CHILDREN IN THE DIGITAL AGE

Influences of Electronic Media on Development

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Chapter 6

Violent Video Games and Aggressive Thoughts, Feelings, and Behaviors

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A tranquil Alaskan night.
So quiet, you can barely hear a neck snap.
—Advertisement for Metal Gear Solid
(*PC Gamer*, February 2001, p. 91)

Media violence is big business. Youth between the ages of 8 and 18 spend over 40 hours per week using some type of media, not counting school or homework assignments (Rideout, Foehr, Roberts, & Brodie, 1999). Television is most frequently used, but electronic video games are rapidly growing in popularity. In the United States, the *average* 2- to 17-year-old child plays console and computer video games seven hours per week (Gentile & Walsh, 2001). In 1999, 2.5% of entering college men reported playing video games over 20 hours per week (CIRP, 1999). More than 191 million video games were sold in 2000, worth $6.5 billion (Video Game Sales, 2001).

A BRIEF HISTORY OF VIOLENT VIDEO GAMES

The first video games emerged in the late 1970s and contained relatively little violence. The violence that did exist in the early games was largely abstract, involving the "shooting" of alien spaceships. But as time passed, and graphics became better, and profits became larger, more frequent and more graphic violence began to appear, even in children's games. For example, the seemingly innocuous Super Mario Brothers games included the capacity to destroy harmful creatures that got in the way of the main characters by jumping on top of them or by throwing fireballs at them.

Truly violent video games came of age in the 1990s with the killing games Mortal Kombat, Street Fighter, and Wolfenstein 3D. In all three games, the main task is to maim, wound, or kill opponents. The graphics (e.g., blood) and sounds (e.g., screams) of these games were cutting edge at the time of their introduction. The 1993 Mortal Kombat, and its later versions, entails a series of fights to the death between the game player and various opponents. The game includes a variety of "fatal" moves that the player can use to finish off an opponent, such as ripping out a beating heart or popping off the head and spine. By the end of the twentieth century even more graphically violent games became available to players of all ages (FTC, 2000; Walsh, 2001). For example, Soldier of Fortune (released in 2000) features 26 different killing zones in the human body. Game characters react realistically to shots to different parts of the body, by different types of weapons. A shot to the arm at close range by a shotgun rips the arm from the socket, leaving exposed bone and sinew. Unfortunately, a recent "mystery shopper"–study conducted by the U.S. Federal Trade Commission (FTC, 2000) found that underage children (13 to 16) unaccompanied by an adult were able to purchase "M" rated games (mature, must be 17 or older to purchase or rent) in 85% of the 380 stores sampled. Similar results have been obtained by others (e.g., Walsh, 2001).

YOUTH ACCESS TO VIOLENT VIDEO GAMES

Although numerous educational, nonviolent strategy, and sports games exist, a significant majority of the most popular video games are extremely violent in nature, involving brutal mass killings as the primary goal in winning the game (e.g., Buchman & Funk, 1996; Dietz, 1998; Funk, Flores, Buchman, & Germann, 1999; Provenzo, 1991). For example, D. D. Buchman and J. B. Funk (1996) found that fourth-grade girls (59%) and boys (73%) report that the majority of their favorite video games are violent ones.

Video games are now subject to voluntary ratings, but there are numerous problems associated with the rating system. The ratings differ by outlet (video arcade versus console and home computer), are not well understood, are not reliably followed by retail outlets (FTC, 2000; Walsh, 2001), and apparently have little impact on the marketing efforts of the companies that produce them. Indeed, at least 70% of "M" rated games are marketed to children under 17 years of age, some as young as age 6 (FTC, 2000). Furthermore, this same FTC report found that over 90% of the surveyed companies producing "M" rated games market at least some of these rated games to children under 17. Finally, the video game ratings provided by the video game industry do not match those provided by other adults and game-playing youngsters. Many games involving violence by cartoon-like characters are classified by the industry as appropriate for general audiences, a classification with which adults and youngsters disagree (Funk et al., 1999).

The rating system itself may contribute to consumer confusion. For instance, games rated "E" (Everyone) can contain any of the following descriptor categories: Mild Animated Violence, Mild Realistic Violence, Animated Violence, Realistic Violence, Animated Blood, and Realistic Blood. Indeed, only two categories of violence are prohibited in "E" games: Animated Blood and Gore, and Realistic Blood and Gore (FTC, 2000). Teen games (age 13 and older) can contain any of these types of violence. So, when the video game industry violates it own standards, as has been found repeatedly, it is violating standards that are already seen by many as unreasonably lax.

A related problem involves the lack of parental oversight. Ninety percent of teens in grades 8 to 12 report that their parents never check the ratings of video games before allowing their purchase, and only 1% of the teens' parents had ever prevented a purchase based on its rating (Walsh, 2000). Also, 89% reported that their parents never limited time spent playing video games.

POTENTIAL NEGATIVE EFFECTS OF VIOLENT VIDEO GAMES

The concern over media violence in general, and violent video games in particular, is driven by the belief that exposure to such violence has negative consequences. School shootings in recent years at Paducah, Kentucky; Jonesboro, Arkansas; and Littleton, Colorado, played a major role in bringing the potential harmfulness of violent video games to the attention of the general U.S. public. In all three cases, the shooters were students who habitually played violent video games. Eric Harris and Dylan Klebold, the Columbine High School students who murdered 13 and wounded 23 in Littleton before killing themselves, enjoyed playing the bloody video game Doom (Glick & Keene-Osborn, 1999). Harris created a customized version of Doom with two shooters, extra weapons, unlimited ammunition, and victims who couldn't fight back—features that are eerily similar to the actual shootings.

As might be expected, the video game industry denies any link between playing violent video games and aggression. For example, in a May 12, 2000 CNN interview, Doug Lowenstein, president of the Interactive Digital Software Association, said, "I think the issue has been vastly overblown and overstated, often by politicians and others who don't fully understand, frankly, this industry. There is absolutely no evidence, none, that playing a violent video game leads to aggressive behavior" (*The World Today*, 2000).

In actuality, the research literature on media violence effects in general

(including television and movie violence studies) is quite large, and by 1975 80 relevant studies had been published. A meta-analysis of those studies clearly showed that by 1975, there was no room for doubt about the significance of media violence exposure to childhood aggression; both experimental and correlational studies demonstrated significant positive relations between media violence and aggression. Of course, the literature is much larger and even more definitive now (Bushman & Anderson, 2001).

Furthermore, research specifically focussing on the effects of exposure to violent video games has been slowly accumulating since the 1980s. The first comprehensive meta-analysis of these studies has only recently been completed (Anderson & Bushman, 2001). Before examining these results, however, it is important to place these concerns in a larger theoretical context.

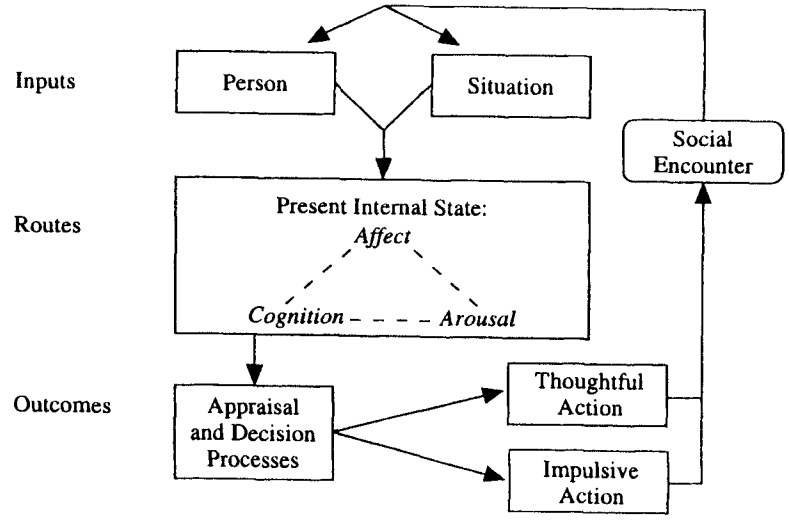
MEDIA VIOLENCE EFFECTS

Theory

Why does exposure to violent media increase aggression and violence? The General Aggression Model (GAM, Anderson & Bushman, 2002), which is based on several earlier models of human aggression (e.g., Anderson & Dill, 2000; Bandura, 1971, 1973; Berkowitz, 1993; Crick & Dodge, 1994; Geen, 1990; Huesmann, 1986; Lindsay & Anderson, 2000; Zillmann, 1983), is a useful framework for understanding violent media effects. The enactment of aggression is largely based on the activation and application of aggression-related knowledge structures stored in memory (e.g., scripts, schemas). Of course, central to any such model is the social learning process, by which the individual acquires these various knowledge structures. Because social learning processes are so well understood, they will not be discussed in detail in this chapter. Briefly, children learn much about their world by observing social events around them, real ones (e.g., interactions with and among family members) as well as media-based events (e.g., television, movies, video games). Of particular relevance to this chapter is the fact that children readily learn how to aggress, when to aggress, and the expected consequences of aggressing from media sources.

Figure 6.1 displays a simplified version of the single episode portion of GAM. This portion of GAM illustrates how recent exposure to violent media can cause short-term increases in aggression and other related effects. For example, playing a violent video game can increase aggressive behavior through its impact on the person's present internal state, represented by cognitive, affective, and arousal variables. Violent media can increase aggression by priming aggressive cognitions (including aggressive scripts and aggressive perceptual schemata), by increasing arousal, or by creating an aggressive affective state. Although not explicitly illustrated in Figure 6.1,

Figure 6.1
Single-Episode General Aggression Model



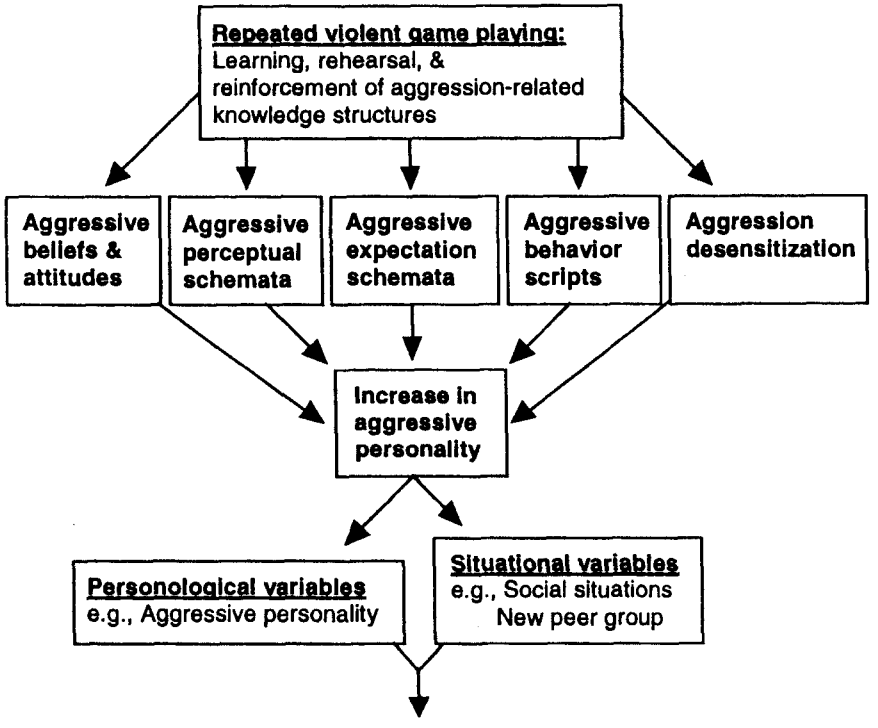
Source: Anderson & Bushman, 2002.

it seems likely that increasing aggressive thoughts, feelings, and behavioral tendencies must also decrease the accessibility of factors underlying other incompatible behaviors, such as prosocial ones, and thereby decreases the likelihood of those behaviors.

Long-term effects of media violence also involve learning processes, such as learning how to perceive, interpret, judge, and respond to events in the physical and social environment. Various types of knowledge structures (e.g., perception, interpretation, judgment, and action) develop over time, and are based on day-to-day observations of and interactions with other people, real (as in the family) and imagined (as in the media). Each violent media episode, as outlined in Figure 6.1, is essentially one more learning trial. Over time and with repeated exposure these knowledge structures become more complex, differentiated, and difficult to change. In a very real sense, a person's set of chronically accessible knowledge structures defines that person's *personality*.

Figure 6.2 illustrates this long-term learning process and identifies five types of relevant knowledge structures changed by repeated exposure to violent media. It also links these long term changes in aggressive personality to aggressive behavior in the immediate situation through both types of input variables described in the General Aggression Model: personological and situational variables. The link to person variables is obvious; less obvious is how long-term effects of repeated exposure to violent media can change situational variables. Briefly, as people become more aggressive,

Figure 6.2
Multiple-Episode General Aggression Model: Long-Term Effects of Video Game Violence



Source: Adapted from Anderson and Dill, 2000.

their social environments respond. The types of people who are willing to interact with them, the types of interactions that occur, and the types of situations made available to them all change. For example, interactions with teachers, parents, and nonaggressive peers are likely to decrease in frequency and quality, whereas interactions with other "deviant" peers are likely to increase.

Figure 6.2 also reveals that short-term effects of violent media on aggressive cognition are especially important. Of the five types of variables identified as contributing to the long-term increase in aggressive personality, four involve aggressive cognitions. Temporary mood states and arousal dissipate over time, but rehearsal of aggressive cognitions can lead to long-term changes in multiple aspects of aggressive personality. Furthermore, the literature on the development of behavioral scripts suggests that even a few rehearsals can change a person's expectations and intentions involving important social behaviors (Anderson, 1983; Anderson & Godfrey, 1987; Marsh, Hicks, & Bink, 1998).

A Recent Meta-analysis

As noted earlier, there is one recent comprehensive meta-analysis (Anderson & Bushman, 2001). Because the new analyses presented later in this chapter are based on this meta-analysis, a few methodological details will be presented here before summarizing the findings of that meta-analysis. Note that changes in methods used for the new analyses presented later in this chapter will be explained in that later section.

Methods

We searched the *PsycINFO* computer database for all entries through the year 2000 using the following terms: (*video** or *computer* or *arcade*) and (*game**) and (*attack** or *fight** or *aggress** or *violen** or *hostil** or *ang** or *arous** or *prosocial* or *help**). This search retrieved 32 research reports that included 46 independent samples of participants.[1] A total of 3,838 participants were included in the studies; over half (57%) were children under 18 years old. Studies were excluded if participants merely watched someone else play a video game. In several studies, half of the participants played the game while the other half watched, and the author(s) collapsed across this play/watch manipulation in their report. In such cases the collapsed results were used in the meta-analysis, but we divided the sample size in half.[2]

We coded the following characteristics for each study: (a) sex of participants, (b) age of participants (adults $\geq$ 18 years old or children $<$ 18 years old), (c) type of study (experimental or correlational), and (d) publication status (published or unpublished). Correlational studies varied in how violent video game exposure was measured. The most direct measure (and the least frequently used) is some type of indicator of amount of time spent playing violent video games (e.g., hours per week). Less direct were measures of video game preferences (e.g., percentage of favorite games that have violent content) and hours per week spent playing any type of video games. We used the most direct measure available for each study, but included all studies even if only the less direct type of measure was used. For experimental studies, we also coded level of violence in the "violent" and "nonviolent" video game conditions.

We used the correlation coefficient as the effect size estimate for all studies, correlational as well as experimental, denoted by r. According to Cohen (1988), a "small" r is $\pm$ .10, a "medium" r is $\pm$ .30, and a "large" r is $\pm$ .50. Fisher's z transformation was applied to the correlations before they were averaged. Each Fisher's z was weighted by the inverse of its variance (i.e., $n - 3$). Once a 95% confidence interval was obtained for the pooled

z score, it was transformed back to a 95% confidence interval for the pooled r, denoted by r_+ (Hedges & Olkin, 1985).

Results

Moderator analyses revealed that there were no significant effects for age (adult versus child), sex of participant, publication status, or study type (experimental versus correlational). Furthermore, all of the average effect sizes were significantly different from zero, all $ps < .001$. Overall, the results indicated that exposure to violent video games significantly increases aggressive behavior ($r_+ = .19$, $k = 33$, $N = 3{,}033$), aggressive affect ($r_+ = .18$, $k = 17$, $N = 1{,}151$), physiological arousal ($r_+ = .22$, $k = 7$, $N = 395$), and aggressive cognition ($r_+ = .27$, $k = 20$, $N = 1{,}495$). Furthermore, exposure to violent video games significantly decreases prosocial behavior ($r_+ = -.18$, $k = 8$, $N = 676$) (k is the number of independent effect sizes in the average; N is the total number of participants in the average).

Discussion

The fact that neither age nor sex of participant moderated the effects suggests that these negative effects of exposure to violent video games occur to males and females at both young (< 18) and older ages. Furthermore, the fact that type of study (experimental versus correlational) didn't moderate the effects demonstrates that the effects are causal (i.e., the experimental studies) and apply to more real-world behaviors (e.g., aggressive delinquency) as well as to laboratory measures of aggression (e.g., the experimental studies). Indeed, if one merely considers the experimental studies, which provide the strongest tests of causality, we find that exposure to violent video games *caused* increases in aggressive behavior and aggressive thoughts, and decreases in prosocial behavior (Anderson & Bushman, 2001). More detailed results can be found in the Anderson and Bushman (2001) article.

These results appear pretty conclusive. Nonetheless, there are several more specific questions that can be addressed with these data, questions that were not directly addressed in the original article (mainly because of space limits). For instance, even though the age variable was not a significant moderator, one could argue that we need to test the effects separately for children under age 18.

In addition, in traditional meta-analyses, an attempt is made to include all possible studies, despite potential methodological shortcomings. If the research domain being examined is sufficiently large, one can code for specific shortcomings and do the appropriate moderator analyses to see which (if any) of the shortcomings reliably influences the estimated effect sizes. Unfortunately, the violent video game literature is not yet sufficiently large to allow such detailed comparisons. Therefore, the Anderson and Bushman (2001) analyses did not attempt such methodological examinations, except for a comparison of correlational effect sizes as a function of the directness of the violent video game exposure measure (which yielded a nonsignificant effect of type of measure). The new analyses in the next section attend to these issues.

A New Meta-analysis

Method

The same data set used in the Anderson and Bushman (2001) article was used in these new analyses. The following changes were implemented: (a) effect sizes were collapsed across sex rather than averaged, where possible;[3] (b) for studies in which the "low violence" video game condition actually contained some violent content and the "no game" control condition was not particularly boring or frustrating, the control condition was used as the comparison group; (c) for studies in which the "no game" control condition was judged by participants as being particularly boring or frustrating, the "low violence" video game condition was used as the comparison group;[4] (d) studies which reported only combined video game player/observer results were dropped; (e) averaged self and observer reports of aggressive behavior; (f) included as aggressive behavior only measures in which aggression was targeted toward another person; (g) dropped one experimental study because the only control condition was rated by participants as significantly less entertaining and exciting than the comparison violent video game.

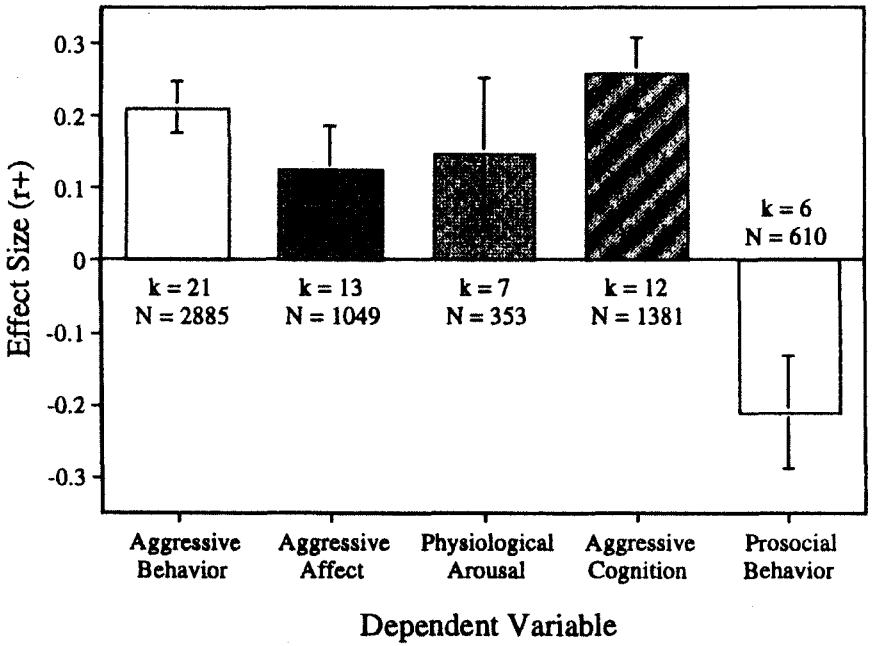
Results: Adults and Children Combined

Figure 6.3 presents the average effect sizes for each of the five dependent variables, along with the 95% confidence intervals, for the combined adult/children analyses. The results are very similar to those reported by Anderson and Bushman (2001). Exposure to violent video games increases aggressive behavior, aggressive thoughts, aggressive affect, and physiological arousal, and decreases prosocial behavior. The two behavioral measures yielded slightly larger effect sizes than in Anderson and Bushman (2001), the affect and arousal measures yielded slightly smaller effect sizes, and the aggressive cognition results were almost identical. For each dependent variable, the new analyses yielded effect sizes that are significantly different from zero and are small to moderate in size.

Results: Children Only

There were only two independent effects of aggressive affect in children, and only two involving physiological measures of arousal, too few for a meta-analytic study. The remaining three dependent variables had sufficient

Figure 6.3
Average Effects of Violent Video Games (r_+), Adults and Children Combined



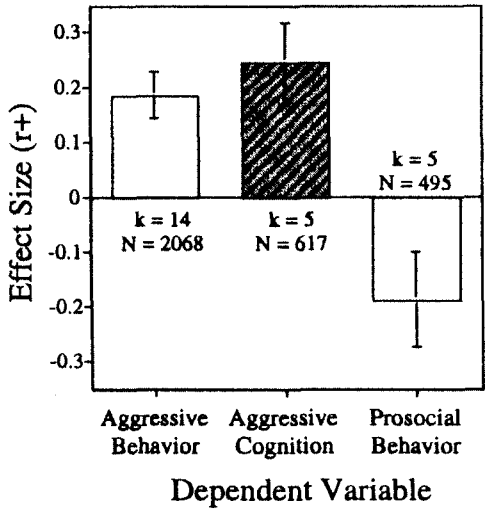
Vertical capped bars indicate 95% confidence intervals; k = number of independent tests; N = number of participants. *Note*: All effects were significantly different from zero, all $ps < .001$, except for physiological arousal, which was $p < .01$.

numbers of independent effects and of participants to warrant calculating effect size estimates separately from adults. Figure 6.4 presents the results. As can be seen, exposure to violent video games significantly increases aggressive behavior and aggressive cognition in children, and significantly decreases their prosocial behavior. Once again, all three effect sizes are small to moderate in size.

Results: Manipulation Size and Effect Size

One problem that became apparent while examining this literature is the vast difference in types of video games used within the violent and nonviolent conditions of various studies. Part of the difference results from the vast changes in video games themselves over the years. In the early days of video games, Pac-Man, in which the player controlled a circular object that "chomped" dots in a maze while trying to avoid being killed by ghosts (who could be killed by Pac-Man under some circumstances), had some parents concerned about potential consequences of playing this "violent" game. So it should come as no surprise that the violence of the "high violence" conditions in early studies is very different from the high violence games in more recent studies. In addition, it appears that researchers using younger children often select fairly tame games for their "violent" conditions. But the problem is actually more than a time- or age-based phenomenon. Several experimental studies have used games with violent content in their "nonviolent" conditions. For example, several studies have used Sonic the Hedgehog games in the nonviolent condition. But Sonic can be hurt by his enemies, and can in turn kill them (e.g., by throwing fireballs at them). Thus, some of the apparent failures to find significant effects of violent content could be the result of poor operationalization of the violent and nonviolent experimental manipulations.

Figure 6.4
Average Effects of Violent Video Games (r_+), Children Only



Vertical capped bars indicate 95% confidence intervals; k = number of independent tests; N = number of participants. *Note*: All effects were significantly different from zero, all $ps < .001$.

To test this idea, we rated the violent content of the video games used in the experimental studies. For a variety of reasons, this was possible for only 11 of the experimental studies. Each game was rated by two independent raters on a feature-anchored scale ranging from 0–10. For each study, then, one can subtract the violence rating of the nonviolent condition from the violence rating of the violent condition. Fortunately, none of the studies produced reversals, with the nonviolent game conditions actually being more violent than the violent game conditions. There was, however, one study in which the violent and nonviolent game conditions differed

only by 2.5 points out of a possible 10. Figure 6.5 presents the scatterplot of the difference between the violent and nonviolent conditions (possible range of 0–10) and the aggressive behavior effect size (r) obtained for each study. As can be seen, the correlation is large and positive ($r = .60$). Studies with stronger manipulations (i.e., bigger differences between the violent and nonviolent game conditions) tended to produce bigger effect sizes on aggressive behavior.

There are too few studies to do this analysis separately for child and adult effects, and too few for reliable inferential statistics. Nonetheless, the point should be clear. Future studies need to be sure that their manipulations of violent and nonviolent games are appropriate, and as different in amount of violent content as is ethically feasible. Otherwise, the study is likely to produce results that are irrelevant at best, and misleading at worst.

DISCUSSION

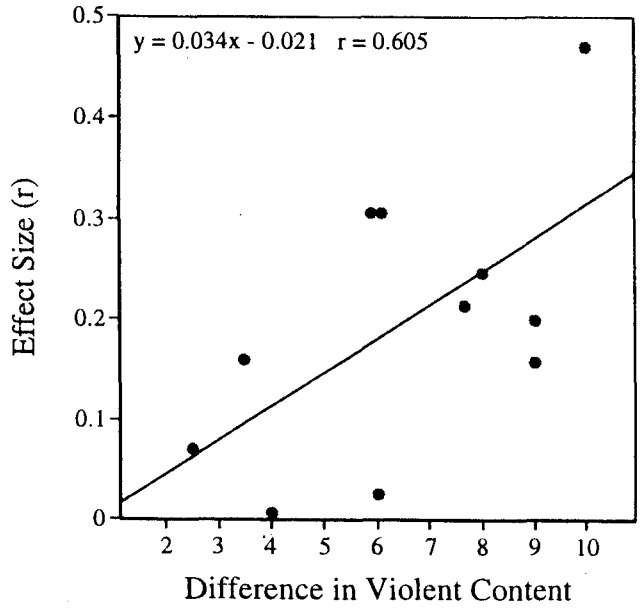
Research Designs

There are several important lessons to be learned from the careful examination of existing violent video game literature. In hindsight, some of these lessons seem obvious. However, the initial studies in new domains frequently look weak when viewed from the perspective of later research and researchers who have benefited from the pioneers' difficulties.

Nonetheless, the field can and should learn and benefit from these early difficulties, and for this reason five key lessons will be highlighted. One has already been mentioned: More attention needs to be paid to the violent content in the selection of violent and nonviolent comparison games in experimental studies. It is imperative that there be a sizable difference in the amount of violent content in the violent and nonviolent conditions, else there is no reason to conduct the study. In recent years the level of violence in video games has increased, making it easier for researchers to create high and low violence conditions that differ appreciably in amount of violent content. Of course, this shift also increases the need for careful consideration of ethical issues in experimental research, especially with younger participants.

A second lesson arises from consideration of the average effect sizes obtained in recent meta-analyses of this literature: Sample sizes have generally been too small to reliably detect violent video game effects. The result of consistently too-small sample sizes is a set of studies that seem to have contradictory results (e.g., some "work" and others do not), but that is actually not contradictory when viewed from the meta-analytic perspective. The too-small sample phenomenon creates problems in any area of research, but it is particularly problematic in areas of direct relevance to

Figure 6.5
Relation between the Violent Content Difference between the Violent and Nonviolent Video Game Conditions and the Effect on Aggressive Behavior, Experimental Studies



controversial public policy issues. In the video game case, the too-small sample size problem provides a motivated industry with ammunition that they can (and do) use to obfuscate the true overall (average) empirical findings and thereby keep consumers, public policy officials, and politicians confused and ineffective in attempts to address the issue.

We now know that the effect size of typical experimental manipulations of video game violence and of correlational studies of video game violence effects are likely to be about 0.18 to 0.20 (Anderson & Bushman, 2001; see Figure 6.3). How big a sample is needed to find a "true" effect of this size at the standard $p < .05$ level, assuming equal variances in the two comparison conditions? If power is set to .80, one would need a sample size of 236, half in each of the two conditions (violent and nonviolent). In other words, one would get a "significant" effect only 80% of the time researchers conduct studies with this sample size if the true effect size is $r = 0.18$. Only one of the existing studies of video game effects has this large a sample size, and that is a study that was not originally conducted with video games as a primary concern (Hagell & Newburn, 1994). Several others had sample sizes almost that large (e.g., Anderson & Dill, 2000).

To increase the probability of finding this true effect to 90% (i.e., power = .90), a sample size of 316 would be needed.

Two additional lessons to be learned have already been hinted at in the section describing methodological changes in the new meta-analysis presented in this chapter. The third lesson concerns the importance of the nonviolent or control comparison condition on dimensions other than violent content. Specifically, if the comparison condition in experimental studies is particularly boring, annoying, or frustrating, it is not an appropriate comparison for the violent condition. As any aggression textbook will note (e.g., Berkowitz, 1993; Geen, 1990), boring, annoying, and frustrating conditions themselves can increase aggressive tendencies. Therefore, using such "control" conditions may lead to an underestimation of the true effect of video game violence. Ideally, the nonviolent game(s) should be equated with the violent game(s) on dimensions that might be related to aggressive behavior but that are not part of the key processes under investigation (see Anderson & Dill, 2000; Panee & Ballard, in press, for two different ways of addressing this issue).

The fourth lesson has to do with reporting results. Meta-analyses are only as good as the data going into them. When research reports do not contain sufficient information to enable accurate calculation of effect sizes, then they cannot be included in future meta-analyses. This is particularly a problem with nonsignificant findings, which many scholars (including the present author, on occasion) simply report as nonsignificant without presenting relevant means, standard deviations, or inferential statistics (e.g., t or F tests). A similar problem in several of the video game studies was the reporting of means collapsed across the very important distinction of whether the participant actually played the assigned game or merely watched another play the game. Without separate means, one cannot accurately estimate the effect of playing the games.

The fifth lesson concerns the violent video game exposure measure to be used in correlational studies. If one wants to test the hypothesis that violent content in video games is associated with heightened aggression, then one should measure exposure to violent content, not exposure to video games in general. Anderson and Bushman (2001) found no significant moderator effects of type of exposure measure, but that may well change as the number of such studies (and hence, total participants) available for such a moderator analysis increases. The pattern of effect sizes across the three main types suggests that the more directly exposure to violent video games is assessed, the higher the correlation between exposure and aggressive behavior (r_+s = .26, .16, and .16 for time on violent content, violent content preference, and time on all video games, respectively).

Magnitude of Effects

Using Cohen's conventional descriptive labels, the average effects of violent video games all fall between "small" and "moderate" in size. Does this mean that concerns about exposing children (or young adults) are overblown? The various media representatives (from TV, movie, music, and video game industries) would certainly like to believe so (*The World Today*, 2000), and frankly, it would be comforting to believe that such effects are not big enough to be troublesome. But such a belief is simply not accurate.

One way to think about the effect size issue is to compare video game violence effects to other effects that U.S. society and U.S. public policy consider large. Interestingly, the effects of violent video games on aggressive and prosocial behavior found in our meta-analyses are larger than effects of several important medical effects: passive smoke on lung cancer (Wells, 1998); exposure to lead and IQ scores in children (Needleman & Gatsonis, 1990); nicotine patches and smoking cessation (Fiore, Smith, Jorenby, & Baker, 1994); calcium intake and bone mass (Welten, Kemper, Post, & van Staveren, 1995); exposure to asbestos and laryngeal cancer (Smith, Handley, & Wood, 1990). Thus, if you believe that any of these medical effects are important, then the video game violence effects should not be dismissed as being too small.

A second way to think about the effect size issue is to consider the "dosage" administered, and whether it is likely to be increasing with time. As Abelson (1985) and Rosenthal (1990) have pointed out, small effect sizes can yield large effects, especially when they accumulate across repeated occasions. Thus, differences in batting skills of major league baseball players account for a trivially small effect size on any given at-bat outcome, but over the course of a season teams with slightly better batters win considerably more games, and across seasons they win more championships. Similarly, the effect of smoking a single cigarette or even a pack of cigarettes on lung cancer is probably unmeasurably small, but the accumulated effects of years of smoking are quite large. As noted at the beginning of this chapter, young people are being exposed to violent video games at a high rate already, and the rate is increasing across time. Therefore, the cumulative long-term impact of exposure to violent video games may be sufficiently large to warrant considerable social concern.

NEW DIRECTIONS

The evidence is now clear that playing violent video games increases aggressive behavior and decreases prosocial behavior in children and in young adults. There is much more work needed, however. What follows is a list of research needs in this domain.

1. Does explicitly gory violence desensitize video game players more so than less gory violence? If so, does this desensitization increase subsequent aggression? Does it decrease helping behavior?
2. What features increase the game player's identification with an aggressive character in video games? Prior research and theory in the media violence domain suggest that the impact of exposure to violent video games is likely to be greater when the game player closely identifies with an aggressive game character.
3. What features, if any, could be added to violent video games to decrease the impact on subsequent aggression by the game player? For instance, does the addition of pain responses by the game victims make players less reluctant to reenact the aggression in later real-world situations, or do such pain responses in the game further desensitize the player to others' pain?
4. Can exciting video games be created that teach and reinforce nonviolent solutions to social conflicts?
5. What are the long-term effects of exposure to violent video games?
6. What types of people are most susceptible to violent video game effects, and who is relatively immune?

Answers to these questions are vital, but will require considerable effort by the research community and considerable funding by federal and other research agencies and foundations. Violence in contemporary American culture is a major social concern, and media violence plays an important role. Ideally, social policy decisions are grounded in solid empirical research. However, policy decisions are made regardless of whether there are good and relevant data. To date, researchers have studied violence and video game questions with virtually no governmental support. As video games continue to evolve in the digital age, becoming ever more realistic and violent, a commitment by the federal government is needed to fund basic research that will more adequately inform policy about the role that these games play in the development of childhood aggression. Both the relatively small research base (relative to the TV/movie literature) and the paucity of funding for video game research are at least partly the result of the fact that such electronic gaming is a fairly new phenomenon. It is clear from the present chapter that there are legitimate concerns about the effects of playing violent video games. It is clear from other chapters in this volume that video gaming already consumes many hours of children's leisure time, and that the amount consumed is rapidly growing. What we've learned so far has taken almost 20 years, in part because of the lack of research funding. It is timely for researchers and governmental agencies to work together to complete the next round of studies on this vital topic.

NOTES

1. A list of the studies included in the meta-analysis can be obtained from the following web site: http://psych-server.iastate.edu/faculty/caa/abstracts/2000-2004/01ABtable.html.

2. For studies that reported effects separately for players and observers, we used the player results. One might expect video game effects to be greater on players than observers (on average), and that studies that report only the combined player/observer results might, therefore, underestimate the true obtained effect on players. For this reason, such studies were dropped in meta-analyses reported in a later section in this chapter.
3. Averaging entails computing separate effect sizes for the male and female participants, and then averaging the two effect sizes using appropriate sample size weightings. Because the meta-analysis did not yield reliable sex effects, the present re-analyses collapsed across sex when possible, that is, used effect size estimates generated by analyses in which sex was not in the statistical model.
4. Frustration and boredom can themselves cause increases in aggression, so "control" conditions which are experienced by participants as highly boring or frustrating do not provide appropriate comparisons for the violent video game conditions, unless, of course, the comparison video game condition also induces boredom and/or frustration.

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