ABSTRACT

VIDEO GAME VIOLENCE AND BEHAVIORAL AGGRESSION:
A META-ANALYTICAL EXAMINATION OF POTENTIAL MODERATORS

By Aaron R. Arbogast

The current study used fixed-effects and random-effects meta-analyses to test four additional potential moderators of the relation between exposure to media violence and aggression. First, fourteen relevant studies meeting Anderson et al.'s (2010) best practices criteria were coded for characteristics related to the violent and non-violent (control) video games and for study authorship. Next, the program *Comprehensive Meta-analysis* was used to conduct a fixed-effects meta-analysis in order to examine the variability between the studies within the sample. Then, potential moderating effects were tested via random-effects analyses.

Consistent with previous research, an average effect of $r+ = .26$ was found for the relation between violent video game play and aggression. The realism of the violent and non-violent video games, competitiveness of the non-violent video game, and authorship were tested for moderating effects. Although, violent video game realism was not found to be a significant moderator $Q(1) = 1.45$, $p > .05$, the unrealistic subgroup of studies produced a significant average effect, $r+ = .33$, $p < .05$, whereas the realistic subgroup did not, $r+ = .18$, $p > .05$. Non-Violent video game realism, non-violent video game competitiveness, and Craig Anderson as author did not moderate the relation, $Q = .08$, $p = .776$; $Q = .01$, $p = .91$; and $Q = .30$, $p = .58$, respectively. Future research should evaluate whether violent video game realism moderates the relation between playing violent video games and aggression using a more definitive methodology.

VIDEO GAME VIOLENCE AND BEHAVIORAL AGGRESSION:
A META-ANALYTICAL EXAMINATION OF POTENTIAL MODERATORS

by

Aaron R. Arbogast

A Thesis Submitted
In Partial Fulfillment of the Requirements
For the Degree of

Master of Science-Psychology

Industrial/Organizational

at

The University of Wisconsin Oshkosh
Oshkosh WI 54901-8621

June 2010

COMMITTEE APPROVAL

_______________ Advisor

6/3/2010 Date Approved

_______________ Member

6/3/2010 Date Approved

_______________ Member

6/3/2010 Date Approved

PROVOST AND VICE CHANCELLOR

____

7/14/10
Date Approved

FORMAT APPROVAL

____

5/11/10
Date Approved

ACKNOWLEDGEMENTS

I would like to thank the librarians at the University of Wisconsin Oshkosh and my thesis committee members, Gary Adams and Keilah Worth, for their support throughout the completion of this project. This paper would not have been possible without the numerous reviews and continuous motivational support from my thesis advisor, David Lishner.

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

Numerous studies have examined the relation between exposure to media violence and aggression. Typically these studies focus on how various measures of aggression are influenced by exposure to violent and non-violent television shows, pornography, song lyrics, and more recently, video games (Anderson & Bushman, 2001). Video games have become an increasing part of children's and young adults' lives. According to Roberts, Foehr, Rideout, and Vrodie (1999), boys ages 8-13 play console or computer video games more than 7.5 hours per week. Among male high school graduates entering college in 1999, 14.8% played video games for at least 6 hours a week (The Cooperative Institutional Research Program). Given these statistics are over 10 years old and the gaming industry continues to show strong growth (Szalai, 2007), these statistics likely underestimate the number of hours spent playing video games in more recent times.

Although video game industry leaders have consistently denied the existence of evidence linking violent video game play to aggression, researchers have been finding a positive association for twenty-five years (Graybill, Kirsh, & Esselman, 1985). A meta-analysis conducted by Anderson & Bushman (2001) determined that the average effect of violent video games on behavioral aggression was $r+ = .19$. Anderson and Bushman (2002b) examined the differential effect sizes reported in experimental and correlational studies, and found larger effect sizes in experimental studies than in correlational studies.

After controlling for methodological limitations, the average effect for this association was about *r*+ = .25 (Anderson, 2004). This evidence influenced the Surgeon General (n.d.) to label media violence as a risk factor for children.

General Aggression Model

The General Aggression Model (GAM) is a framework for understanding human aggression and is a composition of Cognitive Neoassociation Theory, Social Learning Theory, Script Theory, and Excitation Transfer Theory. Proponents of the GAM's broad view believe the model provides insight into the relation between exposure to media violence and aggression that other small-scale theories lack (Anderson & Bushman, 2002a). The proponents explain that more than one motive can be incorporated when explaining aggressive acts, developmental issues are considered, and intervention strategies can be designed from the pathways identified in the GAM. Inputs, routes, and outcomes make up these pathways (Anderson & Bushman, 2002a).

Inputs

There are two categories of inputs in the GAM: person and situational. Personality traits, gender, personal beliefs, attitudes and values, long-term goals, and previously learned scripts are person factors. Anderson and Bushman describe these as "an individual's preparedness to aggress" (2002a, p. 35). Aggressive cues, provocation, frustration, pain or discomfort, the use of drugs, and incentives for aggression make up the situational factors.

Routes

A person’s cognitions, level of arousal, and affect (internal state) can be influenced by the person and situational inputs to which they are exposed to. According to the GAM, the cognition, arousal, and affect routes are the second set of variables involved in the production of behavior.

Cognition consists of learned scripts and hostile thoughts. Scripts are learned through observing reward and punishment contingent upon behavior. Frequent exposure to aggressive scripts can make an individual’s ideas and beliefs of aggressive behavior chronically accessible (Anderson & Bushman, 2002a). Hostile thoughts are developed when an individual is repeatedly confronted by negative events or stimuli in the environment, such as violent media. Exposure to such stimuli results in the temporary subconscious recall (priming) of beliefs and ideas related to the event or stimuli (Fiske & Taylor, 1984; Bargh & Pietromonaco, 1982). When these ideas and beliefs are aggressive in nature, new incoming information will be interpreted in an aggressive manner (Sedikides & Skowronski, 1990).

Aggression can be influenced by arousal in three different ways (Anderson & Bushman 2002a). First, an individual can wrongfully label arousal from extraneous sources as anger or hostility. This was demonstrated by Zillmann (1988) who found aroused participants to be more aggressive than relaxed participants during their cognitive preappraisal, appraisal, and reappraisal of endangering situations. Second, increased arousal in combination with provocation can promote aggressive reactions. For example, Geen and O’Neal (1969) found that participants who had been aroused by listening to white noise or had been exposed to a video of a fighting scene gave confederates significantly more electrical shocks during a provoked scenario than participants who were not exposed to arousing or violent stimuli. Finally, extremely high or low levels of arousal can create aggression if they are seen as aversive.

Affect (i.e. feelings of hostility or anger) can increase the likelihood of aggressive behavior when aversive inputs are present. Anderson, Anderson, and Deuser (1996) demonstrated the ability of uncomfortable temperatures to increase aggressive affect, and then noted a positive relation between aggressive affect and aggressive behavior. In Anderson and Bushman (2001) a positive relation was found between exposure to video game violence and aggressive affect, suggesting the aggressive affect was brought on by an increase of feelings of anger and hostility due to witnessing the violent video game. Anderson (2002a) also describes the reciprocal inter-relatedness of cognitive, arousal, and affective routes. An increase in one can potentially increase at least one other route.

Outcomes

The outcomes described by the GAM are actions that may be thoughtful or impulsive (Anderson & Bushman, 2002a). Thoughtful action occurs when the individual appraising the situation has sufficient resources (time, cognitive capacity) and the outcome is perceived as important. Impulsive action is found when the outcome is not perceived as important to the individual, regardless of the access to resources. According the GAM, aggressive behavior is less likely to occur when there is thoughtful action than when there is impulsive action.

Definitions of Aggression

The most widely used and comprehensive definition of behavioral aggression is outlined in Anderson and Bushman (2001). They propose that “aggression is behavior intended to harm another individual who is motivated to avoid that harm (p. 354).” Harmful thoughts, plans, and behaviors that are the result of accidents or are designed to aid another person would not constitute aggressive behavior under this definition. Anderson and Bushman’s definition allows research conducted prior to its statement to be incorporated in the GAM model. For example, Irwin and Gross (1995) measured physical aggression as hitting, shoving, pinching, pulling at clothes or hair and kicking in a free play setting. In this example, if a boy shoved another boy that didn’t want to be shoved, it would be considered an act of aggression. However, if the second boy welcomed the shove (e.g., as in rough-and-tumble play) it would not be considered an act of aggression.

In addition to behavioral measures of aggression, some research measures aggression indirectly through the use of self-reports of aggressive behavior and interpretation of ambiguous provocation stories. Self-reports that measure the construct of aggression include the Buss and Durkee Hostility Inventory (1957), which consists of an assault subscale that assesses physical violence against others (Vassar & Hale, 2009), and the Buss and Perry Aggression Questionnaire (1992), which contains an aggression subscale that assesses the tendency for an individual to become involved in physical confrontations. Another commonly used measure of aggression is ambiguous provocation stories. Such measures ask participants to describe how they would react in a hypothetical situation where someone hit them or stole something from them. Content analysis is then used to determine the number of aggressive behaviors participants said they would commit in their reply.

Violent Video Game Exposure and Aggression

A fixed-effects meta-analysis conducted by Anderson and Bushman (2001) found that exposure to video game violence has an average effect of $r+ = .19$ on aggression. This study included 33 independent samples composed of 3,033 participants. The authors also conducted a moderator analysis that examined the impact of participant age (average age equal to or greater than 18 versus younger), study type (experimental versus non-experimental), and publication status (published versus non-published) on this association. No significant effects on the association were found for these moderators. Most recently, Anderson et al. (2010) conducted a fixed-effects meta-analysis containing 75 independent samples and more than 18,000 participants. Here, an average effect size was calculated for the full sample of experimental studies and for "best practice" studies alone. Six criteria had to be met for a study to qualify for inclusion in the best practice category:

1. The compared levels of the independent variable were appropriate for testing the hypothesis.
2. The independent variable was properly operationalized.
3. The study had sufficient internal validity in all other respects.
4. The outcome measure used was appropriate for testing the hypothesis.

5. The outcome measure could reasonably be expected to be influenced by the independent variable if the hypothesis was true.
6. The outcome variable was properly computed (Anderson et al., 2010, p. 159).

The average effect sizes of best practice and not-best practice studies in which a behavioral measure of aggression was used were $r+ = .24$ and $r+ = .16$, respectively. Moderator analyses were also conducted on the best practices group to determine whether the player's perspective (first or third person), violent game targets (human, nonhuman, both), character's role (heroic or not heroic), and dependent measure (Competitive Reaction Time Task or other) influenced the relation; however, none were significant.

In the two previously mentioned meta-analyses, participant characteristics, methodological quality, and some violent video game characteristics were assessed as potential moderators. However, additional characteristics related to the violent video games and non-violent video games, such as violence realism, neutral game realism, and competitiveness of the non-violent control game have not been looked at. Examination of these qualities in published studies suggests they may be important moderators to consider. For example, Kirsh (1998) compared the level of aggression produced by a neutral (NBA Jam) versus violent video game (Mortal Kombat). NBA Jam is an active, arousing game that requires fast reflexes to play a game of basketball. The objective is to score more points than the opposing team. Mortal Kombat, the violent stimulus, is a fantasy martial arts fighting game where players try to kill one another in a series of fights. Kirsh measured aggression using ambiguous provocation stories and found significantly more aggressive behaviors in the responses of those in the violent video game group than in the responses of those in the neutral video game group.

In a study conducted by Irwin and Gross (1995), Double Dragon and Excitebike were the violent and non-violent stimuli. The theme of Double Dragon involves a duo of martial arts heroes who face ruthless street gangs as they fight their way through alleyways, underwater hideouts, and construction sites to save a friend. In Excitebike, the player controls the movements and speed of a motorcycle in a race against the clock. Following exposure to the violent and non-violent video games, aggression was measured as the number of aggressive behaviors exhibited by young participants toward other participants in a playroom setting. Participants who were exposed to the violent video game performed significantly more aggressive behaviors than the participants who were exposed to the non-violent video game.

In a third example, Anderson and Dill (2000, Experiment 2) defined behavioral aggression as the intensity and duration of a noise blast given to a competitor. This measure was taken after the participant had played Street Fighter II or Oh No! More Lemmings. Street fighter II is a third person fighting game where the player controls an on-screen character who engages in a series of fights with another character. Oh No! More Lemmings involves helping characters reach safety by directing them to cut holes through walls and build steps over pitfalls. Again, participants in the violent video game condition scored significantly higher on the aggression measure than the non-violent video game condition.

Finally, Craig Anderson is the most prevalent author in the body of experimental research examining the effects of violent video game play on aggression. However, he has been accused of using controversial methods in his previous meta-analyses in order to inflate summary statistics (Ferguson, 2007; Ferguson, & Kilburn, 2010). Anderson has also appeared before congress to support the regulation of violent video games (Brownback, 2000). Given his active involvement in the public debate regarding the regulation of violent video games and the criticism of his meta-analytical methodologies, some may be tempted accuse Anderson of bias. To determine if his primary research findings appear to indicate bias in the form of higher than typical violent video game-aggression effects sizes, the current study examined whether Craig Anderson's primary research moderates the relation.

Present Research

The present study aims to use meta-analytical methods to identify potential moderators of the relation between violent video game exposure and aggression. It is hypothesized that the realism of violent and non-violent video games, the competitiveness of the non-violent video game, and a specific author will serve as moderators in the association between violent video game exposure and behavioral aggression.

Each moderator was divided into two subgroups to create a dichotomous categorical variable. The first moderator, realism of the violent video game, was defined by whether the aggressive video game took place in a plausible setting and scenario that was synonymous to settings and scenarios found in today's real world. The same realistic and unrealistic definitions were applied for assessing the realism of the non-violent video games, only the non-violent games were considered instead of the violent games. Next, the neutral stimuli were evaluated for competitiveness. A competitive game was defined as one in which the player faced rival opposition, where the goal was to beat or overcome an opponent. Finally, studies where Craig A. Anderson was listed as an author created one subgroup and the other contained studies that did not list him as an author.

HYPOTHESES

It is hypothesized that (a) studies including realistic violent video games will have a stronger relation with aggression than studies that used unrealistic games because of the similarity between the video games and real-life. In contrast, (b) studies containing competitive non-violent video games will produce more arousal than non-competitive non-violent video games and this will produce a weaker violent video game-aggression relation. (c) It is unclear why realistic and unrealistic non-violent video games would differ, but their relations may have important practical implications for future research. (d) Craig A. Anderson demonstrated his support for higher violent video game regulations, and has been accused of promoting his agenda through his research (Brownback, 2000). If such an accusation is true, then one would expect that the association between violent video games and aggression would be larger for studies that he helped conduct.

METHOD

Completion of this study was done in four phases. First, all published studies involving a true behavioral measure of aggression which were identified as “best practices” according to Anderson et al.’s (2010) best practices coding frame were collected and coded for moderating characteristics. Second, it was assumed there is more than one population effect size for the sample of “best practice” effect sizes, one for each moderator subgroup. To test this assumption a fixed-effects model meta-analysis was run to test for significant heterogeneity between effect sizes. Third, a random-effects model meta-analysis was run to estimate the average population effect size for the relation. Then, group differences were tested for each moderator variable using a random-effects meta-analysis. The program *Comprehensive Meta-Analysis* was used for all calculations and analyses.

Literature Search and Coding Procedures

Published studies identified as best practices in the supplemental packet for Anderson et al. (2010) that contained an experimental method and a measure of behavioral or physical aggression were collected, coded for moderator characteristics, and all statistical information reported regarding the treatment effect for exposure to media violence on aggression was recorded for each study.

Meta-Analytical Procedures:
Assessing Homogeneity Using a Fixed-Effects Model

In order to synthesize the information obtained from each study the individual test statistics were converted into common effect sizes. Following previous research, the data were converted into correlation coefficients, denoted by r, for each study. Cohen (1988) indicates a small r is ±.10, a medium r is ±.30, and a large r is ±.5. Next, the homogeneity of the sample of effect sizes was tested with a fixed-effects model meta-analysis and the Q statistic. Fixed-effects models assume the only source of effect size variation is due to sampling error and the sample of effect sizes is homogeneous, without additional unexplained variance. The Q statistic determines whether the variance between studies is greater than would be expected by chance and identifies the sample of effect sizes as homogeneous or heterogeneous. A significant Q statistic signifies a heterogeneous sample, such that unexplained variance is not due solely to sampling error (Cooper, Hedges, & Valentine; 2009).

Meta-Analytical Procedures:
Random-Effects Model Meta-Analysis

Random-effects model meta-analyses differ from fixed-effects models in the between-study variance that is accounted for under random-effects models. Whereas both models consider within-study variance (sampling error), random-effects models also calculate a constant between-study variance, which is used to minimize the differences between the multiple population effect sizes. This makes random-effects models more conservative by creating larger summary statistics with wider confidence. The summary statistics calculated were pooled effect sizes, denoted as *r*+, which is the average effect size for a group of effect sizes, or an estimate of a population effect size. Moderator analyses examined the extent to which the moderator subgroup confidence intervals overlap using the *Q*(between) statistic. This process was completed for each moderator individually (Cooper, Hedges, & Valentine; 2009).

RESULTS

Examination of the “best practice” studies included in Anderson et al. (2010) identified 27 studies with experimental designs and dependent measures of behavioral or physical aggression. Of these studies, thirteen were not included in the current analyses because they were written in Japanese and were unpublished, making their attainment difficult. The thirteen remaining independent samples consisted of 1,574 participants. Two independent raters coded the thirteen studies according to the moderator subgroup definitions and came to an initial agreement of 94.87%. The two disagreed upon cases were and discussed until an agreement was reached. After agreement between the raters was obtained, the sample was explored and the moderators were examined.

In order to determine the appropriate model of meta-analysis for the sample, a fixed-effects model meta-analysis was used to examine homogeneity. Then, the summary statistic was estimated, and a threat to validity was considered. The summary statistic provided by the fixed-effects model estimated an average effect of $r+ = .23$ within the heterogeneous sample, $Q(12) = 69.216$, $p < .001$. Hence, a random-effects model was chosen to be the appropriate model for all other meta-analytical analyses. The random-effects model resulted in an average population effect size of r+ = .26, $p < .001$, for the relation between exposure to media violence and aggression. Next, the fail-safe *n* was calculated to examine whether the data were free of publication bias (the file drawer problem), an inflated summary statistic resulting from research journals being more likely to publish studies with significant findings than insignificant findings, which is a common threat to the validity in any meta-analysis. Publication bias was not evident in the sample, the fail-safe *n* = 298, meaning 298 additional studies with null results would be required to reduce the *p* value to an insignificant level.

Moderator 1: Violent Video Game Realism

Interestingly, the seven studies containing unrealistic violent video games produced the largest average effect on aggression, $r+ = .33$, $p < .001$, and the only insignificant effect was found in the six studies containing realistic violent video games, $r+ = .18$, $p = .07$. However, the difference between studies containing realistic and unrealistic violent video games was not significant, $Q(1) = 1.448$, $p = .229$. Appendix A contains the upper and lower bounds for confidence intervals, z-values, and *p*-values for their respective pooled effect sizes.

Moderator 2: Non-violent Video Game Realism

The relations found when the studies were grouped based on realistic ($k = 6$) and unrealistic ($k = 7$) non-violent video game characteristics differed only slightly, $r+ = .28$, $p < .01$ and $r+ = .24$, $p < .01$, respectively, and were not significant, $Q(1) = .081$, $p = .776$. Results from the analysis can be found in Appendix B.

Moderator 3: Non-Violent Video Game Competitiveness

The average effect found in studies that contained competitive non-violent video games ($k = 5$) was approximate to the effect found when non-competitive non-violent video games ($k = 8$) were used ($r+ = .25$, $p < .05$ and $r+ = .27$, $p < .01$, respectively), $Q(1) = .012$, $p = .914$. Appendix C displays these results.

Moderator 4: The Anderson Effect

Studies where Craig A. Anderson was listed as an author were found to have a smaller effect ($k = 7$; $r+ = .23$, $p < .01$) than studies authored by others ($k = 6$; $r+ = .30$, $p < .01$). However, the Anderson Effect was not profound enough to serve as a moderator in the relation between exposure to video game violence and aggression, $Q(1) = .307$, $p = .580$. Appendix D displays these results.

DISCUSSION

The current study found effects similar to those reported in previous meta-analyses. Anderson (2004) reported an average effect of $r+ = .25$, Anderson et al. (2010) found an average effect of $r+ = .24$, and the current study reported an average effect of $r+ = .26$. These congruent findings demonstrate that exposure to violent video games compared to non-violent video games is associated with higher degrees of aggressive behavior. In Anderson's two previous meta-analyses, study type and study quality were found to be moderators; however, characteristics related to the video games content were not. Consistent with Anderson et al. (2010), the current meta-analysis found no significant moderators regarding type of video game.

Three interesting key findings were reported in the current meta-analysis. First, the realistic violent video game subgroup produced a non-significant effect size and the unrealistic subgroup produced a significant effect, even though the difference in effect sizes of the subgroups was not found to be significant. Specifically, those who played unrealistic violent video games did exhibit a higher degree of aggressive behavior than non-violent video game players, whereas individuals who played realistic violent video games did not. Consequently, the lack of a significant difference in effect sizes may implicate a Type II error in the realistic violent video game subgroup. Perhaps the Q statistic was too conservative of a measure for assessing the difference in effect sizes between the realistic and non-realistic violent video game subgroups.

Second, the non-violent video game subgroups were not associated with varying levels of aggression. Interestingly, consideration of non-violent video game characteristics raises questions about what drives the violent video game effect on aggression. Do those playing violent video games become more aggressive, do those playing non-violent games become less aggressive, or both? One major limitation of the literature is a lack of data pertaining to baseline levels of aggression in the absence of video game play.

Finally, the findings were not consistent with a claim of possible bias in Anderson's primary research studies. Anderson's body of research actually produced a smaller average effect than did the research of others. Thus, there is no evidence that Anderson is promoting a violent video game regulation agenda through compromised primary research. Anderson's studies also contained less unexplained between-studies variance than the other researcher subgroup (t^2 = .000 and t^2 = .129, respectively), which suggests the average effect found from his research might be confounded with less extraneous variables than the research of others.

Practical Implications

The results of the present meta-analysis may be useful in guiding decisions of parents, policy makers, and researchers dealing with questions about the effects of playing violent video games on children's behavior. The apparent popularity of video game play among children and adolescents means parents face decisions about which games to buy (or not) for their children. The present findings suggest that children playing violent video games are more likely to behave aggressively than children who play non-violent games. If one decides to purchase a violent video game but hopes to minimize game influence on aggressive behavior, then the present results suggest one may want to consider choosing a more realistic violent video game than an unrealistic violent video game. Policy makers may also want to use these data to determine whether resources and regulation should be differently allocated to different classes of violent video games.

Limitations

The current meta-analysis was limited by the covariation of moderators and the inability to include the entire body of research regarding exposure to violent video games and behavioral aggression. It is common for meta-analyses to examine categorical moderator variables, even though there may be a confounding overlap between the variables that cannot be controlled for. For example, in the present meta-analysis the realistic non-violent video game subgroup contained four studies with competitive non-violent game characteristics that were unable to be controlled for. It is unknown if the competitive characteristics affected the association found for the realistic non-violent subgroup. Similarly, the subgroups of the theoretical moderators examined in the present study shared a degree of variance with those examined in the past and will inevitably contain a portion of variance that will be accounted for by potential moderators examined in future research. For example, if one chose to examine the effect of aggression on exposure to violent video games that varied in the degree they appeared visually realistic (e.g., games in standard definition versus high definition, games differing in image pixel number), several video games labeled as realistic in the present study would be labeled as unrealistic under the visually realistic definition. However, some video games would be labeled as realistic under both definitions, resulting in a degree of overlap in the two approaches to conceptualizing realism.

Also, the current research was limited in sample size. The addition of the fourteen irretrievable independent samples would have provided a more accurate estimate of the summary statistics and the moderator subgroup variances. However, doing so may have increased the amount of non-rigorous data included in the analysis, which may have obfuscated the effects of the moderators.

Future Research

The present analysis offers several suggestions for future research. First, there was some evidence that unrealistic violent video games may increase aggression to a greater extent than realistic violent video games. Consequently, further research should attempt to clarify whether this is indeed the case. Second, future research is also needed to determine aggression following exposure to violent and non-violent video games relative to a base-line (no exposure) group. Such an analysis would contribute to an understanding of the behavioral dynamics provided by exposure to violent video games.

Third, future research may benefit from quantifying variables according to a more continuous scale of measurement. Such quantification could be subjective (e.g., use a continuous rating scale of realism) or objective (e.g., number of different violent acts players can inflict on game characters). This form of quantification might prove beneficial in illuminating the potential role of moderators such as amount of violent content, controller complexity, realism, and the degree the game player relates to the character.

The use of meta-analysis for examining bias may prove useful in instances where such bias has previously been claimed. The approach adopted here can demonstrate an absence of empirical bias in primary research (as in Anderson’s case), but cannot prove the existence of such bias. Other factors must be considered before accusations of bias are made if the analysis resulted in an alignment between the size of the average effect size and the bias one is accused of. Using this approach to examine issues of bias also cannot speak to bias in the design or implementation of other meta-analyses (Ferguson & Kilburn, 2010).

APPENDIX A

Table A-1
Violent Video Game Characteristics: Realistic versus Unrealistic

Table A-1

Violent Video Game Characteristics: Realistic versus Unrealistic

Violent Video Game Characteristics		**Effect size and 95% interval**			**Test of null (2-Tail)**		**Heterogeneity**		
	K	Point estimate	LL	UL	*Z*	*P*	*Q*	*df (Q)*	*P*
Random effects analysis									
Realistic	6	0.176	-0.016	0.356	1.799	0.072			
Unrealistic	7	0.326	0.162	0.472	3.801	0.000			
Total within									
Total between							1.448	1.000	0.229
Overall	13	0.258	0.107	0.397	3.307	0.001			

Note. Effect sizes were measured as *r*. LL = lower limit and UL = upper limit.

APPENDIX B

Table B-1
Non-Violent Video Game Characteristics:
Realistic Versus Unrealistic

Table B-1

Non-Violent Video Game Characteristics: Realistic versus Unrealistic

Non-Violent Video Game Characteristics		Effect size and 95% interval			Test of null (2-Tail)		Heterogeneity		
	K	Point estimate	LL	UL	*Z*	*P*	*Q*	*df (Q)*	*P*
Random effects analysis									
Realistic	6	0.281	0.088	0.453	2.827	0.005			
Unrealistic	7	0.245	0.079	0.398	2.874	0.004			
Total within									
Total between							0.081	1.000	0.776
Overall	13	0.260	0.136	0.377	4.021	0.000			

Note. Effect sizes were measured as *r*. LL = lower limit and UL = upper limit.

APPENDIX C

Table C-1
Non-Violent Video Game Characteristics:
Competitive Versus Non-Competitive

Table C-1

Non-Violent Video Game Characteristics: Competitive versus Non-Competitive

Non-Violent Video Game Characteristics	*K*	**Effect size and 95% interval**			**Test of null (2-Tail)**		**Heterogeneity**		
		Point estimate	LL	UL	*Z*	*P*	*Q*	*df (Q)*	*P*
Random effects analysis									
Competitive	5	0.252	0.043	0.439	2.357	0.018			
Non-Competitive	8	0.266	0.105	0.413	3.202	0.001			
Total within									
Total between							0.012	1.000	0.914
Overall	13	0.260	0.134	0.378	3.974	0.000			

Note. Effect sizes were measured as *r*. LL = lower limit and UL = upper limit.

APPENDIX D

Table D-1
The Anderson Effect

Table D-1

The Anderson Effect

The Anderson Effect	*K*	**Effect size and 95% interval** Point estimate	LL	UL	**Test of null (2-Tail)** *Z*	*P*	**Heterogeneity** *Q*	*df (Q)*	*P*
Random effects analysis									
Anderson	7	0.230	0.066	0.383	2.722	0.006			
Other	6	0.297	0.116	0.459	3.166	0.002			
Total within									
Total between							0.307	1.000	0.580
Overall	13	0.260	0.139	0.373	4.138	0.000			

Note. Effect sizes were measured as *r*. LL = lower limit and UL = upper limit.

APPENDIX E

Studies Used in the Meta-Analysis

Studies Used in the Meta-Analysis

Anderson, C. A., & Carnagey, N. L. (2009). Causal effects of violent sports video games on aggression: Is it competitiveness or violent content? *Journal of Experimental Social Psychology, 45,* 731–739.

Anderson, C. A., Carnagey, N. L., Flanagan, M., Benjamin, A. J., Eubanks, J., & Valentine, J. C. (2004). Violent video games: Specific effects of violent content on aggressive thoughts and behavior. *Advances in Experimental Social Psychology, 36,* 199–249.

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., Gentile, D. A., & Buckley, K. E. (2007). *Violent video game effects on children and adolescents: Theory, research, and public policy.* New York, NY: Oxford University Press.

Anderson, C. A., & Murphy, C. R. (2003). Violent video games and aggressive behavior in young women. *Aggressive Behavior, 29,* 423–429.

Ballard, M. E., & Lineberger, R. (1999). Video game violence and confederate gender: Effects on reward and punishment given by college males. *Sex Roles, 41,* 541–558.

Barlett, C. P., Branch, O., Rodeheffer, C., & Harris, R. J. (2009). How long do the short-term video game effects last? *Aggressive Behavior, 35,* 225–236.

Bartholow, B. D., & Anderson, C. A. (2002). Effects of violent video games on aggressive behavior: Potential sex differences. *Journal of Experimental Social Psychology, 38,* 283–290.

Bartholow, B. D., Sestir, M. A., & Davis, M. D. (2005). Correlates and consequences of exposure to videogame violence: Hostile personality, empathy, and aggressive behavior. *Personality and Social Psychology Bulletin, 31,* 1573–1586.

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,* 882–889.

Ferguson, C. J., Rueda, S. M., Cruz, A. M., Ferguson, D. E., Fritz, S., & Smith, S. M. (2008). Violent video games and aggression: Causal relationship or byproduct of family violence and intrinsic violence motivation? *Criminal Justice and Behavior, 35*, 311–332.

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.

Schutte, N. S., Malouff, J. M., Post-Gorden, J. C., & Rodasta, A. L. (1988). Effects of playing video games on children's aggressive and other behaviors. *Journal of Applied Social Psychology, 18,* 454–460.

REFERENCES

Anderson, C.A., Anderson, K.B., & Deuser, W.E. (1996). Examining an affective aggression framework: weapon and temperature effects on aggressive thought, affect, and attitudes. *Personality and Social Psychology Bulletin*, 22(4), 366-376.

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., & 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. (2002a). Human aggression. *Annual Review of Psychology*, 53, 27-51.

Anderson, C.A., & Bushman, B.J. (2002b). Media violence and the American public revisited. *American Psychologist*, 57(6-7), 448-450.

Anderson, C.A., Berkowitz, L., Donnerstein, E., Huesmann, L.R., Johnson, J.D., Linz, D., Malamuth, N.M., & Wartella, E. (2003). The influence of media violence on youth. *Psychological Science in the Public Interest*, 4(3), 81-110.

Anderson, C.A. (2004). An update on the effects of violent video games. *Journal of Adolescence*, 27, 113-122.

Anderson, C.A., Shibuya, A., Ihori, N., Swing, E.L., Bushman, B.J., Sakamoto, A., Rothstein, H.R., & Saleem, M. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: A meta-analytic review. *Psychological Bulliten*, 136(2), 151 -173.

Bargh, J.A., & Pietromonaco, P. (1982). Automatic information processing and social perception: The influence on trait information presented outside of conscious awareness on impression formation. *Journal of Personality and Social Psychology*, 43(3), 437-449.

Brownback, Sam. (2000). Senate Commerce Committee hearing on *"The Impact of Interactive Violence on Children."* Retrieved on May 1, 2010 from http://www.psychology.iastate.edu/faculty/caa/abstracts/2000-2004/00Senate.html.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences (2nd Edition).* Hills-dale, NJ: Erlbaum.

Cooper, H., Hedges, L.V., & Valentine, J.C. (2009). *The handbook of research synthesis and meta-analysis (2nd Edition).* New York, NY, US: Russell Sage Foundation.

Cooperative Institutional Research Program. (1999). *Cooperative Institutional Research Program survey results.* Ames, IA: Office of Institutional Research.

Dodge, K.A., & Coie, J.D. (1987). Social information-processing factors in reactive and proactive aggression in children's peer groups. *Journal of Personality and Social Psychology*, 53, 1146-1158.

Ferguson, C.J. (2007). The good, the bad and the ugly: A meta-analytical review of positive and negative effects of violent video games. *Psychiatric Quarterly*, 78, 309-316.

Ferguson, C.J., & Kilburn, J. (2010). Much ado about nothing: the misestimation and overinterpretation of violent video game effects in eastern and western nations: comment on Anderson et al. (2010). *Psychological Bulletin*, 136(2), 174-178.

Fiske, S.T., & Taylor, S.E. (1984). *Social Cognition (2nd Edition)*. New York, NY, England: Mcgraw-Hill Book Company.

Geen, R.G., & O'Neal, E.C. (1969). Activation of cue-elicited aggression by general arousal. *Journal of Personality and Social Psychology*, 11, 289-292.

Graybill, D., Kirsh, J.R., & Esselman, E.D. (1985). Effects of playing violent versus nonviolent video games on the aggressive ideation of aggressive and nonaggressive children. *Child Study Journal*, 15, 199-205.

Hedges, L.V., & Olkin, I. (1985). *Statistical methods for meta-analysis.* New York: Academic Press.

Hunter, J.E., & Schmidt, F.L. (2004). *Methods of meta-analysis*. Thousand Oaks, CA: Sage Publications, Inc.

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.

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*, 5, 177-184.

Roberts, D.F., Foehr, U.G., Rideout, V.J., & Vrodie, M. (1999). *Kids & Media @ the new millennium.* Menlo Park, CA: Kaiser Family Foundation.

Sedikides, C., & Skowronski, J.J. (1990). Towards reconciling personality and social psychology: a construct accessibility approach. *Journal of Social Behavior and Personality*, 5, 531-546.

Surgeon General. (n.d.). *Youth violence: a report of the surgeon general*. Retrieved October, 12, 2009, from http://mentalhealth.samhsa.gov/youthviolence/ surgeongeneral/SG_Site/chapter4/sec3.asp.

Szalai, Georg. (2007). *Video Game Industry Growth still Strong: Study*. Retrieved April 25, 2010 from http://www.reuters.com/article/idUSN2132172920070623.

Vassar, M., & Hale, W. (2009). Reliability reporting across studies using the Buss Durkee Hostility Inventory. *Journal of Interpersonal Violence*, 24, 20-37.

Zillmann, D. (1988). Cognition-excitation interdependencies in aggressive behavior. *Aggressive Behavior*, 14, 51-64.