (2004). Media violence research and youth violence data: Why do they conflict? *Academic Psychiatry*, 28(2), 144-150.
- Panee, C.D., & Ballard, M.E. (2002). High versus low aggressive priming during video-game training: Effects on violent action during game play, hostility, heart rate, and blood pressure. *Journal of Applied Social Psychology*, 32(12), 2458-2474.

- Pena, J., & Hancock, J.T. (2006). An analysis of socioemotional and task communication in online multiplayer video games. *Communication Research, 33*(1), 92-109.
- Quaiser-Pohl, C., Geiser, C., & Lehmann, W. (2006). The relationship between computer-game preference, gender, and mental-rotation ability. *Personality and Individual Differences, 40*(3), 609-619.
- Rosenberg, B.H., Landsittel, D., & Averch, T.D. (2005). Can video games be used to predict or improve laparoscopic skills? *Journal of Endourology, 19*(3), 372-376.
- Sargent, J.D., Heatherton, T.F., Ahrens, M.B., Dalton, M.A., Tickle, J.J., & Beach, M.L. (2002). Adolescent exposure to extremely violent movies. *Journal of Adolescent Health, 31*(6), 449-454.
- Scott, D. (1995). The effect of video games on feelings of aggression. *Journal of Psychology, 129*(2), 121-132.
- Sheese, B.E., & Graziano, W.G. (2005). Deciding to Defect: The Effects of Video-Game Violence on Cooperative Behavior. *Psychological Science, 16*(5), 354-357.
- Sherry, J.L. (2001). The effects of violent video games on aggression: A meta-analysis. *Human Communication Research, 27*(3), 409-431.
- Smith, S.L., Lachlan, K., & Tomborini, R. (2003). Popular Video Games: Quantifying the Presentation of Violence and Its Context. *Journal of Broadcasting and Electronic Media, 40*(1), 58-76.
- Spielberger, C.D. (1991). *State-Trait Anger Expression Inventory: Revised Research Edition Professional Manual*. Florida: Psychological Assessment Resources, Inc.
- StatSoft, Inc. (2003). STATISTICA (data analysis software system) (Version 6).

- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.
- Tabachnick, B.G., & Fidell, L.S. (2001). *Using multivariate statistics* (4 ed.). Needham Heights: Allyn & Bacon.
- Thornberry, T.P., & Krohn, M.D. (2000). The Self-Report Method for Measuring Delinquency and Crime. *Criminal Justice*, 4, 33-84.
- Uhlmann, E., & Swanson, J. (2004). Exposure to violent video games increases automatic aggressiveness. *Journal of Adolescence*, 27(1), 41-52.
- Unsworth, G. (2004). *Style of player: A clarifying approach to the violent videogame debate*. The University of Melbourne, Melbourne.
- Unsworth, G., Devilly, G.J., & Ward, T. (In Press). The effect of playing violent videogames: Are adolescents doomed to violence?
- Unsworth, G., & Ward, T. (2001). Video games and aggressive behaviour. *Australian Psychologist*, 36(3), 184-192.
- Weber, R., Ritterfeld, U., & Mathiak, K. (2006). Does playing violent video games induce aggression? Empirical evidence of a functional magnetic resonance imaging study. *Media Psychology*, 8(1), 39-60.
- Wegman, C. (1985). *Psychoanalysis and cognitive psychology: a formalization of Freud's earliest theory*. London: Academic Press.
- Williams, D. (2002). Structure and competition in the US, home video game industry. *International journal of media management*, 4, 41-54.

- Williams, R.B., & Clippinger, C.A. (2002). Aggression, competition and computer games: computer and human opponents. *Computers in Human Behavior, 18*(5), 495-506.
- Zillmann, D., & Weaver, I., James B. (1997). Psychoticism in the effect of prolonged exposure to gratuitous media violence on the acceptance of violence as a preferred means of conflict resolution. *Personality and Individual Differences, 22*(5), 613-627.
- Zillmann, D. (1988). Mood management: Using entertainment to full advantage. In L. Donohew, H.E. Sypher & E.T. Higgins (Eds.), *Communication, social cognition, and affect*. Hillsdale, NJ: Lawrence Erlbaum.

## Appendix C

### *Self-Regulation: Reasons for Playing or not Playing Violent Videogames*

Using a grounded theory approach (Strauss, & Corbin, 1990) participants' reasons for enjoying or not enjoying violent videogames were examined for meaning units (i.e., passages that express a distinct idea) and collapsed into the mutually exclusive categories of: (i) Escape Reality; (ii) Excitement/Arousal; (iii) Catharsis/Mood Management; (iv) Challenge; (v) Skill Development; (vi) Social Aspects; (vii) (best) Graphics; and (viii) Other.

The same approach was taken for reasons for disliking playing violent videogames. The mutually exclusive categories were; (i) Boring; (ii) Violence; (iii) Antisocial; and (iv) Other. A psychology honours student from a different university classified meaning units in to the above categories. By calculating the 'percentage of agreement' (Murphy, & Davidshofer, 1998) among raters' classification of each participant, the inter-rater reliability was found to be very high (93%).

### *Results*

Participants were asked why they enjoyed playing violent videogames (Self Regulation). If multiple answers were provided, they were recorded in the order they were written, with up to three possible reasons. First response represents primary reason for playing. Figure 14 presents only the primary reason for playing, while Figure 15 includes the total of all reasons provided, regardless of order. Figure 16 provides reasons for some participants not enjoying violent videogames.

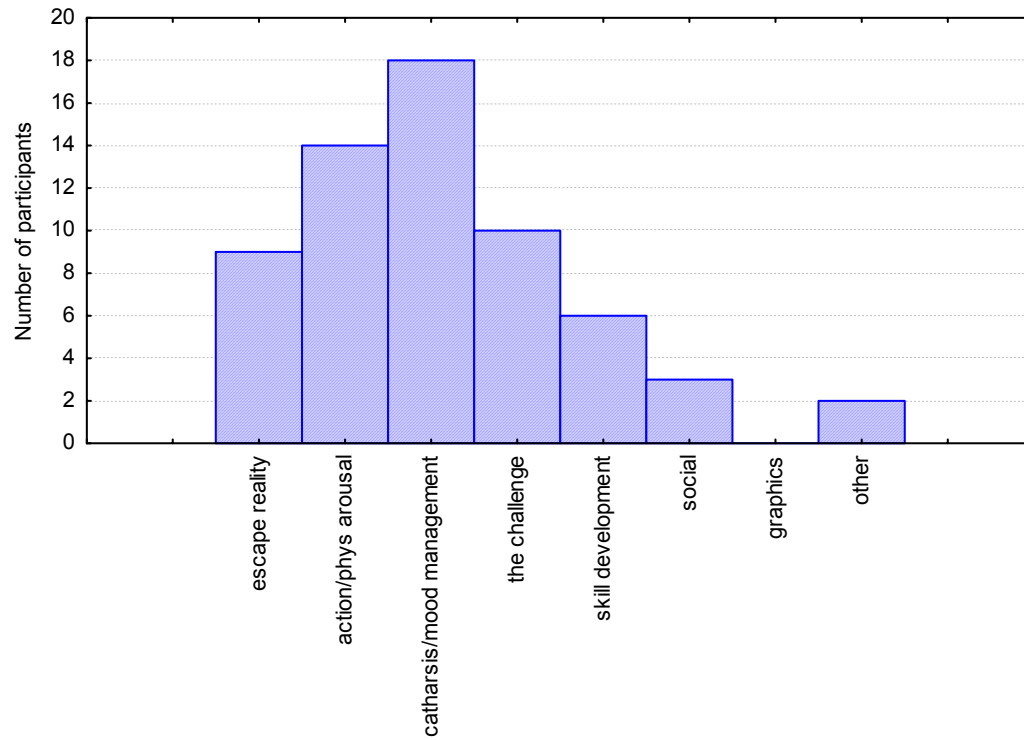


Figure 14. Primary reasons for enjoying violent videogames.

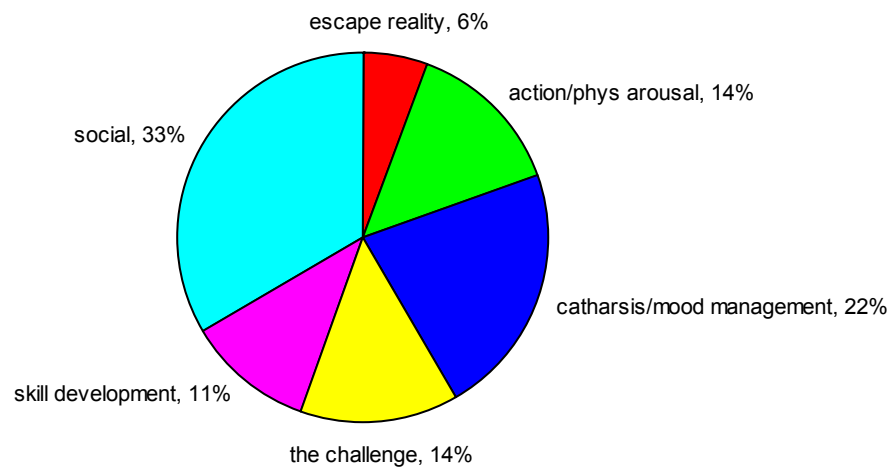
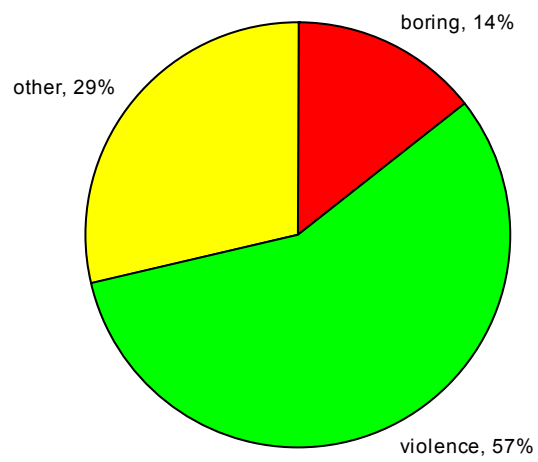


Figure 15. All reasons combined for enjoying violent videogames.





*Figure 16.* Reasons for not enjoying violent videogames.

## Appendix D

*Calculation of the Reliable Change (RC) Index (Jacobson & Traux, 1991)*

The RC Index is calculated from the following equation:

$$RC = \frac{x_2 - x_1}{S_{diff}}$$

Where  $x_2 - x_1$  is CSA.  $S_{diff}$  represents the standard error of CSA and is computed from the standard error of measurement (SEM):

$$S_{diff} = \sqrt{(2(SEM))^2}$$

Where

$$SEM = SD\sqrt{(1-r_{xx})}$$

RC is a psychometric application that reliably measures if the observed CSA is more than “fluctuations of an imprecise measuring instrument” (Jacobson & Traux, 1991, p.14). If RC is  $<1.96$ , it is unlikely ( $p<.05$ ) CSA in not reflecting real change.

Cahill (2003) reported a test-retest reliability of .77 for a sample of college students with a mean state anger score on the STAXI of 11.78 ( $SD = 3.27$ ). The RC Index was state anger on the STAXI was therefore calculated as follows:

$$SEM = 3.27\sqrt{(1-.77)} = 1.57$$

$$S_{diff} = \sqrt{(2(1.57))^2} = 2.22$$

$$RC = \frac{x_2 - x_1}{2.22}$$

Given the RC Index must be  $>1.96$  for 95% confidence, the minimum change (MC) required is therefore:

$$MC = 1.96 \times 2.22 = 4.53 (p<.05)$$