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Effects of Violent Video Games on Aggressive Behavior: Potential Sex Differences

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Evidence of the effects of playing violent video games on subsequent aggression has been mixed. This study examined how playing a violent video game affected levels of aggression displayed in a laboratory. A total of 43 undergraduate students (22 men and 21 women) were randomly assigned to play either a violent (*Mortal Kombat*) or nonviolent (*PGA Tournament Golf*) video game for 10 min. Then they competed with a confederate in a reaction time task that allowed for provocation and retaliation. Punishment levels set by participants for their opponents served as the measure of aggression. The results confirmed our hypothesis that playing the violent game would result in more aggression than would playing the nonviolent game. In addition, a Game × Sex interaction showed that this effect was larger for men than for women. Findings are discussed in light of potential differences in aggressive style between men and women.

Key Words: aggressive behavior; video games; sex differences; provocation; punishment.

During recent years, violence among children and adolescents has received increased attention. In several places around the United States—from urban Detroit, to suburban Georgia and Colorado, to rural Kentucky—incidents of youth violence have claimed the lives of schoolchildren and their teachers as guns have appeared in schools in alarming numbers. The issue of youth violence is complex, and the search for causes is often frustrating. The prevailing explanation has been to consider aggressive youths as abnormal isolated individuals with serious psychological disorders. This is not surprising given the Western cultural belief that people are responsible for their own behavior and that behavior is internally caused (e.g., Dix, 1993). Reports following recent school shootings indicate that classmates of the shooters tended to view them as outsiders or loners who were somehow different and undesirable (Aronson, 2000). However, a theoretical, social psychological perspective on this problem may focus more attention on external/situational factors that can also account for aggressive behavior.

For at least 30 years, researchers have been interested in the influence of media violence on the aggressive behavior of children and adults (e.g., Andison, 1977; Bushman & Huesmann, 2001). The violent content of television and movies is well documented. In a recent article, Seppa (1997) noted that 58% of all television programs contain violence. Another recent article reported that by 12 years of age, the average child has witnessed more than 100,000 acts of violence on television (Signorielli, Gerbner, & Morgan, 1995). Experimental and correlational research generally suggest that exposure to media violence is related to increases in aggressive behavior and aggression-related attitudes and beliefs (e.g., Bushman, 1998; Bushman & Geen, 1990; Donnerstein, Slaby, & Eron, 1994; Huesmann & Miller, 1994; Paik & Comstock, 1994; Smith & Donnerstein, 1998).

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Due in part to the accumulating evidence that exposure to violent media contributes to aggression in children, researchers and policy makers have begun to examine the influence of violent video games on aggressive behavior. During recent years, the video game industry has boomed, as video games of all kinds have become very popular among young people. Annual video game industry sales consistently outpace sales of movie tickets (Elmer-Dewitt, 1993; Hettrick, 1995; Walsh, 1999). Recent surveys have shown that upward of 84% of American teens (roughly 90% of boys and 75% of girls) play video games regularly (Funk, 1993; Walsh, 1999). Perhaps most alarming is that a majority of the most popular video games are extremely violent in nature, involving brutal mass killings as the primary strategy for winning the game (e.g., Buchman & Funk, 1996; Dietz, 1998; Funk, Flores, Buchman, & Germann, 1999; Provenzo, 1991). One such violent game, called *Mortal Kombat*, has consistently been among the most popular video games since its introduction during the early 1990s (Elmer-Dewitt, 1993; Funk et al., 1999).

Several recent studies suggest that playing violent video games leads to both short-term and long-term increases in aggression-related outcomes for game players (for a critical perspective, see Griffiths, 2000). For example, Anderson and Dill (2000) found a correlation between violent video game play and several indices of aggression, including delinquency and self-reported aggressive behavior (Study 1). They also found (Study 2) that participants who played *Wolfenstein 3D* (a violent game where the player "walks" through a castle, armed with various weapons, and attempts to kill people) in the lab behaved more aggressively than participants who played a nonviolent game. Similar results have been reported by other researchers (see Dill & Dill, 1998). However, the empirical literature in this area remains small, and most experimental work has involved very young participants (e.g., Cooper & Mackie, 1986; Graybill, Strawniak, Hunter, & O'Leary, 1987; Schutte, Malouff, Post-Gorden, & Rodasta, 1988).

Although evidence for a causal relationship between violent video games and aggression has been accumulating, it is currently unclear whether video game effects are similar in males and females. Potential sex differences are theoretically important because although males are more aggressive than females in general (see Geen, 1990), environmental cues to aggression (e.g., media or video game violence) may be equally powerful in both sexes (see Bettencourt & Miller, 1996). Previous experiments have produced mixed results regarding potential sex differences in the influence of violent video games. Anderson and Dill (2000, Study 2) found no reliable difference in video game effects on male versus female college student participants. Cooper and Mackie (1986) asked fourth- and fifth-grade boys and girls to play either *Pac-Man* (low-violence game) or *Missile Command* (high-violence game). The children's play during a postgame free play period was then observed and coded for aggressive content. The results showed that girls who played the high-violence game were more aggressive than girls who played the low-violence game. The effects of video game play on boys' aggression were in the same direction but not statistically significant. Cooper and Mackie reasoned that the relative inexperience of girls with video games might make them more susceptible to violent video game effects.

In another such study, Silvern and Williamson (1987) measured aggressive free play in 4- to 6-year-old children both before and after they watched a violent television cartoon or played a violent video game. Both the cartoon and the video game significantly increased aggressive play relative to baseline measures for both boys and girls, in apparent contrast to the findings of Cooper and Mackie (1986). Similarly, Schutte et al. (1988) found that children (ages 5 to 7 years) who played a karate video game were more aggressive later than children who played a nonviolent jungle swing video game, and this effect was similar among boys and girls.

Taken together, the results of these studies are inconclusive with regard to potential sex differences. Although Cooper and Mackie (1986) reasoned that girls are more influenced by violent video games than are boys, their study was the only one to show such a difference. Several factors in the design of these studies make strong conclusions from their results difficult. First, most of the games that were used would not be considered violent by contemporary standards, and only the karate game used by Schutte et al. (1988) and the *Wolfenstein 3D* game used by Anderson and Dill (2000) contained characters that resemble humans. As such, the independent variable manipulations may have been weak in these studies. Second, the aggression measures used in most studies were simply observations of aggressive play. The use of more objective, laboratory-based measures could provide convergent evidence of video game effects. Third, the participants in many studies were very young, and it is likely that violent video games have different effects depending on participants' level of development. For example, young children are less able to distinguish fantasy from reality, or to draw appropriate inferences from a violent story line, than are older children and adults (Smith & Donnerstein, 1998). Cognitive "scripts" pertaining to the appropriateness of aggressive solutions to problems also are more labile in children than in adolescents and adults (Huesmann, 1998). As a result, the effects of television violence on aggression and other antisocial behavior may be greater in children than in adults (Bushman & Huesmann, 2001), and the same might be true for video games.

Another concern with previous research is that the participants' levels of prior experience with video games were seldom controlled. As noted by Fling et al. (1992), habitual video game players may represent a select subgroup that

responds more aggressively to video game play than do people who do not play regularly. Prior experience also may reduce habitual game players' aggression via desensitization. In either case, if males play video games more frequently than do females (e.g., Funk, 1993), the sex of participants may have been confounded with prior video game experience in many previous studies of video game effects.

Overview and Hypotheses

Although there is evidence that playing violent video games increases aggressive behavior, findings have been mixed regarding the effects of video game violence among males versus females. Much of the work comparing the sexes has involved young children as participants, and so little is known about the effects of playing violent video games in adolescents and adults. Furthermore, the games used in most previous studies would not seem violent by contemporary standards, and researchers have failed to control for prior video game-playing experience among participants. To address these issues, we recruited male and female college students who were not habitual game players and looked to see whether they would display similar levels of aggression after playing popular video games that were violent or nonviolent in nature. We hypothesized that participants who played the violent video game would later display more aggression than would participants who played the nonviolent video game. Based on the results of previous research, it was unclear whether this effect would be similar for men and women.

METHOD

Participants

A total of 43 undergraduate students (22 men and 21 women, ages 18–23 years) participated in this study as volunteers. Potential participants were contacted by telephone and asked several questions about their video game-playing habits, including how often they played video games and which games were familiar to them. We sought people who had already played both of the games used in this experiment, but we avoided habitual video game players (who reported playing more than once a week during the previous 6 months).

Materials

Video games. *Mortal Kombat* (version 1, circa 1992) was chosen as the violent video game because of its popularity (Elmer-Dewitt, 1993) and level of violence. At the start of this game, a player selects a character to control from a group of six males and one female. The player then fights and tries to kill all other characters one at a time through various rounds of the game. Each character has unique "powers" such as throwing lightning bolts and momentarily freezing opponents. Players earn more points as they kill more opponents and as the violent nature of their victories increases. It is important to note that the female character in this game is just as strong and likely to win as are the male characters.

The nonviolent game was *PGA Tournament Golf.* In this game, a player competes on a simulated golf course using whatever golf clubs he or she chooses. The object of the game is to complete the 18-hole course using as few strokes as possible. Factors such as wind strength and direction, hazards such as trees and sand traps, and simulated nature sounds all combine to make the game seem like a real round of golf. The popularity of nonviolent sports video games is nowhere near that of violent video games of all types (Buchman & Funk, 1996), but this game seemed to us engaging and interesting enough to be appropriately compared to the *Mortal Kombat* game.

Retaliation reaction time task. This task involved a computerized "game" in which each participant was led to believe that he or she was competing with another person (actually a confederate of the experimenter) to see who could respond most quickly to an auditory tone by clicking a mouse button. Actually, the participants did not compete with anyone, and the computer randomly determined the 12 trials out of 25 that each participant won. To raise the stakes, participants received a punishment after each losing trial in the form of white noise delivered via headphones (see Bushman & Geen, 1990). Prior to each trial, the participant's opponent ostensibly set the severity of punishment that the participant would receive if he or she lost that trial.

The game was played in two phases. During Phase 1, the participant was informed that before each trial, the opponent would set the duration and intensity of punishment that he or she would receive for responding more slowly. During Phase 2, the roles were reversed; the participant was told that before each trial, he or she could now set the duration and intensity of punishment for the opponent when that person responded more slowly. Note that because the game ended after this phase was completed, the participant could retaliate for the punishment that he or she received from the opponent during Phase 1 without fearing any retaliation by that opponent. The severity of punishment that each participant set for his or her opponent prior to each of the 25 trials during Phase 2 (retaliation) was our measure of aggressive behavior. This and similar measures have been shown to be valid indices of aggression (Giancola & Zeichner, 1995; see also Anderson & Bushman, 1997; Anderson, Lindsay, & Bushman, 1999; Carlson, Marcus-Newhall, & Miller, 1989).

Procedure

A female confederate acted as a "participant" in each experimental session. The confederate was an undergradu-

ate research assistant who pretended to play a video game in the first part of the session and was each participant's alleged opponent during the retaliation reaction time task.

Participants were randomly assigned to either the violent or nonviolent video game condition. They were told that the purpose of the experiment was to examine whether playing video games influences reaction times. During each session, the participant and the confederate were led to separate adjoining rooms where the video game systems were set up. They were given written and verbal instructions for the games they were assigned to play, along with game demonstrations by the experimenter. After fielding questions and establishing that each participant could play the game, the experimenter left the room and the participant played the game for 10 min.

After the game-playing session, participants were led into a narrow hallway dividing two additional experimental rooms, where they again met the confederate. Participants were informed that for the second part of the experiment, they would engage in a competitive task to test the speed of their reactions to auditory tones. A mock coin toss was used to determine which computer and which room each person would use for the reaction time task. The participants were always assigned to the same room, where the real amplifier and headphones were set up. The rooms were wired to appear as though the computers in them were networked together. Once the players were seated in their respective rooms, the experimenter stood in the hall and read the instructions for the retaliation reaction time task.

The experimenter explained the two phases of the task and what the players' roles would be during each phase. Participants were told that they could set both the duration and level of punishment for their opponent. The design of the computer interface stressed the intensity control. This apparently led participants to ignore the duration control, as there were no significant effects of game type or participants' sex on any duration measures. Therefore, those measures are not considered further in this article.

The noise intensity scale ranged from 0 to 10. All participants were given sample noise blasts of levels 1 (60 dB), 3 (70 dB), 5 (80 dB), 7 (90 dB), and 9 (100 dB) and were taught how to set the level of noise for their opponent. Finally, the experimenter explained that during each trial, a green square in the middle of the screen would turn yellow as a warning that a tone would soon sound. Participants were instructed to click on the mouse button as quickly as possible after hearing each tone. Participants also were told to expect feedback about the level of noise that their opponent set for them on each trial, whether they won or lost. This feedback was presented in a bar graph on the computer screen. If the participant took too long (greater than 500 ms) to respond on a trial, then it became a "lose" trial, even if it was originally scheduled to be a "win" trial. This helped to maintain the viability of the cover story.

TABLE 1

Mean Levels of Punishment and Frequency of High-Intensity Punishment Set by Participants during the Reaction Time Task as a Function of Sex and Video Game Condition

	Violent game	Nonviolent game
Mean punishment intensity		
Men	7.01 (2.28)	4.60 (1.06)
Women	5.05 (1.13)	4.61 (0.63)
Frequency of high-intensity trials		
Men	12.62 (9.44)	2.91 (4.76)
Women	4.44 (1.13)	3.09 (1.22)

Note. Numbers in parentheses are standard deviations. *n*s for each condition were as follows: men, violent game = 8, nonviolent game = 11; women, violent game = 9, nonviolent game = 11.

After answering questions, the experimenter left the room and told participants to begin. Participants then completed the 25 trials of Phase 1. Afterward, the experimenter briefly reappeared to remind both players that their roles would be reversed for Phase 2. The experimenter then reset the computers and left the room as Phase 2 began. On completion of Phase 2 of the task, participants were led into an adjacent room for debriefing and were then excused. During their debriefing, none of the participants indicated any suspicion concerning the task or the confederate.

RESULTS

Two dependent variables were created from the punishment levels set by participants during the retaliation reaction time task. These were mean intensity levels (0–10 scale) over the 25 trials and counts of high-intensity settings (8 or higher on the scale [95–105 dB]). We chose to define settings of 8 or higher as high intensity because noise in this decibel range seemed particularly punishing and therefore represented the most aggressive responses available. These variables were analyzed in separate 2 (Sex) × 2 (Video Game) analyses of variance (ANOVAs).[1] Descriptive statistics, as a function of sex and video game condition, are shown in Table 1.

Mean Punishment Intensity

Analysis of the mean intensity settings showed that participants who played *Mortal Kombat* set higher levels of

[1] To test for potential differences in the video game effect over the course of the task, data for both dependent variables also were separated into five equal trial blocks and examined in additional 2 (Sex) × 2 (Game) × 5 (Trial Block) mixed factorial ANOVAs. These analyses showed that video game effects did not differ by block for either mean punishment intensity, $F(4, 140) = 1.93$, $p > .10$, or frequency of high-intensity trials, $F(4, 140) = 1.48$, $p > .20$. The Game × Trial Block × Sex interactions also were not significant, Fs < 1.50, ps $> .20$, for both dependent variables.

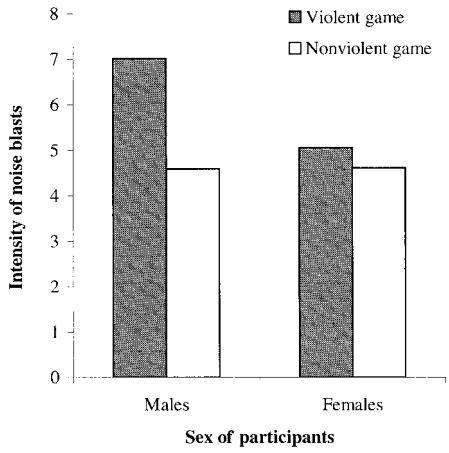

FIG. 1. Mean intensity of punishment as a function of video game condition and participant sex.

noise punishment ($M = 5.97$) than did those who played *PGA Tournament Golf* ($M = 4.60$), $F(1, 35) = 11.06$, $p < .005$. In addition, men ($M = 5.61$) set higher noise levels than did women ($M = 4.80$), $F(1, 35) = 5.01$, $p < .05$. Finally, there was a significant interaction, $F(1, 35) = 5.13$, $p < .05$. The effects of playing the violent video game were greater for males than for females, as shown in Fig. 1. Simple effects tests examining the effects of video game type on aggression for men and women showed that men who played the violent game set higher noise levels than did men who played the nonviolent game, $t(18) = 3.09$, $p < .01$, $d = 1.36$, but that women set similar noise levels regardless of the game they played, $t(19) = 1.12$, $p > .25$, $d = 0.48$.

Number of High-Intensity Trials

Analysis of how often high-intensity settings were used showed that participants who played *Mortal Kombat* used such levels more often ($M = 8.29$) than did participants who played *PGA Tournament Golf* ($M = 3.00$), $F(1, 35) = 11.72$, $p < .005$. In addition, men ($M = 7.00$) set high noise levels more often than did women ($M = 3.70$), $F(1, 35) = 6.12$, $p < .05$. Finally, a significant interaction was found, $F(1, 35) = 6.69$, $p < .05$. As shown in Fig. 2, the effects of playing the violent video game were again stronger for men than for women.[2] However, simple effects tests examining the video game effect separately for men and women showed that the effect was present for both women, $t(18) = 2.55$, $p < .05$, $d = 1.15$, and men, $t(17) = 2.96$, $p < .05$, $d = 1.37$.

[2] Means and standard deviations were significantly correlated across conditions for this variable, a common occurrence in frequency data. To ensure that our findings were not spurious, we computed a log transformation of the number of high-intensity noise trials, which substantially reduced the correlation. Analysis of these log-transformed data produced results essentially equivalent to those we report here.

DISCUSSION

The results of this experiment supported our prediction that playing violent video games would increase aggressive behavior. Participants who played the violent video game later showed more aggression toward an opponent during the retaliation task than did participants who played the nonviolent game. However, the results for men versus women offered a more complex picture of video game effects. Whereas both of our measures of aggression indicated that men who played *Mortal Kombat* responded more aggressively during the retaliation task than did men who played *PGA Tournament Golf*, women who played the violent game used a higher number of high-intensity noise settings, but did not set higher mean punishment levels overall, than did women who played the nonviolent game. Even on the high-intensity noise measure, mean differences were clearly larger across video game conditions for men than for women (see Fig. 2). The effect sizes for females in our experiment are comparable to those reported in previous research (e.g., Anderson & Dill, 2000; Schutte et al., 1988; Silvern & Williamson, 1987), but the effect sizes for males are larger than those typically reported. The current result is inconsistent with the findings of Cooper and Mackie (1986), who found that girls were more influenced by playing a violent video game than were boys.

These findings suggest that young men may be more affected by violent video games than are young women. Why? One possibility is that because men are more aggressive than women in general (e.g., Baron & Richardson, 1994; Geen, 1990), they are more sensitive to aggressive cues. Although researchers have not systematically studied this issue, two meta-analytic reviews of gender differences in aggression provide relevant information. First, Eagly and Steffen (1986) investigated whether men are more aggres-

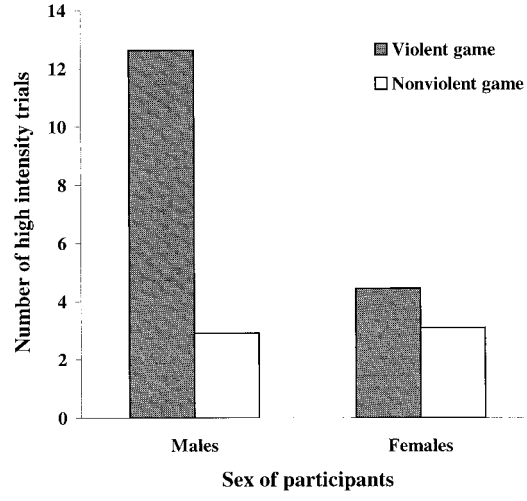

FIG. 2. Number of trials (out of 25) during which participants used high-intensity noise settings as a function of video game condition and participant sex.

sive than women across a variety of settings by examining studies in which behavioral measures of aggression were reported for both men and women. Although the predicted gender difference was found, the effect size was small and the finding was quite variable across the studies that were examined.

Bettencourt and Miller (1996) meta-analytically reviewed gender differences in aggression preceded by provocation. In our experiment, participants were provoked by the noise blasts they received during Phase 1 of the competitive reaction time task. Hence, their aggression during Phase 2 can be viewed as responses to provocation. Bettencourt and Miller found that although men are more aggressive than women in neutral conditions, this gender difference is attenuated following provocation. However, we obtained reliable gender differences after provocation.

Overall, the results of these meta-analyses do not point clearly to a simple gender explanation of the current findings. Another possibility is evident when the results of this experiment are compared to those of another recent study in our laboratory. Using a very similar paradigm, Anderson and Dill (2000) found no differences as a function of video game condition on the intensity of noise blasts used by participants. As Anderson and Dill noted, experimental instructions in that study emphasized the duration of noise rather than its intensity, and this may account for their result. Note that the instructions for the current experiment stressed the intensity of noise instead, apparently leading our participants to ignore noise duration. Indeed, the relatively fast pace of the reaction time task may make it difficult for participants to use both duration and intensity controls consistently.

Furthermore, Anderson and Dill (2000) found that females delivered longer noise blasts than did males, regardless of game condition. This result, along with the fact that men were more affected by the violent video game in the current experiment, presents a rather puzzling picture. However, it is important to consider that the intensity and duration of noise blasts are qualitatively different indices of aggression. Compared to intensity settings, which clearly indicate levels of aggression on a numbered scale, duration settings are more ambiguous or subtle, which may fit the aggressive style of women better than that of men. If so, then women may be less likely to use noise intensity as an aggressive tool. The noise intensity setting was emphasized in the instructions given to participants in the current experiment. If women are less likely to use this aggressive tool in general, then those who played the violent game may have been reluctant to express aggression during the competitive reaction time task.

This notion is based on previous empirical evidence and theoretical accounts suggesting that sex differences in aggression are dependent on the aggression measure that is used. For example, Bjorkquist and colleagues (Bjorkquist, Lagerspetz, & Kaukianen, 1992; Lagerspetz, Bjorkquist, & Peitonen, 1988) found that whereas male adolescents are more likely to trip, hit, kick, or shove a provocateur, female adolescents are more likely to tell lies about, ignore, or replace the provocateur as a friend with a rival. In other words, males are more likely to employ direct forms of aggression, whereas females are more likely to use indirect forms of aggression—actions that are harmful to others in more subtle ways (e.g., Baron & Richardson, 1994; Geen, 1990; see also Frodi, Macaulay, & Thome, 1977). Eagly and Steffen (1986) also found evidence of this difference in their meta-analytic review of gender differences in aggression. Differences in the aggressive styles of males and females have been attributed to the influence of sex roles in determining appropriate aggressive responses; physical aggression is viewed as more appropriate for men, whereas verbal or psychological aggression is viewed as more appropriate for women (e.g., Bettencourt & Miller, 1996; Deaux & Major, 1987; Eagly & Steffen, 1986).

In addition, our choice of video games may have contributed to the sex differences in aggression that we found. *Mortal Kombat* was chosen for the violent game primarily because of its sustained popularity and realistic aggressive content. However, nearly all of the characters in the game are male, so our male participants may have identified more with the characters and been more engaged by the game than were our female participants, resulting in a larger impact on men. Also, statements made by some participants during debriefings suggested that women did not like playing the *PGA Tournament Golf* game, whereas men did. In other words, the golf game may have been a poor choice for a control game. These possibilities suggest that the women in our experiment may have been both less engaged in the games than the men and less likely to use the noise intensity settings to express their aggression.

Using a mixed-gender sample of adolescents and young adults, avoiding habitual video game players, and selecting a popular and realistic violent video game were important strengths of this research. Nevertheless, our research was limited in some ways. First, the sample was relatively small, which may limit the generalizability of our results. The duration of game play could have influenced our results as well. Participants played the games for only 10 min, which might not have been long enough for the violent game to have a large effect on women. Finally, the fact that the confederate was always female could have affected the male and female participants' aggression differently. Previous research suggests that people are more likely to behave aggressively toward same-sex targets than opposite-sex targets (see Eagly & Steffen, 1986). This reasoning would suggest, however, that women should have been more aggressive than men in the current experiment, and the results clearly showed that they were not. It is important to note that gender of target differences generally diminish follow-

ing provocation (Bettencourt & Miller, 1996), and as such, effects related to the gender of the target may have been overwhelmed by provocation effects in the current experiment. In any case, our results may have differed somewhat if we had used both male and female confederates to serve as participants' opponents in the retaliation task. It also should be noted that sex of experimenter was a variable of potential importance that we did not record. Replication of our results using different games and a larger sample would probably help us to better understand differences in the effects of violent video games on young men and women.

In addition to replicating our results, researchers in the future should consider examining more directly gender differences in aggressive style within a video game paradigm. This could be accomplished by randomly assigning males and females to conditions in which either direct (e.g., intensity of punishment) or indirect (e.g., duration of punishment) forms of aggressive responding were available. Also, systematic research on how habitual video game exposure affects aggressive behavior should be conducted as a potential indicator of desensitization to video game violence. The larger standard deviations for males on our measures of aggression indicate that there may be a subgroup of relatively inexperienced men who are particularly susceptible to the effects of violent video games. This issue should be examined more directly.

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