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Longitudinal Effects of Violent Video Games on Aggression in Japan and the United States

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Keywords: Aggression, longitudinal study, media impact, video games, youth violence

Abstract

Context: Youth worldwide play violent video games many hours per week. Prior research suggests that such exposure can increase physical aggression.

Objective: To determine whether high exposure to violent video games increases physical aggression over time in both high (U.S.) and low (Japan) violence cultures. We hypothesized that amount of exposure to violent video games early in a school year would predict changes in physical aggressiveness assessed later in the school year, even after statistically controlling for sex and prior physical aggressiveness.

Design: In three independent longitudinal samples, participants' video game habits and physically aggressive behavior tendencies were assessed at two points in time, separated by three to six months.

Participants: Three population-based samples were assessed. One sample consisted of 181 Japanese junior high students ranging in age from 12 to 15 years. A second Japanese sample consisted of 1050 students ranging in age from 13 to 18 years. The third sample consisted of 364 U.S. 3rd, 4th, and 5th graders ranging in age from 9 to 12 years.

Results: Habitual violent video game play early in the school year predicted later aggression even after controlling for sex and prior aggressiveness in each sample, *p*s < .01. Those who played a lot of violent video games became relatively more physically aggressive. Multi-sample structure equation modeling revealed that this longitudinal effect was of a similar magnitude in the U.S. and Japan for similar age youth (*Bs* = .158 & .139, respectively, *p*s < .0001), and was smaller (but still significant) in sample that included older youth (*B* = .075, *p* < .01).

Conclusions: These longitudinal results confirm earlier experimental and cross-sectional studies that had suggested that playing violent video games is a significant risk factor for later physically

aggressive behavior, and that this violent video game effect on youth generalizes across very different cultures. As a whole, the research strongly suggests reducing the exposure of youths to this risk factor.

Keywords: Aggression, longitudinal study, media impact, video games, youth violence

INTRODUCTION

In the late 1980s American children played video games about four hours a week (1). They now average 13 hours overall, with boys averaging 16 to 18 hours per week (2). Furthermore, 90% of American children between the ages of 8 and 16 play video games at home (3). Children's favorite games often are violent (4). Currently, of all games classified by the industry's ratings group as appropriate for everyone aged 10 and older (E10+), over 90% contain violence (5). Over 75% of teen gamers under 17 report playing Mature-rated video games (the most graphically violent type) despite industry-wide restrictions (3). In a recent "secret shopper" study, over 80% of attempts by underage children to purchase an M-rated video game from rental stores were successful (3). If playing violent video games has harmful effects on some portion of players, then the vast majority of American youth are highly exposed to an unnecessary risk factor.

The general public typically define "violent media" as only those television shows, films and video games that include graphic images of blood and gore, but media violence researchers also include products without such images. Violent media are those that depict characters intentionally harming other characters who presumably wish to avoid being harmed. Thus, even children's video games that lack depictions of blood and gore can, and frequently do, include violence. "Aggression" also is defined differently by behavioral scientists than by the general public. Social and developmental psychologists typically define "aggression" as behavior that is intended to harm another person who is motivated to avoid that harm. In other words, aggression is an act carried out by one person with the intent of hurting another person; it is not an emotion, thought, or intention. For most social and developmental scientists, "violence" is the most extreme form of physical aggression, specifically physical aggression that is likely to cause

serious physical injury.

Past research on violent video games has discovered consistent links to increased levels of aggression (6, 7). Existing experimental studies demonstrate that playing a violent video game causes an immediate increase in aggressive behavior, aggressive thoughts, and aggressive emotions (6, 8, 9). Existing cross-sectional studies (i.e., correlational studies that measure independent and dependent variables at one point in time) clearly link violent video game play to high levels of aggression and violence in real world contexts. They also rule out a number of non-causal explanations (10, 11).

However, establishing long-term causal effects of violent video games also requires longitudinal studies. Only one published longitudinal study with children has specifically examined longer term effects of exposure to violent video games (10), and no studies have investigated longitudinal effects in low violence cultures.

Longitudinal studies have investigated television and media violence in general among children and adolescents (12-14), and have demonstrated their causal longitudinal impact. Furthermore, these studies suggest that the long-term impact of television violence is larger for children than for adolescents. Nonetheless, the interactive nature of video games—their capacity to reward and punish the player for various actions, their immersive qualities, the fact that the user is an enactor as well as an observer of aggression—means that research specifically focusing on longitudinal violent video game effects is badly needed.

METHODS

Participants

In the present research, three samples of male and female school children were assessed at two points in time. Two samples are from Japan (15, 16); one is from the U.S. (17). Table 1

displays sample size and age ranges of the three samples. Although there are important developmental differences between middle childhood and adolescence (18), the psychological mechanisms postulated as underlying media violence effects are the same for each age such as priming processes; the learning of aggression-related scripts, attitudes, hostile attribution bias, and normative beliefs; and emotional desensitization (see 10, 19, for detailed descriptions of the short-term and long-term mechanisms).

Procedure

For all participants we assessed how much they habitually played violent video games, and how physically aggressive they had behaved in recent months. Table 1 describes the three samples. The samples varied in grade level (from 3rd to 12th graders), time lag between the two assessments (3 to 6 months), measure of habitual video game violence exposure (HVGV), and measure of recent physical aggressiveness.

Habitual Video Game Violence Exposure

Two of the studies—the younger Japan sample and the U.S. child sample—assessed habitual video game violence exposure (HVGV) in ways that fairly directly take into account violent content of favorite games and amount of time playing those violent games. The U.S. sample listed their three favorite video games and then rated each on amount of violent content and on how frequently they played each of the three games. HVGV for this sample was computed by multiplying the violent content rating by the frequency of play for each listed game, then averaging the three scores. This has been the standard procedure for several years (20). The younger Japan sample indicated how frequently they had played each of eight types of video games (fighting action, action, action role playing game, shooting, adventure, simulation, sports, puzzle). Based on prior content analyses of popular video games among Japanese children,

HVGV was computed by averaging the frequency of play for the five types of games that are predominantly violent (fighting action, action, action role playing game, shooting and adventure).

The third study assessed HVGV in a somewhat less direct way. Participants listed their most favorite game genre and three additional favorite genres, and reported how many hours per week they spent playing any type of video game. For each participant, we assigned a favorite genres violence score which could range from 0 to 5. If their "most favorite" genre was a violent type, they received 2 points; if it was a nonviolent type they received a zero. For the remaining three favorites, they received an additional point for each that was a violent type of genre. We then multiplied the favorite genres violent score by the total number of hours per week spent playing video games.

Aggressive Behavior

For both Japan samples, the measure of aggressive behavior was self-reported trait physical aggression. For the younger sample, a 6-item Japanese version of the Buss and Perry physical aggression scale was used (21). This self-report measure asks about frequency of physically aggressive behaviors. This scale has been validated in a wide range of studies, including prior media violence studies. For the older Japanese sample, a 1-item self-report measure of frequency of physical aggression (involving punching or kicking someone) in the last month. For the U.S. sample, the measure of aggressive behavior was an index of teacher, peer, and self-reports of physical aggression, such as hitting, kicking, and getting into fights in the last year.

RESULTS

Despite the differences between samples in measures of HVGV, physical aggression,

country, and age, each sample yielded statistically reliable positive correlations between Time 1 HVGV and Time 2 physical aggression of a magnitude that falls in the medium to large range for longitudinal predictors of physical aggression and violence (see Table 1). The weighted average longitudinal correlation across the three samples was: $r+ = .28$, $Z = 11.65$, $p < .0001$, 95% confidence interval = +.26 to +.31. The corresponding Odds Ratio is 2.10. Interestingly, the largest of these lagged correlations was for the sample that: (a) used the most direct measure of HVGV; (b) used multiple reports of aggressive behavior; (c) had the longest lag between the two measurement time periods; and (d) had the youngest participants—the U.S. sample ($r = .40$). The smallest correlation was from the sample with the least direct measure of HVGV, the shortest lag, a single item measure of physical aggression, and the oldest participants ($r = .23$). These two correlations are significantly different from each other, $Z = 2.79$, $p < .01$.

For our main analyses, we used the maximum likelihood structural equation procedures of the LISREL 8.5 statistical package to conduct a path analysis on the three correlation matrices (22). The first (baseline) model forced the estimated path weights linking the measured variables to be equal across the three samples. This model should yield the optimum fit *if* the variations in methods, ages, and sampled country have relatively little impact on the structure of the relations among the conceptual variables. However, if the longitudinal effect of HVGV on later aggression differs across samples, for example if it is stronger in the U.S. than the Japan samples, this baseline model should not fit the data very well. This model also provides a baseline for comparative testing of additional hypotheses about the relative magnitude of the longitudinal effect of HVGV on later physical aggression. Table 2 displays the results.

The baseline model fit the data quite well, as indicated by the measures of fit in Table 2 (23). Table 2 presents three additional and slightly different models, each of which was tested to

see whether it fit the data better than the baseline model. One model allowed an independent estimate of the HVGV longitudinal path weight (*B*) for each sample. These path weights were similar for the two samples with younger participants and better measures of HVGV and physical aggressiveness, larger than the path weight the third sample, as shown in the bottom row of Table 1. However, this model did not yield a significantly better fit than the baseline model, as shown by the nonsignificant Chi-square difference test in Table 2.

A second comparative model specifically tested the hypothesis that the longitudinal effect is larger for the U.S. sample than for the two Japanese samples. The Chi-square fit test in Table 2 revealed that this model also was not significantly better than the baseline model.

A third model (labeled the "Age Model" in Table 2) tested the hypothesis that the older sample with the shorter lag and the weakest measures of HVGV and physical aggressiveness would yield a smaller longitudinal effect than the two younger samples (Japan 7^{th}-9^{th} graders, U.S. 3^{rd}-5^{th} graders). This model yielded a fit that was somewhat better than the baseline model. The estimated HVGV longitudinal path for the two younger samples ($B = .152$) was larger than the corresponding path for the older sample, $B = .075$.

Figure 1 displays the results of this path analysis. As expected, sex of participant strongly predicted HVGV and physical aggressiveness. Boys played more violent video games and were more physically aggressive than girls. Furthermore, physical aggressiveness at Time 1 was an extremely good predictor of physical aggressiveness at Time 2, consistent with much prior research which shows that the best predictor of future aggression is history of past aggression. Of primary importance, though, is the finding that across two very different cultures HVGV predicts physical aggression 3 to 6 months later, even after controlling for prior aggressiveness and sex. This result strongly supports the view that playing violent video games is a causal risk factor for

relative increases in later physical aggressiveness. The main alternative explanation of prior cross-sectional correlation studies—that the association between amount of violent video game play and physical aggressiveness is merely an artifact of "naturally" aggressive children preferring violent video games—is ruled out by the longitudinal design and analysis. By controlling for participants' aggressiveness at Time 1, these longitudinal results also control for the innate aggressiveness of the participants as well as other factors that influence trait aggressiveness.

DISCUSSION

This study adds two critical pieces of evidence on the issue of the potential aggression-enhancing effects of violent video games. First, it confirms that habitually playing violent video games leads to *increases* in physical aggression some months later in children and adolescents, relative to those who do not play violent video games. Second, it demonstrates that such longitudinal effects occur in highly individualistic cultures with high societal levels of physical aggression and violence (the U.S.), and in more collectivistic cultures with low levels of physical aggression and violence. That both cultures yielded significant longitudinal effects of approximately the same magnitude illustrates the power of violent video games to affect children's developmental trajectories in a harmful way. These findings also contradict another popular alternative hypothesis: that only highly aggressive children (either by nature, culture or other socialization factors) will become more aggressive if repeatedly exposed to violent video games.

A third finding of importance was the trend of the longitudinal effect of video game violence to be larger in the younger samples. Of course, the younger two samples also had somewhat longer time lags and somewhat better measures of habitual exposure to video game

violence and physical aggression, so it is not clear which of these sample differences contributed to this trend. Additional studies are needed in which the same measures are used with varying ages and longer time lags.

Of course, a short lag should theoretically make finding an effect of Time 1 video game violence exposure on Time 2 aggression (controlling for Time 1 aggression) *less* likely, because aggressive behavior is generally fairly stable across time, especially across shorter time lags than longer ones (24, 25). Therefore, it may be that the long-term effects of violent media exposure on later aggression and violence will be larger with longer time lags than were used in the present samples.

The study also is limited by the fact that the measures were not identical across samples. On the other hand, this fact also demonstrates the robustness of the violent video game effect across different measures of the same conceptual variables. In this way, the use of somewhat different measures of video game habits and of physical aggression in our three samples provides conceptual replication within this one study.

Additional research also is needed to further examine underlying psychological mechanisms of longitudinal change. Although prior research suggests that exposure to violent models, in either the real world or in entertainment media, teaches a host of aggression-enhancing behavioral scripts, attitudes, and beliefs, these effects have been tested most directly in short-term studies (10, 19, 26). Similarly, future research should further investigate the characteristics of violent games that may make some less harmful than others. For example, there is some evidence from television research that a focus on the pain and suffering of the victims of violence may reduce its harmful impact, whereas glamorizing the violent actions of attractive perpetrators may increase the harmful impact (19). Measures of video game exposure that more

clearly distinguish among different types of violent video games may allow tests of these important theoretical and practical questions.

Youth violence is a public health issue in the U.S., because it accounts for so may deaths (25). Only accidental injury consistently leads homicide as the cause of death of one to twenty-four year olds. For those ten to twenty-four years old, homicide is the leading cause of death for African Americans, and the second leading cause for Hispanics. Finally, it is worth noting that in 2005, twelve to twenty year olds committed 28 percent of the single-offender and 41 percent of the multiple-offender violent crimes in the U.S., despite comprising only thirteen percent of the population (27).

Even so, such extreme violence is relatively rare in the age groups we studied (relative to milder forms of physical aggression). Thus, longitudinal studies of extreme violence will require much larger sample sizes (e.g., 25,000) and much longer time periods (e.g., 20-30 years) (12). But because physical aggressiveness in youth is one of the largest risk factors for later violence, an understanding of factors that increase (or decrease) youth aggression is vitally important if we are to understand and reduce violence in modern society. Prior experimental studies have clearly shown causal mechanisms by which violent video games can lead to long term changes in aggressive personality. Cross-sectional studies have repeatedly linked habitual video game violence to mild and severe forms of physical aggression, while ruling out plausible alternative explanations. The present study fills an import gap in the literature by confirming—with longitudinal data—prior empirical and theoretical work suggesting that frequent playing of violent video games is an important causal risk factor for youth aggression.

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Study concept and design: Anderson, Sakamoto, Gentile, Ihori, Shibuya

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Table 1. Characteristics of the three samples.

Country/Sample size	Japan/181	Japan/1050	U.S./364
Age range (years)	12-15	13-18	9-12
Measure of habitual violent video game exposure	Average frequency of playing five violent video game genres	Violence of favorite genres X weekly amount	Violence of game X play frequency, average across 3 favorite games
Physical aggression measure	6 item trait physical aggression scale	1 item, frequency of physical aggression in the last month	Index of teacher, peer & self reports; current school year time frame
Time lag between 1st & 2nd assessment	4 months	3 to 4 months	5-6 months
T_1vgv, T_2agg Effects			
Correlation (*r*)	*r* = .34	*r* = .23	*r* = .40
Odds Ratio (*OR*)	*OR* = 2.46	*OR* = 1.81	*OR* = 2.92
Longitudinal *Beta*	*B* = .139	*B* = .075	*B* = .158
Standard Error	SE = .054	SE = .027	SE = .038
95% CI	.033 to .245	.022 to .128	.084 to .232

T_1vgv = Time 1 habitual video game violence exposure. T_1agg = Time 1 physical aggression. T_2agg = Time 2 physical aggression. *B* = longitudinal path weight (beta) with sex and T_1agg controlled. SE = Standard error. CI = Confidence interval.

Table 2. Tests of different models of long term effects of habitual playing of violent video games on physical aggression assessed 3 to 6 months later, controlling for sex and earlier physical aggressiveness.

	Baseline model: 1 estimate of T_1vgv → T_2agg	Independent model: 3 estimates of T_1vgv → T_2agg	U.S. vs. Japan model: 2 estimates of T_1vgv → T_2agg	Age Model: 2 estimates of T_1vgv → T_2agg
Overall Fit: Chi-Square/*p* =	23.73 /0.164	19.91/0.224	21.07 /0.223	20.00 /0.274
Model d.f.	18	16	17	17
Chi-Square (d.f.) difference from the Baseline Model		3.82 (2) $p > 0.10$	2.66 (1) $p > 0.10$	3.73 (1) $p < 0.10$
RMSEA	.0251	.0213	.0212	.0181
NFI	.982	.985	.984	.985
CFI	.996	.997	.997	.998

T_1vgv = Time 1 video game violence exposure. T_2agg = Time 2 physical aggression. d.f. = degrees of freedom. RMSEA = Root Mean Square Error of Approximation. NFI = Normed fit index. CFI = Comparative fit index.

Figure 1. Longitudinal model of long term effects of habitual playing of violent video games on physical aggression assessed 3 to 6 months later, controlling for sex and earlier physical aggressiveness, combined across 1 U.S. and 2 Japanese samples. The two path weights for the Habitual Video Game Violence path to Time 2 Physical Aggression are for the younger/older samples (*p*s < .0001 & .01, respectively). All other paths were constrained to be equal across samples and are statistically significant at $p < .0001$. Path coefficients are standardized.