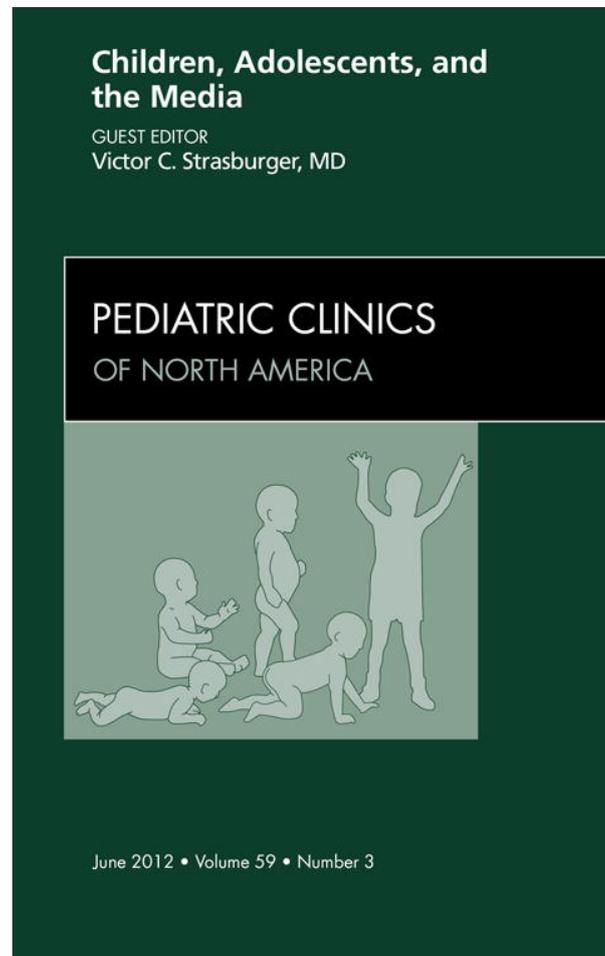


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Video Games: Good, Bad, or Other?

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KEYWORDS

- Media effects • Video games • Aggression • Prosocial behavior

KEY POINTS

- The growing popularity of video games has instigated a debate among parents, researchers, video game producers and policymakers concerning their harmful and helpful effects.
- Video games are very effective teachers that affect players in multiple domains.
- Some of these effects can be harmful (eg, effects of violent video games on aggression).
- Other video game effects can be beneficial (eg, effects of action games on visual-spatial skills).
- Video game effects are complex and would be better understood as multiple dimensions rather than a simplistic “good-bad” dichotomy.

Video games are an extremely popular pastime among children and adolescents. Today, 90% of American children and teens play video games.^{1,2} On a typical day, youth play video games for an average of 2 hours.³ Time spent playing is even higher among some segments of the population, with 25% of young males reporting playing video games for 4 hours a day or more.⁴

The rising popularity of video games has instigated a debate among parents, researchers, video game producers, and policymakers concerning potential harmful and helpful effects of video games on children. Views expressed in this debate have often been extreme, either idealizing or vilifying video games.^{5–7} The critics and the proponents tend to ignore research evidence supporting the views of the opposing camps and label video games as clearly “good” or “bad.”

Are video games good or bad? Several relevant findings on the effects of video games are displayed in **Table 1**. The explosion in research on video games in the past 10 years has helped increase our understanding of how video games affect players. It is clear that video games are powerful teachers that have significant effects

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Table 1 Summary of main research findings on positive and negative effects of video games on players	
Positive Effects	Negative Effects
Action games improve a range of visual-spatial skills ⁸	Violent games
Educational games successfully teach specific knowledge and skills ⁹	Increase aggressive thoughts, feelings and behaviors ¹³
Exergames can improve physical activity levels ¹⁰	Desensitize players to violence, decrease empathy and helping ¹⁴⁻¹⁶
Prosocial games	Video game play is negatively related to school performance ¹⁷
Increase empathy and helping ¹¹	Video games may exacerbate attention problems ¹⁸
May decrease aggression ¹²	It seems that some players can become addicted to video games ¹

in several domains, some of which could be considered beneficial and some of which could be considered harmful.^{19,20}

The aim of this article is to give an overview of research findings on positive and negative effects of video games, thus providing an empirical answer to the question, “are video games good or bad?” Several negative effects of video games are reviewed first, including effects of violent video games on aggression-related variables as well as effects on attention deficits, school performance, and gaming addiction. Next, positive effects of video games are described, including effects of action games on visual-spatial skills, and effects of educational video games, exergames, and prosocial video games. Finally, some conclusions and guidelines are offered with the goal of helping pediatricians, parents, and other caregivers protect children from negative effects while maximizing the positive effects of video games.

FIVE DIMENSIONS OF THE EFFECTS OF VIDEO GAMES

Gentile and colleagues²¹⁻²³ have proposed that video games can affect players on at least 5 dimensions (**Box 1**).

Games are multidimensional and have complex effects on players. Each dimension is likely to be associated with different effects. The amount of game play has been linked to poorer academic performance and increased risk of obesity.^{24,25} Violent game content is a significant risk factor for aggression, whereas prosocial game content can increase empathy and helping, and educational games can improve specific skills.^{9,11,13} The context in which games are played may alter or create new effects. For example, playing in virtual teams can encourage collaboration.²⁶

Box 1 Five dimensions of the effects of video games
1. Amount of game play
2. Content of play
3. Context of the game
4. Structure of the game
5. Mechanics of game play

Research on effects of game structure shows that fast-paced action games can increase visual/spatial skills (sometimes misinterpreted as “improved attention”).^{27–29} Innovative game mechanics such as the interactive *Wii* controller have been successfully used to promote physical activity and have even been used for physical therapy.^{10,30}

A great strength of this approach is that it offers a different way of thinking about the effects of video games that surpasses a simplistic good-versus-bad dichotomy. Video games are complex and may influence players in different ways through different learning mechanisms. Even a single video game, such as *Grand Theft Auto*, might simultaneously have positive effects on players (improved visual processing) and negative effects (increased aggressive thoughts and feelings).

NEGATIVE EFFECTS OF VIDEO GAMES

Violent Video Game Effects

By far the largest and best understood research domain concerns the effects of violent video games on aggression. Findings of experimental, correlational, and longitudinal studies confirm that video game violence can significantly increase aggressive thoughts, emotions, and behavior over both the short term and the long term.^{13,17}

Although there are differing opinions about the strength of the data, a recent comprehensive meta-analytical review examined effects of violent video games on 6 relevant outcomes (aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, empathy, and prosocial behavior).¹³ The meta-analysis included 136 research articles with 381 effect-size estimates involving more than 130,000 participants. This large sample included both published and unpublished studies from Eastern and Western cultures. The main findings of the meta-analysis are shown in **Fig. 1**. Video game play had significant effects on all 6 outcomes. Exposure to violent video games can be seen as a causal risk factor for increased aggressive behavior, cognition, and affect, with reduced empathy and prosocial behavior.

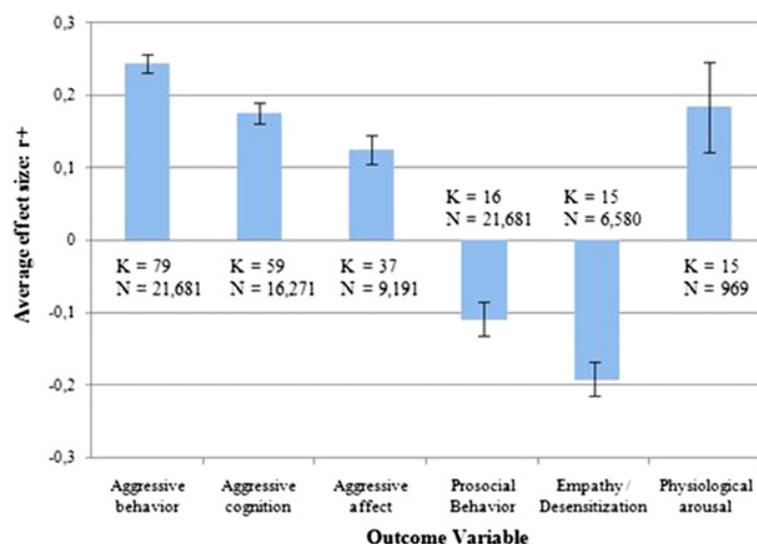


Fig. 1. Effects of violent video games on aggression and related variables (results from the “Best raw” sample). K, number of effects; N, total sample size. Vertical capped bars are the upper and lower 95% confidence intervals. (From Anderson CA, Shibuya A, Ihori N, et al. Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries. *Psychol Bull* 2010;136:162–6; with permission.)

Are the effect sizes large enough to be considered important? Even small effect sizes can have large practical consequences. Because such a high percentage of children and adolescents spend large amounts of time playing violent games, small effects can accumulate and significantly influence individuals and society. In fact, the obtained effect sizes of violent video games on aggression-related variables are comparable in size with the effect of second-hand smoke on lung cancer and the effect of calcium intake on bone mass (see **Fig. 1**).³¹

Aggressive Cognition, Affect, and Behavior

Findings from experimental, correlational, and longitudinal studies generally show that violent video game play is a significant risk factor for aggression (**Box 2**). This effect has been demonstrated in both short-term and long-term contexts, and in diverse populations.

Studies suggest that violent video games increase aggression by increasing aggressive thoughts and emotions, even when their physiologic arousal properties have been controlled. Playing violent video games can prime aggressive thoughts, increase positive attitudes toward violence, and help create a hostile attribution bias: a tendency to perceive other people's behaviors as malevolent.^{33–35} In the short term, exposure to video game violence produces feelings of anger and hostility in players.³⁶ Even the critics of violent game research support the findings on aggressive thoughts, arousal, and decreased prosocial behavior.³⁷ Over longer periods of time, such changes can lead to the development of an aggressive personality.¹⁵

Empathy, Desensitization, and Helping

Another line of research has found that video game violence produces desensitization to violence and decreases in empathy and helping. Desensitization can be defined as reduction in physiological and emotional reactivity to violence.¹⁴ Short-term exposure to violent media has been shown to produce physiological desensitization in only 20 minutes, whereas habitual video game playing has been linked to chronic desensitization.^{14,38,39}

A related line of research examined links between violent video games and empathy, the degree to which a person identifies and commiserates with a victim.¹³

Box 2

Effects of violent video games on aggressive behavior

- Experimental studies have been used to show causal effects of video game violence on immediate increases in aggression. For example, in a laboratory experiment, children and adolescents were more likely to blast a supposed opponent with loud noise through headphones after playing a violent video game compared with a nonviolent game.¹⁷
- Correlational studies enabled researchers to explore associations between violent video game play and real-life instances of aggression. For example, adolescents who had consumed greater amounts of video game violence were more likely to be involved in a physical fight.³²
- Longitudinal studies have shown relationships between video game violence and increases of aggression over time. For example, children who played more violent games early in the school year were found to display more physical and verbal aggression 5 months later.¹⁷
- Meta-analyses combine results of multiple studies and provide the strongest evidence that video game violence increases the risk of aggression. The most recent meta-analysis in this area showed a significant effect of video game violence on aggressive behaviors across different types of research designs.¹³

Empathy has been shown to significantly mediate the link between violent video game play and aggressive behavior.¹⁵ It seems that this emotional numbing can also lead to a reduction in helping behavior. For example, students who had just played a violent video game were less likely to perceive a fight they witnessed as serious or to help the injured victim.¹⁶

Attention Deficits and Cognitive Control

Findings of positive effects of gaming experience on visuospatial skills are sometimes misinterpreted to mean that video games benefit attention in general. However, a growing body of evidence suggests that video games may actually exacerbate attention problems and have harmful effects on some aspects of cognitive control.

- Several studies have found correlations between attention problems in childhood and video game play.^{16,40,41} High excitement and rapid changes of focus that occur in many video games may weaken children's abilities to maintain focus on less exciting tasks (eg, schoolwork) and shorten their attention spans.
- In a longitudinal study on video game use and attention problems, video game play predicted children's attention problems 13 months later, even while controlling for other relevant variables (earlier attention problems, television viewing, and gender).¹⁸ A 3-year longitudinal study of more than 3000 children found evidence of a bidirectional relation between attention problems and video game playing, and found a stronger relation between the amount of gaming and later attention problems than for the content of gaming.⁴²
- Several studies have also shown negative relations between video game play and cognitive control.^{43–45} It seems that video games have specific effects on different types of cognitive processing: they can increase visuospatial processing skills and can also harm proactive cognitive control.^{27,45}

Video Game Addiction

There are now scores of studies looking at what is being called pathological gaming or video game "addiction." Many researchers define pathologic use of video games in the same way as pathological gambling, focusing on damage to family, social, school, occupational, and psychological functioning.¹⁹ Like gambling, playing video games starts as a form of entertainment. It becomes pathological for some people when video games start producing negative life consequences.²¹ Overall, studies examining pathological video gaming show good reliability and validity. For example, a study conducted in the United States with a national sample of 1100 youth found that 8.5% of youth gamers could be classified as pathological,²¹ and similar percentages are being found in other countries.^{46–51} At present, video game addiction is not classified as a formal disorder in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM). The American Psychiatric Association has proposed a new category for the DSM-V of addiction-like behavioral disorders. Gambling has been moved into this category, but more research is needed before video game and Internet addictions should be included.⁵²

Video Games and School Performance

Several studies have found a significant negative relation between the amount of screen time (television viewing and video game play) and school performance of children, adolescents, and college students.^{3,17,25,33,53,54} That is, high amounts of time on screen media are associated with poorer school performance. One explanation is the displacement hypothesis, which states that video games (and other screen media)

may displace time that would otherwise be spent on activities such as reading, homework, or other enrichment activities.³² There has been some evidence to support the displacement hypothesis. In one study of a large nationally represented sample of youth aged 10 to 19 years, gamers spent 30% less time reading and 34% less time doing homework in comparison with nongamers.⁵⁵

POSITIVE EFFECTS OF VIDEO GAMES

Visual-Spatial Skills

Several studies show that video game play can improve a wide range of visual and spatial skills.^{27–29,56}

- Correlational studies have found positive associations between gaming experience and performance in numerous visual tasks, such as target localization²⁹ and faster visual reaction times.⁸
- Experimental studies have demonstrated that even as little as 10 hours of video game play can improve spatial attention and mental rotation.^{27,57}

These beneficial effects may have a range of practical applications. For example, an early experimental study showed that Israeli Air Force cadets trained using the game *Space Fortress 2* had better subsequent flight performance.⁵⁸ As a result, the game became a part of the training program of the Israeli Air Force. The largest enhancements to visuospatial processing have been shown for fast-paced action games, which also often contain violence.⁸ This fact illustrates the point that the effects of video games are not simple, and a game can simultaneously have positive effects (increased visuospatial skills) and negative effects (increased aggressive emotions, thoughts, and behaviors).

Educational Video Games

Video games are highly effective teachers. Well-designed video games are attention-grabbing, set clear objectives, provide feedback and reinforcement, actively involve the player, offer adaptable levels of difficulty, and use many other powerful teaching techniques.²⁰ A wide range of educational games have been developed, taking advantage of these features of video games and using them to teach specific knowledge and skills.

- Schools: Video games have been successfully used to teach children and adolescents a variety of topics, such as reading skills, mathematics, and biology.^{9,59}
- Business: Video games are often used to teach job skills to employees. For example, Canon USA uses a video game to train copier technicians, Volvo uses an online game to teach car sales employees, and the US military uses video games to train combat skills and increase recruitment.^{60,61}
- Health-related outcomes: Games have been developed to teach youth about smoking, diabetes, and cancer.^{62–64} These games have been shown to be highly effective. For example, asthmatic children who played the game *Bronkie the Bronchiasaurus* showed significant improvements in their knowledge about asthma and self-care behaviors.⁶²

Exergames

Video games have traditionally been a sedentary activity. However, in recent years a new type of video game has emerged that requires interactive physical activity. Exercise games, or exergames, combine video games and exercise.⁶⁵

- Active games, such as *Dance Dance Revolution* and *Wii Fit* can increase energy expenditure, prolong time spent in physical activity, and increase preference for physical activity among players.^{66–68}
- Exergames have been shown to increase engagement and enjoyment. For example, a 6-week-long training study demonstrated that interactive videobikes increase adherence to a training program and attitudes toward exercise compared with traditional bikes.¹⁰
- Particularly positive attitudes toward exergaming are found among sedentary individuals, indicating that this may be an effective way of increasing physical activity in this group.⁶⁵

It is a worrying fact that American children tend to spend more than 6 hours per day watching television and playing video games, yet almost half of preschool children do not meet recommended levels of physical activity of at least 1 hour per day prescribed by the American Academy of Pediatrics.^{3,69} Given the tremendous popularity of video games among youth, combining gaming and physical activity may be a good strategy to increase physical activity among children and adolescents.

Prosocial Video Games

Prosocial video games are those in which the primary purpose of the player is to help other game characters. Although the literature on the effects of prosocial games is much smaller than that on effects of violent video games, there is growing support for the idea that prosocial video games can promote prosocial tendencies.^{11,70} It must be noted that games with violent content are not considered truly prosocial, even if the player's character is helping other players by killing mutual enemies.

Playing a nonviolent prosocial video game in the laboratory has actually been shown to decrease aggressive thoughts, feelings, and behaviors.^{12,71} Prosocial video game play can also increase prosocial thoughts, enhance empathy, and promote helping behavior.^{70,72–74} For example, in a series of experimental studies, playing a prosocial video game made participants more predisposed to help the researcher pick up fallen pencils, agree to participate in further experiments, and come to the aid of a female experimenter who was being harassed by a supposed ex-boyfriend (actually a confederate).¹¹

These findings are not limited to laboratory experiments. For example, a large-sample correlational study showed significant associations between prosocial video game play and prosocial behaviors in real life (eg, spending money to help those who are in need).⁷¹ In a follow-up longitudinal study, prosocial game play predicted increases in prosocial behavior among children over a period of 3 to 4 months, confirming that prosocial games can have a long-term impact on helping.¹²

GUIDELINES FOR PARENTS, PEDIATRICIANS, AND OTHER CAREGIVERS

The research on positive and negative effects of video games clearly shows that video games are effective teachers that can affect players in multiple ways simultaneously. Therefore, the original question asked about whether games were “good” or “bad” is demonstrated to be a false dichotomy. Some effects are harmful (such as effects of violent video games on aggression and the effect of screen time on poorer school performance), whereas others are beneficial (eg, effects of action games on visual-spatial skills).

Suggestions are made in **Box 3** as to what can be done to maximize the positive effects of video game use and minimize harm.

Box 3**Advice for pediatricians, parents, and other caregivers on choosing and using video games**

- Ask about games and other media use at well-child checkups. Pediatricians and general practitioners are in the unique role of helping parents to understand that they need to take their children's media use seriously. Parents setting limits on the amount and content of children's media is a powerful protective factor for children.^{2,17,32}
- Do not rely solely on ratings. Even games rated E for Everyone often contain depictions of violence.⁷⁵ Instead, try playing the game yourself, ask someone to demonstrate it for you, or look for descriptions or video clips of the game on the Internet.
- Choose well. Select nonviolent games that have been shown to have positive effects, such as educational games, prosocial games, and exergames. Do not allow access to violent video games, defined as games in which you must harm other characters to advance.
- Set limits on both the amount and content of games. Create clear rules about amount of time and the kind of content that is allowed. Even positive games can be played too much. The American Academy of Pediatrics recommends no more than 1 to 2 hours of total screen time (video games, TV, DVDs, computer, and so forth, all summed together) per day.
- Keep game devices in public space. When gaming devices are in private space (child's bedroom), it is very difficult to control either content or time. Move them to public space (eg, living room, kitchen).
- Stay involved. Explain to your children why playing violent games or playing games for an excessive amount of time may be harmful to them. Discuss your family's values concerning violence and aggression. Help them learn to make good choices.
- Spread the word. Help educate others in your community (parents, youth, public officials). Although almost 100% of pediatricians have been convinced by the data that the media have significant effects,⁷⁶ the public do not know this. The mainstream media often sensationalize and polarize discussion on this topic; it is important that people understand that there are both potential benefits and harms to be derived from game play.

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