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Social Context and Video Game Play: Impact on Cardiovascular and Affective Responses

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We examined if cardiovascular and affective responding to video game play changed across social context or with game content. Male participants (13-22 years old) played a violent or nonviolent video game. Each participant played the game individually, competitively against a male partner, and cooperatively with the partner. There was no effect of social condition on heart rate (HR) or diastolic blood pressure (DBP). Participants had significantly higher systolic BP (SBP) when playing individually and competitively than when playing cooperatively, probably because play was more continuous. There was no impact of game type for HR or SBP. DBP was significantly higher for participants who played the violent game, perhaps because participants found the violent game more exciting and enjoyable. Participants who played the violent game rated the experimenters more positively than those who played the nonviolent game. Participants found game play more exciting, enjoyable, stressful, and frustrating, but less boring and relaxing, when they

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played competitively or cooperatively than when they played individually. The results are discussed in terms of the general aggression model.

INTRODUCTION

This study has two purposes: to examine video game play in a social context and to test aspects of the general aggression model (GAM; Anderson, 1997; Anderson, Benjamin, & Bartholow, 1998; Anderson & Bushman, 2002; Anderson & Carnagey, 2004; Anderson & Dill, 2000; Bushman & Anderson, 2002; Carnagey, Anderson, & Bushman, 2007) within the context of a friendly, but competitive, social environment similar to day-to-day video game play. Video games are often played in a social environment (Cole & Griffiths, 2007; Kim & Ross, 2006; Olson, 2010), and gamers cite socialization and competition as primary motivations for play (Griffiths, Davies, & Chappell, 2004; Kim & Ross, 2006; Olson, 2010; Sherry, Lucas, Greenberg, & Lachlan, 2006; Yee, 2006). Gamers often report making lifelong friends through game play (Cole & Griffiths, 2007; Olson, 2010). However, few studies have focused on the social aspects of video game play.

Several studies have examined ostensible video game competition (i.e., "competition-priming"; Anderson & Carnagey, 2009; Anderson & Dill, 2000; Anderson & Morrow, 1995; Eastin & Griffiths, 2006; Ferguson & Rueda, 2010; Ferguson et al., 2008; K. D. Williams, 2009), real competition with auditory—but not visual—contact (Eastin, 2007) and game play where participants were told that they would be competing against others but not against the participant who was playing in the same room (Sheese & Graziano, 2005). However, a literature search reveals only two studies (Ballard & Lineberger, 1999; Oxford, Ponzi, & Geary, 2010) that specifically examined responses to *direct face-to-face competitive* video game play. The current study fills this gap by examining responses to video game play across competitive and cooperative contexts. The participants—high school and college young men aged 13 to 22—played a violent or nonviolent game individually, cooperatively with another male participant, and competitively against another male participant; no extrinsic motivations (e.g., rewards or punishments) were provided for game performance. Cardiovascular (CV) reactivity and affective responses were examined to test aspects of the GAM (e.g., Anderson & Bushman, 2002; Anderson & Dill, 2000).

When people play video games against a computer—regardless of game content—they display an array of positive (e.g., enjoyment) and negative (e.g., frustration, hostility) affective and social outcomes (e.g., Ballard, Hamby, Panee, & Nivens, 2006; Smyth, 2007; D. Williams, Yee, & Caplan,

2008; K. D. Williams, 2009). In terms of CV reactivity, heart rate (HR) and diastolic blood pressure (DBP) typically increase across a session of game play, whereas systolic blood pressure (SBP) often decreases (Ballard et al., 2006; Ballard & Lineberger, 1999; Ballard & Wiest, 1996; Borusyak, Bouikidis, Liersch, & Russell, 2007; Panee & Ballard, 2002). CV desensitization occurs over several sessions of play (Ballard et al., 2006). Some studies indicate that violent versus nonviolent game content does not significantly affect CV reactivity (Ballard et al., 2006; Hamby & Ballard, 2006; Panee & Ballard, 2002); other studies (e.g., Anderson & Carnagey, 2009; Ballard & Wiest, 1996) find CV reactivity to be greater after violent game play.

Some correlational research suggests that prolonged exposure to violent video games is correlated with poor social and cognitive functioning and antisocial behavior (Anderson & Bushman, 2001; Anderson & Dill, 2000; Funk, Buchman, Jenks, & Bechtoldt, 2003). Van Schie and Wiegman (1997) concluded that this effect is minimal. A time-lag study found that aggressive behavior and violent media use have bidirectional effects, with both increasing over time (Slater, Henry, Swaim, & Anderson, 2003). However, other studies (e.g., Durkin & Barber, 2002; Olson, 2010) report that playing video games, including violent games, is a part of normal child and adolescent development and is correlated with a number of positive social, cognitive, and emotional outcomes. Prospective studies have failed to find correlations between violent video game play and negative outcomes. Ferguson (2011) conducted a prospective study among mostly Hispanic adolescents; neither exposure to violent video games nor violent television predicted youth aggression. Similarly, D. Williams and Skoric (2005) found that violent online video game play was not tied to increases in real-world aggression over time, and Shibuya, Sakamoto, Ijori, and Yukawa (2008) found that violent video game play was related to decreased aggression among girls but not boys. Further, a number of recent studies have found that both violent and nonviolent video game play has some positive effects, including the development of visuospatial skills (see Ferguson, 2010, for a review).

An early focus on negative findings, both empirically and in the media, led Anderson and colleagues (e.g., Anderson & Bushman, 2002; Anderson & Carnagey, 2009; Anderson & Dill, 2000) to develop the GAM to examine complex social-cognitive responses to violent media. Anderson and colleagues have argued that violent video games are negative stimuli that adversely impact behavior via the interaction of modeling and reinforcement, increased negative affect, heightened physiological arousal, cognitive priming of aggressive scripts, and desensitization to violence. Specifically, they have argued that violent video game play results in hostile affect and physiological arousal and elicits aggressive scripts. When coupled with desensitization to violence the likelihood of aggressive behavior increases.

particularly if a negative stimulus occurs proximally to video game play. They have argued that violent media has both short-term effects and long-term cumulative effects. Individual difference factors (such as trait aggression) and situational variables are included in the GAM. See Figure 1 for an example of the GAM as applied to the current study.

Most of the research testing the GAM has focused on whether violent video games produce short-term effects (e.g., hostility, arousal, and aggressive priming) in the lab. Several theorists have criticized the GAM on empirical and theoretical grounds (e.g., Grimes, Anderson, & Bergen, 2008; K. D. Williams, 2009). Ferguson and Kilburn (2010) argued that the meta-analyses (e.g., Anderson & Bushman, 2001; Fischer, Greitemeyer, Kastenmüller, & Vogrinic, in press) used support the GAM have methodological flaws (e.g., including studies that are not tied to serious aggression, including a biased sample of unpublished studies) and small effect sizes. They also argued that youth violence has declined across cultures since

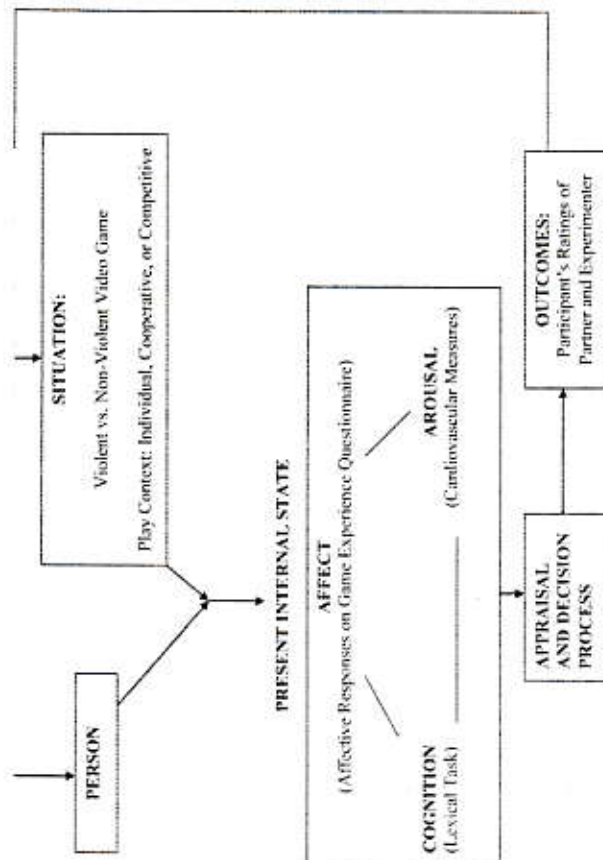


FIGURE 1 Anderson and Carnagey's (2004) general aggression model modified to incorporate the variables from the current study. The model predicts that the situation (violent vs. non-violent game play and individual, cooperative, and competitive play context) will influence the individual's present internal state and, in turn, affect the participant's ratings of the partner and experimenter. The present internal state includes the participant's affective responses on the Game Experience Questionnaire, the Lexical task (if it had been successful) and the participant's arousal level, reflected by their cardiovascular arousal.

the advent of video games, which does not support a "real-world" impact of violent video games on youth aggression. Grimes and colleagues (2008) argued that the theories—including the GAM—used to explain the impact of media violence on the individual are post hoc and too simplistic to encompass the wide array of factors and multidirectional effects that need to be considered to adequately examine the issue.

Research evidence regarding the GAM is inconsistent. In laboratory settings, violent video game play sometimes elicits negative emotions, and there is some evidence that graphic game violence exacerbates these effects (Anderson & Bushman, 2001; Anderson & Carnagey, 2009; Anderson & Dill, 2000; Ballard & Lineberger, 1999; Ballard & Wiest, 1996; Bartholow & Anderson, 2002; Bushman & Anderson, 2002; Calvert & Tan, 1994; Dill & Dill, 1998; Eastin & Griffiths, 2006; Pance & Ballard, 2002; Tamborini et al., 2004; K. D. Williams, 2009). Research also suggests that violent video games prime aggressive cognitive scripts (Anderson, 1997; Anderson, Anderson, & Deuser, 1996; Anderson et al., 1998; Anderson & Carnagey, 2009; Anderson & Dill, 2000; Bushman, 1998). Both negative emotion and the availability of aggressive scripts increase the likelihood of aggression (Berkowitz, 1998; Canary, Spitzberg, & Semic, 1998). Some meta-analyses offer support for the GAM (e.g., Anderson & Bushman, 2001; Fischer et al., in press). However, experimental situations are often arranged to elicit negative emotions. In natural, day-to-day settings, video game play may elicit negative or positive emotions and peer interactions, depending on performance, competition, and other contextual factors. Also, stimulating media (e.g., violent games or heavy metal music) that are positively arousing by fans are often perceived as negatively arousing by others (Ballard, Snider, Curtin, & Zrull, 2003). Cognitive mediation is necessary to assess the emotional valence of physiological arousal (e.g., Blascovich, 1990; Snider et al., 2004). Thus, the circumstances surrounding game play are necessary to predict if a cycle of negative affect and aggression or a cycle of positive affect and affiliation is likely to occur.

In fact, several studies have found no links between game violence and aggressive behavior, feelings of hostility, or aggressive cognitions (e.g., Bösch, 2010; Colwell & Kato, 2003; Durkin & Barber, 2002; Ferguson, 2011; Ferguson & Rueda, 2010; Ferguson et al., 2008; Ferguson, San Miguel, & Hartley, 2009; Funk et al., 2003; Hamby & Ballard, 2006; Ivory & Kalyanaraman, 2009; Scott, 1995; Unsworth, Devilly, & Ward, 2007; Winkel, Novak, & Hopson, 1987), and a few studies have found positive affect from violent game play. Specifically, Ferguson and Rueda (2010) found that hostility and depression were lower among those who played higher rates of violent video games. They suggested that violent games might facilitate mood management. Bösch (2010) found that violent video game

play primed both positive and aggressive cognitions, regardless of game play history. Two meta-analyses support the argument that violent video games do not result in negative outcomes (e.g., Ferguson et al., 2009; Sherry, 2001). Sherry (2001) concluded that the link between violent video game play and aggression was less significant than that of television violence, particularly among heavy players. Sherry (2007) stated in strong terms that there is too much evidence to the contrary to continue to argue that video games are dangerous.

Further, experiments also find that playing a *frustrating but not violent* video game may result in heightened negative affect (Ferguson & Rueda, 2010; K. D. Williams, 2009). K. D. Williams (2009) found that in the short-term violent games elicited greater hostility only when they were also frustrating. In a study of the long-term effects of video game play, K. D. Williams found that trait hostility did not differ between participants with a history of violent versus nonviolent video game play, even though those who played violent games played more often and longer. Further, participants' trait hostility did not predict their state hostility after game play. K. D. Williams concluded that playing violent video games does not affect trait hostility and, subsequently, questioned if the GAM predicts long-term cumulative effects. He also questioned the rationale behind focusing on short-term effects in the lab if there are no cumulative effects, as the short-term effects found in laboratory research may not predict day-to-day behavior. There is anecdotal evidence to suggest that violent video game play might be related to real-world incidents of interpersonal aggression; however, K. D. Williams suggested that situational factors, like frustration, play a larger role in predicting reactions to video game play than personality or history of game play.

Markey and Markey (2010) agreed. Based on the results of a meta-analysis they argued that most people are not negatively influenced by violent video games over time. However, contrary to K. D. Williams's (2009) conclusions, they suggested that personality—particularly trait aggression, neuroticism, and psychoticism (unsympathetic, unemotional, antisocial, untrustworthy, etc.)—moderates the impact of violent media, making some people more susceptible to its influence than others (Markey & Markey, 2010). Similarly, Unsworth and colleagues (2007) found that, in general, violent video game play was not related to increases in anger but that those with a more labile temperament displayed more increases in anger after game play. Thus, both trait temperament and state affect before game play may moderate responses to violent games.

Although only some video games are violent, most are competitive. Most theorists argue that competition increases the likelihood of aggression and decreases the likelihood of cooperation (e.g., Anderson & Carnagey, 2009; Buss, 1963; Sherif, 1966). Adachi and Willoughby (2011) argued that

competition, not violence, may account for many of the findings reported earlier, including increased CV reactivity (e.g., Holt-Lunstad, Clayton, & Uchino, 2001; Scheepers, 2009). In a set of studies designed to examine the affect of competition using video games as stimuli, Anderson and Carnagey (2009) had participants play either a violent or nonviolent sports video game against the computer. The results of the first two studies indicated that physiological arousal, aggressive cognitions, and aggressive affect were higher after playing a violent game. In a third study, after participants played a video game, they were told that they were competing against another participant in a reaction time task. The "loser" of the reaction time task was exposed to a noise blast. A computer program—ostensibly another participant—punished participants with noise blasts when they "lost" a round of the task. Participants could choose the intensity of a noise blast to expose their "opponent" to when the "opponent" lost a round. Participants chose higher intensity noise blast settings if they had played the more violent game. Anderson and Carnagey (2009) argued that these results suggest that violent game content, not competition per se, results in increased aggressive affect, cognitions, and behavior and provides support for the GAM.

Several studies have examined ostensible, competition against others where participants played against computers (e.g., "competition-priming"; Anderson & Carnagey, 2009; Anderson & Morrow, 1995; Eastin & Griffiths, 2006; K. D. Williams, 2009) or in contexts where competition against real people occurred, but with the competitors out of the sight of the participants (e.g., Eastin, 2007; K. D. Williams, 2009). However, only two studies examined *face-to-face* responses to video game competition (Ballard & Lineberger, 1999; Oxford et al., 2010). And although competition-priming does affect gaming strategy (e.g., Anderson & Morrow, 1995), it does not affect ratings of—or behavior toward—the partner (Anderson & Morrow, 1995; Eastin, 2007; Eastin & Griffiths, 2006; Sheese & Graziano, 2005).

In one face-to-face study (Ballard & Lineberger, 1999) participants played a violent or nonviolent game before engaging in a teacher-learner paradigm where participants rewarded a confederate with candy for correct responses and punished them by placing their hand in a cold press or device for incorrect responses. The male participants punished their competitor longer after playing a violent game than after a nonviolent game, particularly if the competitor was female. In a second face-to-face study, Oxford and colleagues (2010) examined competitive video game play in within- and between-group contexts to assess testosterone and cortisol responses. In the within-group condition, participants competed against two players; they could see and interact with the competitors. In the between-group condition, participants cooperated with teammates against an opposing team;

participants could hear, but not see, the opposing team. Participants only showed increased hormonal responses during the between-group competition. Thus, face-to-face competition was not related to heightened hormonal responses, but competing against unseen competitors was. This finding is particularly interesting in terms of the implications for online gaming.

STUDY OVERVIEW AND HYPOTHESES

This study was designed to (a) test two factors (affect and arousal) included in the "present internal state" component of the GAM (see Figure 1), (b) examine the impact of social context on the effects of video game play, and (c) examine the impact of violent versus nonviolent game play on the evaluation of the play partner and experimenter. This study adds to the literature by specifically examining responses to *direct face-to-face competitive* video game play. Because few studies have examined the social context of game play, this is an important area of research to consider (Gentile, 2011). Based on the evidence just cited and predictions derived from the GAM, we posited five hypotheses:

- H1: Participants who played the violent game would have greater cardiovascular reactivity than those who played the nonviolent game.
- H2: Participants would have higher HR, SBP, and DBP when playing competitively and cooperatively than when playing individually.
- H3: Participants would view the experimenter and partner in a more negative light after playing the violent than the nonviolent game.
- H4: Participants would report more negative affect (stress, frustration) and less positive affect (enjoyment, relaxation) after playing the violent game than after playing the nonviolent game.
- H5: Participants would find game play more exciting, less boring, more enjoyable, more stressful, more frustrating, and less relaxing when playing competitively or cooperatively than when playing individually.

METHOD

Participants

Participants included 171 adolescents and young men. We used males as participants because they are the primary consumers of video games, particularly sports genres (e.g., Cole & Griffiths, 2007; Griffiths et al., 2004). Of these, 101 were undergraduates recruited via the Psychology Department

participant pool; they received course credit for participation. Students could choose from a variety of studies and were given other reasonable options for accruing course credit. The remainder of the sample ($n = 70$) were male adolescents recruited from the community; they were paid \$20 for participation. Most ($n = 152$) participants were White; the remainder were African American ($n = 11$), Latino ($n = 3$), Asian American ($n = 4$), or did not report ($n = 1$). Participants ranged in age from 14 to 22 ($M = 17.48$). Data from two nontraditional students were excluded from use. During recruitment, participants were asked not to ingest caffeine or nicotine or exercise for 3 hours prior to their session.

Materials

Game selection. A PlayStation 2 game console was used to conduct the study. Research assistants (RAs) who were heavy gamers determined several violent and nonviolent games that could be played individually against the computer, cooperatively with another person against the computer, and competitively against another player. Violent and nonviolent games fitting this criterion were played by novice and expert players. The games were compared with regard to learning curve, controller use, graphics, characters, and control over game play (e.g., music, setting up matches, time limits, ease of play). Tekken Tag Tournament, a martial arts game (rated T [teen]; Namco Hometek, Inc., San Jose, CA), was chosen as the violent game. Top Spin, a tennis game, (rated E [everyone]; 2K Sports, New York, NY) was chosen as the nonviolent game. These games were chosen because they are two-player games with good graphics, control over time limits, a similar learning curve, and similar controller use. Both games received favorable scores from users and critics on Metacritic.com (2011), although Tekken was rated as somewhat more enjoyable.

There is no music in Top Spin; Tekken was set for play without music. Female characters, animal characters, and characters deemed too easy or difficult to use were ruled out by RA play. Two characters with moderate ease of use and similar skills were selected for use: Lee and Law for Tekken and Federer and Grosjean for Top Spin. The contexts chosen for play were New York for Top Spin and the arcade mode for Tekken.

Measures

Demographic and game play questionnaire. Basic demographic information and data regarding average daily and weekly game play, including the amount of gaming that occurred individually or with someone else, were gathered. Participants also listed the video games they played most often.

Cardiovascular measures. HR, SBP, and DBP were gathered prior to, during, and after game play. Detailed information about when CV measures were gathered is included in the procedure. CV measures were taken using an Omron (n.d.) Model HEM-707 automatic HR and BP monitor with fuzzy logic (a microprocessor that adjusts the inflation level to accommodate changes in BP). Measures were noted on a data sheet. The reliability of the monitor was checked periodically by a trained RA. Game play was paused during measurement to decrease any movement artifact.

Game experience questionnaire. This 21-item questionnaire assessed six affective dimensions (boring, frustrating, exciting, relaxing, enjoyable, and stressful) and one performance assessment (how well did you play today) across the three game-play contexts (individual, cooperative, and competitive). Items were scored on a 5-point Likert scale from *not at all* to *extremely*. For example, the participant would respond to the question, "How enjoyable did you find playing the video game *cooperatively* today?" by indicating if it was "not at all enjoyable," "somewhat enjoyable," "moderately enjoyable," "very enjoyable," or "extremely enjoyable." The order of the seven affective variables was counterbalanced, but each affective variable (e.g., enjoyment) was grouped together; the order of social context was not counterbalanced. The 22nd item asked "How much experience have you had playing the game you played today?" Participants responded on a 5-point Likert scale ranging from *no experience* to *extensive experience*.

Experiment evaluation form. Six items examined responses to the experiment and experimenters. Two questions examined the efficacy of the experimenters; participants were instructed to rate the male partner ("Rate how well your playing partner played the game today.") and female experimenter ("Rate how well the experimenter ran the experimental session today.") on a 5-point Likert scale ranging from *not well at all* to *extremely well*. Two questions examined experimenter likeability; participants were asked, "Rate how much you liked or disliked your playing partner/the experimenter." on a 5-point Likert scale ranging from *disliked a lot* to *liked a lot*. Two questions assessed enjoyment; the participant rated "how much you enjoyed playing with your playing partner today" and "how much you enjoyed participating in this experiment today" on a 5-point Likert scale ranging from *did not enjoy at all* to *enjoyed a lot*. These questions were counterbalanced. A final open-ended question asked, "What do you think the hypothesis of the experiment was?"

Procedure

Participants read and signed an informed consent and completed the demographic/game history form. Pretest measures of HR and BP were

gathered by a female RA; she also noted if the participant had exercised or ingested caffeine or nicotine in the past 3 hours. The BP cuff remained in place throughout the procedure.

Each participant played the selected video games for three 15-minute sessions. The three game conditions (individual, cooperative, and competitive) and two game types (nonviolent or violent) were counterbalanced across participants (87 played Top Spin and 85 played Tekken). Game performance was assessed via statistics displayed on the screen following each match. A ratio describing Tekken game performance was determined by dividing winning matches by number of matches played. Top Spin game performance was determined by totaling winning shots, games held, and breaks (W) and totaling double faults and errors (L). Performance = $W/(W + L)$. A male RA set up the game, paused game play for CV measures, and served as the play partner. The participant was aware that the RA was an experimenter.

During each session of video game play CV measures were taken at 3, 8, and 13 minutes after initiation of game play; the female RA collected these measures. Participants were asked to remain still and quiet while CV measures were gathered to decrease any movement artifact. After game play, posttest measures were collected. Finally, the participant completed the game experience questionnaire and experiment evaluation forms. The session took approximately 1 hour. Participants were allowed to ask questions at the end of the session. Participants were thanked and given a credit slip or monetary payment.

PRELIMINARY DATA ANALYSES

CV Data

The two pretest and posttest measures for each CV variable were averaged. These averages were compared using paired *t* tests. The pretest measures were significantly higher than the posttest measures for HR and SBP but not for DBP. This may be because (a) the participants had just walked to the session, (b) they were aroused by the anticipation of the study, and/or (c) they found game play to be relaxing. Given these findings, the appropriate posttest CV average was used as the covariate in the analysis of the CV data. See Table 1 for means, standard deviations, and *t* and *p* values.

Developmental Status

To examine the impact of developmental status, high school students were compared to college students on game play per week, scores on the Game

TABLE 1
Comparison of Averaged Pretest and Posttest Measures for HR, SBP, and DBP

	Pretest (SD)	Posttest (SD)	<i>t</i>	<i>p</i>
HR	78.46 (13.70)	76.33 (10.50)	2.80 (167)	<.01
SBP	130.45 (13.50)	124.82 (13.33)	7.90 (167)	<.001
DBP	77.49 (9.24)	76.90 (9.73)	.87 (167)	.38

Note. HR = heart rate; SBP = systolic blood pressure; DBP = diastolic blood pressure.

Experience Questionnaire for each affective variable for each condition, game performance, and evaluation of the experiment and experimenters. We did not control for family-wise error because we thought it important to examine for systematic developmental differences. See Table 2 for all means, standard deviations, and *t* and *p* values. Because posttest CV measures were used as covariates in the analyses, we did not examine developmental differences in CV measures.

Adolescents played more video games individually per day than the college students, but there was no difference in time spent playing with others. On the Game Experience Questionnaire, adolescents ($M = 1.77$, $SD = .91$) and undergraduates ($M = 1.42$, $SD = .71$) differed only in regard to the amount of stress during game play, $t(168) = 2.83$, $p < .01$. College students ($M = 58.63$, $SD = 54.49$) performed better than high school students in the cooperative condition when playing Top Spin ($M = 33.06$, $SD = 44.02$), $t(168) = 2.42$, $p < .05$, but not during the other conditions. Adolescents and undergraduates did not differ in their evaluation of the male partner's

play, enjoyment of playing with the partner, or liking of the partner. Undergraduates rated the female experimenter's effectiveness in running the experiment higher and reported liking her more; the undergraduates also enjoyed participating in the experiment slightly more than the adolescents. Because few of these 37 omnibus analyses were significant, particularly in regard to game performance and affective reactions to game play, we did not control for developmental status in the multivariate analyses of variance.

Descriptive Data

Participants reported playing video games 79 minutes per day on average, 46 minutes (58%) in solitary play and 33 minutes (42%) playing with others. Participants preferred sports (32.7%) and first-person-shooter (22.8%) games over role-playing (12.3%) and fighting (9.4%) games. Participants (on a 5-point scale) reported that the RA played well ($M = 4.13$, $SD = .83$), that they enjoyed playing with him ($M = 3.91$, $SD = .95$), and liked him ($M = 4.46$, $SD = .75$). They reported that the experimenter ran the session well ($M = 4.51$, $SD = .62$) and that they liked her ($M = 4.59$, $SD = .65$). They enjoyed participating in the experiment ($M = 4.16$, $SD = .88$). Participants did not have much experience playing the assigned game, but those who played Tekken ($M = 2.25$, $SD = 2.73$) had significantly more experience than those who played Top Spin ($M = 1.38$, $SD = .71$), $t(167) = 2.85$, $p < .01$, though the effect was small ($r = .21$). Overall, collapsed across social condition and game played, participants found playing the game moderately to very enjoyable ($M = 3.14$, $SD = .86$), not at all to somewhat stressful ($M = 1.68$, $SD = .71$), not at all to somewhat boring ($M = 1.89$, $SD = .91$), somewhat frustrating ($M = 1.97$, $SD = .82$), somewhat to moderately relaxing ($M = 2.87$, $SD = .83$), somewhat to moderately exciting ($M = 2.45$, $SD = .86$), and that they played from "somewhat like I wanted to play" to "just like I wanted to play" ($M = 2.69$, $SD = .96$). Participants performed better when playing Top Spin ($M = .92$, $SD = .13$) than when playing Tekken ($M = .62$; $SD = .12$), $t(178) = 16.14$, $p < .001$, $r = -.77$.

RESULTS

Analysis of Variance of CV Data

Three mixed-design analyses of covariance (one each for HR, SBP, and DBP) were used to test H1 (participants would have greater CV reactivity

TABLE 2
Comparison of Adolescent and College Males with Regard to Game Play in Minutes and Evaluation of the Experimenters and Experiment

	Adolescents (SD)	Undergraduates	<i>t</i> (169)	<i>p</i>
Total daily game play ^a	110 (94)	58 (58)	4.49	<.001
Daily individual game play	73 (76)	28 (37)	5.20	<.001
Daily social game play	36 (43)	32 (40)	.56	.590
How well partner played ^b	4.01 (.97)	4.22 (.72)	1.58	.116
Enjoy playing w/partner	3.76 (1.04)	4.02 (.86)	1.80	.074
Like partner	4.36 (.76)	4.52 (.73)	1.45	.150
Experimenter effectiveness	4.34 (.66)	4.63 (.56)	3.10	<.01
Like experimenter	4.47 (.66)	4.67 (.62)	2.02	<.05
Enjoy experiment	4.00 (.83)	4.27 (.90)	1.99	<.05

^aGame play variables are in minutes.

^bExperiment evaluation variables are on a 5-point scale.

Mean Comparison of Experimenter and Partner Ratings

These analyses test H3 (participants would view the experimenter and partner more negatively after playing the violent game). These ratings were compared, using *t* tests, with regard to game type. Participants who played Tekken rated how well the partner played, how much they enjoyed playing with the partner, how much they liked/disliked the partner, how well the experimenter ran the session, how much they liked/disliked the experimenter, and how much they enjoyed participating more positively than those who played Top Spin. These differences were significant for each variable except for like/dislike partner. See Table 4 for means, standard deviations, and *t* and *p* values.

Analysis of Variance of Affective Data

The six affective variables (boring, frustrating, exciting, relaxing, enjoyable, and stressful) and the performance self-assessment (how well did you play today) were analyzed using seven 3 (social condition) $\times$ 2 (game type) analyses of variance (ANOVAs). These analyses test H4 (participants would report more negative affect and less positive affect after playing the violent game) and H5 (participants' affective responses would be positively affected by social context of game play).

There was a significant effect of social condition on how boring participants found game play, Hotelling's Trace $F(2, 169) = 28.29, p < .001$. Pairwise comparisons indicate that participants found the game significantly more boring ($M = 2.22, SD = 1.12$) when playing individually than when playing cooperatively ($M = 1.79, SD = 1.15, p < .001, r = .19$) or competitively ($M = 1.68, SD = .99, p < .001, r = .25$). There was no effect of game type and no interaction.

TABLE 4
Comparison of Game Type With Regard to Evaluation of the Experimenters and Experiment

	Top spin (SD)	Tekken	<i>t</i> (170)	<i>p</i>
How well partner played ^a	3.83 (.85)	4.45 (.68)	5.26	< .001
Enjoy playing w/partner	3.54 (.91)	4.29 (.81)	5.71	< .001
Like partner	4.34 (.79)	4.56 (.68)	1.95	.52
Experimenter effectiveness	4.33 (.69)	4.71 (.46)	4.14	< .001
Like experimenter	4.48 (.70)	4.69 (.58)	2.16	< .05
Enjoy experiment	3.99 (.93)	4.33 (.79)	2.58	< .01

^aExperiment evaluation variables are on a 5-point scale.

after playing the violent game) and H2 (participants would have greater CV reactivity after playing competitively and cooperatively). An average score was calculated for each CV variable from the measures taken during each social condition (individual, competitive, and cooperative). A 3 (social condition) $\times$ 2 (game type—violent or nonviolent game) analysis of covariance, with social condition as a within-participants factor, game type as a between-participants factor, and the posttest CV measure as the covariate, was used for each CV (HR, SBP, DBP) measure. Table 3 contains adjusted means by condition and game type for CV measures.

There were no significant main effects or interactions for HR. For SBP, there was a significant main effect for social condition, Hotelling's trace $F(2, 164) = 7.44, p < .001$, there was no effect of game type, $F(1, 165) = 3.51, p = .06$, and no interaction. Pairwise comparisons indicate that participants had significantly higher SBP when playing individually ($M = 127.96, SD = 19.60; p < .05, r = .08$) and competitively ($M = 127.84, SD = 12.33, p < .001, r = .10$, than when playing cooperatively ($M = 125.27, SD = 12.43$). With regard to DBP, there was a significant main effect of game type, $F(1, 165) = 3.96, p < .05$, but no main effect of social condition and no interaction. Those who played Tekken ($M = 79.05, SD = 13.74$) had significantly higher DBP than those who played Top Spin ($M = 76.29, SD = 6.99, r = .12$).

TABLE 3
Adjusted Means for HR, SBP, and DBP by Social Condition and Game Type

	HR (SE)	SBP	DBP
Individual (total)	75.50 (.65)	127.95 (1.88) _a	76.97 (.64)
Tekken	76.75 (.66)	128.30 (1.89)	77.63 (.65)
Top Spin	76.25 (.65)	127.61 (1.87)	76.31 (.64)
Cooperative (total)	76.03 (.65)	125.27 (.93) _b	79.11 (2.38)
Tekken	76.47 (.66)	127.15 (.94)	81.88 (2.39)
Top Spin	75.59 (.65)	123.39 (.93)	76.33 (2.37)
Competitive (total)	76.13 (.59)	127.84 (.82) _b	76.94 (.74)
Tekken	75.78 (.60)	129.23 (.83)	77.65 (.74)
Top Spin	76.48 (.59)	126.46 (.82)	76.22 (.74)
Game totals across social condition			
Tekken	76.33 (.63)	128.22 (1.22)	79.05 (1.26) _a
Top Spin	76.11 (.63)	125.82 (1.21)	76.29 (1.25) _b

Note. Means not sharing a common subscript differed by ($p < .001$) across social conditions and by ($p < .05$) between game types. HR = heart rate; SBP = systolic blood pressure; DBP = diastolic blood pressure.

For frustration, there were significant main effects for social condition, Hotelling's Trace $F(2, 168) = 20.16, p < .001$, and game played, $F(1, 170) = 19.82, p < .001$, but these were qualified by a significant Condition $\times$ Game interaction, Hotelling's Trace $F(2, 169) = 7.53, p = .001$. One-way ANOVAs controlling for game played followed by pairwise comparisons were used as follow-up tests; there were no differences across social condition for Top Spin. Participants found Tekken significantly more frustrating when playing competitively ($M = 2.20, SD = 1.12$), Hotelling's Trace $F(2, 82) = 32.17, p < .001$, than when playing individually ($M = 1.54, SD = .74, p < .001, r = .33$, or cooperatively ($M = 1.37, SD = .62, p < .001, r = .42$). They also found Tekken significantly more frustrating when playing individually versus cooperatively ($p < .05$). Regardless, frustration was low across conditions.

There were significant main effects of game played, $F(1, 169) = 15.71, p < .001$, and social condition, Hotelling's Trace $F(2, 168) = 66.17, p < .001$, for how exciting participants found game play; there was no interaction. Participants found Tekken ($M = 3.17, SD = .79, p < .001$) significantly more exciting than Top Spin ($M = 2.62, SD = .80, p < .001, r = .33$). Pairwise comparisons indicate that participants found game play significantly more exciting when playing competitively ($M = 3.18, SD = 1.03$) than when playing individually ($M = 2.44, SD = .92, p < .001, r = .35$) or cooperatively ($M = 2.97, SD = .90, p < .001, r = .11$). They also found game play significantly more exciting when playing cooperatively versus individually ($p < .001$).

Social condition, Hotelling's Trace $F(2, 168) = 21.96, p < .001$, was the only significant factor in predicting how relaxing participants found the games. Pairwise comparisons indicate that participants found game play significantly less relaxing when playing competitively ($M = 2.15, SD = 1.04$) than when playing individually ($M = 2.60, SD = 1.03, p < .001, r = -.21$) or cooperatively ($M = 2.61, SD = 1.00, p < .001, r = -.22$).

There were significant main effects of game played, $F(1, 169) = 17.87, p < .001$, and social condition, Hotelling's Trace $F(2, 168) = 40.77, p < .001$, for how enjoyable participants found play; there was no interaction. Participants found Tekken ($M = 3.41, SD = .80, p < .001$) significantly more enjoyable than Top Spin ($M = 2.88, SD = .84, p < .001, r = .31$). Pairwise comparisons indicate that participants found the game significantly more enjoyable when playing competitively ($M = 3.28, SD = 1.04, r = .23$) or cooperatively ($M = 3.33, SD = .95, r = .26$) than when playing individually ($M = 2.81, SD = .99, p < .001$).

There were significant main effects of game played, $F(1, 169) = 6.81, p < .05$, and social condition, Hotelling's Trace $F(2, 168) = 26.32, p < .001$, for how stressful participants found game play. There was no interaction.

Participants found Top Spin ($M = 1.80, SD = .77$) significantly more stressful to play than Tekken ($M = 1.56, SD = .61, p < .05, r = .17$). Pairwise comparisons indicate that participants found game play significantly more stressful when playing competitively ($M = 1.98, SE = 1.00$) than when playing cooperatively ($M = 1.56, SD = .81, p < .001, r = .23$) or individually ($M = 1.50, SD = .79, p < .001, r = .26$).

Both game played, $F(1, 169) = 6.81, p < .001$, and social condition, Hotelling's Trace $F(2, 168) = 5.52, p < .01$, significantly affected participants' perception of their game play. There was no interaction. Participants felt that they played Tekken ($M = 3.14, SD = .89$) significantly better than Top Spin ($M = 2.27, SD = .83$). Despite the robust effect of this perception ($r = .45$), the game statistics described earlier indicate otherwise. Pairwise comparisons indicate that participants felt that they played significantly better when playing individually ($M = 2.74, SD = 1.10$) than when playing competitively ($M = 1.82, SD = 2.03, p < .01$) or cooperatively ($M = 2.49, SD = 1.23, p < .01$).

DISCUSSION

We had three hypotheses related to the GAM (e.g., Anderson, 1997; Anderson et al., 1998; Anderson & Bushman, 2002; Anderson & Dill, 2000; Bushman & Anderson, 2002; Carnagey et al., 2007) and two hypotheses regarding the social context of game play. Based on the GAM we predicted that (a) CV reactivity would be higher following violent game play and after competition (Anderson & Carnagey, 2009; Ballard & Wiest, 2006), (b) those who played the violent game would evaluate the experimenters more negatively and display more negative emotions than those who played the nonviolent game, and (c) participants would report more negative affective responses following violent game play. The hypotheses based on the GAM were unsupported by the results.

First, there was no effect of game type on HR or SBP. DBP was significantly higher for those participants who played Tekken than for those who played Top Spin. This effect may be due to the violent content. Alternatively, it might be because participants found playing Tekken more exciting and enjoyable than Top Spin. But, this finding is inconsistent with studies indicating that negative emotions are more often related to increased SBP and DBP than positive emotions are (e.g., Ballard, Cummings, & Larkin, 1993; Ballard & Wiest, 1996; Ong & Allaire, 2005; Starner & Peters, 2004). Explaining reactivity in CV measures is difficult because there is little systematic research examining the types of stressors that impact SBP versus DBP reactivity and results are inconsistent. For example, whereas some

video game studies (e.g., Holt-Lunstad et al., 2001; Panee & Ballard, 2002) also found that video game play is more strongly related to DBP than SBP reactivity, others (e.g., Ballard et al., 2006) found that HR and SBP, but not DBP, varied across the course of game play. Age, gender, and context also moderate cardiovascular reactivity to various stimuli (e.g., Ballard et al., 1993; Ong & Allaire, 2005; Stamer & Peters, 2004). Regardless, only a few studies (e.g., Anderson & Caragey, 2009; Ballard & Wiest, 1996) have found game genre to affect CV reactivity.

Based on the GAM, we predicted that violent game play would negatively impact the participants' evaluation of the experimenters. However, participants who played Tekken rated the experimenters and experiment more positively than those who played Top Spin. This is likely due to the fact that participants enjoyed playing Tekken more than playing Top Spin and perceived that they had played Tekken better than Top Spin, creating a halo effect (e.g., Balzer & Sulsky, 1992).

The third hypothesis based on the GAM, that participants would display more negative affect after playing the violent game, was not supported. Overall, participants had more positive affect after playing the violent game, reporting that it was more exciting, enjoyable, and less stressful than the nonviolent game.

Two hypotheses were related to the social context of game play. Players enjoy the social and competitive environment of game play (Cole & Griffiths, 2007; Griffiths et al., 2004; Kim & Ross, 2006; Olson, 2010; Yee, 2006). We hypothesized that participants would find game play more exciting, enjoyable, frustrating, and stressful and less boring and relaxing when they were playing competitively or cooperatively than when playing individually (e.g., Holt-Lunstad et al., 2001; Scheepers, 2009). This hypothesis was supported. We also anticipated greater arousal (e.g., higher HR, SBP, and DBP) when the participants played with someone than when they played individually (Ballard et al., 2006; Ballard & Lineberger, 1999; Borusiak et al., 2007; Holt-Lunstad et al., 2001; Scheepers, 2009). This hypothesis was partially supported. Participants had significantly higher SBP when playing competitively and individually than when playing cooperatively. However, this effect may be due to the continuous play involved in the individual and competitive conditions. There was no effect of social condition on HR or DBP, perhaps because the participants are accustomed to playing with and against others, which desensitized them to these social contexts (e.g., Ballard et al., 2006).

In sum, these results do support the hypothesis that social interaction during game play enhances the game play experience for participants. However, the results do not provide support for the GAM in that violent game play did not elicit greater CV reactivity, hostile evaluations, or negative

affect (Anderson, 1997; Anderson et al., 1998; Anderson & Bushman, 2002; Anderson & Dill, 2000; Bushman & Anderson, 2002; Carnagey et al., 2007). In fact, the players enjoyed the violent game more and liked both experimenters more following violent game play. These results are consistent with other studies finding that ostensible competition and violent game content do not result in negative ratings of others (Anderson & Morrow, 1995; Eastin, 2007; Eastin & Griffiths, 2006; Sheese & Graziano, 2005). Most of the previous studies testing the GAM in competitive contexts incorporated extrinsic rewards and/or punishment as an aspect of the laboratory paradigm. Rewards and punishments change the context of the situation substantially, increasing the likelihood of hostility or other negative affect and influencing CV reactivity (e.g., Ferguson, 2011; K. D. Williams, 2009). Our results suggest that the GAM does not predict reactions in a positive social context. It seems unlikely that a single model can exemplify the impact of violent media on the consumer given the plethora of factors involved.

Thus, although violent video games might be related to negative outcomes in some contexts or among people with particular traits (e.g., Anderson & Carnagey, 2009; Markey & Markey, 2010), violent video games often do not result in negative outcomes (e.g., Böse, 2010; Colwell & Kato, 2003; Durkin & Barber, 2002; Ferguson, 2011; Ferguson & Rueda, 2010; Ferguson, San Miguel, & Hartley, 2009; Ferguson et al., 2008; Ferguson & Rueda, 2010; Funk et al., 2003; Hamby & Ballard, 2006; Ivory & Kalyanaraman, 2009; Scott, 1995; Unsworth et al., 2007; K. D. Williams, 2009). Finally, despite the focus on the potential negative effects of video game play, many studies have found that video game play benefits cognitive (Pope & Bogart, 1996) and visual-spatial performance (Green & Bavelier, 2007; Rossner et al., 2007) and distracts patients from the pain associated with minor medical procedures (Wiederhold & Wiederhold, 2007).

Strengths and Limitations

This study has several strengths. There was extensive piloting of the games and game characters. We used a multimeasure procedure examining responses across domains of functioning. Our sample presents both a strength (we included a sample of adolescent participants) and a weakness (we used only male participants). Another weakness of the study is that two experimenters were always present. Automating the procedure so that the participant is alone in the room when they play individually and only the competitor is present during cooperative and competitive play would strengthen the procedure. Finally, although both games had positive ratings on Metacritic.com (2011), professional reviewers found Tekken more

enjoyable than Top Spin, which is similar to our results. Future studies should equate violent and nonviolent games in terms of enjoyability.

SUMMARY AND DIRECTIONS FOR RESEARCH

This study is one of the first to examine the impact of direct, face-to-face social interaction on responding to violent and nonviolent video game play. The findings failed to support the GAM. Social context impacted affective responses to game play, mostly in a positive way. These findings are important because they add to the knowledge related to developing theories regarding the impact of video games and informing us regarding the effects of social interaction on the impact of video game play, suggesting that playing video games might facilitate social interactions and have positive outcomes, even if the content of the game is violent.

Further research needs to be conducted on video games in a social context. It would be interesting to examine cooperative and competitive play with friends versus play with strangers. Future studies should vary the emotional context of social play, including adding provocation as a contextual factor, as this methodology is common in examining reactions to non-social play. It is essential that video game research move into a more extensive examination of social interactions during massively multiplayer online role-playing games and on social networking sites such as Facebook. Avatar creation, interaction between avatars, development of real-life friendships from online game play, bullying, and conflict resolution within the online realm are areas that deserve more attention.

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"You Don't Understand, This is a New War!" Analysis of Hate Speech in News Web Sites' Comments

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Because news websites' comments have become an important space of spreading hate speech, this article tries to contribute to uncovering the characteristics of Internet hate speech by combining discourse analyses of comments on Slovenian news websites with online in-depth interviews with producers of hate speech comments, researching their values, beliefs, and motives for production. Producers of hate speech use different strategies, mostly rearticulating the meaning of news items. The producers either are organized or act on their own initiative. The main motive of soldiers and believers is the mission; they share characteristics of an authoritarian personality. The key motives of the players are thrill and fun. The watchdogs are motivated by drawing attention to social injustice. The last two groups share the characteristics of a libertarian personality.

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