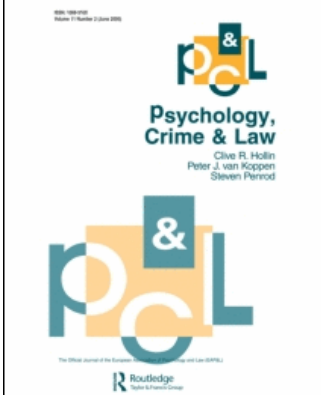

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The effect of playing violent video games on adolescents: Should parents be quaking in their boots?

GABRIELLE UNSWORTH[1], GRANT J. DEVILLY[2], & TONY WARD[2,3]

[1]*Department of Psychology, The University of Melbourne, Australia,* [2]*Brain Sciences Institute, Swinburne University, Hawthorn, Victoria, Australia, and* [3]*School of Psychology, Victoria University of Wellington, New Zealand*

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Abstract
Debate regarding the psychological and behavioural effects of playing violent video games has recently led to claims that violent video games increase aggression effects in adolescents, and that this issue has now been settled. However, other researchers have found either no detrimental effects from game playing or even positive (cathartic) effects. In this research we demonstrate that these different conclusions are not mutually exclusive and can be explained by the method of assessment and analytic techniques utilised. We had adolescents play a violent video game (*Quake II*) and took measurements of anger both before, during and after game play. The results demonstrated that some people increase, some decrease and the majority show no change in anger ratings. Unlike past research, we also demonstrate that these changes are mediated by the player's feelings immediately prior to game play and a labile temperament – one predisposed to aggression – and that these variables predict people's reactions with an average 73% concordance rate.

Keywords: *Video games, violence, adolescents, anger*

Introduction

Craig Anderson and colleagues (2003) have recently concluded that the debate regarding the effects of violent video gaming on adolescents is "essentially over", claiming that violent video games lead to an increase in aggressive thoughts, feelings and behaviours. Built upon the rationale that violent media content leads to the modelling of violence and triggering of aggressive acts, it has been argued that these games increase the likelihood of aggressive outbursts in both the short term and long term. While such claims are very compelling at a "common sense" level, there is evidence to suggest that general media violence is not a significant factor in violent crime rates (Browne & Pennell, 1998; Hagell & Newburn, 1994) and that violent video gaming does not lead to social dysfunction (Egli & Meyers, 1984). Furthermore, other researchers have found either no detrimental effects from game playing (Fleming & Rickwood, 2001; Nelson & Carlson, 1985; Winkel, Novak, & Hopson, 1987) or even positive (cathartic) effects (Kestenbaum & Weinstein, 1985).

Correspondence: Grant J. Devilly, Brain Sciences Institute, Swinburne University, PO Box 218, Hawthorn, Victoria 3122, Australia. E-mail: gdevilly@swin.edu.au

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Such a divergence of views has led to the journal *Nature* to write a commentary on this debate. Reichhardt (2003) has suggested the need for a convergence of views – or at least the need to achieve a unifying theory. A longitudinal design, over the lifespan of players, would be the most preferable design to elucidate the long-term effects of playing violent video games. However, there is still no convincing explanation for the disparate short-term effects of exposure to such games. Whilst it is a logical fallacy that a "middle ground" approach to the debate is the most likely explanation to be correct, we do need a theory that explains all of our current data.

Assertions that violent video games lead to increased aggression are predominantly based on research that has examined these effects by assessing the statistical difference between the players' average scores on a measure of aggression over time (e.g. pre- to post-game-play). Not only are such conclusions drawn from a "general group trend", which may lead to a misinterpretation of the experiences of individual players, but they fail to address the imprecision of post-game-play scores related to limitations in the reliability of the assessment instruments being used. However, a Reliable Change Index (RCI; Jacobson & Truax, 1991) allows for a range of scores to be defined, within which an individual's score may fluctuate due to imprecision of the measuring instrument. That is, the RCI is a psychometrically reliable way of measuring whether the change in observed state anger from pre- to post-game-play is more than what might be expected due to the reliability of the measure being used. RC is a psychometrically reliable way of measuring whether the change observed in state anger scores from pre- to post-game-play is more than "the fluctuations of an imprecise measuring instrument" (Jacobson & Truax, 1991, p. 14).

This is the first study to apply the RCI to change in aggression scores after violent video game play. This research is particularly important in the current climate of high-school shootings and the growing trend to apportion blame to what is essentially a form of entertainment for many people.

Anderson and Dill's (2000) research is arguably the most comprehensive examination of the effects of violent video games on undergraduate students. Within the context of a General Aggression Model (GAM), these researchers investigated the moderating role of exposure to violent video games and the mediating roles of trait irritability and accessibility to aggressive thoughts. The GAM endeavours to explain both short-term and long-term effects of violent video games by integrating social learning theory, arousal theory and cognitive processing models. The model begins with the assumption that aggressive behaviour is "largely based on knowledge structures (e.g. scripts, schemas) created by social learning processes" (Anderson & Dill, 2000, p. 773). There are four stages whereby "personological" (e.g. aggressive personality) and "situational" (e.g. video game play, provocation) variables influence the "internal state" of the video game player through priming aggressive cognitions, increasing aggressive affect or heightening arousal. The individual then appraises the situation for level of threat. Finally, if these three stages have resulted in the activation of an aggressive behavioural script, the player will, in the short term, behave aggressively. For example, playing a violent video game may prime aggressive cognitions through the activation of aggressive scripts and concepts, increase physiological arousal, and create feelings of anger. This altered internal state leads to an aggression biased appraisal of external cues, which leads to an aggressive response (Bushman & Anderson, 2002). In the long-term, the GAM predicts that repeated exposure to violent video games will result in changes to the individual's personality, leading the player to become "more aggressive in outlook, perceptual biases, attitudes, beliefs, and behaviour" (Anderson & Dill, 2000, p. 774).

One problem with this model is the assertion that personality, which has long been recognised as relatively stable, can be changed by exposure to violent media through the rehearsal and reinforcement of aggressive knowledge structures. Secondly, even if media violence teaches the individual that "aggression is an appropriate way to deal with conflict and anger" (Bushman & Anderson, 2002, p. 1680), the model does not consider other learning experiences which may be equally powerful and yet provide a less aggressive alternative to conflict resolution.

It was hypothesised in the current study that some of the inconsistencies in the violent video game research might be explained by an individual's ability to regulate arousal and emotion. A small group of violent video game players may seek out this form of media as a means of managing their emotional state and level of arousal. This may be in the form of decreasing arousal to achieve a cathartic effect. Alternatively, an individual may play video games for the purpose of increasing arousal, which may, if the arousal is mis-attributed to threatening or aggressive external stimuli (see Arousal Theory, Schacter & Singer, 1962; Zillmann, 1971), increase aggressive affect and aggressive behaviour.

Therefore, an individual's level of arousal as a function of their state affect may mediate the effects of violent video game play. Mood management theory (Zillmann, 1988) suggests that playing violent video games can serve to stimulate the player and relieve boredom, or to act as a coping mechanism for the temporary relief of stress and anxiety. It was hypothesised that a participant's reason for playing video games and their affect immediately prior to game play would be related to their affective state at post-game-play.

The current study extends from Anderson and Dill by acknowledging the possibility of *three* distinct outcomes of violent video game play, and by examining the role of predictors in the context of all three outcomes. Each outcome is dependent on the combination of state and trait variables intrinsic to the individual player. Integrating the existing theory and research, this study introduces a new model [the Immersive Media Prediction (IMP) model] and hypothesised one moderating variable (exposure to violent video games), and four mediating variables (temperament, affect prior to game play, accessibility to aggressive cognitions, and self-regulation of affect) as possible predictors of the short-term effects of violent video game play.

Method

Participants

One hundred schools from the Eastern and Southern Metropolitan Regions of Melbourne were initially contacted – of which 10 expressed their interest in the study. Students in years 8, 9 and 10 from participating schools were then approached through their teachers and given an information sheet and consent form. One hundred and twenty male and 15 female students aged between 12 and 18 years volunteered for the study. Disruptive behaviour by some students may have compromised the validity of one testing session and, consequently, the data of all students in that group was discarded. This left the final sample consisting of 111 male (mean age = 14.6, SD = 1.06) and 15 female (mean age = 14.8, SD = 0.86) participants with an overall mean age of 14.6 years (SD = 1.04). All missing cases in the results were deleted leaving a final sample of 107 participants (94 male, 13 female) with a mean age of 14.7 years. This disparity between male versus female participants may be partly explained by the requirement that all participants have prior experience of playing the game *Quake II*. Games of this genre have been found to be significantly more popular with

males than females (see Durkin & Aisbett, 1999). The ratio of males to females in this study is therefore considered to be representative of the general population of *Quake II* players.

Materials and Procedure

Participants were asked to complete a Gaming Questionnaire, measuring their gaming habits, and three questionnaires designed to measure (i) personality traits, specifically: Psychoticism, Neuroticism and Extroversion (Eysenck Personality Questionnaire-Junior; EPQ-J, Eysenck & Eysenck, 1975); (ii) Trait Anger (STAXI, Spielberger, 1991); and (iii) Trait Anxiety (STAI, Spielberger, 1983). The STAXI also provided a pre-game-play measure of participants' state anger. While it is acknowledged that state anger is not a measure of aggressive behaviour, given that angry affect is frequently a requirement for aggressive behaviour (Spielberger, 1991), it was considered a useful measure for the purpose of informing about the short-term effects of violent video game play.

Participants were then asked to play the game *Quake II*, which was chosen for the combination of its violence rating, genre, popularity, and high-resolution 3D graphics. For ethical reasons, and to control for issues of gaming difficulty and player frustration, all participants had prior knowledge and experience of playing *Quake II*.

Accessibility to aggressive thoughts during game-play was assessed using the Articulated Thoughts in Simulated Situations (ATSS) Paradigm (Davison, Vogel, & Coffman, 1997). This process enabled a more "pure" measure of accessibility to aggressive cognitions than methods used in previous studies. These studies have assessed accessibility to aggressive thoughts during game-play by using a post-game-play reaction-time task (Anderson & Dill, 2000) or a free-recall task (Calvert & Tan, 1994). This study measured accessibility to aggressive thoughts using the ATSS. Unlike previous methods, ATSS allows for the player's thoughts to be recorded and measured *during game-play* and may have more veracity and be less open to demand effects than retrospective reports. However, the trade-off is that the process may interfere with game play immersion for some and help for others. Either way, Davison et al. (1997) argue that "because think-aloud methods assess cognitions concurrently with their occurrence, they may be better suited to tapping actual thought content than other modes" (p. 950). The cognitions recorded in this study have high specificity to violent video game play because they were taped while the participants were playing *Quake II*. After playing the game uninterrupted for 5 min (considered sufficient for players to become immersed in the game), participants were asked to talk out-loud their thoughts into a microphone during 15 min of gaming. At the end of this 20-min period participants were re-administered the STAXI and STAI for the purpose of obtaining a post-game-play state-anger measure. The inclusion of the anxiety measure was to deflect participants from the main purpose of the post-game-play assessment.

Participants' scores for each of the independent measures were then calculated. Exposure to violent video games was calculated by combining the violence ratings of participants' self-reported favourite and most frequently played video games with the amount of time they spend playing video games, in general, per week. The violence rating of the video games was ascertained from the Office of Film and Literature Classification (OFLC) web site (http://www.oflc.gov.au). These levels (none, low, medium and high level violence) were assigned a score of 0, 1, 2 and 3, respectively. Participants were assigned a violence score for their favourite video game, and for each of the five video games they most frequently played. The average of these six scores was then calculated, and each participant was given an overall violence score. Exposure to violent video games was then calculated by multiplying each player's violence score with their self-reported frequency of game play (hours per week).

Participants' temperament was measured from six subscales of the STAXI, STAI and EPQ-J: (i) Trait Anger; (ii) Anger Expression; (iii) Trait Anxiety; (iv) Extroversion; (v) Neuroticism; and (vi) Psychoticism. A score of accessibility to aggressive cognitions was calculated from the recordings of player's thoughts during game-play that were transcribed and analysed for number of aggressive thoughts per total number of thoughts recorded, and converted to a percentage score (inter-rater reliability of $r = 0.80$, $p < 0.001$). Finally, participants' self-regulation was calculated from information they provided about why they liked playing video games. Using a grounded theory approach (Strauss & Corbin, 1990) reasons for game play endorsed by the participants were examined for meaning units (i.e. passages that express a distinct idea) which were eventually collapsed into the mutually exclusive categories of: (i) Increase Arousal; (ii) Escape Reality; (iii) Improve Mood; or (iv) Other. By calculating the "percentage of agreement" (Murphy, & Davidshofer, 1998) among raters' classification of each participant, inter-rater reliability was assessed as good (81%).

Results

Our results were first analysed using a cluster analysis to assess the prediction that adolescents, after playing a violent video game, naturally fall into one of the hypothesised three groups. Results indicated that participants' change in state anger could be reliably clustered into the three distinct categories of increased ($M = 15.92$), decreased ($M = -7.00$), and no change ($M = 1.42$) on aggression [$F(2,104) = 219.50$, $p < 0.001$].

To ensure that group membership was reflective of a reliable change in state anger (as opposed to measurement error), a RCI (Jacobson, & Truax, 1991) was calculated for the state anger scores on the STAXI, and used to assist the classification process. Using the STAXI state anger short-term (20 min) test–retest reliability of 0.77 provided by Cahill (S. Cahill, personal communication, 11 February 2003), the minimum change required to be classified as reliable (95%) was 4.35 points (requiring a change of at least ± 5 points). A summary of the three derived groups is provided in Table I. Important to note is that participants in the Increase and No Change groups reported similar levels of angry affect at pre-game-play, demonstrating that the self-reported change in state anger at post-game-play was not an artefact of regression to the mean.

A discriminant function analysis was then performed on the nine continuous predictor variables (Exposure, Psychoticism, Extroversion, Neuroticism, State Anger Pre-Game-Play, Trait Anger, Trait Anxiety, Anger Expression, and Aggressive Cognitions) to assess their

Table I. Summary of participants' state anger pre- and post-game-play by derived group.

	Group		
State anger	Increase ($n = 22$)	Decrease ($n = 8$)	No Change ($n = 77$)
Pre-game-play			
M	11.64	22.50	12.05
SD	2.79	5.71	3.51
Post-game-play			
M	23.18	13.75	12.58
SD	6.64	6.78	3.86
Difference between pre- and post-game-play			
M	11.54	−8.75	0.53
SD	5.96	3.06	1.64

utility in predicting a player's group membership. As there were three groups in this study, two discriminant functions were calculated, with a combined $\chi^2(18) = 96.52$, $p < 0.001$. After removal of the first function, there was still a strong association between groups and predictors, $\chi^2(8) = 32.86$, $p < 0.001$. The two discriminant functions accounted for 70% and 30% of the between group variance, respectively. As shown in Figure 1, the first discriminant function maximally separates the "decrease" in state anger group from the other two groups. The second discriminant function discriminates the "increase" in state anger group from the "no change" group, with the "decrease" in state anger group falling between those two reactions.

As presented in Table II, correlations between predictors and functions suggest that state anger at pre-game-play is the best predictor for distinguishing between the "decrease" in state anger group and the other two groups (first function). Individuals whose state anger decreased at post-game-play had a higher state anger score before playing than those whose state anger increased or did not reliably change.

Six predictors (Psychoticism, Neuroticism, Trait Anxiety, Trait Anger, Anger Expression, and Aggressive Cognitions) all had a loading in excess of $r = 0.33$ on the second discriminant function, which separates players whose state anger increased after playing, from players whose state anger did not change at post-game-play. In other words, those who have an aggressive/labile temperament (trait), yet are not high on anger ratings before playing (state), are the most likely to increase in anger as a result of playing.

A series of one-way ANOVAs were conducted for aggressive/labile temperament (as measured by Psychoticism, Neuroticism, Trait Anxiety, Trait Anger, and Anger Expression) and Aggressive Temperament by Change in State Anger. A main effect was found for all six analyses. As results from the discriminant function analysis would suggest, LSD *post hoc* analysis revealed significant differences between the Increase and No Change groups for all six variables. Similar differences were found between the Decrease and No Change groups for Psychoticism ($p < 0.05$), Neuroticism ($p < 0.01$), Trait Anger ($p < 0.01$) and Anger Expression ($p < 0.01$). However, no significant differences were found between the No Change and Decrease groups for Aggressive Cognitions and Trait Anxiety.

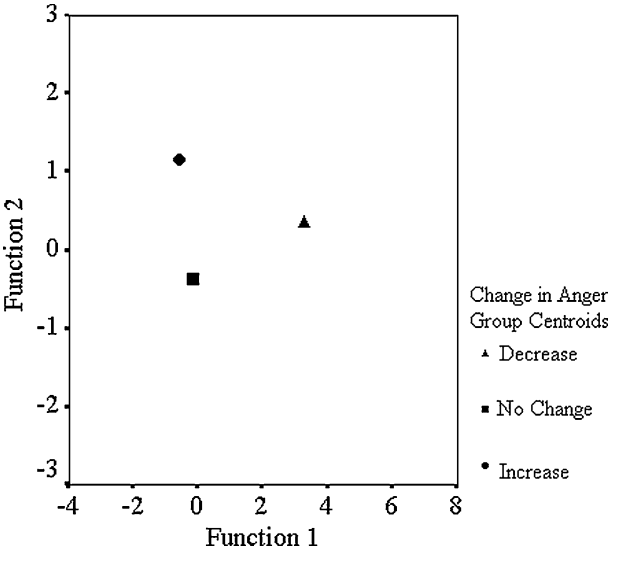

Figure 1. Discriminant functions of three change in anger categories derived from nine predictor variables.

Table II. Pooled within-group correlations between predictor variables and discriminant functions.

	Discriminant function	
Predictor variable	1	2
Psychoticism	0.130	0.471*
Extroversion	0.098	0.191
Neuroticism	0.206	0.488*
Exposure to violent video games	0.022	−0.007
Trait anxiety pre-game-play	0.040	0.420*
Trait anger pre-game-play	0.198	0.724*
State anger pre-game-play	0.830*	0.149
Anger expression pre-game-play	0.245	0.699*
Aggressive cognitions during game-play	0.093	0.505*

*Significant correlations in excess of 0.33.

When assessing the predictive utility of these identified variables, a jack-knifed classification procedure was used, thus avoiding bias associated with testing a classification system with the sample from which it was derived. As can be seen from Table III, for the total sample of 107 game players, the concordance rate for predicted changes (using Immersive Media Prediction model predictors) and observed changes (using reliable change) in angry affect is above 71.3% in *each* case. This compares to 20.6% who would have been correctly classified by predicting that *all* would increase in angry affect, as would have been the conclusion if we were to have just used a means test approach as Anderson and colleagues. Chance would have led to a correct prediction rate of only 33%.

Changes in scores on the state anger scale for the "increase" group were examined to assess whether these individuals experienced a reliable increase in anger that would also be considered significant at a clinical level. Jacobson and Truax (1991) define one method of classifying a "clinically dysfunctional" score as extending two standard deviations beyond the mean of the normal population. All 22 participants whose state anger reliably increased at post-game-play began with a state anger score that fell within the range of "functionality". Only two participants' t-scores on state anger at post-play were two standard deviations (SD = 10) above the mean of the normal population ($M = 50$). This suggests that while playing violent video games, in the short term, might lead to an increase in angry affect for a small number of players, this increase is unlikely to be of a magnitude that warrants concern from a functional perspective.

A chi-square analysis for the categorical predictor variable, Self Regulation, by Change in State Anger at post-game-play was not appropriate due to six cells (50%) with an expected frequency of less than five. However, examination of the observed and expected frequencies for these two variables suggested that participants' reasons for playing video games did not systematically differ across the dependent variable.

Table III. Jack-knifed classification matrix for reliable change in state anger at post-game-play.

		Predicted by IMP model		
		Increase	No Change	Decrease
Observed – Reliable Change Index	Increase ($n = 22$)	72.7%	27.3%	0%
	No Change ($n = 77$)	19.5%	71.4%	9.1%
	Decrease ($n = 8$)	12.5%	12.5%	75%

IMP, Immersive Media Prediction.

As shown in Figure 2, results from this study suggest that an aggressive/labile temperament predicts a short-term change in a player's feelings of anger after playing a violent video game. The direction of this change is to some extent dependent on how that player feels immediately prior to playing the game. As outlined in the Immersive Media Prediction model in Figure 2, if the player is feeling angry, he or she is more likely, in the short-term, to experience a decrease in angry affect after playing a violent video game (classified as a "*Manager*" here). If the player does not feel angry prior to game play then he or she is more likely to temporarily experience an increase in angry feelings at post-game-play (termed a "*Hood*"). Classification as a "*Player*" involves a more stable and non-aggressive temperament, and indicates that the individual is more likely to not experience any change in angry feelings after playing a violent video game.

Exposure to violent video games correlated with neither pre-game-play state anger ($r = 0.00$, NS) nor trait anger($r = -0.14$). However, exposure was found to be positively correlated with Psychoticism ($r = 0.25$, $p < 0.01$) and negatively correlated with Extroversion ($r = -0.23$, $p < 0.05$).

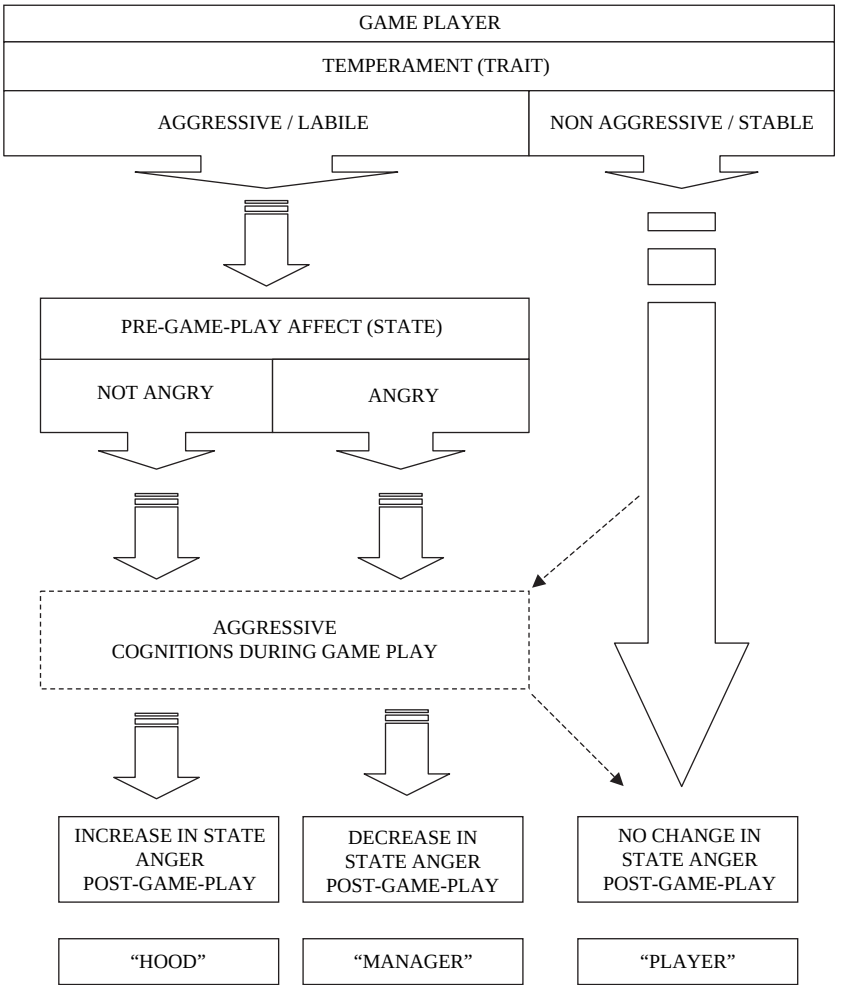

Figure 2. Derived Immersive Media Prediction model of effects of violent video game play.

Discussion

Reichhardt (2003) highlighted the divide in the current debate on the effects of violent video games and suggested the need for an explanatory model. This research found that there were three types of reliable short-term reactions in regards to anger following game-playing: increase, decrease and no effect. We found that these reactions could be predicted using state and trait variables. A "labile" temperament coupled with high state anger at pre-game-play led to a cathartic effect; a "labile" temperament coupled with low state anger at pre-game-play led to an increase in angry affect; and a "stable" temperament led to no change in angry effect following game-play.

Three aspects of this study were unique to the violent video game literature. Firstly, it considered the possibility of three different effects of violent video game play; secondly, accessibility to aggressive thoughts were measured during game-play using ATSS Paradigm; and thirdly, individualised analyses were used to assess change in state anger at post-game-play. While the finding of three different effects is not new to the violent video game literature, this is the first research to find such a result within the same study and provide a unified explanation. Another interesting finding was, consistent with other researchers (Durkin & Barber, 2002), the absence of any real evidence to suggest that a history of exposure to violent video games increases aggressive affect. In addition to aggressive cognitions, the GAM posits that exposure to violent video games, in the long-term, "changes the individual's personality ... [to being].. more aggressive in outlook and propensity" (Anderson & Dill, 2000, p. 774). As a result, it was assumed that exposure to violent video games is associated with aggressive temperament and delinquent behaviour. However, results from this study found that exposure to violent video games has no predictive utility in the short-term effect on angry affect. In addition, there was no evidence to suggest that exposure to violent video games is related to aggressive temperament (state anger, trait anger or anger expression). There was, however, evidence of a small effect size linking exposure to violent video games with the personality variables of Psychoticism ($r = 0.25$) and Introversion ($r = 0.23$). Eysenck and Eysenck (1975) describe children who score on the Introversion side of the E scale as seldom aggressive, often keeping their feelings under close control and unlikely to lose their temper easily. Contrastingly, his account of children who score high on the Psychoticism scale describes an individual who is indiscriminately aggressive and hostile, sensation seeking, and lacks empathy and feelings of guilt. This suggests that exposure to violent video games is related to two very different temperaments. While any causal conclusions are made tentatively, it is suggested that certain personality traits (Introversion and Psychoticism) might mediate an individual's choice of video game genre. That is, it may be that adolescents scoring high on Introversion play violent video games for the purpose of controlling or channelling their aggression, and those who score high on Psychoticism seek out such games purely for the "rush" of their violent content. This contrasts with the GAM (Anderson & Dill, 2000), which suggests that repeated exposure to violent video games shapes aggressive personalities leading to heightened aggressive behaviour. This study found no evidence to suggest that exposure to violent video games has an effect on trait anger. Furthermore, of those players whose feelings of anger was found to increase at post-game-play, only 9.1% demonstrated feelings of anger that might be considered dysfunctional or warrant concern.

We suggest the need to be more specific in future research, particularly when the findings of violent video game research are being used in policy making (DPA, 2003), and cited as evidence of a causal link with the proclivity for mass murder (Anderson & Dill, 2000; Bushman & Anderson, 2002; Grossman, 2004). While the violent video game debate is far

from over, findings from this study have moved one step closer to a unified understanding of the effects of this form of media. Immersive Media Prediction is not a static model, but rather a clarifying approach toward understanding the effects of violent video game play and awaits refinement and replication.

There are also some other factors to consider when reviewing this research. It may be suggested that state affect is not a good measure for aggression effects of violent video games. Indeed, any claims of a direct link between an individual's feelings of anger and their potential for aggressive behaviour are tenuous and dependent on many situational variables (e.g. perceived threat, provocation, lack of inhibition due to substance use, etc.). While a behavioural measure of aggression would be ideal, current measures employed by researchers (e.g. reward/punishment tasks; competitive reaction time trials) are not "pure" measures of aggressive behaviour. The primary purpose of this study was to examine the effects of violent video games from a new perspective. It is acknowledged that angry affect does not predict aggressive behaviour; however, since angry affect has been argued as a necessary requirement for aggressive behaviour by some researchers (Spielberger, 1991) it was considered a useful measure for the purpose of informing about the short-term effects of violent video game play. Future research may consider replicating this study using a behavioural measure of aggression, rather than a measure of angry affect.

This study only used one violent video game (*Quake II*). It is possible that the observed effects are not specific to violent video games, or that they are specific to the type of game chosen for this study (i.e. level of violence and genre). As mentioned, the present study was exploratory in nature and it was, therefore, considered appropriate to limit it to one violent video game. It would be useful to replicate the present findings with a non-violent video game control. It might also be useful to include a number of violent video games that vary in genre and level of violence to assess the generalisability of the Immersive Media Prediction model.

Not only did this study focus on the short-term effects of violent video game play, but due to testing requirements, the period of time participants played *Quake II* was limited to 20 min (including the warm-up and training session). Given that feelings of state anger prior to game play was the only predictor variable to discriminate the *Hood* from the *Manager*, and that the *Manager* reported higher feelings of state anger prior to game play, it may be that a longer gaming session would produce a desensitisation effect whereby the heightened affect initially experienced by the *Hood* decreases over time. Indeed, Sherry (2001) provided evidence to support this, reporting a marked difference in effect size between two studies ($r = 0.90$, Ballard & Weist, 1995 vs $r = 0.05$, Hoffman, 1995) that only differed on the amount of time participants spent playing the violent video game *Mortal Kombat* (10 min, Ballard & Weist, 1996 vs 75 min, Hoffman, 1995). A replication of the present study, extending the time of game play, might assist to further clarify this issue.

While exposure to violent video games was not found to have any predictive value for short-term change in angry affect, previous researchers (Anderson & Bushman, 2002; Anderson & Dill, 2000; Bushman & Anderson, 2002) maintain that exposure to violent video games, in the long term, leads to an increase in aggressive behaviour. It may, therefore, be useful to further clarify this issue by following-up participants over a 5-year period, assessing various areas that inform on aggressive behaviour, such as forensic history, academic records, teacher reports, and history of self-injurious behaviour. One would then also be able to test the Immersive Media Prediction model over the long term. It may be that the same, extra, or different variables predict outcome. Efforts to accomplish this are underway.

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References

Anderson, C. A., & Boshman, B. J. (2002). Human aggression. *Annual Review of Psychology*, *53*, 27–51.

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*, 772–790.

Anderson, C. A., Berkowitz, L., Donnerstein, E., Huesmann, L. R., Johnson, J. D., Linz, D., *et al.* (2003). The influence of media violence on youth. *Psychological Science in the Public Interest*, *4*, 81–110.

Ballard, M. E., & Wiest, 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.

Browne, K., & Pennell, A. (1998). The effects of video violence on young offenders. Home office research and statistics directorate: Research findings No. 65. London: HMSO.

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*, 1679–1686.

Calvert, S. L., & Tan, S. L. (1994). Impact of virtual reality on young adults' physiological arousal and aggressive thoughts: Interaction versus observation. *Journal of Applied Developmental Psychology*, *15*, 125–139.

Davison, G. C., Vogel, R. S., & Coffman, S. G. (1997). Think-aloud approaches to cognitive assessment and the articulated thoughts in simulated situations paradigm. *Journal of Consulting and Clinical Psychology*, *65*, 950–958.

DPA (2003). Video game makers sued in murder case. The Age. Available online: http://www.theage.com.au/articles/2003/10/23/1066631542647.html (23 October).

Durkin, K., & Aisbett, K. (1999). *Computer games and Australians today*. Sydney: Office of Film and Literature Classification.

Durkin, K., & Barber, K. (2002). Not so doomed: Computer game play and positive adolescent development. *Journal of Applied Developmental Psychology*, *23*, 373–392.

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. B. G. (1975). *Manual of the Eysenck Personality Questionnaire (junior & adult)*. San Diego: Educational and Industrial Testing Service Inc.

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.

Grossman, D. (2004). Trained to kill. Killology Research Group: The Psychological Cost of Learning to Kill. Available: http://www.killology.com/print/print_trainedtokill.htm (17 June).

Hagell, A., & Newburn, T. (1994). *Young offenders and the media: Viewing habits and preferences*. London: Policy Studies Institute.

Hoffman, K. (1995). Effects of playing versus witnessing video game violence on attitudes toward aggression and acceptance of violence as a means of conflict resolution. *Dissertation Abstracts International*, *56*, 747.

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, *59*, 12–19.

Kestenbaum, G. I., & Weinstein, L. (1985). Personality, psychopathology, and developmental issues in male adolescent videogame use. *Journal of the American Academy of Child Psychiatry*, *24*, 329–333.

Murphy, K. R., & Davidshofer, C. O. (1998). *Psychological testing: Principles and applications* (4th edn). Upper Saddle River, NJ: Prentice Hall.

Nelson, T. M., & Carlson, D. R. (1985). Determining factors in choice of arcade games and their consequences upon young male players. *Journal of Applied Social Psychology*, *15*, 124–139.

Reichhardt, T. (2003). Playing with fire? *Nature*, *424*, 367–368.

Schacter, S., & Singer, J. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review*, *69*, 379–399.

Sherry, J. L. (2001). The effects of violent video games on aggression: A meta-analysis. *Human Communication Research*, *27*, 409–431.

Spielberger, C. D. (1991). *State-trait anger expression inventory revised research edition: Professional manual*. Odessa, FL: Psychological Assessment Resources Inc.

Spielberger, C. D. (1983). *State-trait anxiety inventory for adults: Sampler set, manual, test, scoring key*. Redwood City, CA: Mind Garden Inc.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Winkel, M., Novak, D. M., & Hopson, H. (1987). Personality factors, subject gender, and the effects of aggressive video games on aggression in adolescents. *Journal of Research in Personality*, *21*, 211–223.

Zillmann, D. (1971). Excitation transfer in communication-mediated aggressive behaviour. *Journal of Experimental and Social Psychology*, *7*, 153–159.

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.