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The effects of violent video game habits on adolescent hostility, aggressive behaviors, and school performance

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Abstract

Video games have become one of the favorite activities of American children. A growing body of research is linking violent video game play to aggressive cognitions, attitudes, and behaviors. The first goal of this study was to document the video games habits of adolescents and the level of parental monitoring of adolescent video game use. The second goal was to examine associations among violent video game exposure, hostility, arguments with teachers, school grades, and physical fights. In addition, path analyses were conducted to test mediational pathways from video game habits to outcomes. Six hundred and seven 8th- and 9th-grade students from four schools participated. Adolescents who expose themselves to greater amounts of video game violence were more hostile, reported getting into arguments with teachers more frequently, were more likely to be involved in physical fights, and performed more poorly in school. Mediational pathways were found such that hostility mediated the relationship between violent video game exposure and outcomes. Results are interpreted within and support the framework of the General Aggression Model.
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"Whenever we separate kids from their parents and take them to a children's shelter they're always excited that they will get to play video games, since there is a Nintendo in the shelter" (Child Welfare Worker, Oklahoma).

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Introduction

Video games have become one of the favorite activities of children in America (Dewitt, 1993). Sales have grown consistently with the electronic entertainment category taking in between $7 billion and $7.5 billion in 1999, surpassing theatrical box office revenues for the first time (Come in and play, 2000). Worldwide video game sales are now at $20 billion (Cohen, 2000), fueled in part by the more than 100 million Gameboys and 75 million PlayStations that have been sold (Kent, 2000). The average American child aged 2–17 years plays video games for 7 h a week (Gentile & Walsh, 2002). This average masks wide differences between boys and girls and children of different ages. In the present study, for example, adolescent girls played video games for an average of 5 h a week whereas boys averaged 13 h a week.

Over the past 25 years, a number of studies have looked at the effects of video games on children and adolescents. A majority of this research has examined associations between video game use and aggressive behavior, but there has also been some interest in the effects of video games on school performance. There are at least two aspects of video game use that are of interest to researchers—amount and content. With respect to content, researchers have been most interested in violent games compared with non-violent games. Although not all studies have differentiated between violent and non-violent content, this is an important distinction, as it is likely that the effects of amount of play and the content of games may be independent of each other. For example, most evidence suggests that amount of play affects school performance, whereas violent content affects aggressive outcomes.

Effects of amount of video game play on school performance

A number of studies have shown a negative association between amount of video game play and school performance for children, adolescents, and college students (e.g. Harris & Wiliams 1985; Creasey & Myers, 1986; Lieberman, Chaffee, & Roberts, 1988; van Schie & Wiegman, 1997; Roberts, Foehr, Rideout, & Brodie, 1999; Anderson & Dill, 2000; Walsh, 2000). In general, a preponderance of studies show a fairly consistent negative correlation between recreational video game play and grades. For example, high-school students who report spending more time playing video games or who report spending more money on video games had poorer grades in English classes (Harris & Wiliams, 1985). Others have documented a similar negative correlation with college students between amount of time playing video games and grades (Anderson & Dill, 2000; Paschke, Green, & Gentile, 2001).

The content of the games being played certainly could affect the relationship between amount of play and school performance. If, for example, students played only educational games, they would probably be less likely to show a corresponding deficit in school performance. Lieberman et al. (1988) have shown that children who use computers to play games frequently perform more poorly in school, whereas those who use computers for schoolwork perform better in school. However, regardless of content, the amount of play could affect grades negatively by displacing time spent in other educational and social activities. This "displacement hypothesis" suggests that electronic media can influence learning and social behavior by taking the place of activities such as reading, family interaction, and social play with peers (Huston et al., 1992). If the average child plays video games for 7 h a week, those are 7 h that the child is not engaged in reading, homework,

or participating in creative activities. Therefore, it is important to examine video game play in the context of other media habits, such as television viewing and reading for pleasure.

Effects of violent video game content on aggression

Although video games are designed to be entertaining, challenging, and sometimes educational, most include violent content. Recent content analyses of video games show that as many as 89% of games contain some violent content (Children Now, 2001), and that about half of the games include serious violent content towards other game characters (Dietz, 1998; Children Now, 2001; Dill, Gentile, Richter, & Dill, 2001). Therefore, among the games being purchased and played by youth, a majority contain violence. The popularity of video game violence has spurred much research on the possible harmful effects on children and adolescents.

A meta-analysis by Anderson and Bushman (2001) found that across 54 independent tests of the relation between video game violence and aggression, involving 4262 participants, there appear to be five consistent results of playing games with violent content. Playing violent games increases aggressive behaviors, increases aggressive cognitions, increases aggressive emotions, increases physiological arousal, and decreases prosocial behaviors. These effects are robust; they have been found in children and adults, in males and females, and in experimental and non-experimental studies. This is not to say that no studies have failed to find evidence of an effect. However, the majority of studies have found such evidence.

Possible moderators of the effects of video game violence

Some of the existing research may be difficult to interpret because most studies of violent video games do not measure individual differences that may moderate the effects. Indeed there have been some intriguing research findings demonstrating individual differences in response to the effects of violent video games. For example, a few recent studies have shown that trait hostility may moderate the effects of playing violent video games (Lynch, 1994; Lynch, 1999; Anderson & Dill, 2000). Lynch (1994, 1999) has found that the physiological effects of playing violent video games may be even greater for children who already show more aggressive tendencies. Adolescents who scored in the top quintile for trait hostility showed greater increases in mean arterial pressure, epinephrine, and nor-epinephrine levels in the blood than those in the lower quintiles. Additionally, a correlational study by Anderson and Dill (2000) found that associations between violent video game play and aggressive behavior and delinquency were stronger for those who were characteristically aggressive. This interaction of violent content with trait hostility is important because it suggests that the harmful effects of playing violent games may be even greater for children who are already at higher risk for aggressive behavior.

A second variable that may moderate the effects of video game play is parental monitoring and limiting. Research regarding limits, coviewing, and mediation of television messages has shown that each of these strategies can have beneficial effects (e.g. Gadberry, 1980; Austin, 1993; Strasburger & Donnerstein, 1999). Parent-imposed limits have been shown to be effective in reducing time with television (Truglio, Murphy, Oppenheimer, Huston, & Wright, 1996). Active parental involvement, such as rules limiting media use and active mediation (both positive encouragement to watch "positive" media and discouragement of "negative" messages), can be

effective in influencing children's viewing, understanding, reactions to, and imitation of program content (Lin & Atkin, 1989; Dorr & Rabin, 1995). Parental mediation is correlated with better academic performance, and has been shown to increase beliefs in social norms (both positive and negative), and to decrease fear (Corder-Bolz, 1980; Austin, Pinkleton, & Fujioka, 2000).

Few studies have looked at parental limits with video games. In a nationally representative study of parents, 55% say they "always" or "often" put limits on the amount of time their children may play computer and video games, and 40% say they "always" or "often" check the video game rating before allowing their children to buy or rent computer or video games (Gentile & Walsh, 2002). Even though these numbers are not particularly high, they may overestimate the amount of parental monitoring of children's video game play. In one study, nine out of ten teenagers said that their parents "never" check the ratings before allowing them to rent or buy games (Walsh, 2000). Funk, Hagan, and Schimming (1999) found that most parents could not correctly identify their 3rd- to 5th-grade child's favorite game. In 70% of the cases where parents named an incorrect game (or could not name any), children described their favourite game as violent. Active parental limits in children's game selection and amount of play could play an important moderating role in the effects of video games on children.

The evolution of video game violence

When reviewing the existing research, it is important to note that some studies may be somewhat outdated in an environment that is continually evolving in terms of violent content. In the late 1970s and early 1980s when Atari dominated the market, the graphic capability of games was very simplistic to the point that video game violence was largely abstract and rarely involved violence between humans (Dill & Dill, 1998). With the introduction of Nintendo in the mid-1980s, and later the Sony PlayStation in the mid-1990s, violence became more graphic and realistic. For example, the game *Soldier of Fortune*, which was released for personal computer in 2000, features 26 different "killing zones" in the body and employs the first-person mode, which allows the player to view violence through the eyes of the video game character. With this in mind, it is likely that studies carried out 10–15 years ago on the effects of violent video games underestimate the effects of modern violent games on children today.

Although the existing research provides some support for links between both violent video game content and amount of play with aggressive and academic outcomes, there is a need for additional research. The current study expands upon and adds to the literature in the following three ways: (1) It measures video game effects in the advanced technological video game environment of 2000; (2) it measures trait hostility and parental limits as possible moderators of the effects of violent video game play; (3) it measures amount of play and violent video game content separately.

A theoretical model for the effects of violent video game content

Anderson and colleagues (Anderson & Dill, 2000; Anderson & Bushman, 2002) have developed the General Aggression Model (GAM) to explain theoretical links between violent video game exposure and aggressive cognitions, attitudes, and behaviors. This model describes a "multi-stage process by which personological (e.g. aggressive personality) and situational (e.g. video game play

and provocation) input variables lead to aggressive behavior by influencing several related internal states and the outcomes of automatic and controlled appraisal (or decision) processes'' (Anderson & Dill, 2000, p. 773).

GAM differentiates between short- and long-term effects of video game violence on the game player. With regard to the short-term effects of violent video games, GAM predicts that both kinds of input variables, person and situation, can influence the present internal state of the person. Summarizing GAM's predictions for the effects of violent video games on behavior, Anderson and Dill drew the following conclusions. ''Short-term violent video game increases in aggression are expected by [the model] whenever exposure to violent media primes aggressive thoughts, increases hostile feeling or increases arousal'' (Anderson & Dill, 2000, p. 774). This suggests that in the short term, trait hostility may be a moderator of the effects of violent content, because aggressive thoughts and feelings may be more easily accessible for more hostile individuals.

With respect to long-term exposure to violent content, GAM suggests that this may result in the development, over-learning, and reinforcement of aggression-related knowledge structures. These knowledge structures include vigilance for enemies (i.e. hostile attribution bias), aggressive action against others, expectations that others will behave aggressively, positive attitudes towards use of violence, and the belief that violent solutions are effective and appropriate. Repeated exposure to graphic scenes of violence is also postulated to be desensitizing. Furthermore, it is predicted that long-term game players become more aggressive in outlook, perceptual biases, attitudes, beliefs, and behavior than they were before the repeated exposure. Therefore, trait hostility may play a different role in the long term. Over time, increases in trait hostility may result from video game play, and therefore trait hostility may become a *mediator* of the effects of violent game content on aggressive behaviors (in contrast to being a moderator).

The current research tested four hypotheses regarding video game content derived from GAM: (1) exposure to violent video games is positively correlated with trait hostility, (2) exposure to violent video games is positively correlated with aggression in naturalistic settings, namely arguments with teachers and physical fights, (3) trait hostility moderates the effects of violent video game exposure on aggressive behaviors, and (4) trait hostility mediates the effects of violent video game exposure on aggressive behaviors. In addition, two hypotheses were tested with respect to amount of video game play: (1) amount of video game play is negatively related to academic performance, namely grades, and (2) amount of video game play is not associated with aggressive behaviors. Because parental limits have not been studied systematically, these data were treated as exploratory and no a priori hypotheses were advanced.

Method

Participants

Six hundred and seven 8th-grade ($n = 496$) and 9th-grade ($n = 111$) students participated in the study. Students were recruited from four Midwestern schools, including one urban private school ($n = 61$), two suburban public schools ($n = 350$), and one rural public school ($n = 196$). Students were recruited from mandatory classes within their schools. The mean age of respondents was

14 years (s.d. = 0.64). Fifty-two percent of respondents were male. Eighty-seven percent of the respondents classified themselves as Caucasian (which is representative of the region of the country from which they were recruited). Participants were treated in accordance with the "Ethical Principles of Psychologists and Code of Conduct" (American Psychological Association, 1992).

Procedure

Data were collected between 4 April and 2 May 2000. Letters were mailed directly to the parents of students in participating classrooms informing them about the study and requesting consent. Consent levels were greater than 90% for all classrooms. Interested teachers volunteered their classrooms for inclusion in the study. Each of the participating classrooms was a mandatory class (i.e. not elective) to reduce the likelihood of self-selection bias.

Each participant completed an anonymous survey that gathered descriptive data about students' habits, attitudes, and knowledge about video games, as well as school performance, demographic data, and a measure of trait hostility. The survey was pretested with 143 7th- through 12th-grade students (Walsh, 2000). The classroom teachers were trained to administer the surveys, which were administered during one class period. The students were instructed that video games included any games played on computer, video game consoles (such as Nintendo), on hand-held game devices (such as Gameboy), or in video arcades.

Variables

Violent video game exposure. Similar to Anderson & Dill's (2000) approach, participants were asked to name their three favorite video games. For each named game, participants were asked to rate how frequently they played the game on a 7-point Likert scale (1 = "rarely", 7 = "often"). Participants were also asked to rate how violent each game is on a 7-point Likert scale (1 = "little or no violence", 7 = "extremely violent"). A video game violence exposure score was computed for each participant by multiplying the frequency of play for each game by its violence, and taking the mean of the three products. Cronbach's alpha for this three-item scale was 0.68, which is lower than the 0.86 alpha Anderson and Dill (2000) obtained. However, Anderson and Dill used five items rather than three, and we would predict reliability to drop somewhat with fewer items.[1] Participants were also asked to indicate how much violence they prefer to have in their video games on a 10-point scale (1 = "no violence", 10 = "extreme violence"), and how much violence they prefer to have in their video games compared to 2–3 years ago on a 5-point scale (1 = "a lot less", 5 = "a lot more").

Amount of video game play. Participants were asked the amount of time they spent playing games during different time periods on weekdays and weekends. Weekly amount of game playing was calculated from these responses.

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[1] It is unclear whether we should even expect the video game violence exposure scale to have high reliability. Calculating violence exposure from favorite games appears to be an empirically appropriate approach. However, it is entirely likely that some players would like both violent and non-violent games, which would make the scale appear unreliable, when in fact the scale is measuring exactly what it is intended to measure—that some people play only violent games, some play only non-violent games, and some play a mix of violent and non-violent games.

Trait hostility. Hostility was measured using the Cook & Medley Hostility Scale (Cook & Medley, 1954), a commonly used reliable instrument. Because the items for the Cook & Medley are taken from the MMPI, some were inappropriate for young adolescents. The instrument was modified by deleting seven items and changing the wording of some items to make them easier for 8th graders to understand. These modifications were based on those made by Matthews and colleagues (e.g., Woodall & Matthews, 1993).

Parental limits. Participants were asked how often their parents put limits on how much time they are allowed to play video games, and how often their parents check the ratings before allowing them to buy or rent video games. Responses were rated on a 5-point Likert scale (ranging from "always" to "never"). Participants were also asked whether their parents had ever kept them from getting a game because of its rating, and whether their parents knew what games they had. A parent involvement scale was created by averaging the frequency with which parents check the ratings before allowing students to purchase or rent games and the frequency with which parents put limits on the amount of time students can play video games (these two items were correlated with each other at $r = 0.36$, $p < 0.001$).

Arguments with teachers. Participants were asked how often they had gotten in arguments with their teachers in the past year. Responses were rated on a 4-point Likert scale (ranging from "Almost daily" to "Less than monthly"). Responses were coded such that higher scores indicate higher incidence of arguments with teachers.

Grades. Participants were asked to report their average school grade, ranging from A+ through F. Answers were coded such that higher scores indicate higher grades in school.

Physical fights. Participants were asked if they had been in a physical fight in the last year. This question yielded a dichotomous response (yes/no).

Results

Descriptive statistics

Descriptive statistics of media habits, including video game use, can be seen in Table 1. The average amount of time 8th- and 9th-grade students spent playing video games was 9 h per week. Males spent significantly more time playing video games each week than females (13 and 5 h per week, respectively; $t(585) = 8.6$, $p < 0.001$). Compared to time spent playing video games, adolescents spent more time watching television and listening to music, but less time reading for pleasure. Video game play was widespread in this sample; only 6% of 8th and 9th graders said they never play video games, and 59% reported playing at least once a week.

When asked to rate how much violence they like to have in video games on a scale from 1 to 10 (1 = no violence, 10 = extreme violence), youth reported preferring a moderate amount of violence ($M = 5.4$; s.d. $= 2.73$). There were significant sex differences on this variable, with boys ($M = 6.7$; s.d. $= 2.3$) preferring higher levels of violence than girls ($M = 3.8$; s.d. $= 2.3$), ($t(551) = 14.2$, $p < 0.001$). Two-thirds (68%) of boys chose the scale point six or higher, whereas only 22% of girls preferred this much violence in their video games. Only 1% of boys and 16% of girls said they preferred to have no violence in video games.

Table 1
Amounts of media use (hours/week)

	Boys and girls ($n = 607$)		Boys ($n = 311$)		Girls ($n = 290$)	
	M	S.D.	M	S.D.	M	S.D.
Playing video games	9.0	11.9	12.9[a]	13.3	4.9[a]	8.6
Watching TV	25.3	15.4	27.4[b]	16.4	23.2[b]	14.0
Listening to music	20.7	24.4	18.6	23.3	21.9	23.0
Reading for pleasure	3.4	4.3	3.0[c]	4.2	3.8[c]	4.4

Note. Not all participants indicated their sex, therefore, the number of boys and girls is not equal to the sum of boys and girls.

[a] Means significantly different from each other at $p < 0.001$.
[b] Means significantly different from each other at $p < 0.01$.
[c] Means significantly different from each other at $p < 0.05$.

Overall, when asked to rate the amount of violence in their three favorite games, 62% of the games named were rated as having some violence on a 7-point scale, and 37% were rated as including violence at or above the midpoint of the scale. Boys were less likely to name games with no violence as their favorite games (30% of the favorite games named by boys include no violence, compared to 50% of the favorite games named by girls). Boys were also more likely to name games that they rated as having high violence (rated at or above the scale midpoint) as their favorite games. Almost half (49%) of the favorite games named by boys had high violent content, compared to 20% of the favorite games named by girls.

Parents are not heavily involved with their adolescents video game playing. Only 13% of young adolescents who play video games said their parents "always" or "often" put limits on the amount of time they are allowed to play video games, while 43% say they "never" do. Only 31% of young adolescents think that their parents understand the video game ratings system, and only 15% said their parents "always" or "often" check the ratings before allowing them to buy or rent video games (53% "never"). Fewer than one in five parents (19%) have ever kept their children from getting a game because of its rating. Eighty-eight percent of respondents own their own games, and 10% of these admitted that they have games their parents would not approve of if they knew the content of the games.

Overall, 23% of children reported getting into arguments with their teachers "almost weekly" or "almost daily", and 34% reported getting into a physical fight within the past year. Again, there were sex differences. Boys were more likely to be aggressive, with 28% saying they get into arguments with teachers "almost weekly" or "almost daily", whereas only 17% of girls get into arguments with teachers that frequently ($\chi^2(3, N = 435) = 9.69$, $p < 0.05$). Forty-seven percent of boys reported getting into fights in the past year, whereas only 19% of girls reported getting into physical fights ($\chi^2(1, N = 589) = 51.07$, $p < 0.001$). Girls also reported slightly higher average grades than boys (mean grade equivalents = B+ and B, respectively; $t(578) = 4.53$, $p < 0.001$).

As shown in Tables 2 and 3, there were significant, though moderate, intercorrelations among the outcome measures (Table 2) and among the predictor variables (Table 3).[2]

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[2] The full intercorrelation matrix is available at http://www.mediafamily.org/research/VGEA.shtml.

Table 2
Intercorrelations among arguments, school grades, hostility, and fights ($n = 427$–584)

	Hostility	Fights	Grades
1. Arguments with teachers	0.31***	0.32***	−0.36***
2. Trait hostility	—	0.29***	−0.24***
3. Physical fights		—	−0.29***
4. School grades			—

***$p < 0.001$.

Table 3
Intercorrelations among predictor variables ($n = 529$–587)

	VGV	Par. Inv	Sex
1. Amount of video game play	0.55***	−0.08[+]	−0.34***
2. Violent video game exposure (VGV)	—	−0.12**	−0.45***
3. Parental involvement		—	0.02
4. Sex[a]			—

[+]$p < 0.10$; **$p < 0.01$; ***$p < 0.001$.
  [a] 1 = male, 2 = female.

Associations between video game habits and parental limits and outcomes

Zero-order correlations between video game habits and parental limits and the outcomes (trait hostility, arguments with teachers, physical fights, and school grades) can be seen in Table 4.[3] Exposure to violent video game content and amount of video game play were both positively associated with adolescents' trait hostility, the frequency with which they get into arguments with teachers, and whether or not they have been in a physical fight, and negatively associated with school grades.

Parental limits were correlated negatively with arguments with teachers and trait hostility, and were positively correlated with school performance. *T*-tests of independent samples were conducted to test for differences in parental limits between adolescents who had or had not been involved in physical fights the previous year. Adolescents who had been involved in physical fights were less likely to have had parents check the ratings before allowing them to buy or rent video games ($t(539) = 4.9$, $p < 0.001$, means = 1.6 and 2.2 on a 5-point verbally anchored "never" to "always" scale). Similarly, adolescents who had been involved in physical fights were less likely to have had parents put time limits on their video game play ($t(551) = 2.1$, $p < 0.05$, means = 1.9 and 2.1 on a 5-point verbally-anchored "never" to "always" scale).

Adolescents' trait hostility levels were significantly correlated with their media habits. Adolescents who were more hostile tended to consume more electronic media, played more

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[3] Note that because physical fights is a dichotomous variable (yes/no), this correlation should be interpreted as a point-biserial correlation.

Table 4
Correlations between media habits and parental limits and outcomes ($n = 399–586$)

	Trait hostility	Arguments with teachers	Physical fights	Grades
Amount variables				
Amount of video game play	0.20***	0.12*	0.21***	−0.25***
Amount of time watching TV	0.20***	0.10*	0.12***	−0.20***
Amount of reading for pleasure	−0.08†	−0.17***	−0.07	0.07†
Violent content variables				
Violent video game exposure	0.21***	0.20***	0.32***	−0.23***
Preferred violence in video games	0.31***	0.25***	0.36***	−0.34***
Preferred violence compared to 2 or 3 years ago	0.23***	0.16**	0.19***	−0.14**
Parental involvement scale	−0.14**	−0.27***	−0.18***	0.27***

$^{†}p<0.09$; $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$.

violent video games, prefer more violent content, and have fewer parental limits on the content of their video games.

Exposure to video game violence

Given the high intercorrelations among trait hostility, media habits, sex, and aggression variables (e.g. physical fights), it would be reasonable to question whether video game violence contributes any independent variance to fights. Perhaps trait hostility is the only factor that matters, and that all other correlations reflect their associations with hostility. To test this, we conducted logistic regressions predicting physical fights in the past year (dichotomous variable). We entered trait hostility (Ho), video game violence exposure (VGV), and their interaction (Ho × VGV) as independent variables. The two main effects were significant independent predictors of fights, although the interaction did not predict a significant amount of variance. These variables in combination predicted 20% of the variance in physical fights ($p<0.001$). Table 5 displays this effect graphically. When Ho and VGV are split into quartiles, an increase in either predicted an increase in the percent of students who have been involved in physical fights. The students with the lowest hostility (Ho 1) and lowest exposure to violent video games (VGV 1) also had the lowest incidence of physical fights (4%). The highest hostility students (Ho 4) with low exposure to violent video games had relatively low incidence of physical fights (28%). However, the lowest hostility students (Ho 1) who expose themselves to the greatest amount of video game violence (VGV 4) had a higher incidence of physical fights (38%). Sixty-three percent of high hostile (Ho 4) and high video game violence (VGV 4) students have been involved in physical fights.

To provide a stricter test of whether VGV contributes independently to fights, we conducted a logistic regression in which we entered sex, trait hostility, and amount of video game play per week in Step 1. In Step 2, we entered violent video game exposure. In Step 3, we entered the parent involvement scale. Exposure to violent video games contributed a significant amount of variance even when controlling for sex, trait hostility, and amount of play; parental involvement

Table 5
Percentage of students who have been involved in a physical fight in the past year split by hostility and exposure to violent video games

Hostility quartiles	Exposure to violent video games—quartiles				
	1—Lowest exposure	2	3	4—Highest exposure	Average
1—Lowest hostility	4%	26%	15%	38%	14%
2	16%	33%	27%	58%	31%
3	24%	42%	44%	54%	41%
4—Highest hostility	28%	37%	58%	63%	50%
Average	14%	34%	39%	55%	

Table 6
Logistic regression predicting physical fights ($N = 512$)

Predictor	B	S.E.	Wald statistic	df	R^2
Step 1: Sex[a]	−0.77	0.24	10.94**	1	
Trait hostility	0.06	0.02	15.65***	1	
Amount of video game play	0.01	0.01	0.38	1	0.18***
Step 2: Violent video game exposure	0.04	0.01	10.66**	1	0.21***
Step 3: Parental involvement	−0.42	0.12	12.78***	1	0.24***

**$p < 0.01$; ***$p < 0.001$.
[a] 1 = male, 2 = female.

contributed a significant amount of additional variance. These five variables accounted for 24% of the variance in physical fights ($\chi^2(5, N = 512) = 97.54$, $p < 0.001$). This regression can be seen in Table 6.

A similar analysis using multiple regression was conducted using arguments with teachers as the dependent variable (see Table 7). Sex, trait hostility, and amount of video game play per week were entered in Step 1. In Step 2, we entered violent video game exposure. It contributed a non-significant amount of variance when controlling for sex, trait hostility, and amount of play. In Step 3, we entered the parent involvement scale, which contributed a significant amount of additional variance. These five variables accounted for 17% of the variance in arguments with teachers ($F(5, 376) = 14.91$, $p < 0.001$).

A similar analysis was conducted using school grades as the dependent variable (see Table 8). However, because amount of play is more likely to predict grades than game content, predictors were entered in a slightly different order. Sex, trait hostility, and violent video game exposure were entered in Step 1. In Step 2, we entered amount of video game play. It contributed a significant amount of variance even when controlling for sex, trait hostility, and violent game exposure. In Step 3, we entered the parent involvement scale, which also contributed a significant amount of additional variance. These five variables accounted for 14% of the variance in school grades ($F(5, 497) = 16.51$, $p < 0.001$).

Table 7
Hierarchical multiple regression predicting arguments with teachers ($N = 381$)

Predictor	β	R^2	ΔR^2	$\Delta R^2 F$	df
Step 1: Sex[a]	−0.02				
Trait hostility	0.29				
Amount of video game play	0.04	0.12***	0.12***	17.43	3, 378
Step 2: Violent video game exposure	0.06	0.13***	0.01	1.49	1, 377
Step 3: Parental involvement	−0.21	0.17***	0.04***	18.26	1, 376

***$p < 0.001$.
[a] 1 = male, 2 = female.

Table 8
Hierarchical multiple regression predicting grades ($N = 502$)

Predictor	β	R^2	ΔR^2	$\Delta R^2 F$	df
Step 1: Sex[a]	0.06				
Trait hostility	−0.15				
Violent video game exposure	−0.03	0.08***		13.83	3, 499
Step 2: Amount of video game play	−0.15	0.09***	0.01**	9.72	1, 498
Step 3: Parental involvement	0.22	0.14***	0.05***	27.80	1, 497

**$p < 0.01$; ***$p < 0.001$.
[a] 1 = male, 2 = female.

Path analyses predicting physical fights, school grades, and arguments with teachers

Fig. 1 shows a model for the prediction of the dichotomous outcome of physical fights, testing the hypothesis that hostility may mediate the effects of video game habits. A series of logistic regressions were conducted in order to test this model. The model was significant ($\chi^2(3, N = 514) = 76.24$, $p < 0.001$) and explained a moderate amount of the variance in physical fights. As can be seen from Fig. 1, trait hostility was associated with both amount of play and violent video game exposure. Violent video game exposure was both *directly* associated with physical fights and *indirectly* associated, with trait hostility mediating the effects of violent video game exposure on physical fights.

The same path model was tested using multiple regression and the two continuous outcomes— school grades and arguments with teachers (Fig. 2). The model was significant and explained a moderate amount of the variance in school grades ($F(3, 534) = 18.94$, $p < 0.001$) and arguments with teachers ($F(5, 401) = 18.64$, $p < 0.001$). Trait hostility was associated with both amount of play and violent video game exposure. Violent video game exposure, controlling for amount of play, was not *directly* associated with grades, and was marginally *directly* associated with arguments with teachers. Both *indirect* pathways were significant, with trait hostility mediating the effects of violent video game exposure on the outcomes. Amount of play, controlling for violent
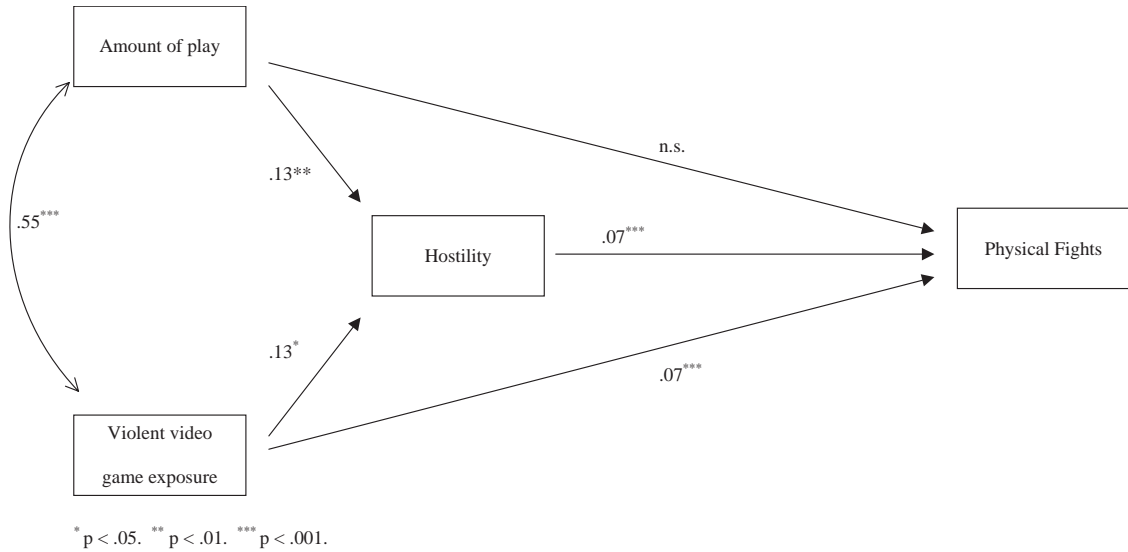
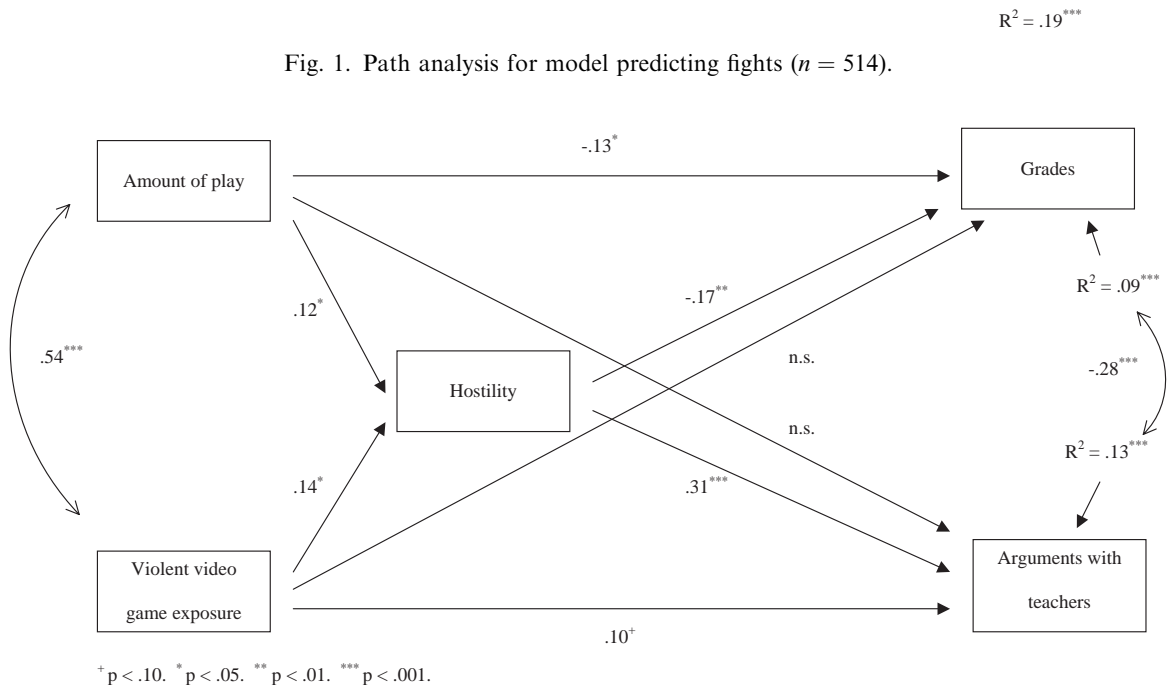Fig. 1. Path analysis for model predicting fights ($n = 514$).

Fig. 2. Path analysis for model predicting grades and arguments with teachers ($n = 404$).

video game exposure, was still *directly* and negatively associated with school grades. However, the effect of amount of play on arguments with teachers was indirect and mediated through trait hostility.

Discussion

Each of the hypotheses was supported by the results of the study. Based on the GAM, it was hypothesized that exposure to video game violence would be positively correlated with trait hostility. This hypothesis was generally confirmed. Hostility was correlated significantly with three measures of violent content: the amount of violence adolescents like to have in video games, whether they like more or less violence now compared to 2 or 3 years ago, and the amount of video game violence they expose themselves to.

It was hypothesized that exposure to video game violence would be positively related to aggressive behaviors, such as arguments with teachers and physical fights. This hypothesis was confirmed. Students who play more violent video games are more likely to have been involved in physical fights and get into arguments with teachers more frequently. The relation between violent video game exposure and physical fights is stronger than that between violent game exposure and arguments with teachers. There are several possible reasons for this, including (1) arguing is less aggressive than fighting, (2) the target of arguing is an authority figure, rather than peers, and (3) there is very little arguing modelled in violent video games whereas there is a great deal of physical aggression modelled in violent games.

That youth who are more hostile also play more violent video games raises questions of causality. Are young adolescents more hostile and aggressive because they expose themselves to media violence, or do previously hostile adolescents prefer violent media? Due to the correlational nature of this study, we cannot answer this question directly. Some studies have suggested that there is a bidirectional relationship (see Donnerstein, Slaby, and Eron (1994) for a review). GAM predicts a bidirectional effect, in which personological variables such as hostility affect media habits, which in turn reinforce and can modify the personological variables. Huesmann and colleagues (Lefkowitz, Eron, Walder, & Huesmann, 1972) have shown in long-term longitudinal studies that early media violence consumption habits predict later aggressive behaviors, but that early aggressive behaviors do not predict later media violence consumption habits. In the present research, video game violence exposure was a significant predictor of physical fights, even when sex, trait hostility, and weekly amount of video game play were statistically controlled. Clearly, hostility is not the whole story. If it were, then we would expect that children with the lowest hostility scores would not get into physical fights regardless of their video game habits. Following this logic, we would also expect that children with the highest hostility scores would get into physical fights regardless of their video game habits. Yet, *low-hostile* students who have the highest exposure to violent video games are *more* likely to have been involved in fights than *high-hostile* students who have the lowest exposure to violent video games (38% compared to 28%, respectively).

Some studies have suggested that personality traits such as hostility may moderate the effects of media violence (e.g. Lynch, 1994, 1999; Anderson & Dill, 2000). Indeed, GAM is designed to accommodate these moderator variables. This is an important issue to consider. It is possible that the people who are most affected by violent media are those who are most naturally aggressive, thus putting the most vulnerable at the greatest risk for increased aggression. There have not been very many studies designed to test this hypothesis, nor have the results been consistent. The present research found no interaction between trait hostility and exposure to video game violence.

Instead, an additive effect was found, such that a combination of high hostility and video game violence places an adolescent at an increased risk for higher levels of aggression.

We recommend approaching the question of media violence from a risk factors perspective (Gentile & Sesma, 2003). Clearly, media violence is not the sole cause of aggression. But it is likely that it is one of several causes leading to it. Indeed, the American Psychological Association, the American Academy of Pediatrics, the American Academy of Child and Adolescent Psychiatry, and the American Medical Association recently issued a joint statement that there is a "causal connection" between media violence and aggressive behavior, but that it is a complex effect (AAP, APA, AACAP, & AMA, 2000). We hypothesize that children with multiple risk factors for violence are more likely to exhibit aggressive behavior. The present data lend support to this hypothesis. Children with high levels of hostility are more likely to be involved in fights than low-hostile children. If they expose themselves to more video game violence, their odds of being involved in fights increase even more. This approach may also be fruitful when considering differential effects correlated with sex. This study clearly shows that even after controlling for sex, video game violence exposure is a significant factor related to physical fights for both boys and girls. However, boys are generally at greater risk for aggressive behaviors, and they compound that risk by playing more violent games for greater amounts of time than girls play.

In addition to examining trait hostility as a possible *moderator* of the effects of violent video game play, this study addressed GAM's prediction that in the long term, trait hostility is a *mediator* of the effects of violent video games on aggressive behavior. The path analyses clearly showed this mediating effect of hostility, in which hostility mediates the effects of both amount of play and violence exposure on grades and aggressive behaviors. Because correlational studies are more likely to show long- than short-term effects, this pattern of results is perhaps not surprising. Short-term effects studies (such as experimental studies) are probably more likely to find moderator effects than long-term effects studies (such as correlational studies).

It is worth noting that the Cook and Medley Hostility Scale includes measures of hostile actions, attitudes, and beliefs. Therefore, controlling for trait hostility is a very conservative procedure when testing predictors of antisocial (e.g. arguments) and aggressive (e.g. fights) behaviors. It is likely that partialling out hostility underestimates any true direct effect of violent video game exposure on antisocial and aggressive behaviors.

Two hypotheses were advanced regarding the amount of video game play—that amount would be negatively related to school performance and that it would not be related to aggressive behaviors. The first hypothesis was supported and the second was partially supported. As shown in Fig. 1, amount of play is both directly and indirectly (mediated by hostility) related to grades. This result is consistent with the displacement hypothesis and with previous research both with video games (e.g. Anderson & Dill, 2000) and television (e.g. Williams, Haertel, Haertel, & Walberg, 1982). Amount of play was not directly related to arguments with teachers or physical fights, but it was indirectly (mediated by hostility) related to arguments with teachers (but not fights). It is possible that the amount is related to arguments indirectly because hostile children play more and are also more likely to play violent games when they do play.

Parent involvement in video game habits appears to act as a protective factor. Parental limits to violent video game play are negatively correlated with fights and arguments, and positively correlated with school performance. In a recent intervention study, 3rd- and 4th-grade students

received classroom instruction designed to reduce media consumption (Robinson, Wilde, Navracruz, Haydel, & Varady, 2001). The intervention focused on limiting the amount of TV, video game, and video use at home, but did not focus specifically on changing habits regarding violent media. After 6 months of instruction, students who had received the intervention (and had reduced their media consumption) displayed lowered peer ratings of aggression and lower observed verbal aggression compared to matched samples of students. The results of the present study are consistent with the findings of Robinson and colleagues. Limits on amount of video game play by parents were related to fewer arguments with teachers and lower incidence of physical fights. In addition, the present study offers a hint that limiting content may also bring beneficial effects. Students who reported that their parents more frequently checked the ratings before allowing them to buy or rent video games were also less likely to argue with teachers or get into physical fights. In fact, statistically controlling for respondent sex, hostility, weekly amount of video game play, and video game violence exposure, the frequency with which parents monitor their adolescents' video game habits added a significant amount of predictive power when predicting physical fights. Parents who are involved in video game selection and monitor hours played are more likely to have children who get into fewer physical fights. However, it is unclear whether these results are due to parents' media-specific behaviors (monitoring) or whether they are due to a broader pattern of more-involved parenting styles. Future research on this issue is needed.

GAM also describes the etiology of aggressive behavior over the long term. GAM hypothesizes that playing violent video games over time leads to increases in aggressive personological and behavioral variables. The pattern of intercorrelations among personological variables (e.g. hostility, preference for violent content) and behavioral variables (e.g. arguments and physical fights) and the path analyses predicting aggressive behaviors are both consistent with this prediction of the model.

It is important to note, however, that this study is limited by its correlational nature. Inferences about causal direction should be viewed with caution. However, these results suggest that concern about exposure to violent video games is not misplaced. This study is also limited by a reliance on self-report and by not being able to assess the type of violence (e.g. realistic vs. cartoon-style). However, it is likely that if the participants did not report truthfully, they would have been likely to try to portray themselves positively (e.g. underestimate their aggressive behaviors). This would have only reduced our ability to find significant results. Similarly, given that other research suggests that realism in media violence is linked with greater effects (e.g. Potter, 1999), our inability to separate realistic from cartoonish portrayals only serves to weaken our ability to find significant results. Associations were found among video game habits, aggressive behaviors, and school performance. These results are consistent with the substantial amount of other media violence research, video game research, and the predictions from the GAM. Furthermore, the findings regarding parental involvement are consistent with other research on parental monitoring and limits, both in terms of how few parents monitor or set rules, and the beneficial effects of such monitoring and limits (e.g. Lin & Atkin, 1989; Huston et al., 1992; Austin, 1993; Dorr & Rabin, 1995; Strasburger & Donnerstein, 1999). Additional experimental and longitudinal research is needed. Yet, it is hoped that youth, parents, and educators can begin to use the results of this research to modify children's video game habits in ways that promote children's health and school success.

Acknowledgements

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