

Effects of Electronic Games on Children

Jeffrey Goldstein, Ph.D.

Department of Social & Organizational Psychology
University of Utrecht, The Netherlands

Email: j.goldstein@wxs.nl

March 2000

My name is Jeffrey Goldstein. I received a PhD in psychology from Ohio State University, following which I was professor of psychology at Temple University (Philadelphia) for nearly 20 years. Since 1992 I have been with the Department of Social and Organizational Psychology at the University of Utrecht, in the Netherlands. Among the books I have written or edited are Sports, Games and Play (Lawrence Erlbaum Associates), Aggression and Crimes of Violence (Oxford University Press), Toys, Play and Child Development (Cambridge University Press), and in 1998, Why We Watch: The Attractions of Violent Entertainment (Oxford University Press). I am a Fellow of both the American Psychological Association and the American Psychological Society. I serve on the academic advisory committee of the Entertainment Software Rating Board (New York), which developed a widely used system for rating video and online games.

This overview of research on the effects of electronic games was prepared at the request of the Interactive Digital Software Association (Washington, D.C.), for whom I regularly review research on this subject. I have read nearly all the published English-language research on electronic games, which includes video and computer games, CD-ROM and online games. Neither the quantity nor the quality of research on video games does much to inspire confidence in solid conclusions about their effects. Nearly every study suffers from unclear definitions (of violence or aggression), ambiguous measurements (confusing aggressive play with aggressive behavior, or using questionable measures of aggression, such as blasts of noise or self-reports of prior aggression), and overgeneralizations from the data. Experiments that claim to study the effects of playing electronic games rarely study play at all. In reality, a game player chooses when and what to play, and enters in a different frame of mind than someone who is required to >play= on demand.

Some have argued that the link between media violence and aggressive behavior is as strong as the link between cigarette smoking and cancer. This is not so. We can measure the presence or absence of disease with reasonable precision, but we cannot easily or reliably measure aggressive behavior in laboratory settings. We have only indirect and often questionable measures of aggression at our disposal.

Research on Electronic Games

There are 4 types of research on electronic games: 1) Demographic surveys describe who plays which games. 2) Correlational studies examine the relationship between video game play and other behaviors, such as aggression or school performance. 3) Experiments seek to establish cause-and-effect relationships by requiring some individuals to play video games and others to play other (or no) games. Measurements are then taken to establish the effects of video games. 4) Applied research uses electronic games as a medium for education, training, medicine, and therapy.

The file drawer problem

Published research in scholarly journals does not represent all the research on electronic games. Studies that fail to find statistically significant results are less likely to be accepted for publication. So the published record is an unknown fraction of all research, and it tends to consist of those studies with statistically significant results. This is known as >the file drawer problem= because studies that do not find any effects of video games remain unpublished, locked away in the researcher=s files.

Surveys

Industry people can provide demographics of games players of the growth of electronic games from a youth activity to one that cuts across all ages and both sexes. Research by social scientists tends to focus on potential problem areas, such as video game >addiction= or the relationship between the extent of gaming and school performance. Concerns about addiction to video games have lately given way to concerns about internet addiction (Kraut, et al. 1998).

Studies that consider addiction to video games offer snapshots in time rather than dynamic pictures of play over a period of weeks or months. At any given moment, there are players deeply immersed in the gaming experience, but this obsession is temporary, according to a large-scale Australian survey (Durkin 1998).

Barrie Gunter (1998) concludes in his review of video game research, *AThere is international evidence that video games do not preoccupy children and teenagers to the exclusion of other pursuits Y. Some children may admit to playing more than they think they should, but few signs have emerged so far that video game addiction is a growing social problem. Video game players do not differ significantly from non-players in terms of other activities, including sports.®*

Correlates of Violent Video Game Play

Some studies compare the most frequent players of electronic games with those who play less often (for example, Anderson & Dill in press; Griffiths & Hunt 1998; Roe & Muijs 1998). In some studies, frequent play with violent video games is correlated with lower school performance, more aggression, delinquency, and behavioral and emotional problems. The heaviest users of video game are males, and those who prefer violent video games are most likely to be above average in aggression, and to show other characteristics of aggressive men: namely, poorer school performance, less interest in bookish activities, more delinquency, and so on. These correlations do not imply causality. According to one study (Roe & Muijs 1998), poor performance in school motivates some boys to achieve success in the world of video games. Following are descriptions of recent correlational studies of violent electronic games.

Jeanne B. Funk and her colleagues (1999) claimed to examine whether a preference for violent electronic games is associated with an increase in problem behaviors in adolescents. Boys and girls at a middle school and at a school for children with behavioral problems completed questionnaires about their video game experience and problem behaviors. The children were divided in half according to whether they played video games high in violence or low in violence. For girls, playing violent video games was not associated with any clinical problems. Those who played violent video games scored higher on something called thought problems, but this is not further defined or described. Boys who played video games low in violence had higher delinquency scores than boys who played more violent video games! Other studies also fail to find that higher levels of violence in video games has stronger effects than lower levels of violence (for example, Anderson & Ford, 1986).

Comments on the Funk et al study

The study cannot possibly show whether violent electronic games are related to an increase in adolescent problems because it does not measure changes in problem behaviors. It is a static study that measures self-reports of play with violent games and self-reported problem behaviors at one point in time. The study did not find more violent video game playing among children at the school for adolescents with behavior problems. Suppose instead of finding very little, Funk et al. had found that those who played violent electronic games had more behavior problem behaviors. What would that tell us about violent electronic games? It would not imply that games cause these problems. Some youngsters with problems may use video games as a way of coping with problems. There is no way to draw sound conclusions from such a study.

Craig Anderson and Karen Dill (in press) conducted a study on the correlates of experience with violent video games. Seventy-eight men and 149 women undergraduates at a midwestern university completed questionnaires about their exposure to video game violence and paper-and-pencil measures of delinquency, aggression, irritability, world view, and grade point average. The university students indicated their favorite games, and were asked to recall how often they played video games in recent months, during the 11th and 12th grades, during the 9th and 10th grades, and during the 7th and 8th grades. Also measured were perceptions of crime and feelings of safety.

Results. As in some previous research, Anderson and Dill found a positive correlation between experience with violent video games and measures of aggression and delinquency. This does not mean that the former is a cause of the latter. Highly aggressive youngsters are attracted to violent video games (Goldstein, 1998). Both aggression/delinquency and involvement with violent video games may be the result of other factors, such as a high need for arousal, excitement, or attention. Perception of crime was not significantly related to play with violent video games. George Gerbner and others found that people with the most exposure to television overestimate crime rates. Anderson and Dill did not find that here; experience with violent video games was not related to perception of crime.

Anderson and Dill write of their data as though they are describing a causal sequence. *A The positive association between violent video games and aggressive personality is consistent with a developmental model in which extensive exposure to violent video games (and other violent media) contributes to the creation of an aggressive personality Y. In sum, Study 1 indicates that concern about the deleterious effects of violent video games on delinquent behavior, aggressive and nonaggressive, is legitimate,* write Anderson and Dill. But their study has nothing to do with the effects of video games, deleterious or otherwise [emphasis added]. Correlation is not causality, no matter how tempted one may be to argue otherwise. The authors acknowledge this when they write, *However, the correlational nature of Study 1 means that causal statements are risky at best. It could be that the obtained video game violence links to aggressive and nonaggressive delinquency are wholly due to the fact that highly aggressive individuals are especially attracted to violent video games.*

Experiments with Violent Video Games

Much of what is written about video games with violent themes assumes that the media (including electronic games) affect vulnerable groups of people in ways that go against their grain, a >magic ray= approach to the media. In contrast, I believe that

people are extremely selective in the media they use and attend to, and that the effects the media have on them are pretty much the effects that the user is seeking.

Physiological reactions to video games

Electronic games are challenging, sometimes frustrating, exciting, surprising, and often funny. While playing, individuals may experience a range of emotions accompanied by physiological changes. In one study with university students, heart rate accelerated while playing a violent video game, and returned to baseline within 15 minutes following play (Griffiths & Dancaster 1995).

Winning a competitive video game did not result in a rise in testosterone level, as happens with the victors of competitive sports and chess matches (Mazur, et al., 1997). This may be because players do not regard video games as truly competitive, but see video game play instead as a cooperative activity.

Positron emission tomography (PET) scans were taken while healthy men played a video game. The neurotransmitter Dopamine, thought to be involved in learning, reinforcement of behavior, attention, and sensorimotor coordination, was released in the brain during play (Koepp 1998).

Violence and >violence= -- Matters of definition

When people refer to violence in the media or violent video games they rarely distinguish between real violence or people hurting one another as in warfare or a slap in the face and symbolic or fantasy violence, in which characters engage in mock battle. Nor do they distinguish between cartoon characters, fantasy figures in electronic games, dramatic violence portrayed by human actors, and real violence in news and documentary programs. Psychologists define violence or aggression as the intentional injury of another person. However, there is neither intent to injure nor a living victim in an electronic game. Anderson and Dill (in press) write that the goal of the player in *Mortal Kombat* is to kill any opponent he faces. But there is no literal killing here; something else is going on, namely, play and fantasy. When discussing violence in the media people do not usually mean literal violence.

An article by Dill and Dill (1998) further illustrates this confusion. They write, *If violent video game play indeed depicts victims as deserving attacks, and if these video games tend to portray other humans as >targets, =then reduced empathy is likely to be a consequence of violent video game play, thus putting the player at risk for becoming a more violent individual.* The Dills write that perhaps video games would have stronger effects than television because of the active involvement of players. They

argue that players must **act aggressively** and are then reinforced for this **aggression**. *In violent video games, aggression is often the main goal, and killing adversaries means winning the game and reaping the benefits. While in real life, murder is a crime, in a violent video game, murder is the most reinforced behavior. The violent video game player is an active aggressor according to the Dills, and the player's behavioral repertoire is expanded to include new and varied aggressive alternatives.*

Likewise, Anderson and Dill (in press) write, *Each time people play violent video games, they rehearse aggressive scripts which teach and reinforce vigilance for enemies, aggressive action against others, expectations that others will behave aggressively, positive attitudes towards use of violence, and beliefs that violent solutions are effective and appropriate. Furthermore, repeated exposure to graphic scenes of violence is likely to be desensitizing. Long-term video game players can become more aggressive in outlook, perceptual biases, attitudes, beliefs, and behavior than they were before the repeated exposure.* To my knowledge, there are no studies of the long-term effects of video games. There is no evidence that video games actually have any of these effects.

Effects of violent video games

Lt. Col. Dave Grossman (1995; 1999) has stressed the similarities between combat training and violent video games. He could just as logically have stressed their differences. Among the differences between training soldiers for combat and playing video games are:

- The motivations for undertaking the tasks are different.
- The individual can play or not, and can come and go, as he pleases.
- The intentions of the players are different.
- The players' beliefs about what they are doing and why differ.
- There are many cues in video games that **this is play** (for example, sound effects, fantasy figures, scorekeeping).
- The behaviors reinforced (play vs. aggression) and the reinforcements themselves are different.
- The social relationships among the individuals involved are different.

Experiments on the effects of violent video games on the behavior of elementary school children typically fail to distinguish between aggressive play and aggressive behavior. After playing a *Mortal Kombat*-style video game, children, boys especially, are likely to engage in martial arts play-fighting. To many adult observers, the boys

are thought to be acting aggressively, but in fact are engaged in aggressive play, where there is no intent to injure anyone (Silvern & Williamson 1987). Media violence research is clouded by such ambiguities.

According to British psychologist Mark Griffiths (1999) *Athe majority of studies on very young children tend to show that children become more aggressive after playing or watching a violent video game, but these were all based on the observation of free play.*® This is precisely the problem, confusing aggressive play with aggressive behavior, that leads to fuzzy conclusions. In the rare study that measures both aggressive play and aggressive behavior (for instance, Cooper & Mackie 1986; Hellendoorn & Harinck 1998), violent games affect the former but do not affect aggressive behavior.

In part because of these ambiguities, those who review the existing research on violent video games arrive at different conclusions. Among recent reviews, some conclude that violent video games are a cause of violent behavior (Anderson & Dill in press; Ballard & Lineberger 1999; Dill & Dill 1998), while others conclude that there is insufficient evidence to draw any conclusion (Australia 1999; Durkin 1995; Gunter 1998; Griffiths 1999). Anderson & Dill review published studies on video games and aggressive behavior, and conclude as have others, that every study suffers from flaws in methodology, ambiguous definitions, is open to alternative explanations, or results in inconsistent findings. *AIIn sum,*® they write, *Athere is little experimental evidence that the violent content of violent video games can increase aggression in the immediate situation.*®

Anderson and Dill experiment

In an experiment by Anderson and Dill (in press), students played a violent video game (*Wolfenstein 3D*) or a nonviolent game (*Myst*) that were similar in their degree of difficulty, enjoyment, and frustration (although men considered *Wolfenstein 3D* more exciting than *Myst*). One hundred four women and 106 men from a midwestern U.S. university visited the laboratory twice, playing each assigned video game 3 times for 15 minutes per time. In the first session participants played the game, completed the affective and world view measures, and played the game again, then completed the cognitive measure. The cognitive measure of aggressive thoughts was the time it took to recognize aggressive words (for example, >murder-) flashed on a computer screen. Aggressive thoughts were not measured directly in this experiment, only reaction time to words flashed on a screen.

During the 2nd session, participants played the game again for 15 minutes and completed the behavioral aggression measure. Aggressive behavior was measured

during a >competitive reaction time task,= in which the participant is told to push a button faster than an opponent. If participants lose this race, they receive a noise blast at a level supposedly set by their opponent. As their measure of aggressive behavior Anderson and Dill use the intensity and duration of noise blasts the participant chooses to deliver to the opponent. They write that this is *Aa widely used and externally valid measure of aggressive behavior,*® but this is open to doubt because there is nothing in this method nor in the instructions to the participants to indicate that there was any intention to injure anyone in this situation.

Results: Greater exposure to violent video games predicted greater aggressive behavior, particularly among those who were high in aggressiveness to begin with, and this was especially the case with men. The effect of violent video games was no different from that of nonviolent games on state hostility, or on crime perception or feelings of safety. The average reaction time to aggressive words was faster among those who had played the violent video game. The researchers interpret this to mean *A the violent video game primed aggressive thoughts. This result suggests one potential way in which playing violent video games might increase aggressive behavior, by priming aggressive knowledge structures.*® [Does reacting quickly to aggressive words indicate aggressive thoughts?]

There were *Aabsolutely no statistically significant effects of any of the independent variables B sex, trait irritability, video game type B on either the win or lose noise intensity settings.*® Participants who had played *Wolfenstein 3D* delivered significantly longer noise blasts after lose trials than those who played the nonviolent game *Myst*. *APlaying a violent video game increased the aggressiveness of participants after they had been provoked by their opponent= noise blast.*®

Anderson and Dill write, *AThe present research demonstrated that in both a correlational investigation using self-reports of real world aggressive behaviors and an experimental investigation using a standard, objective laboratory measure of aggression, violent video game play was positively related to increases in aggressive behavior Y. The convergence of findings across such disparate methods lends considerable strength to the main hypothesis that exposure to violent video games can increase aggressive behavior Y*The present results confirm that parents, educators, and society in general should be concerned about the prevalence of violent video games in modern society, especially given recent advances in the realism of video game violence Y.*The results of the current investigation suggest that short-term video game violence effects may operate primarily through the cognitive, and not the affective route to aggressive behavior Y Thus, the danger in exposure to violent video games seems to be in the ideas they teach and not primarily in the emotions they*

incite in the player. The more realistic the violence, the more the player identifies with the aggressor. The more rewarding the video game, the greater potential for learning aggressive solutions to conflict situations. [emphasis added]

Comments on the Anderson and Dill experiment.

Can one generalize from the Anderson and Dill studies to real-world video game players? Do their results justify the need to be concerned about the prevalence of violent video games, and their increasing realism? Their studies do not address the realism of video games, or identification, or the effects of rewards, or attitudes toward conflict resolution. Do more realistic games have greater impact? Do players really learn that aggression is the solution to conflict? We do not know.

There is no sense in which the participants in this experiment played a video game, violent or otherwise. They were instructed to play a video game for a few minutes. Whatever effects are found may not generalize to the natural play setting in which real gaming takes place. Playing a game at the urging of an experimenter does not resemble the world of play. Almost no studies of the presumed harmful effects of video games have considered how and why people play them, or play at all.

No evidence is given that reaction time to aggressive words is a valid measure of aggressive thoughts, or that noise blasts are intended to injure another person.

Real acts of violence have been modeled on media images. The media may give form to aggressive behavior. But I am aware of no evidence that the media motivate individuals to commit aggression if they are not otherwise inclined to do so.

The Attractions of Violent Entertainment

Some critics condemn the makers of violent entertainment for marketing >violence for violence sake = (Grossman 1995, 1999). But that is not what people seek. People are highly selective in the violence they seek or tolerate. Violence, if it is to be entertaining, must fulfill certain requirements: it must have a moral story in which good triumphs over evil, and it must carry cues to its unreality B music, sound effects, editing, a fantasy story-line, cartoon-like characters.

The audience for violent entertainment

Many who condemn violence in video games eagerly devour the latest novel by Stephen King. Men particularly like violent entertainment. For the majority of consumers, the violence is a means to ends, a device valued more for what it does

than for what it is. The consumers of violent entertainment do not share a single motive. Some play violent video games to experience excitement, some to become experts and impress their friends, others because the games are challenging. Some young people play widely vilified games in order to elicit predictable, if negative, reactions from teachers, parents, or girls. Immersion in a fantasy world is also conducive to the pleasant transcendental experience known as *flow* (Csikszentmihalyi 1990).

People can choose the degree of emotional content with which they are most comfortable, just as they do when selecting music to listen to. An undeniable characteristic of violent imagery is its emotional wallop; it gives most people a jolt. Not everyone finds this kind of stimulation pleasant, but some do. Even if players find the violence repugnant, they can fine-tune their involvement in the game by focusing on its graphics, technique, or on their score, in order to control their emotional involvement.

Youngsters are willing to expose themselves to unpleasant images because the benefits of doing so outweigh the costs. Players, like media researchers, have overriding reasons for engaging with violent themes.

Social identity

Violent entertainment appeals primarily to males, and it appeals to them mostly in groups. These are social occasions, particularly suitable for male bonding and communicating a masculine identity. Boys may play violent video games alone in their rooms, but they are almost certain to talk about them with their friends. In a survey of Canadian youth, Stephen Kline (1999) observes, *For many of the male gamers, video gaming was part of a network of friendships and social affiliations making gaming into a cool thing.*

The importance of context

Both the context of violent images and the circumstances in which they are consumed play a crucial role in their appeal, and probably in their effects. In order to experience pleasure from exposure to violent images players must feel relatively safe in their surroundings. Furthermore, there must be cues that the violent images are produced for purposes of entertainment and consumption. Bloody images lose their appeal when there are few cues to their unreality (McCauley 1998). If the violent imagery does not itself reveal its unreality, the physical environment may do so. We are aware of holding a joystick or remote control, of playing a game on a console or

computer screen. Without background music, special effects, or fantasy characters, images of violence are unattractive.

Electronic Games in Education, Therapy, and Science

In her book *Playing with Power*, Marsha Kinder (1991) notes that video games *have considerable educational and therapeutic value for a diverse range of groups B including adolescents, athletes, would-be pilots, the elderly in old-age homes, cancer patients undergoing chemotherapy, stroke victims, quadriplegics, and young children suffering from palsy, brain damage, and Down=s syndrome .=*

Electronic games are used to teach and reinforce skills in education, science and medicine. Games are used increasingly to study learning (Blumberg 1998; Rieber 1996), memory (Shewokis 1997), motivation (Wong 1996), cognitive processes (Kappas 1999), attention and attention deficits (Pope 1996), and spatial abilities (Subrahmanyam & Greenfield 1998; Tkacz 1998). Electronic games have been developed to teach safe sexual practices to adolescents, and to help diabetic children better manage their illness (Lieberman 1998).

Sometimes the hardware is of interest. Commercial electronic games have much to recommend them as psychological tests. The equipment is robust, inexpensive, small, light and portable, scoring is completely objective and the rules for any given game are the same for every player. An American mountaineering expedition to the 7,700 meter high Tirich Mir used two games to measure performance, *Simon Says* to measure short-term memory, and *Split Second* to measure pattern recognition and reaction time. The games operated normally even at 7,000 meters under the extreme conditions of the climb (but the batteries had to be warmed by the climbers). *What seems beyond doubt is the possibility of testing performance under extreme conditions by means of electronic games@* (Jones 1984).

Spatial abilities

Video games are among the most successful means of reducing the traditional sex difference in spatial abilities (Subrahmanyam & Greenfield 1994).

Video Games in Therapy

Attention deficit / hyperactivity disorder is characterized by the inability to sustain attention long enough to perform activities such as schoolwork or organized play. Treatments include brainwave biofeedback training, in which systems feed back information to trainees showing how well they are producing the brainwave patterns

that indicate attention. Pope and Bogart (1996) developed a video game that expands this concept by becoming more difficult as the player's brainwaves indicate that attention is waning. The trainee can succeed at the game only by maintaining an adequate level of attention.

Video Games and the Elderly

Electronic games can speed reaction times, hone cognitive skills, and may retard memory decline among the elderly (Drew & Waters 1986; Dustman 1992; Goldstein 1997).

What's Missing from Games Research?

The motivation to play is powerful. In seeking a site for a research project, I visited rehabilitation centers for people with severe handicaps. In nearly all of them, people were playing computer or video games, one man with his feet because he did not have the use of his arms, and one woman who had no movement in her arms or legs played by blowing through a straw. It is precisely this spirit of play that is missing from psychological experiments of video games.

Young people bring their entertainment choices and experiences to bear on their intense concerns with questions of identity, belonging, and independence. Much of their public behavior — the clothes they wear, the music they listen to, and the games they play — has a social purpose. How else are we to understand the fads of body piercing and tattooing, or the popularity of horror films or violent video games, except in reference to peer groups? Until researchers look, not at isolated individuals forced to play a video game for a few minutes as part of a laboratory experiment, but at game players as members of extended social groups, we are unlikely to come to terms with violent, or any other, entertainment.

References

Anderson, C. A., & K. E. Dill. (in press). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. Journal of Personality and Social Psychology.

Anderson, C. A., & C. M. Ford. (1986). Affect of the game player: Short-term effects of highly and mildly aggressive video games. Personality and Social Psychology Bulletin, vol. 12, 390-402.

Ballard, M. E., & R. Lineberger. (1999). Video game violence and confederate gender: Effects on reward and punishment given by college males. Sex Roles, vol. 41, 541-558.

Blumberg, F. C. (1998). Developmental differences at play: Children's selective attention and performance in video games. Journal of Applied Developmental Psychology, vol. 19, 615-624.

Cooper, J., & D. Mackie. (1986). Video games and aggression in children. Journal of Applied Social Psychology, vol. 16, 726-744.

Csikszentmihalyi, M. (1990). The flow experience. San Francisco: Jossey-Bass.

Dill, K. & J. Dill. (1998). Video game violence: A review of the empirical literature. Aggression and Violent Behavior, vol. 3, 407-428.

Drew, B., & J. Waters. (1986). Video games: Utilization of a novel strategy to improve perceptual motor skills and cognitive functioning in the non-institutionalized elderly. Cognitive Rehabilitation, vol. 4, 26-31.

Durkin, K. (1995). Computer Games, Their Effects on Young People: A Review. Office of Film & Literature Classification. Sydney. [255 Elizabeth Street, Sydney NSW 2000, Australia]

Durkin, K., & J. Low. (1998). Children, media and aggression: Current research in Australia and New Zealand. In U. Carlsson & C. von Feilitzen (Eds.), Children and Media Violence. UNESCO International Clearinghouse on Children and Violence on the Screen. nordicom. Goteborg, Sweden: Goteborg University.

Dustman, R. E., R. Emmerson, L. Steinhaus, D. Shearer, & T. Dustman. (1992). The effects of videogame playing on neuropsychological performance of elderly individuals. Journal of Gerontology, Psychological Sciences, vol. 47, 168-171.

Funk, J. B., J. Hagan, J. Schimming, W. A. Bullock, D. Buchman, & M. Myers. Playing violent electronic games and indices of psychopathology in adolescents. (1999). Paper presented at the American Psychological Association annual convention.

Goldstein, J. (1999). The attractions of violent entertainment. Media Psychology, vol. 1, 271-282.

Goldstein, J. (1998). Why We Watch: The Attractions of Violent Entertainment. New York: Oxford University Press.

Goldstein, J., L. Cajko, M. Oosterbroek, M. Michielsen, O. van Houten, & F. Salverda. (1997). Video games and the elderly. Social Behavior & Personality, vol. 25, 345-352.

Griffiths, M. (1999). Violent video games and aggression: A review of the literature. Aggression & Violent Behavior, vol. 4, 203-212.

Griffiths, M., & I. Dancaster. (1995). The effect of Type A personality on physiological arousal while playing computer games. Addictive Behaviors, vol. 20, 543-548.

Griffiths, M., & N. Hunt. (1998). Dependence on computer games by adolescents. Psychological Reports, vol. 82, 475-480.

Grossman, D. (1995). On Killing: The Psychological Cost of Learning to Kill in War and Society. Boston: Little Brown.

Grossman, D. (1999). Stop Teaching Our Kids to Kill: A Call to Action against TV, Movie & Video Game Violence. New York: Crown.

Gunter, B. (1998). The Effects of Video Games on Children: The Myth Unmasked. Sheffield, UK: Sheffield Academic Press.

Hellendoorn, J., & F. Harinck. (1997). War toy play and aggression in Dutch kindergarten children. Social Development, vol. 6, 340-354.

Jones, M. B. (1984). Video games as psychological tests. Simulation & Gaming, vol. 15, 131-157.

Kappas, A., & A. Pecchinenda. (1999). Don't wait for the monsters to get you: A video game task to manipulate appraisals in real-time. Cognition & Emotion, vol. 13, 119-124.

Kinder, M. (1991). Playing with Power in Movies, Television and Video Games. Berkeley: University of California Press.

Kline, S. (1999). Video game culture: Leisure and play preferences of British Columbia teens. Simon Fraser University, Burnaby, B.C., Canada

Koepp, M. J., R. N. Gunn, A. D. Lawrence, V. J. Cunningham, A. Dagher, T. Jones, D. J. Brooks, C. J. Bench, & P. M. Grasby. (1998). Evidence for striatal dopamine release during a video game. Nature, vol. 393, 266-268.

Kraut, R., M. Patterson, V. Lundmark, S. Kiesler, T. Mukopadhyay, & W. Scherlis. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? American Psychologist, vol. 53, 1017-1031.

Lieberman, D. A. (1998). Health education video games for children and adolescents: theory, design, and research findings. Paper presented at the annual meeting of the International Communication Association, Jerusalem, 1998. (available online at www.clickhealth.com/lieb98/diabetes.htm)

Mazur, A., E. J. Susman & S. Edelbrock. (1997). Sex difference in testosterone response to a video game contest. Evolution and Human Behavior, vol. 18, 317-326.

McCauley, C. (1998). When screen violence is not attractive. In J. Goldstein (Ed.), Why We Watch: The Attractions of Violent Entertainment. New York: Oxford University Press.

Pope, A. T., & E. H. Bogart. (1996). Extended attention span training system: Video game neurotherapy for attention deficit disorder. Child Study Journal, vol. 26, 39-50.

Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations and games. Educational Technology Research and Development, vol. 44 (no. 2), 43-58.

Roe, K., & D. Muijs. (1998). Children and computer games: A profile of the heavy user. European Journal of Communication, vol. 13, 181-200.

Shewokis, P. A. (1997). Is the contextual interference effect generalizable to computer games? Perceptual and Motor Skills, vol. 84, 3-15.

Silvern, S. B., & P. A. Williamson. (1987). The effects of video game play on young children's aggression, fantasy, and prosocial behavior. Journal of Applied Developmental Psychology, vol. 8, 453-462.

Subrahmanyam, K., & P.M. Greenfield. (1998). Computer games for girls: What makes them play? In J. Cassell & H. Jenkins (Eds.), From Barbie to Mortal Kombat: Gender and Computer Games. Cambridge, MA: MIT Press.

Tkacz, S., & P. LaForce. (1998). Sex of player and practice in lateral discrimination and videogame performance. Perceptual and Motor Skills, vol. 84, 3-15.

Wong, K. K. (1996). Video game effect on computer-based learning design. British Journal of Educational Technology, vol. 27, 230-232.