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Causal effects of violent sports video games on aggression: Is it competitiveness or violent content?

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ABSTRACT

Three experiments examined the impact of excessive violence in sport video games on aggression-related variables. Participants played either a nonviolent simulation-based sports video game (baseball or football) or a matched excessively violent sports video game. Participants then completed measures assessing aggressive cognitions (Experiment 1), aggressive affect and attitudes towards violence in sports (Experiment 2), or aggressive behavior (Experiment 3). Playing an excessively violent sports video game increased aggressive affect, aggressive cognition, aggressive behavior, and attitudes towards violence in sports. Because all games were competitive, these findings indicate that violent content uniquely leads to increases in several aggression-related variables, as predicted by the General Aggression Model and related social–cognitive models.

In 2002, ESPN aired an investigative piece examining the impact of excessively violent sports video games on youth's attitudes towards sports (ESPN, 2002). At the time, Midway Games produced several sports games (e.g., NFL Blitz, MLB Slugfest, and NHL Hitz) containing excessive and unrealistic violence, presumably to appeal to non-sport fan video game players. These games were officially licensed by the National Football League, Major League Baseball, and the National Hockey League, which permitted Midway to implement team logos, players' names, and players' likenesses into the games. Within these games, players control real-life athletes and can perform excessively violent behaviors on the electronic field. The ESPN program questioned why the athletic leagues would allow their license to be used in this manner and what effect these violent sports games had on young players. Then in December 2004, the NFL granted exclusive license rights to EA Sports (ESPN.com, 2005). In response, Midway Games began publishing a more violent, grittier football game based on a fictitious league. The new football video game, which is rated appropriate only for people seventeen and older, features fictitious players engaging in excessive violent behaviors on and off the field, drug use, sex, and gambling (IGN.com, 2005).

Violence in video games has been a major social issue, not limited to violence in sports video games. Over 85% of the games on the market contain some violence (Children Now, 2001). Approximately half of video games include serious violent actions toward other game characters (Children Now, 2001; Dietz, 1998; Dill, Gentile, Richter, & Dill, 2005). Indeed, Congressman Joe Baca of California recently introduced Federal legislation to require that violent video games contain a warning label about their link to aggression (Baca, 2009).

Since 1999, the amount of daily video game usage by youth has nearly doubled (Roberts, Foehr, & Rideout, 2005). Almost 60% of American youth from ages 8 to 18 report playing video games on "any given day" and 30% report playing for more than an average of an hour a day (Roberts et al., 2005). Video game usage is high in youth regardless of sex, race, parental education, or household income (Roberts et al., 2005).

Competition-only versus violent-content hypotheses

Recent meta-analyses (e.g., Anderson et al., 2004, submitted for publication) have shown that violent video game exposure increases physiological arousal, aggressive affect, aggressive cognition, and aggressive behavior. Other studies link violent video game play to physiological desensitization to violence (e.g., Bartholow, Bushman, & Sestir, 2006; Carnagey, Anderson, & Bushman, 2007). Particularly interesting is the recent finding that violent video game play can increase aggression in both short and long term contexts.

Besides the empirical evidence, there are strong theoretical reasons from the cognitive, social, and personality domains to expect

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violent video game effects on aggression-related variables. However, currently there are two competing hypotheses as to how violent video games increases aggression: the violent-content hypothesis and the competition-only hypothesis.

General Aggression Model and the violent-content hypothesis

The General Aggression Model (GAM) is an integration of several prior models of aggression (e.g., social learning theory, cognitive neoassociation) and has been detailed in several publications (Anderson & Bushman, 2002; Anderson & Carnagey, 2004; Anderson, Gentile, & Buckley, 2007; Anderson & Huesmann, 2003). GAM describes a cyclical pattern of interaction between the person and the environment. Input variables, such as provocation and aggressive personality, can affect decision processes and behavior by influencing one's present internal state in at least one of three primary ways: by influencing current cognitions, affective state, and physiological arousal. That is, a specific input variable may directly influence only one, or two, or all three aspects of a person's internal state. For example, uncomfortably hot temperature appears to increase aggression primarily by its direct impact on affective state (Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000). Of course, because affect, arousal, and cognition tend to influence each other, even input variables that primarily influence one aspect of internal state also tend to indirectly influence the other aspects.

Although GAM is a general model and not specifically a model of media violence effects, it can easily be applied to media effects. Theoretically, violent media exposure might affect all three components of present internal state. Research has shown that playing violent video games can temporarily increase aggressive thoughts (e.g., Kirsh, 1998), affect (e.g., Ballard & Weist, 1996), and arousal (e.g., Calvert & Tan, 1994). Of course, nonviolent games also can increase arousal, and for this reason much prior work has focused on testing whether violent content can increase aggressive behavior even when physiological arousal is controlled. This usually is accomplished by selecting nonviolent games that are equally arousing (e.g., Anderson et al., 2004).

Despite's GAM's primary focus on the current social episode, it is not restricted to short-term effects. With repeated exposure to certain types of stimuli (e.g., media violence, certain parenting practices), particular knowledge structures (e.g., aggressive scripts, attitudes towards violence) become chronically accessible. Over time, the individual employs these knowledge structures and occasionally receives environmental reinforcement for their usage. With time and repeated use, these knowledge structures gain strength and connections to other stimuli and knowledge structures, and therefore are more likely to be used in later situations. This accounts for the finding that repeatedly exposing children to media violence increases later aggression, even into adulthood (Anderson, Sakamoto, Gentile, Ihori, & Shibuya, 2008; Huesmann & Miller, 1994; Huesmann, Moise-Titus, Podolski, & Eron, 2003; Möller & Krahé, 2009; Wallenius & Punamaki, 2008). Such long-term effects result from the development, automatization, and reinforcement of aggression-related knowledge structures. In essence, the creation and automatization of these aggression-related knowledge structures and concomitant emotional desensitization changes the individual's personality. For example, long-term consumers of violent media can become more aggressive in outlook, perceptual biases, attitudes, beliefs, and behavior than they were before the repeated exposure, or would have become without such exposure (e.g., Funk, Baldacci, Pasold, & Baumgardner, 2004; Gentile, Lynch, Linder, & Walsh, 2004; Krahé & Möller, 2004; Uhlmann & Swanson, 2004).

In sum, GAM predicts that one way violent video games increase aggression is by the violent content increasing at least one of the aggression-related aspects of a person's current internal state (short-term context), and over time increasing the chronic accessibility of aggression-related knowledge structures. This is the violent-content hypothesis.

The competition hypothesis

The competition hypothesis maintains that competitive situations stimulate aggressiveness. According to this hypothesis, many previous short-term (experimental) video game studies have found links between violent games and aggression not because of the violent content, but because violent video games typically involve competition, whereas nonviolent video games frequently are noncompetitive.

The competitive aspect of video games might increase aggression by increasing arousal or by increasing aggressive thoughts or affect. Previous research has demonstrated that increases in physiological arousal can cause increases in aggression under some circumstances (Berkowitz, 1993). Competitive aspects of violent video games could also increase aggressive cognitions via links between aggressive and competition concepts (Anderson & Morrow, 1995; Deutsch, 1949, 1993). Thus, at a general level such competition effects are entirely consistent with GAM and with the violent-content hypothesis. However, a strong version of the competition hypothesis states that violent content has no impact beyond its effects on competition and its sequela. This strong version, which we call the *competition-only hypothesis*, has not been adequately tested.

Testing the competition-only hypothesis

There has been little research conducted to examine the violent-content hypothesis versus the competition-only hypothesis (see Carnagey & Anderson, 2005 for one such example). To test these hypotheses against each other, one must randomly assign participants to play either violent or nonviolent video games, all of which are competitive. The use of sports video games meets this requirement and has other benefits. Excessively violent sports games still obey the basic rules of the sport that they simulate. For example, MLB Slugfest utilizes the basic rules of baseball (e.g., three outs per half inning, one run scored for each player who crosses home plate). However, it includes violence in the game that would not be found in a regulation Major League Baseball event (e.g., assaulting other players without penalty, throwing baseballs covered in fire). Thus, excessively violent sports games and their same-sport counterparts allow a clean test of the competition-only versus the violent content hypotheses. The competition-only hypothesis predicts that violent and nonviolent sports game groups of participants will not differ on any aggression-related variables measured after gameplay, because both types of games are competitive. However, the violent-content hypothesis predicts that participants who play excessively violent sports video games will display higher levels of at least one aggression-related internal state variable (aggressive cognition, aggressive affect, or physiological arousal) and aggressive behavior, relative to participants who play a nonviolent, simulation-based sports game. Although GAM does not specify which internal states are affected by a particular aggression-enhancing stimulus, prior research suggests that violent video games (relative to matched nonviolent games) can differentially increase both aggressive cognition and aggressive affect even when physiological arousal is controlled.

Overview

Three experiments tested the violent-content hypothesis versus the competition-only hypothesis by examining the impact of

excessively violent sports video games and same-sport nonviolent video games on aggression-related variables. In all studies, participants first completed a questionnaire, then played a randomly assigned sports video game, and subsequently completed measures of key dependent variables. A pilot study tested whether the target video games differed on perceived competitiveness and violence. The remaining experiments examined the game violence effects on aggressive cognition (Experiment 1), aggressive affect and attitudes towards violence in sports (Experiment 2), and aggressive behavior (Experiment 3). This multiple study approach was used because prior studies have shown that in short-term experimental contexts, measuring one aggression-related variable can disrupt the independent variable effects on subsequently measured aggression (e.g., Lindsay & Anderson, 2000). Cardiovascular measures were taken in each experiment, because their measurement does not appear to disrupt independent variable effects on aggression.

The questionnaire included at the beginning of each experiment contained several individual difference measures for possible use as moderating variables. By pooling questionnaire data across studies, we also were able to test the hypothesis that habitual violent video game exposure is positively correlated with trait physical aggression.

Pilot study

A pilot study was conducted to test whether the violent and nonviolent sports video games we selected are: (a) equivalent in rated level of competition, and (b) different in rated level of violence. Each participant played both a violent and a nonviolent video game of the same sport, either a pair of football or baseball games. After playing each game, participants rated them on violence and competitiveness[2].

Method

Undergraduate students (16 men and 16 women) enrolled in introductory psychology classes at a large Midwestern university were recruited using the psychology department's research pool sign-up boards. The study design was a 2 (game violence: violent, nonviolent) × 2 (order: violent game first, nonviolent game first) × 2 (sport: baseball, football) × 2 (sex: male, female) mixed design. The between subjects variables were order, sport, and sex. The within subjects variable was video game violence.

Two violent sports video games (MLB Slugfest Baseball and NFL Blitz Football) and two nonviolent sports video games (MVP Baseball 2004 and Madden Football) were used. The nonviolent sports games attempt to authentically depict the sport, replicating the rules and simulating regulation play. The violent sports games, however, also include unnecessary violence. For example, in MLB Slugfest, players can make a base-runner punch a baseman so that the ball is dropped. In NFL Blitz, players can make excessively violent tackles that would be penalized or result in suspension in a real-life football game.

After completing consent procedures, each participant received instructions on how to play one of the four games, and then played that randomly assigned video game for 20 min. Next, the experimenter administered a video game evaluation questionnaire. This procedure was repeated for the second game.

A competitiveness scale was created from four questionnaire items: "to what extent did you feel like you were competing with the other team," "how hard were you trying to win the game," "how competitive was this video game," and "to what extent did this video game involve competition." Alphas were acceptably high for both violent (.84) and nonviolent (.84) games. A violence scale was created from two items: "how violent was the content of the game," and "how much violent action (e.g., attacking other players) was in this video game." Again, alphas were acceptably high for both violent (.78) and nonviolent (.86) games. Participants also rated "how much sporting action (e.g., athletic behaviors) was in this video game." All items were rated on 7-point scales.

Results and discussion

As expected, participants rated the violent games as containing more violence than the nonviolent games, Ms = 5.39 and 2.52, $F(1, 29) = 119.21$, $p < .0001$, $d = 4.05$. The video game violence × order and violence × sex interactions were non-significant, Fs(1, 29) = 0.01 and 0.51, ps > .05, ds < .27.

Also as expected, participants did *not* rate the violent games as having more competition than the nonviolent games, Ms = 4.89 and 5.03, $F(1, 29) = 0.41$, $p > .50$, $d = .24$. Indeed, the nonviolent games were rated as slightly more competitive than the violent games. The violence × order interaction was non-significant, $F(1, 29) = 0.05$, $p > .80$, $d = .08$. However, the violence × sex interaction was significant, $F(1, 29) = 5.85$, $p < .03$, $d = .90$. Women's ratings of game competitiveness did not significantly differ between violent and nonviolent games, Ms = 5.39 and 5.00, $F(1, 14) = 1.76$, $p > .20$, $d = .71$. However, men rated the violent sports games as somewhat less competitive than the nonviolent sports games, Ms = 4.39 and 5.06, but this difference was not significant, $F(1, 14) = 4.04$, $p < .07$, $d = 1.08$. Participants rated the violent and nonviolent games as having essentially the same amount of sporting action, [Ms = 5.41 and 5.72, $F(1, 29) = 1.10$, $p > .30$, $d = .39$].

In sum, the pilot study showed that the selected violent and nonviolent sport video games are appropriate stimuli to examine the competition-only and violent-content hypotheses. Violent games were rated as more violent than the nonviolent games. Nonviolent games were rated as being at least as competitive as the violent games.

Experiment 1

Method

Participants

Fifty-eight male and 62 female undergraduates at a large Midwestern university participated in a study described as evaluating different types of media. They received course credit.

Materials

Individual differences questionnaire. Participants first completed a questionnaire packet that included a version of the video game violence exposure questionnaire (VGV; Anderson & Dill, 2000). This questionnaire asked participants to list their five most played video games from 7th grade until the present. Participants then estimated how much they have played each game using 7-point scales anchored at 1 (*Rarely*) and 7 (*Often*). Participants also rated how violent each game is using 7-point scales anchored at 1 (*Little or No Violent Content*) and 7 (*Extremely Violent Content*). A video game violence exposure score (VGV) was calculated by multiplying each game exposure by each game's violent content, and then averaging those five scores.

Next, participants indicated how often they play each of five nonviolent sports video games (Madden Football, NHL 2004, MVP Baseball, FIFA Soccer, and ESPN NBA Basketball) and five violent sports video games (NFL Blitz, NHL Hitz, MLB Slug Fest, Red Card Soccer, and NBA Hoopz). Ratings were on 7-point

[2] Pairs of basketball, hockey, and soccer games were also initially considered. However, these games were not used because the violent soccer and basketball games did not clearly depict excessively aggressive actions and the "nonviolent" hockey game also contained excessively aggressive actions.

scales anchored at 1 (*Never*) and 7 (*Often*). A violent sports game (VSG) and nonviolent sports game (NSG) score was calculated for each participant.

Participants then completed the sports experience questionnaire. They indicated how much they watch five different sports (football, hockey, baseball/softball, soccer, and basketball) using 7-point scales anchored at 1 (*Never*) and 7 (*Often*). Participants also rated how much they play each of the five sports using the same 7-point scales. These ratings were combined into a single sports interest measure.

Finally, participants completed the 9-item physical aggression subscale of the aggression questionnaire (TA; Buss & Perry, 1992). Participants rated various statements regarding aggressive actions using 5-point scales anchored at 1 (*Extremely Uncharacteristic of Me*) and 5 (*Extremely Characteristic of Me*).

Video game evaluation questionnaire. After playing a video game, participants completed a video game evaluation questionnaire (Anderson & Dill, 2000). Participants rated the video game on six dimensions: difficulty, enjoyment, frustration, excitement, pace of action, and violence using 7-point scales anchored at 1 (e.g., *Not Enjoyable)* and 7 (e.g., *Enjoyable*). Participants also rated their ability at the video game using a 7-point scale anchored at 1 (*Well* Below Average) and 7 (*Well* Above Average), and how much their ability improved from the first to the last five minutes of gameplay using a 7-point scale anchored at 1 (*No Improvement*) and 7 (*Extreme Improvement*).

Cardiovascular measurements. Blood pressure and pulse were measured at several points in time to allow assessment of pulse rate and mean arterial pressure during three phases of the study: (a) at 2 min and 4 min during completion of the individual differences questionnaire (baseline); (b) at 6, 10, 14, and 18 min during game play; and (c) twice during completion of the main dependent measures. Measurements were averaged within each of the three phases to improve accuracy.

Procedure

After obtaining informed consent, the experimenter attached a blood pressure cuff to the participant's non-dominant arm. Next, participants completed the individual differences questionnaire. Participants then played a randomly assigned violent (MLB Slugfest Baseball, NFL Blitz Football) or nonviolent (MVP Baseball 2004, Madden Football) game for twenty minutes. They then completed the Word Pronunciation Task (Anderson, Carnagey, & Eubanks, 2003). This involves naming words as they appear on a computer screen, one per trial. The computer recorded the time between visual presentation of the word and verbal identification of the word. Fifty-eight words were presented twice (a total of 116 trials) in a different random order for each participant. The word list consisted of 24 aggressive words (e.g., assault, choke) and 36 control words (18 escape words, e.g., abandon, desert; and 18 neutral words, e.g., behold, listen). Next, participants completed the video game evaluation questionnaire. Finally, participants were probed for suspicion and debriefed.

Results

The cardiovascular measures and the video game evaluation questionnaire were administered in the same way to participants in all three experiments. The primary purpose of these measures was to see whether the violent and the nonviolent games differed in ways that might require correction. To obtain the most sensitive test of game differences (and to reduce redundancy), we pooled these results across the three experiments, with over 360 participants. Those characteristics that yielded significant game violence effects became eligible for further testing as possible covariates in each individual experiment.

Video game characteristics—pooled results

Recall that ratings were made on 1-7 point scales. The 2 (game violence) × 2 (sex) ANOVAs yielded significant main effects of game violence on ratings of violent content, difficulty, frustration, action, and ability. Violent games were rated as more violent than the nonviolent games, $Ms = 3.99$ and 2.07, $F(1, 358) = 214.57$, $p < .001$, $d = 1.55$. This was the largest effect by far, and is essentially a manipulation check.

Violent games were also rated slightly higher on difficulty [$Ms = 4.30$ and 3.94, $F(1, 358) = 5.13$, $p < .05$, $d = .24$], frustration [$Ms = 3.99$ and 3.54, $F(1, 358) = 6.94$, $p < .01$, $d = .28$], and action [$Ms = 4.40$ and 3.75, $F(1, 358) = 17.51$, $p < .001$, $d = .44$]. Ratings on ability to play the game were slightly lower for the violent games, [$Ms = 3.15$ and 3.51, $F(1, 358) = 6.39$, $p < .05$, $d = .27$]. Even though these differences are relatively small (ranging from .36 to .65 scale points), each dimension will be examined as a covariate in each experiment to see whether it is significantly related to the outcome variable.

The violent sports games did not differ from the nonviolent sports games in rated enjoyment, excitement, or improvement, $Fs(1, 358) < 1.30$, $ps > .05$. Thus, these dimensions will not be considered further.

Physiological arousal—pooled results

Mean arterial pressure and pulse were examined in separate 2 (game violence: violent, nonviolent) × 2 (participant sex) × 3 (measurement time: baseline, during video game, during DV completion) mixed design ANOVAs. The key game violence × measurement time interaction was non-significant for both mean arterial pressure and pulse, $F(2, 624) = 2.51$, $p > .05$ and $F(2, 618) = 1.01$, $p > .05$, respectively. This indicates that the violent and nonviolent games had the same effects on physiological arousal. Thus, these measures will not be considered further.

Aggressive cognition

As in previous studies, the reaction times for control and aggressive trials were separately examined for outliers, using Tukey's (1977) exploratory data screening procedures. For aggressive words, trials less than 255 ms or greater than 859 ms were removed from the data set. For control words, trials less than 213 ms or greater than 957 ms were removed. Data from participants who had fewer than 32 valid aggressive word trials (two thirds of the 48 possible) were deleted from the data set. All participants had sufficient numbers of valid control word trials to yield stable RT estimates.

A difference score was calculated for each participant by subtracting the average aggressive word reaction time from the control word reaction time. A positive score indicates that the participant identified aggressive words more quickly than control words; thus, larger scores indicate greater aggressive cognition accessibility.

Violent game participants displayed higher levels of aggressive cognition accessibility than nonviolent game participants, $Ms = 26.28$ and 16.85, $F(1, 107) = 6.78$, $p < .05$, $d = .50$. Men were higher in aggressive cognition than women, $Ms = 26.40$ and 16.73, $F(1, 107) = 7.12$, $p < .05$, $d = .52$. The game by sex interaction was non-significant, $F(1, 107) = 0.17$, $p > .05$. None of the game rating covariates significantly predicted aggressive cognition accessibility, all $Fs < 1$.

Moderators

There was a significant trait aggression × experimental game violence effect on aggressive cognition, $F(1, 100) = 4.51$, $p < .05$,

illustrated in Fig. 1. Further analyses revealed that neither trait aggression slope was significantly different from zero, though the violent condition slope was close. For the nonviolent game condition, $F(1, 53) = 0.17$, $b = -1.00$. For the violent game condition, $F(1, 51) = 3.81$, $p < .06$, $b = 5.82$.[3]

Another interpretation of this pattern is that the short term effect of playing a violent (versus a nonviolent) sports video game on aggressive cognition was relatively large for participants who scored higher on trait physical aggression and relatively small (or absent entirely) for those who scored low on trait aggression. In general, people who score above the median on trait aggression tend to be males and those who play lots of violent video games. Given the number of moderation tests and the rarity of significant trait aggression moderation effects in prior experimental studies of this type, we urge caution in interpreting this specific effect until further replication.

Past video game violence exposure, past violent sports video game exposure, past nonviolent sports video game exposure, past sports playing, and past sports viewing were tested to determine whether they were related to aggressive cognition or moderated the violent video game effect on aggressive cognition. None of these factors predicted or moderated the effect of violent sports video game exposure on aggressive cognition, Fs < 1.30, ps > .05.

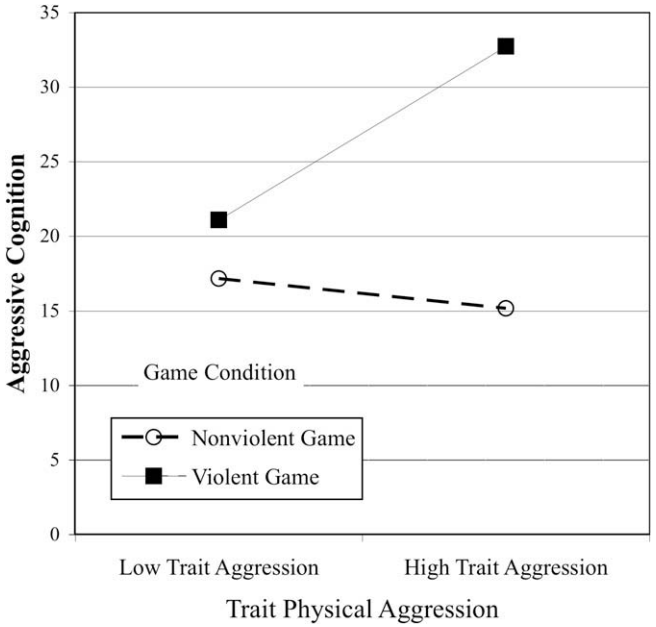

Fig. 1. Interaction of trait physical aggression and experimental game condition on accessibility of aggressive cognitions. high and low trait aggression points are at ±1 standard deviation from the mean.

Discussion

Because the nonviolent games used in this research are at least as competitive as the violent games, the competition-only hypothesis predicted no difference between them in aggressive cognition. The results of Experiment 1 contradicted this hypothesis and supported the violent-content hypothesis; participants who played an excessively violent sports video game verbally identified aggressive words relatively faster than those who played a more standard simulation-based sports video game. We also found a hint that individuals who are relatively high on trait aggression may be especially vulnerable to this short-term effect. Experiment 2 further tested the violent-content and competition-only hypotheses, but with a focus on aggressive affect and attitudes towards violence in sports.

Experiment 2

Method

Participants

Seventy-two male and 82 female undergraduates at a large Midwestern university participated in exchange for course credit. Three women and three men were deleted due to suspicion or clothing incompatible with the blood pressure equipment.

Procedure

The procedures were identical to Experiment 1 except the Word Pronunciation Task was replaced with the State Hostility Scale (SHS) and the newly developed Attitudes Towards Violence in Sports Questionnaire (ATVS). Participants always completed the State Hostility Scale first, because it was the variable of primary interest.

The ATVS was included in this experiment in an exploratory attempt to see whether attitudes—relatively stable person variables—might be affected at least temporarily by brief exposure to violent versus nonviolent media. Social–cognitive models (including GAM) suggest that long term changes in aggressive personality brought about by habitual exposure to violent media can include changes in attitudes towards aggression. However, one brief exposure may be too weak produce even a temporary shift attitudes.

The SHS (coefficient $\alpha = .94$; Anderson, Deuser, & DeNeve, 1995) entails rating current feelings on 35 adjectives, such as "irritated," "kindly" (reverse scored), and "mean." The newly created ATVS (coefficient $\alpha = .93$) involved rating the appropriateness (e.g., "it is appropriate for a football player to…") of various aggressive behaviors in five different sports: football ($\alpha = .76$; e.g., "hit an opponent after a play is over"), hockey ($\alpha = .77$; e.g., "use their stick as a weapon"), baseball ($\alpha = .75$; e.g., "intentionally hit a batter with a pitch"), soccer ($\alpha = .83$; e.g., "to knock an opponent down"), and basketball ($\alpha = .77$; e.g., "foul a player that does not have the ball"). There were five items for each sport, for a total of 25 items. Items were rated on 7-point scales anchored at 1 (*Strongly Disagree*) and 7 (*Strongly Agree*). The complete scale is available from the authors.

Results

Aggressive affect

Because so many of the SHS items are closely related to frustration, and others reflect a lack of positive social emotions, we decided to compute SHS subscale scores based on a factor analysis of the individual items (after deleting the frustration item). We conducted a principal components factor analysis with a Harris-Kaiser oblique rotation. Four factors were extracted based on eigenvalues greater than one. The first factor, labeled feeling unsociable, contained the items unsociable, willful, and disgusted ($\alpha = .59$). The second factor, labeled feeling mean, contained the items mean, like yelling at somebody, cruel, like I'm about to explode, burned up, bitter, offended, angry, outraged, enraged, like swearing, like banging on a table, mad, and disagreeable ($\alpha = .95$). The third factor, labeled lack of positive feelings, contained the reversed-scored items friendly, understanding, amiable, good-natured, cooperative, agreeable, kindly, polite, sympathetic, and tame ($\alpha = .90$). The fourth factor, labeled aggravation,

[3] Reported slopes are based on standardized predictor variables and raw score outcome variables.

contained the items aggravated, discontented, irritable, vexed, furious, and stormy ($\alpha = .85$).

Aggravation. Of these four subscales, the second (feeling mean) and fourth (aggravation) appear most relevant to media violence inspired affect. Only aggravation yielded a significant game violence effect, $F(1, 144) = 10.84$, $p < .01$, $d = .55$. Those who had just played an excessively violent sports video game felt more aggravated than those in the nonviolent condition, Ms = 2.40 and 1.96. The sex main effect and the sex × game interaction were non-significant, Fs < 2.15.

Interestingly, even though the rated game frustration effect on aggravation was huge [$F(1, 143) = 81.46$, $p < .001$, $b = .27$], when frustration was statistically controlled the game violence effect on aggravation remained significant, Ms = 2.32 and 2.05, $F(1, 143) = 6.24$, $p < .02$, $d = .42$. The only other covariate that was significantly related to aggravation was difficulty of the game, $F(1, 143 = 14.20$, $p < .001$, $b = .15$. Those who rated the game as more difficult also reported greater aggravation. The game violence main effect on aggravation was only slightly reduced when difficulty was statistically controlled, Ms = 2.38 and 2.00, $F(1, 143) = 9.09$, $p < .01$, $d = .50$.

Feeling mean. Feeling mean yielded a marginally significant effect of game violence, $F(1, 144) = 3.68$, $p < .06$, $d = .32$. Violent game players reported slightly greater levels of feeling mean than did nonviolent game players, Ms = 2.08 and 1.92, respectively. Rated game frustration was a significant predictor of feeling mean, $F(1, 143) = 30.27$, $p < .001$, $b = .28$. Including it in the model reduced to game violence effect to non-significance, $F(1, 143) = 1.27$, $p > .25$. None of the other covariates approached statistical significance.

Moderators of aggressive affect

Aggravation. Trait aggression, past violent sports video game exposure, past nonviolent sports video game exposure, past sports playing, and past sports viewing did not predict or moderate the violent game condition effect on aggravation, Fs < 3.40, ps > .05. Past video game violence exposure was positively related to aggravation [$F(1, 143) = 7.83$, $b = .23$, $p < .01$], but it did not interact with game violence, $F(1, 140) = 1.19$, $p > .05$. The experimental game violence effect was essentially unchanged even with past video game violence exposure in the model, Ms = 2.39 and 1.95 in the violent and nonviolent conditions, $F(1, 143) = 11.48$, $p < .01$, $d = .57$.

Feeling mean. As with aggravation, none of the potential moderators yielded a significant moderator effect on feeling mean. However, past video game violence exposure was a significant predictor of feeling mean, $F(1, 143) = 7.50$, $p < .01$, $b = .18$. Interestingly, adding past game violence exposure to the model slightly increased the experimental game violence effect, Ms = 1.67 and 1.46 in the violent and nonviolent conditions, $F(1, 143) = 3.91$, $p < .05$, $d = .33$.

ATVS

Exposure to a violent or nonviolent game did not significantly affect overall attitudes about violence in sports, $F(1, 144) = 1.69$, $p > .05$, $d = .22$; however, it did affect attitudes towards particular sports. Violent game participants were more supportive of violence in hockey than nonviolent game participants, [Ms = 2.75 and 2.35, $F(1, 144) = 4.49$, $p < .05$, $d = .35$]. A similar but weaker game violence effect occurred on attitudes towards violence in soccer, Ms = 2.35 and 2.05, $F(1, 144) = 2.98$, $p < .09$, $d = .29$. Men were more supportive (relative to women) of violence in hockey [Ms = 2.79 and 2.31, $F(1, 144) = 6.65$, $p < .05$, $d = .43$] and in soccer [Ms = 2.41 and 1.99, $F(1, 144) = 6.06$, $p < .05$, $d = .41$]. The game × sex interaction was non-significant for both hockey and soccer attitudes, Fs(1, 144) = 1.78 and 0.90, ps > .05. None of the rated game covariates was a significant predictor of either hockey or soccer attitudes, Fs(1, 143) < 3.10, ps > .05.

Moderators of ATVS

The individual difference measures neither predicted nor moderated the effect of violent sport game exposure on hockey attitudes, Fs < 2.70, ps > .05. Past video game violence exposure was marginally related to violence in soccer attitudes [$F(1, 143) = 3.19$, $b = .19$, $p < .08$], but did not interact with experimental game violence, $F(1, 140) = 0.75$, $p > .05$.

Discussion

Experiment 2 also yielded support for the violent-content hypothesis while contradicting the competition-only hypothesis. This study found that exposure to excessive violence in games can increase players' aggressive affect and can influence attitudes towards violence in sports. Violent game participants scored higher than nonviolent game participants on the aggravation and the feeling mean subscales of state hostility, and gave significantly more approval to violence in sports (but only for hockey). The latter finding could be due to the relatively ambiguous acceptance of violence in hockey compared to the other sports used in the attitudes scale. In other words, the ambiguity of the proper role of violence in hockey may make violence attitudes somewhat more amenable to temporary changes by situational manipulations such as playing a violent or nonviolent sports game. Similarly, the marginally significant game violence effect on soccer may be the result of its relatively low popularity in the US, making it ambiguous whether violence in the sport is acceptable. In either case, we expect that such changes in attitudes as a result of such brief exposure to violent and nonviolent video games to be temporary.

Experiment 3

Method

Participants

Sixty-five male and 38 female undergraduates at a large Midwestern university participated in exchange for course credit in this experiment. Participants were told that the purpose of the study was to measure abilities on simple and complex computer tasks.

Procedure

Participants were instructed that they would complete one complex computer task—a sports video game—and one simple computer task—the Competitive Reaction Time Task (CRT). The rest of the procedures were identical to Experiment 2 except that the SHS and the ATVS were replaced with the CRT and the CRT Motivation Questionnaire.

The CRT is a widely used and externally valid measure of aggressive behavior (see Anderson & Bushman, 1997; Anderson, Lindsay, & Bushman, 1999; Carnagey & Anderson, 2005; Giancola & Chermack, 1998). CRT participants believe they are competing with another participant to see who can press a mouse button faster after hearing an auditory cue. Participants are told the "loser" of each trial receives a burst of white noise, the intensity of which is supposedly set by their opponent (a computer program in this study). Prior to each of 25 reaction time trials, participants select the intensity level they want their opponent to hear ranging from level 0 (0 dB) to level 1 (60 dB) to level 10 (105 dB). The computer recorded participants' intensity selections. These selections constitute the measure of aggressive behavior.

The CRT task was preprogrammed with a random pattern of 13 "win" and 12 "lose" trials, with Trial 1 always being a loss (with intensity five) and Trial 25 being a win. After each trial, the computer displayed the level supposedly set by the opponent, so that the participant always knew what intensity was set by the opponent, even on trials that they won (and therefore did not get blasted). We used an "ambiguous" pattern of noise blasts from the opponent, because prior research suggests that this pattern makes the CRT task more sensitive to effects of other predictor variables. An ambiguous pattern is one in which the correlation between intensity and trial number is essentially zero. For the final 24 trials, three blasts each were at intensity levels 2–9.

The CRT Motivation Questionnaire asked participants why they selected the particular intensities for their opponent during completion of the CRT (Anderson, Buckley, & Carnagey, 2008; Anderson et al., 2004). Six items measured participants' instrumental motivation (e.g., "I wanted to control my opponent's level of responses") and revenge motivation (e.g., "I wanted to pay back my opponent for the noise levels (s)he set.").

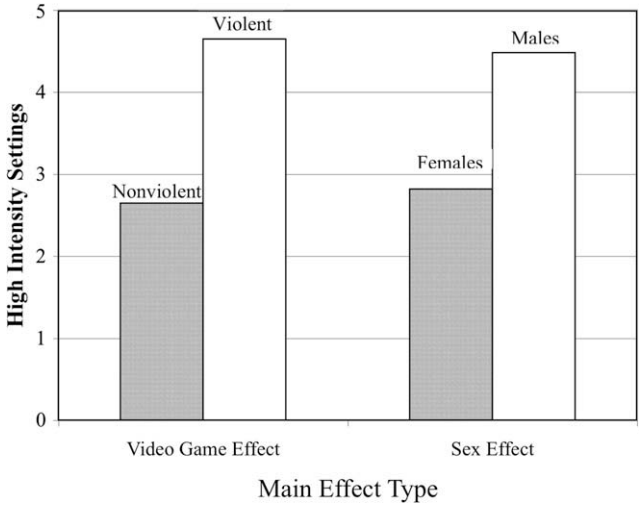

Fig. 2. Effects of excessively violent games and of participant sex on high intensity aggression.

Results

Aggressive behavior

Aggressive behavior was calculated in two ways (e.g., Anderson et al., 2008; Bartholow & Anderson, 2002; Giancola, 2003). *High intensity aggression* was assessed by counting the total number of high intensities (levels 8–10) selected by the participant across the 25 trials. Scores could range from 0 to 25. Our research team has focused on this measure in recent years for three main reasons: (a) high intensity punishments are more clearly aggressive than moderate intensities; (b) such clearly aggressive behavior is the most likely to instigate retaliation; and (c) this measure is easier to communicate to non-expert audiences. *Average intensity aggression* was assessed by averaging the noise intensity settings selected by the participant across the 25 trials. The main advantage of this measure is that the distribution of scores is more symmetric than the high intensity measure. The two measures are necessarily highly correlated, $r = .75$ in the present study.

High intensity aggression. As predicted by the violent-content hypothesis, violent game participants behaved more aggressively than nonviolent game participants, Ms = 4.65 and 2.65, $F(1, 99) = 6.27$, $p < .05$, $d = .50$. In other words, participants who had just played an excessively violent sports video game gave over 75% more high intensity noise blasts than did those who had played a normal sports video game. Men were more aggressive than women, Ms = 4.48 and 2.82, $F(1, 99) = 4.38$, $p < .05$, $d = .42$. The game × sex interaction was non-significant, $F(1, 99) = 2.31$, $p > .05$. Fig. 2 illustrates both of these main effects.

None of the rated game covariates was significantly related to aggressive behavior, Fs < 2.95, ps > .05. Likewise, the individual difference measures neither predicted nor moderated the violent video game effect on aggressive behavior, Fs < 3.71, ps > .05.

Average intensity aggression. One extreme outlier (more than three standard deviations below the mean) was deleted.[4] The effects of the game experimental manipulation were very similar to the results for the high intensity measure. Violent game condition participants gave higher average intensity noise blasts than nonviolent game participants, Ms = 5.15 and 4.62, $F(1, 98) = 4.71$, $p < .05$, $d = .44$. Men were more aggressive than women, $F(1, 98) = 12.70$, $p < .01$, $d = .72$. The game by sex interaction was not significant, $F(1, 98) = 0.26$.

Rated ability at the game they had just played was positively related to average intensity aggression, $F(1, 97) = 8.91$, $p < .01$, $b = .27$. Those who indicated greater ability behaved more aggressively. Interestingly, the main effect of the game violence manipulation became slightly larger when ability rating was statistically controlled, $F(1, 97) = 5.03$, $p < .05$, $d = .45$. However, the sex main effect became non-significant, $F(1, 97) = 1.63$, $p > .05$, $d = .26$.

Rated difficulty of the game also related to average intensity aggression, $F(1, 97) = 7.07$, $p < .01$, $b = -.21$. Once again, the game main effect became larger when this covariate was statistically controlled, Ms = 5.21 and 4.63 for the violent and nonviolent game conditions, $F(1, 97) = 6.13$, $p < .05$, $d = .50$. The sex main effect decreased in size, $F(1, 97) = 5.70$, $p < .05$, $d = .48$. None of the other game covariates or the individual difference measures predicted or moderated the violent video game effect on average intensity, Fs < 3.00, ps > .05.

Motivations for aggressive behavior

Revenge motivation was a strong predictor of both aggression measures: $F(1, 98) = 13.78$, $p < .05$, $b = 2.22$ for high intensity aggression; $F(1, 97) = 8.16$, $p < .01$, $b = .54$ for average intensity aggression. Instrumental aggression motivation was not significantly related to high intensity aggression, $F(1, 98) = 2.26$, $p > .05$, $b = .74$. However, it was a significant predictor of average intensity, $F(1, 97) = 6.28$, $p < .05$, $b = .38$. These motivational results add to the validity of the CRT by demonstrating that the intensities selected by the participants are based on identifiable forms of aggression motivation to harm the opponent.

Discussion

Similar to Experiments 1 and 2, the results of Experiment 3 contradicted the competition-only hypothesis and supported the violent-content hypothesis. The competition-only hypothesis predicted that there should have been no effect of game violence on aggression, because the target nonviolent games are at least as competitive as the target violent games. Nonetheless, violent sports game participants behaved more aggressively towards their "opponent" than did nonviolent sports game participants, on both measures of aggression.

[4] This participant' high intensity score was not an outlier, because many participants give few or no high noise blasts.

General discussion

Main findings

Three experiments tested the competition-only hypothesis against the violent-content hypothesis. This was accomplished by exposing participants to either an excessively violent sports video game or a matched-sport nonviolent video game. On average, the nonviolent games were seen as slightly more competitive than the violent games, significantly so by males. This ensured a somewhat easy test for the competition-only hypothesis and a very stringent test of the violent-content hypothesis.

The competition-only hypothesis predicted that violent and nonviolent games would yield no differences on any aggression-related variables measured after gameplay. All three experiments rejected this hypothesis in favor of the violent-content hypothesis by demonstrating that violent content increases aggressive cognitions (Experiment 1), aggressive affect (Experiment 2), acceptability of violence in certain sports (Experiment 2), and aggressive behavior (Experiment 3). These studies also demonstrated that these main results were not attributable to differences in physiological arousal. In sum, the violent-content hypothesis, and thereby GAM and other social–cognitive models of social behavior, were strongly supported.

Moderation

Although there were multiple opportunities for moderation of the experimental game violence effects, with multiple potential individual difference moderator variables, only one was statistically significant (the trait physical aggression by game violence interaction illustrated in Fig. 1). The paucity of significant moderation effects by sex, trait physical aggression, and the various habitual media experience variables further strengthens other implications of GAM and similar social–cognitive models. Specifically, these models suggest that short-term effects can be seen as a form of priming (e.g., Anderson et al., 2003; Bushman & Huesmann, 2006), and there does not appear to be any population that is wholly immune to violent media effects (e.g., Anderson et al., 2003, 2007).

Limitations

Violent and nonviolent versions of two sports were investigated in all three studies: baseball and football, thereby increasing generalizability. Our original intent was to have three or four different sports represented to further maximize generalizability. However, pilot testing revealed that paired samples of more and less violent hockey, golf, soccer, and basketball games were either too similar in violent content, too difficult for use in a short term experimental setting, or differed in other respects that made them unsuitable for the present line of research. Nonetheless, the use of two pairs of sports games (versus one) increases our confidence in the generalizability of these results, as do other analyses showing that the relative effect sizes of the two sports were quite similar.[5] Another limitation is the sequential nature of these studies. Ideally, one could test mediation models of short term violent game effects by measuring aggressive cognitions, aggressive affect, and aggressive behavior in the same study. Unfortunately, order effects in this research domain prevent us from using such a design. The field needs to devise measures of aggressive affect, cognition, and behavior that do not interfere with each other, if indeed it is possible to do so.

Although the present findings show that the violent video game effects typically found in experimental studies are not the result of violent games having a competition element that nonviolent games lack, they do not rule out the possibility of competition effects. One hypothesis that was not tested in these studies concerns the effect of competitiveness on aggression. We selected only highly competitive games in order to cleanly test the competing violent-content and competition-only hypotheses, but thereby precluded tests of whether competition itself is sufficient to prime increases in aggression-related variables. As noted earlier, there are theoretical and empirical reasons to believe that competition can have such effects. Further work in this area could usefully extend the field's understanding of competition, video games, and social behavior.

[5] Specifically, the game violence × sport interactions were non-significant.

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