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EMPIRICAL RESEARCH

Video Games and Youth Violence: A Prospective Analysis in Adolescents

Christopher J. Ferguson

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Abstract The potential influence of violent video games on youth violence remains an issue of concern for psychologists, policymakers and the general public. Although several prospective studies of video game violence effects have been conducted, none have employed well validated measures of youth violence, nor considered video game violence effects in context with other influences on youth violence such as family environment, peer delinquency, and depressive symptoms. The current study builds upon previous research in a sample of 302 (52.3% female) mostly Hispanic youth. Results indicated that current levels of depressive symptoms were a strong predictor of serious aggression and violence across most outcome measures. Depressive symptoms also interacted with antisocial traits so that antisocial individuals with depressive symptoms were most inclined toward youth violence. Neither video game violence exposure, nor television violence exposure, were prospective predictors of serious acts of youth aggression or violence. These results are put into the context of criminological data on serious acts of violence among youth.

Keywords Computer games · Mass media · Aggression · Violence · Adolescence

Introduction

Concerns about the potential influence of violent video games on serious acts of youth aggression and violence have been debated in the general public, among policy makers and among social scientists for several decades. At present, a general consensus on video game violence effects has been elusive, with great debate occurring among scholars in this field. Some scholars have concluded that strong video game violence effects on aggression have been conclusively and causally demonstrated in wide segments of the population (e.g., Anderson et al. 2008; Anderson 2004). Others have concluded that video game violence may have only weak effects on youth aggression, or may only influence some youth, particularly those already at-risk for violence (e.g., Giumetti and Markey 2007; Kirsh 1998; Markey and Scherer 2009). Still others have concluded that video game violence effects on youth aggression are either essentially null, or that the field of video game violence studies has difficulties with methodological problems to such an extent that meaningful conclusions cannot be made about the existing research (e.g., Durkin and Barber 2002; Kutner and Olson 2008; Olson 2004; Savage and Yancey 2008; Sherry 2007; Unsworth et al. 2007). For instance, as some have noted (e.g., Olson 2004), the increased popularity of video game play among youth has been correlated with a societal reduction in youth violence rather than an increase in youth violence.

The divergence in findings may be understood as a function of methods used. As has been found for television research (Ferguson and Kilburn 2009; Savage and Yancey 2008; Paik and Comstock 1994), studies of video games that use well validated measures of aggression or violence find less evidence for harmful effects, as do studies that employ greater statistical controls for third variables

Although several prospective studies of video game effects refer to themselves as "longitudinal", none use multiple assessment periods over years that typically mark longitudinal designs. Rather they are short-term prospective studies by and large.

C. J. Ferguson (✉)
Department of Behavioral, Applied Sciences and Criminal Justice, Texas A&M International University, Laredo, TX 78045, USA
e-mail: CJFerguson1111@Aol.com

(Ferguson and Kilburn 2009). Thus, put generally, it appears that more careful controls are correlated with weaker effects, which essentially was the conclusion of Ferguson and Kilburn (2009) in their review of the research. For example, Ybarra et al. (2008) found weak bivariate correlations between video game violence exposure and youth violence. However, as indicated in their Fig. 2, these correlations vanished once other relevant factors were controlled, such as family environment and personality. Similarly, Ferguson and colleagues (Ferguson et al. 2008) found that controlling for "third" variables in a correlational study, and using a well-standardized aggression measure in an experimental design (as opposed to ad hoc unstandardized measures often used as discussed in Ferguson et al. 2008) resulted in no correlational or experimental evidence for harmful effects.

Prospective Studies of Violent Video Game Effects

At present, a small number of prospective designs have examined video game violence influences on player aggression. Thus far, results have been mixed and arguably limited by use of aggression measures that do not necessarily tap well into serious aggression or violence, nor use sophisticated controls for third or confounding variables. As such, the generalizability of existing prospective designs to behavioral outcomes of most interest, namely serious/pathological aggression and criminally violent behavior, may be limited (see Gauntlett 1995; Savage and Yancey 2008 for a discussion of aggression measure validity issues). Below, a review of prospective studies of video game violence appearing in peer-reviewed journals follows.

The first prospective study of video game violence was by Williams and Skoric (2005). This study was unusual in that it employed an experimental design, randomly assigning 213 volunteers to either play a violent on-line game *Asheron's Call 2*, or to a control group that did not play the game (none of the participants had previously played the game). Outcome measures included a scale of normative beliefs in aggression (NOBAGS) as well as a self-report measure of engaging in verbal aggression such as arguments and name calling with others. Results indicated that, controlling for previous game exposure, randomized exposure to the violent game did not influence players' normative beliefs in aggression, nor frequency of verbal altercations. However, this study has some significant weaknesses. First, the prospective period was fairly short (1 month). Second, the outcome measures are more relevant for mild or non-serious aggression (i.e., intention physical assaults were not measured) and cannot be generalized to more serious aggressive acts. Further the outcome measures related to constructs such as "normative beliefs" in aggression are among those criticized for not predicting actual aggressive behavior effectively (Savage and Yancey 2008).

Anderson et al. (2008) reported on several prospective studies, two occurring with Japanese samples and one with an American sample, all involving youth. The prospective periods in these studies ranged from 3 to 6 months. The authors found small but statistically significant prospective effects (ranging from .075 to .152, suggesting the covariance between video game violence exposure and aggression may range between .5 and 2.3% when time 1 aggression is controlled). Although the authors interpret these findings as highly significant and generalizable to serious youth violence, it is not clear how to interpret such small effects (falling mainly near or below Cohen's 1992 guidelines for trivial findings). None of these prospective results control for third variables, thus it is possible that the actual effects may even be lower than reported here. Finally, the aggression measures used in this study again fall under the category of those that have been criticized in the past for validity problems (Gauntlett 1995; Savage and Yancey 2008), particularly when generalizing to serious aggression or violence.

Shibuya et al. (2008) report a prospective study of 591 fifth-grade Japanese youth with a prospective period of 1-year. Gender and living area (urban or rural) were controlled as third variables, but other variables known to be predictive of youth violence (peer delinquency, depressive symptoms, family environment, etc.) were not. The outcome measure was trait aggression, once again not clearly well-validated as a predictor of serious youth aggression and violence (Gauntlett 1995; Savage and Yancey 2008). Interestingly in this study, time spent playing violent video games (exposure to violent games × time spent playing interaction) was related to *reduced* trait aggression ($\beta = -.15$) in boys, but had no influence on girls. Weaknesses of this study are similar to those above. Although the authors did control for gender and living area, other third variables were not controlled, nor was a well-validated measure of serious aggression employed.

Finally, Moller and Krahe (2009) provide a prospective analysis of 143 German youth with a 30 month prospective period. Outcome measures included normative beliefs about aggression (NOBAGS. similar to Williams and Skoric 2005), hostile attribution bias and a measure of trait aggression (divided into physical and relational aggression subscales). Results of this study were inconsistent. At Time 1, video game violence exposure was not related to physical aggression ($\beta = .09$, NS), but was slightly related to relational aggression (i.e., arguing, spreading rumors, similar to Williams and Skoric 2005, $\beta = .19$). In the prospective analyses, exposure to violent video games did not have direct effects on either physical aggression

($\beta = .11$, NS) or relational aggression ($\beta = .02$, NS), but did potentially indirectly influence physical aggression through a small moderating relationship with normative aggressive beliefs ($\beta = .26$). This indirect relationship was not found for relational aggression.

In summary, among existing prospective studies of video game violence on aggression, two do not find evidence of effects or (in the case of Shibuya et al. 2008) suggest violent game exposure may reduce aggression for boys. One study (Moller and Krahe 2009) finds inconsistent evidence for an indirect relationship between video game violence and physical but not relational aggression, but no evidence for direct effects, and the last finds consistent effects but of small magnitude. Arguably, across these studies, prospective analyses of video game violence effects raise little cause for alarm.

Despite whether individual prospective studies appear to support or not support causal beliefs in negative video game violence effects, these studies display several consistent flaws including the failure to consider and control for third variables (family environment, peer delinquency, etc.) and reliance on outcome measures that are not well validated as measures of pathological youth aggression and violence. To qualify in the latter category, it would be desirable for outcome measures to demonstrate high predictive validity coefficients (.3–.4 or above) with pathological outcomes. Otherwise, it is unclear if research studies are merely examining minor fluctuations in normal, even healthy levels of aggression (see Hawley and Vaughn 2003). The intent here is not to be overly critical of the above studies, it is merely to argue that much remains to be known about the prospective influences of violent video games on *pathological* aggression.

Three Theoretical Views of the Video Game Violence/Serious Aggression Relationship

There are three basic views of the potential relationship between video game violence exposure and serious aggressive behavior among youth. Quite simply, these are: first, video game violence exposure has a learning-based causal influence on subsequent serious aggression; second, individuals with high levels of a priori aggression are subsequently drawn to video game violence or; third that any correlation between the video game playing and aggression is due to underlying third variables. Each of these views present different hypotheses for the ways in which video game violence and serious aggression/youth violence relate.

The "causal" view, namely that video game violence exposure causes subsequent serious aggression in players, has roots in Bandura's social learning experiments in which children modeled aggressive behavior of adults in experimental videos (e.g., Bandura et al. 1961, 1963), although elements of the same view can be traced back at least to the Payne Fund studies of movie violence (Blummer 1933) or even Plato's concerns that Greek plays would cause rebelliousness and licentiousness in youth who watched them (Griswold 2004). As noted above, much of the debate on video game violence focuses on whether this theoretical perspective is "true." Proponents of this view tend to express considerable certitude (e.g., Anderson 2004; Huesmann 2007) where as detractors suggest that existing evidence is not sufficient to support this view (Cumberbatch 2008; Mitrofan et al. 2009; Olson 2004; Savage and Yancey 2008) or suggest the causal view relies on outdated tabula rasa theories (Pinker 2002).

The second view, that a priori aggression leads to extensive video game violence use, is most often offered as a counterargument by skeptical scholars (e.g., Freedman 2002; Gauntlett 1995) to the causal view. However, this basic position is likely consistent with both social and biological theories that emphasize influences more proximal to youth than media effects, such as family environment, peer influences and evolutionary and biological influences (e.g., Beaver et al. 2007, 2009; Buss and Shackelford 1997; Pinker 2002). Similarly, research has indicated that exposure to and selection of different forms of media is not a passive process but that individuals actively seek out certain forms of media and these preferences are correlated with pre-existing personality profiles (e.g., McCown et al. 1997; Rentfrow and Gosling 2003). In relation to video game violence, two models have emerged that typify this view to varying degrees. First the "catalyst" model developed by Ferguson et al. (2008) suggests that serious aggression and violence results from a combination of genetic and proximal environmental influences (such as family and peers) but that distal environmental factors such as media, have little influence on behavior. Patrick Markey (Giumetti and Markey 2007; Markey and Scherer 2009) has developed a somewhat different view in which a priori personality traits such as psychoticism interact with violent video game exposure to produce serious aggression.

Finally, it could be argued that video game violence use and serious aggression have little real influence on each other. Some correlation between aggression and video game violence use may exist, but such correlations are expected to be rather small in size, and due to underlying third variables rather than any direct relationship between aggression and video game violence. For example, boys play more violent video games and are more inclined toward aggressive and violent behavior than girls. As such, gender is an obvious and important "third" variable, although one still overlooked in some studies. Similarly, aggressive or antisocial personality traits may direct individuals to be more inclined to violent games and violent

behavior. Peer and family influences may have a similar impact, and individuals with certain mental health problems may be both more inclined toward aggression and seek violent games as a form of cathartic release (Olson 2010). This perspective appears to be endorsed by research indicating that video game use, including the use of violent games, is widespread among even non-violent youth, particularly boys (e.g., Lenhart et al. 2008; Kutner and Olson 2008; Olson et al. 2007). It is important to note that temporal sequencing cannot rule out this possibility. For instance, maturational processes that lead to increased violent video game use in early childhood may not necessarily produce increased aggression until later in adolescence. Thus, the temporal sequence of video game violence use and the emergence of aggression, even if correlated, does not rule out the influence of third variables.

The Current Study

The current study intends to improve upon past designs in several ways. First, the present study will focus to a much greater extent on clinical and criminological measures that are well validated as outcome measures for pathological, serious aggression and rule-breaking (i.e., parent and youth report versions of the Child Behavior Checklist; CBCL), bullying other children (the Olweus Bullying Questionnaire; OBQ) and criminologically violent behavior (Negative Life Events, NLE). A focus on these clinical and criminological outcome measures will help illuminate the potential impact of violent game exposure on serious levels of aggression and violent crime among youth. Second, most previous prospective studies have employed only basic controls and have not considered the potential influence of third variables.

Several hypotheses will be tested in the current article. First, it is hypothesized that exposure to violent content in video games will be consistent across time (H1). Second, the frequency of exposure to violent content in video games at Time 1 will predict serious aggressive behavior across outcome measures 1-year later once third variables have been controlled (H2). Third, aggression level (composite across aggression measures) at Time 1 will be predictive of video games exposure at Time 2 (H3).

As a note, H2 and H3 essentially are opposing perspectives, both presented in the affirmative. Finding evidence for H2 but not H3 would support the overarching theory that video game violence exposure comes first in the temporal pattern, where as finding evidence for H3 but not H2 would suggest that aggressive tendencies come first in the temporal sequence. Finding support for H2 and H3 would suggest the relationship is bidirectional, whereas finding evidence for neither H2 nor H3 would suggest that the interaction between violent video game exposure and aggression is limited (meaning that children's choice to play violent video games is not dependent upon their aggressiveness nor vice versa).

Methods

Participants

Participants in the current study were recruited from a prior study of youth violence (Ferguson et al. 2009). This study examined cross section data on correlates of youth violence in a sample of 603 mainly Hispanic youth. Results from this study indicated that depressive symptoms and peer delinquency were the best predictors of concurrent aggression and violence, as were antisocial traits and parental psychological aggression. Video game and television violence were not strong correlates of youth violence. The present study presents prospective data not included in the prior study, thus there is no resubmission of prior existing data (i.e., data presented here do not overlap with that presented in the previous study). 536 children (89%) from the original sample volunteered to participate in this prospective design at Time 1 (T1). As with the discussion of the T2 dropout below, the sample who volunteered for the prospective study did not systematically differ from those who did not. As this sample was drawn from a small Hispanic-majority city population on the border of Mexico, this sample of youth were almost all (519; 96.8%) Hispanic. Proportions of Caucasian, African American, Asian American and other ethnic groups were all at 1% or less. This ethnic composition is consistent with the ethnic composition of the city from which the sample was drawn and represents a "convenience" sample, meaning that Hispanics were not specifically recruited for a theoretical reason. However, to date, no prospective (and few cross sectional or experimental) studies of video game violence have considered Hispanic majority samples. As such, examining such a sample may help generalize this research to ethnic groups beyond Causasians and Japanese. All participants were between the ages of 10 and 14 at T1 ($M = 12.34$, SD = 1.33) as this age was viewed as that likely to see high rates of video game play (Griffiths and Hunt 1995; Lenhart et al. 2008; Olson et al. 2007) yet young enough that developmental processes may still be strong and easily observable. About an equal number of boys (275, 51.3%) and girls (261, 48.7%) were included in the study. Children included in this study were from the general community, not specifically at-risk children for serious aggression.

Recruitment

Recruitment of a representative community sample of youth was obtained using a modified multimethod "snowball" approach. Snowball sampling, like other forms of non-random sampling, is not without the potential for certain kinds of biases. At the same time snowball sampling has been shown to be an effective sampling approach under most conditions and is better at detecting "hidden populations" as may be the case with violent youth, than are institutional sampling techniques (Goodman 1961; Salganik and Heckathorn 2002). In snowball sampling, respondents for a sample are drawn from associates nominated by an initial group of study participants. Several variations on this approach were used in this study in an attempt to achieve as representative a sample as possible. First an approach similar to that used by McCrae et al. (2002) in which college students at a local university nominated relatives or associates within the targeted age range for inclusion in exchange for extra credit, was employed. Second, several community social organizations were approached for nominations of children to be included in the study. Third, the study was advertised in the local newspaper and on several popular local FM radio stations (catering to both English and Spanish language music), including interviews between the DJ and lead investigator on several radio stations during prime (i.e., morning traffic) listening hours. These interviews were very brief, requesting participants for a study of "youth health." No discussion of video games or youth violence took place during any of these media appeals. Families were encouraged to nominate themselves for the study. No compensation was offered for participation.

Analysis of T2 Nonresponse/Drop-Out

All participants who volunteered at T1 were contacted again approximately 12 months later for the Time 2 (T2) assessment. T2 assessments were conducted via phone interview with a trained research assistant using a standardized scripted interview comprised mainly of items taken from the outcome assessments (CBCL, OBS, NLE) and video game use. At T2 302 children and their families completed the follow up assessment representing a completion rate of 56%. This figure is reasonably representative of dropout rates typical in prospective studies although at greater issue is whether drop-out is selective or random (Wolke et al. 2009). In particular, were children with greater rates of serious aggression or violent behaviors to drop from the study than children without these problem behaviors, results obtained in this study would potentially be confounded. To examine for this potential t-test comparisons on all outcome variables (CBCL parent and child report, OBQ, NLE violent and non-violent crime subscales, all of which are described below) were conducted. All t-test comparisons were non-significant ($p > .05$) lending confidence to the conclusion that drop-out in this study was random rather than selective. Gender (52.3% female), age and ethnicity composition of the final T2 sample of 302 children was essentially identical in proportion to that reported above for the T1 original sample. Given that the local city includes a fairly high proportion of both migrant workers and transient government employees (e.g., Border Patrol, FBI. DEA. etc.,), some degree of dropout was expected. Retention rates for the current study reflect the general pattern from other prospective studies of video game violence. Williams and Skoric (2005) report a retention rate of approximately 75% at 3 months, Shibuya et al. (2008) report a retention rate of 62% at 1-year, whereas Moller and Krahe (2009) report a retention rate of 48% at 30 months. Anderson et al. (2008) do not report retention rates.

Measures

With exceptions noted below, all materials used Likert-scale items and demonstrate psychometric properties suitable for use in multiple regression and path analyses. All measures were included in the T1 assessment. For the T2 follow up, only the media exposure, depressive symptoms and outcome variables were reassessed. Alphas reported are for T1; T2 alphas did not differ greatly.

Media Violence Questionnaire

Child participants were asked to list their 3 favorite television shows and video games and estimate how often they play or view the media in question. Many media studies in the past asked respondents to rate violence levels in media they watched, although this runs the risk of variable estimates between respondents. In the current study, I took a slightly different approach, using existing Entertainment Software Ratings Board (ESRB) video game ratings as an estimate of video game violence exposure. ESRB ratings were obtained for each game reported by the respondent, and ordinally coded (a maximal score of 6 for "Adults Only," 5 for "Mature," 4 for "Teen," etc.). This ordinal coding system was designed to correspond to the levels of the ESRB rating system. The ESRB system has been supported by the Federal Trade Commission (2009) and the Parent Teacher Association (2008) as effective and reliable.

Many factors go into an ESRB rating, including language, sexual content, and use of (or reference to) drugs or gambling. However, among those factors that determine the age-based rating, violence appears to take priority. Of

the 30 "content descriptors" that accompany ratings, ten concern violence. Descriptors of listed games were reviewed to ensure that high ratings had not been obtained primarily for sexual content; this was not the case for any of the games reported by youth. The ESRB rating system was also tested by pulling a random sample of ten commercially available games (Lego Star Wars II: The Original Trilogy, Call of Duty 4, F.E.A.R., Bioshock, Race Pro, Baja: Edge of Control, Sonic Unleashed, Spiderman 3, Silent Hill: Homecoming. Lego Indiana Jones). Each of the games were played (for approximately 45 min each) by two independent student RAs (one male, one female, neither heavy gamers). The RAs had not played any of the games previously, and was not aware of the ESRB ratings for each game. The RAs were provided with and trained on a standardized 5-point violence assessment ranking system and asked to code each game on this system after playing. Each RA was alone while playing and ranking the games and did not know of each others' ratings. Interrater reliability was high (kappa = .95). The RAs' rankings, which focused exclusively on violence, were then correlated with the categorical ESRB ratings for each game. The correlation between the mean RA rankings and the ESRB ratings was .98, providing external evidence for validity of the ESRB ratings as estimates of violent content.

The ESRB ratings were multiplied against the respondents' reported time spent playing each game then summed across the 3 games listed. For television ratings a similar approach was employed using the TV Parental Guidelines System (PGS; i.e., TV-Y through TV-MA). As with the video game ratings, the television ratings were checked for violent content using the external check process described above. The sampled television shows were Wizards of Waverly Place, Hannah Montana, Spongebob Squarepants, South Park, Zoey 101, Heroes, CSI, Chowder, WWE Superstars and Robot Chicken, all shows reported by youth in our current database as among those watched. Interrater reliability between the RAs for rating violent content in the shows was kappa = .88. The correlation between the mean RA rating and the PGS was .89, lending evidence to the validity of using the PGS system as an estimate of violent content in television shows.

This general approach has been used with success in the past (Olson et al. 2009). As with all attempts to assess game or television content exposure, this is only an estimate; however, it removes some of the subjectivity inherent in previous methods.

Negative Life Events

The Negative Life Events instrument is a commonly used and well validated measure of youth behaviors used in criminological research (NLE; Paternoster and Mazerolle 1994) and includes the following scales used in this study as third variables:

1. *Neighborhood problems* (e.g., How much of a problem are each of the following in your neighborhood? Vandalism, traffic, burglaries, etc.; alpha in current sample = .86).
2. *Negative relations with adults* (e.g., My parents think I break rules, My parents think I get in trouble, etc.; alpha = .95)
3. *Antisocial personality* (e.g., It's important to be honest with your parents, even if they become upset or you get punished, To stay out of trouble, it is sometimes necessary to lie to teachers, etc.; alpha = .70)
4. *Family attachment* (e.g., On average, how many afternoons during the school week, from the end of school or work to dinner, have you spent talking, working, or playing with your family, etc.; alpha = .86)
5. *Delinquent peers* (e.g., How many of your close friends purposely damaged or destroyed property that did not belong to them, etc.; alpha = .84).

This measure tapped multiple constructs related to family, peer and school environment as well as delinquent behavior and beliefs. Scales described here are used as predictor third variables, although two scales (violent crimes and non-violent crimes) related to delinquent behaviors (described below) function as outcome variables. There are no item overlaps between subscales.

Family Environment

The Family Environment Scale (FES; Moos and Moos 2002) is a 90-item true–false measure designed to assess styles of family interaction and communication. Research on this instrument has demonstrated good internal consistency and test–retest reliability, as well as validity in distinguishing between functional families and families experiencing a variety of dysfunctions including psychiatric and substance abuse problems and physical abuse. The family conflict subscale (alpha = .57) was used in the current project. Sample items include "We fight a lot in our family" and "Family members sometimes get so angry they throw things."

Family Violence

The child's primary guardian was asked to fill out the Conflict Tactics Scale (CTS; Straus et al. 2003), a measure of positive and negative behaviors occurring in marital or dating relationships. The CTS has been shown to have good reliability and corresponds well to incidents of dating and family violence. It is used here to get a measure of conflict and aggression occurring between the primary

caregiver and their spouse or romantic partners and thus a sense of the child's exposure to domestic violence. Subscales related to physical assaults (e.g., "I beat up my partner"; "I pushed or shoved my partner"; alpha = .88) and psychological aggression ("I insulted or swore at my partner"; "I called my partner fat or ugly"; alpha = .81) were used in the current study. The physical assaults subscale was found to have a significantly skewed distribution and a square-root transformation was conducted to produce a normalized distribution.

Depressive Symptoms

The withdrawal/depression scale of the *Child Behavior Checklist Youth Self-Report* (YSR; Achenbach and Rescorla 2001) indicated child depressive symptoms. This scale has no item overlaps with the aggression/rule breaking scales described below. Depressive symptoms were reassessed at T2 and this variable, current depressive symptoms, is used in the regression equations described below. Coefficient alpha of the scale with the current sample was .80. Sample items include "I feel sad" and "I would rather be alone."

Serious Aggression

Regarding mental health, youth and their primary caregivers filled out the *Child Behavior Checklist* (CBCL, Achenbach and Rescorla 2001). The CBCL consists of a youth self-report and parent report on problematic behaviors which may represent psychopathology. The CBCL is a well researched and validated tool for measuring behavioral problems in children and adolescents. Research indicates the CBCL is highly valid in diagnosing serious externalizing behavior problems in children including conduct disorder (Hudziak et al. 2004; Tackett et al. 2003). Caregivers filled out the parental version of the CBCL, whereas children filled out the YSR on themselves. These indices were used to indicate outcomes related to delinquency and aggressiveness. All alphas with the current sample were above .70. Sample items for the aggression scale (from the child prospective, parents items are simply reworded) include "I attack people" and "I threaten others" and for the rule breaking scale "I lie or cheat" and "I skip school."

Bullying

The Olweus Bullying Questionnaire (OBQ; Olweus 1996) was used to measure bullying behaviors in the current study. This measure is commonly used and well researched with high reliability and validity reported. With the current sample, alpha was .83. Sample items include "In the past month I have called another kid "stupid, fat, ugly" or other mean names" and "In the past month I have Forced another kid to do something they didn't want to do."

Delinquent Behavior

The NLE questionnaire, described above has a subscale related to *general delinquency* (e.g., How many times in the following year have you stolen something worth more than $50, etc.). The *general delinquency* scale can be further divided into non-violent (alpha = .96) and violent (alpha = .98) criminal activities. As indicated above, these scales are widely used in criminological research and do not overlap in items with the third variable predictor scales described above.

Statistical Analyses

Main analyses consisted of hierarchical multiple regression equations. Separate hierarchical multiple regressions were run for each of the outcome measures related to pathological aggression (parent and child versions of the CBCL aggression and rule-breaking scales, violent and non-violent crime commission as reported on the NLE, and bullying behavior). In each case, gender, depressive symptoms and T1 pretest score for the specific scale were entered on the first step, NLE variables (neighborhood, negative adult relationships, antisocial personality, family attachment and delinquent peers) were entered on the second step, the FES conflict scale was entered on the third step, CTS psychological aggression and physical assault were entered on the fourth step and television and video game violence exposure entered on the fifth step. Lastly, interaction terms between antisocial traits and depressive symptoms and media violence exposure (a composite of television and video games) were included on the final step. The antisocial, depressive symptoms and media violence terms were first centered before creating the interaction terms to avoid multicollinearity. This hierarchy was designed theoretically to extend from most proximal variables outward (e.g., Bronfenbrenner 1979). Out of concern that placing video game violence exposure in the last step may artificially reduce the predictive value of this variable on youth aggression, each regression equation was then rerun with video game violence exposure included as a step 1 variable. Multicollinearity was examined using tolerance and VIF statistics and found to be acceptable in all cases. Highest VIF values were 1.9, and lowest tolerance values were .54, which fall within most recommended acceptable guidelines (Keith 2006). Secondary analyses involved the use of path analysis to test alternate causal models regarding the development of pathological youth

aggression as well as temporal relationships between video game violence exposure and youth violence outcomes.

Power Analysis

A post-hoc power analysis was conducted to examine the sensitivity of the current design and sample to pick up small effects. Results indicated that the current design is capable of detecting effects as statistically significant at or just below the $r = .14$ level, close to Cohen's threshold for trivial effects (Cohen 1992).

Results

Prevalence of Violent Game Exposure and Criminal Activity

At T2 75% of children reported playing some video games on computer, console or other devices in the preceding month. 40.4% of children reported playing games with violent content as indicated by their own self-ratings of violence in games. Using the ESRB ratings, 20.9% reported playing an M-rated game in the preceding month. Consistent with past research (Griffiths and Hunt 1995; Olson et al. 2007), boys were more likely to play violent video games than girls [$t(234) = 6.65$, $p \leq .001$, $r = .40$, $.30 \leq r \leq .49$]. Video game violence exposure was not correlated with age of the child $r = .02$, nor reported GPA of the child ($r = -.02$), nor did hours spent playing video games predict GPA ($r = -.09$).

As for criminal activity, at T2 22 children (7.3%) reported engaging in at least one criminally violent act over the previous 12 months based specifically on the results from the NLE. Most common violent crimes were physical assaults on other students and strong-arm robbery (i.e., using physical force to take an object or money from another person). Regarding non-violent crimes, 52 (19.2%) of children reported engaging in at least one non-violent crime over the past 12 months based on the NLE. Most common non-violent crimes include thefts of small objects (i.e., shoplifting) and thefts occurring on school property. The commission of violent and non-violent crimes was highly correlated ($r = .51$, $p \leq .01$, $.42 \leq r \leq .59$).

Consistency Among Parent and Child Reports of Aggression on the CBCL and YSR

One intended strength of the current research design is that it includes both parent and child report based outcome assessments. Consistency between child and parent report on the CBCL/YSR rule-breaking scales was $r = .57$ ($.49 \leq r \leq .64$), and for aggressive behavior, $r = .52$ ($.43 \leq r \leq .60$). Paired samples t-tests indicated that children tended to report both higher levels of rule-breaking [$t(301) = 8.16$, $r = .43$, $.34 \leq r \leq .52$] and aggression [$t(301) = 6.62$, $r = .36$, $.26 \leq r \leq .46$]. Taken together, these results suggest that parents have a good idea of the "gist" of how problematic the behavior of their children is relative to other children, but generally are unaware of the full scope of children's behavior problems.

Consistency in Video Game Violence Exposure Over Time (H1)

Table 1 presents bivariate correlations between video game violence exposure at time 1 and time 2.

Video game violence exposure at T1 was significantly correlated with video game violence exposure at T2 ($r = .33$, $p \leq .01$, $.23 \leq r \leq .43$); however, the effect size was small, allowing a considerable amount of variance across time in video game violence exposure, probably as children put away older games and pick up news games that are different in genre and violence content.

Long-Term Relationships Between Aggression and Video Game Violence Exposure (H2, H3)

Bivariate Correlations Between Video Game Violence Exposure at T1 and Violence and Aggression Related Outcomes

Table 1 presents bivariate correlations between video game violence exposure at T1 and aggression related outcomes at T1 and T2. A Bonferroni correction due to multiple comparisons of $p = .004$ was applied. As can be seen, bivariate correlations between T1 video game violence exposure were significant only for bullying at T1, and T2, but not for the other six outcome variables. Those results that were significant were still small in size with none reaching $r = .2$.

Table 1 T1 Video game violence bivariate correlations with aggression and violence related outcomes at T1 and T2

Outcome variable	Time 1 outcome	Time 2 outcome
CBCL rule breaking (parent report)	.05	.05
YSR rule breaking (child report)	.12	.10
CBCL aggression (parent report)	.06	.01
YSR aggression (child report)	.12	.06
OBQ	.18*	.18*
NLE violent crimes	.06	.09
NLE non-violent crimes	.03	.07

* $p \leq .004$

Prospective Hierarchical Multiple Regressions (H2)

Seven sets of hierarchical multiple regressions were run with the steps described above in the procedure section. These results are presented in Table 2. Steps in the hierarchical model are broken down by double solid lines in the Table, with delta R^2 reported at each step. Standardized regression coefficients (beta-weights) presented are for the final model in each case, as all model steps were statistically significant. A representation of the depressive symptoms/antisocial personality interaction (using a composite of the aggression/violence/bullying measures) is provided in Fig. 1. Both variables were split into four categories (i.e., "quartiles") based on mean and standard deviation scores to make visualization easier; however, it should be clearly stated that continuous scores were used in the regression model. Quartiles based on means and standard deviations were viewed as more clinically meaningful than percentile splits. As can be seen, the influence of depressive symptoms on violence was most severe for individuals with preexisting antisocial personality traits. In each case, reversing the step on which the video game violence variable was entered did not influence results.

For the child-report aggression YSR outcome variable, current level of depressive symptoms predicted aggressiveness and this was a strong predictor ($\beta = .66$) of T2 aggression as was the interaction between antisocial traits and depressive symptoms ($\beta = .15$). Video game violence exposure was not predictive of T2 aggression.

For the child-report rule-breaking YSR outcome variable, current level of depressive symptoms predicted rule breaking and this was a strong predictor ($\beta = .62$) of T2 rule breaking whereas peer delinquency at T1 was a significant but weaker predictor ($\beta = .12$) as was the antisocial/depressive symptoms interaction ($\beta = .12$). Video game violence exposure was not predictive of T2 rule-breaking.

For the parent-report aggression CBCL outcome variable, T1 CBCL aggression ($\beta = .22$), current depressive symptoms ($\beta = .54$), the antisocial/depressive symptoms interaction ($\beta = .14$) and parental level of psychological abuse in relationships ($\beta = .15$) were all predictive of T2 aggression. Video game violence exposure was not predictive of T2 aggression.

For the parent-report rule-breaking CBCL outcome variable, T1 CBCL rule breaking ($\beta = .20$), current depressive symptoms ($\beta = .52$), and parental level of psychological abuse in relationships ($\beta = .15$) were all predictive of T2 rule-breaking. Video game violence exposure was not predictive of T2 rule-breaking.

For NLE non-violent crimes at T2, T1 commission of nonviolent crimes ($\beta = .26$) was significant predictive of T2 commission on non-violent crimes as was the interaction of antisocial traits and depressive symptoms ($\beta = .12$) and between antisocial traits and media violence ($\beta = .18$). An examination of this latter interaction suggested that individuals who were low in antisocial traits, but who were exposed to more violent media committed fewer non violent crimes than their peers. However, the most antisocial youth who also consumed the most violent media committed more non-violent crimes than their peers. Direct video game violence exposure was not predictive of T2 non-violent criminal behavior.

For NLE violent crimes at T2, attachment to family at T1 served as a protective factor ($\beta = -.15$) at T2, whereas the interaction between antisocial traits and depressive symptoms ($\beta = .17$) and between antisocial traits and media violence ($\beta = .14$). An examination of this latter interaction suggested that individuals who were low in antisocial traits, but who were exposed to more violent media committed fewer violent crimes than their peers. However, the most antisocial youth who also consumed the most violent media committed more violent crimes than their peers. No other variables were significant predictors of T2 violent criminal behavior. Video game violence exposure was not predictive of T2 violent criminal behavior.

For the OBQ at T2, only current depressive symptoms ($\beta = .32$) and T1 antisocial personality ($\beta = .12$) were significant predictors. Video game violence exposure was not predictive of T2 bullying behavior.

The above regressions were rerun with T1 depressive symptoms replacing current (T2) depressive symptoms on step 1. T1 depressive symptoms did not prove to be predictive of T2 aggressive or violent outcomes in any of the equations. As such, current depressive symptoms rather than a past history of depressive symptoms is most predictive of violent outcomes. In each of these regressions with T1 depressive symptoms, T1 violent video game exposure remained non-significant as a predictor of T2 aggression and violence outcomes.

Prospective Video Game Violence Analysis (H3)

To examine the temporal sequence between aggression and video game violence use, a hierarchical multiple regression was run with video game violence use at T2 as the dependent variable. Ordering of variables was the same as described for the regressions above, with the exception that video game violence exposure at T1 was entered on step 1 (just as aggression T1 variables were included on step 1 for the aggression regressions). T1 aggression was entered along with T1 television violence exposure on step 5 (this gave T1 aggression the same positioning in this regression as T1 video game exposure had in the aggression regressions). In order to avoid multicollinearity, a composite

Table 2 Multiple regression results for multiple measures of pathological youth aggression at T2

Predictor variable	YSRac	YSRrbc	CBCL ap	CBCLrbp	NVCrime	VCrime	Bully
Male gender	.04	.07	−.01	−.06	−.02	.05	−.06
T2 depressive symptoms	.66 (.59, .73)*	.62 (.55, .69)*	.54 (.46, .61)*	.52 (.43, .60)*	.03	.07	.32 (.22, .42)*
Pretest score	.11	.10	.22 (.11, .33)*	.20 (.09, .30)*	.26 (.15, .37)*	.01	.09
ΔR^2	*.41**	*.38**	*.35**	*.31**	*.07**	*.01*	*.13**
Neighborhood problems	.05	−.02	.03	.00	.07	−.03	.07
Neg. rel. with adults	.04	−.02	.05	.05	−.01	.08	.03
Antisocial personality	.08	.09	.00	.02	−.04	−.01	.12 (.04, .21)*
Family attachment	.06	.04	.04	.01	.00	−.15 (−.07, −.24)*	.10
Delinquent peers	.08	.12 (.04, .21)*	−.04	.06	.06	.04	.07
ΔR^2	*.03**	*.02*	*.01*	*.01*	*.01*	*.04*	*.03*
FES conflict	−.07	−.5	.01	.03	.03	.03	−.06
ΔR^2	*.01*	*.00*	*.00*	*.00*	*.00*	*.00*	*.00*
CTS psychological agg.	−.01	−.03	.15 (.07, .24)*	.15 (.07, .24)*	−.12	.08	−.10
CTS physical abuse	−.02	−.04	.04	−.09	−.04	.06	
ΔR^2	*.00*	*.00*	*.03**	*.02**	*.02*	*.01*	*.01*
Television violence	.04	.07	−.04	−.09	−.04	−.08	.05
Video game violence	−.03	−.01	−.01	.09	.07	.07	.12
ΔR^2	*.00*	*.01*	*.00*	*.01*	*.00*	*.00*	*.02*
Antisocial/DS int.	.15 (.07, .24)*	.12 (.04, .21)*	14 (.06, .23)*	.08	.12 (.04, .21)*	.17 (.08, .28)*	.05
Antisocial/media int.	.01	−.02	.06	.02	.18 (.09, .29)*	.14 (.06, .23)*	.03
ΔR^2	*.02**	*.01*	*.02**	*.01*	*.04**	*.04**	*.01*

Numbers in parentheses represent 95% confidence interval for standardized regression coefficients. Confidence intervals included only for significant results. Pretest score = T1 score for the specific outcome measure. Italicized values represent steps in the regression model. Adjusted R^2 is reported for each step in the hierarchical models

YSRac youth self report, aggression, child, *YSRrbc* youth self report, rule breaking, child, *CBCLap* child behavior checklist, aggression, parent, *CBCLrbp* child behavior checklist, rule breaking, parent, *NVCrime* non violent crime, NLE, *VCrime* violent crime, NLE, *Bully* Olweus Bullying Questionnaire, *DS* depressive symptoms

* Statistical significance

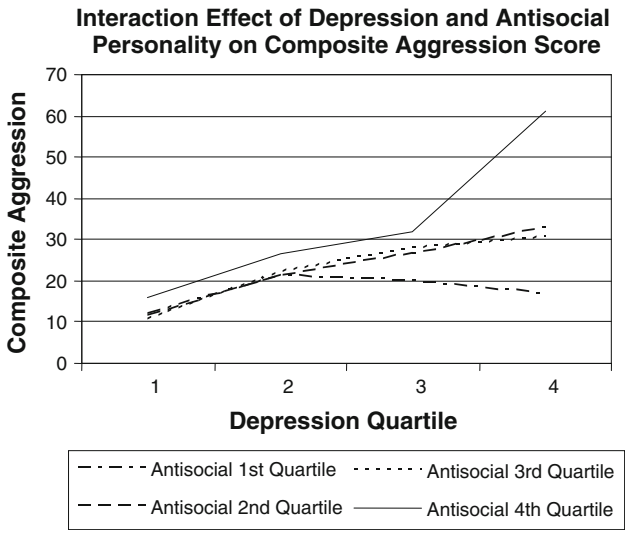

Fig. 1 Depressive symptoms/antisocial interaction

aggression measure was created from the sum of the seven individual aggression measures. This composite measure showed high consistency (alpha = .81). The resulting regression equation was statistically significant [$F(15,250) = 6.20$, $R = .52$, adj $R^2 = .23$] through the last step. Male gender ($\beta = .31$, $.20 \leq r \leq .41$), current (T2) level of depressive symptoms ($\beta = .30$, $.19 \leq r \leq .40$) and T1 video game use ($\beta = .16$, $.05 \leq r \leq .27$) were all significant predictors of T2 video game use. Aggressive behavior at T1 was not predictive of video game use at T2. Adding aggression to step 1 rather than step 5 of the regression did not change the outcome.

Path Analysis of Temporal Sequencing of Video Game Violence Exposure and Aggression (H2, H3)

Path analysis can be used to test the temporal sequence of video game violence exposure and aggressive behavior, using each variable and T1 and T2. If video game violence exposure at T1 is predictive of aggression at T2, but aggression at T1 is not predictive of video game violence exposure at T2 this lends support to causal beliefs that video game violence exposure leads to subsequent aggression as the alternative hypothesis (that aggression leads to subsequent video game violence use) is ruled out (however the data remains correlational, and alternate explanations based on third variables cannot be ruled out).

The basic path analysis was based on that used by Moller and Krahe (2009), and is represented in Fig. 2. Using path analysis, goodness of fit can be evaluated both through a non-significant chi-squared analysis, as well as by several goodness of fit indices such as the "Adjusted Goodness of Fit Index" or root mean squared error of approximation (RMSEA).

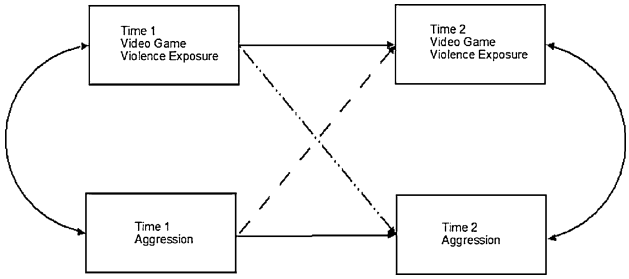

Fig. 2 Initial time sequenced path model

Separate path analyses were run with T1 video game exposure leading to T2 aggression and T1 aggression leading to T2 video game exposure (these paths are represented by the divided arrows in Fig. 2). Aggression was measured by the T1 and T2 composite measures described above. Neither of these proved to be good fits to the data, nor did a combined path analysis with T1 aggression and video game violence exposure both leading to T2 aggression and video game violence exposure.

Next, a path model was developed based on the regression results with aggression pre-score, current depressive symptoms, and the antisocial/depressive symptoms interaction each functioning as separate, direct contributors to the composite youth aggression measure at T2. Although close to the criteria described above, this model did not prove a good fit. Antisocial personality traits were then added to the model as a contributor to T1 aggression. This model proved to be a good fit to the data [$\chi^2(6) = 23.8$, $p \geq .05$, NFI = .91, CFI = .92, RMSEA = .09] and is presented in Fig. 3.

Discussion

The issue of video game violence exposure remains a pressing one in Western society. The US State of California, as well as nations ranging from Australia and Switzerland to China and Venezuela, are considering efforts to restrict youth access to violent video games. As of yet, the empirical understanding of the long-term influences of video games on youth violence remain murky. Although several short-term prospective studies of youth violence have been published (Anderson et al. 2008; Moller and Krahe 2009; Shibuya et al. 2008; Williams and Skoric 2005), these have been inconsistent in results and have been limited by the low clinical validity of the aggression/violence measures used, and paucity of statistical controls for other relevant variables. The current study represents the first prospective study to employ well-validated clinical measures of aggression and violence, and to control carefully for a number of other relevant factors that may influence youth violence.

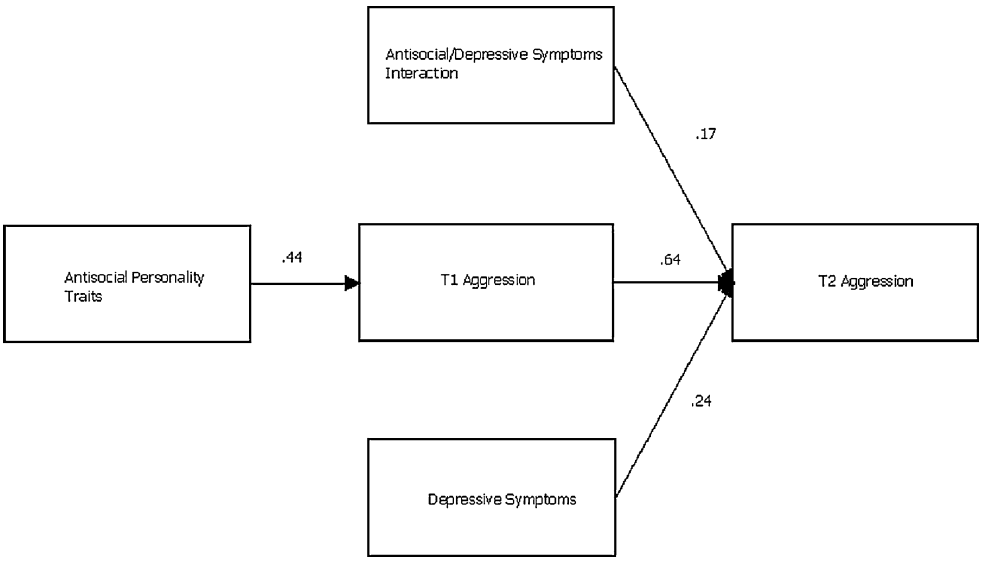

Fig. 3 Final "good fit" path model

Several important conclusions can be made from the current study. First, hypothesis H1, that video game use would be consistent over time, was moderately supported by the current data with a stability coefficient at 1 year of $r = .33$, as indicated in the bivariate correlations. This indicates moderate stability in video game violence exposure over time, but this stability coefficient is far smaller, for instance, than that seen in personality research (McCrae et al. 2002). This suggests that children's video game genre selection may be reasonably variable over time.

Relevant to H2, that video game violence exposure at T1 would prospectively predict serious acts of aggression at T2, no evidence was found to support this hypothesis either in the regression analyses for the seven outcome measures, or for the path analysis using the composite aggression score. No evidence across any of the outcome measures supported H2. This remained true whether video game violence exposure was entered on step 1 or step 5 of the hierarchical multiple regressions. It would be reasonable to express the concern that, despite a reasonable level of power in the current analysis, small effects might have been missed. However, with the exception of bullying ($\beta = .12$), all of the effects for video game violence exposure were at or below Cohen's (1992) suggested threshold of $r = .10$ for trivial effects (the effect for bullying nonetheless fell below Ferguson's 2009 recommendations for interpretation of practical significance). The effect for bullying was slightly larger than for other outcomes. It is important not to overinterpret this, as the bullying finding remained non-significant and very small in effect size. Nonetheless, it may be simply that less serious forms of aggression show slightly higher relations with video game violence than do more serious forms of aggression, an observation made previously in the literature (Ferguson and Kilburn 2009).

It appears reasonable to conclude that, in the current sample, little evidence supported a significant predictive relationship between violent video game exposure and serious user aggression. Results of the current study are, in fact, not out of league with previous prospective studies, all of which have found only small effects (hovering on either side of $r = .10$) of video game violence on subsequent aggression. What seems to vary between reports is the language used in interpreting these effects ranging from attempts to generalize findings to serious acts of youth violence (Anderson et al. 2008) to the conclusion that such small effects effectively represent null findings (Williams and Skoric 2005). It may be prudent for scholars to be more temperate and conservative in their interpretations in the future, particularly where effect sizes have tended to be generally weak.

In the current study, results by and large are at or below $r = .10$ with confidence intervals that, as such, cross the zero mark and thus, irrespective of statistical significance, do not provide support for H2. It may be argued that some scholars have, in the past, been overzealous in arguing for strong, consistent and general effects, when evidence backing such conclusions is limited (see Sherry 2007 for a similar conclusion). The current study, however, is the first prospective study to carefully examine pathological/serious youth aggression and violent behavior using well validated clinical measures. Thus, generalizability to serious youth aggression is more possible with the current study than with those previously mentioned.

For criminal behaviors (both violent and non-violent), although no direct effects of video games or television violence were seen, total media violence consumption interacted with antisocial traits. Interestingly, for children with low antisocial traits, media violence exposure was associated with less criminal behavior. Only for the most

antisocial children was media violence exposure associated with more violent crimes. There are two possible explanations for this phenomenon. First, antisocial children who are most inclined toward criminal behavior may also be those most likely to select violent media. This is the explanation favored by Ferguson et al. (2008) based on similar findings as well as by Kutner and Olson (2008). However, Giumetti and Markey (2007) alternatively suggest that, although violent video games are harmless for the vast majority of children, for those with preexisting high antisocial traits, video game violence may exacerbate these traits. More data is needed to ascertain which of these possibilities is correct. These findings also should be tempered by their small effect size and the fact that the media interaction term was not a good fit for the path analysis.

Related to H3, that a priori aggressiveness predicts T2 video game use, no greater support for this view was found in either the regression analyses or path analysis than for H1. Indeed, aggressiveness and video game violence use do not seem to be highly predictive of one another, at least prospectively. Of the theoretical perspectives discussed earlier in the article, the "third variable" perspective that aggression and video game violence have little causal impact on each other, is best supported by the results of the current study.

Of the third variables that predicted T2 serious aggression and violence, by far the best predictor was current (T2) depressive symptoms in both the regression and path analyses. As such, this variable warrants some discussion. The effect size for the T2 depressive symptoms variable on pathological aggression was, by the standards of social science, large (Cohen 1992), ranging between .5 and .62 for the CBCL outcomes, and .32 for bullying (but non-significant for criminal behavior). Also depressive symptoms and antisocial traits appeared to interact, such that individuals with high antisocial traits who also were depressed were most likely to engage in aggressive and criminal acts. By contrast, T1 depressive symptoms were not predictive of T2 serious aggression. These results suggest that current mood states may be more important in the etiology of aggressiveness than historical influences, at least for children and young adolescents. Although some T1 third variables, such as peer delinquency and parental psychological aggression in romantic relationships, were predictive of some serious aggression outcomes, these effects were generally small and inconsistent across measures. Therefore, in the current analysis, depressive symptoms stand out as particularly strong predictors of youth violence and aggression.

Some research has indicated that low serotonergic functioning is related both to increased levels of depressive symptoms and serious aggressive behavior (Carver et al. 2008) and results of the current study may reflect this. Similarly a US Secret Service and US Department of Education (2002) evaluation of adolescent and young adult "school shooters" (a group often linked with violent video games in the popular press) found that 78% had a history of feeling suicidal prior to their assault, and 61% had a history of significant depressive symptoms or despondency, although this often went undiagnosed (the figure above reflects psychological autopsy results in which diaries or blogs of shooters reflected serious depressive symptoms that was not brought to the attention of mental health professionals). Thus, current levels of depressive symptoms may be a key variable of interest in the prevention of serious aggression in youth.

Results from the current study suggest that long-term prediction of youth violence remains spotty at best and practitioners may need to be careful not to "profile" youth who have not committed serious aggressive acts. Predictive results based on sociological variables (or video game use) may run the risk of significant overidentification of "at risk" status. Practitioners and policy makers may be eager to identify and intervene with at-risk youth, but where long-term prediction remains unreliable, the potential for damage as well as good should temper and restrain efforts in this realm.

No study is without flaws, and it is important to document them in a research report. It should be reemphasized that the current sample is non-random. Although efforts were made to get the most representative sample possible, generalizations from a non-random sample should be undertaken only with caution. The current sample also was a Hispanic-majority sample. Although this represents an important extension of prospective designs into a previously neglected ethnic group, generalization to other ethnic groups and cultures may be unwarranted. Furthermore, it is not possible for a single research design to consider all possible third variables. Important third variables that were not considered in the current study but which have been identified as important in other research (e.g., Pratt and Cullen 2005) include poverty, substance abuse, school influences, self-control and genetics. Further research designs may wish to consider these predictor variables in the future. The aggression related outcome measures used here were designed to tap into more serious forms of aggression, than in previous prospective studies. However, it is reasonable to note differences even between these measures. Arguably the severely violent criminal behaviors referenced by the NLE differ from bullying behaviors tapped by the OBQ. Thus, caution is warranted in generalizing across these outcomes.

In conclusion, the current study finds no evidence to support a long-term relationship between video game violence use and subsequent aggression. Although debates about video game violence effects on player aggression are

likely to continue for some time, it is suggested that the degree of certainty and statements regarding the strength of causal effects should be revised in a conservative direction (similar calls have been made by other scholars, e.g., Cumberbatch 2008, Freedman 2002; Olson 2004, Savage and Yancey 2008; Sherry 2007). A reasonable argument and debate for small influences could probably still be made (e.g., Markey and Scherer 2009), although statements reflecting strong, broad effects generalizable to serious acts of youth violence are at current, likely unwarranted. This is particularly important to note given that, as video games have become more widespread over the past few decades, the incidence rate of criminal youth violence has declined sharply; it has not increased as feared (Childstats.gov 2009). Naturally, video games are an unlikely cause of this youth violence decline (to conclude otherwise would be to indulge in the ecological fallacy), however these results suggest a mismatch between public fears of violent video games and actual trends in youth violence (i.e., fears of juvenile superpredators never materialized, see Muschert 2007). It is argued here that scientists must be cautious to remain conservative in their conclusions lest the public be misinformed. A continued debate over violent video games will likely be positive and constructive, but such a debate must be made with restraint. It is hoped that the current article will contribute to such a debate.

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Author Biography

Christopher J. Ferguson is an associate professor of clinical and forensic psychology at Texas A&M International University. His research has focused on the positive and negative effects of violent video games, and on youth violence more broadly. He lives in Laredo, TX with his wife and young son.