Note: 1 correction has been made to a citation on p. 121, highlighted in yellow. Also, the Short-term and Long-term labels in Fig. 7.1 were reversed in the printed version, but have been corrected in this electronic version.

CHAPTER 7

The Positive and Negative Effects of Video Game Play

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Introduction

Video games have become an incredibly popular and pervasive form of entertainment. Video game use has increased steadily over time (Rideout, Foehr, & Roberts, 2010) and today 9 out of 10 American children and teens play video games (Gentile, 2009; Gentile & Walsh, 2002). On average, youth play video games for two hours a day (Rideout, Foehr, & Roberts, 2010). However, a significant percentage of males report playing four hours a day or more (e.g., Bailey, West, & Anderson, 2010). This fact that such a large number of children and adolescents frequently play video games makes understanding video game effects on players an important research goal.

The rising popularity of video games has brought about an explosion of research on video game effects (Barlett, Anderson, & Swing, 2009). The increasingly large research literature on this topic consistently shows that video game effects are not trivial; significant effects of video game play are found in short-term and long-term contexts, and across a wide range of domains (e.g., Anderson, Gentile, & Dill, 2012). Some of these effects have been extensively researched and are well established, such as the effects of violent video games on aggression (e.g., Anderson & Dill, 2000). However, recent research has revealed a number other positive and negative consequences of video game play, such as beneficial effects of prosocial games on helping (Greitemeyer & Osswald, 2010), positive effects of action games on visual-spatial skills (Green & Bavelier, 2007), harmful effects of fast-paced games on cognitive control (Bailey, West and Anderson, 2010), and the phenomenon of video game addiction (Gentile et al., 2011).
This chapter provides an overview of current research findings in the area of video game effects. First, two theoretical perspectives are described that can be used to understand the mechanisms through which video games affect players. Next, research findings are reviewed concerning a wide range of positive and negative video game effects. Finally, several conclusions are drawn and key unanswered questions are identified that need to be addressed in future research.

Theoretical Frameworks

Several theoretical frameworks have provided useful insights for understanding positive and negative video game effects. Two different approaches are described in this section: (1) the general aggression model and the general learning model and (2) the five dimensions of video game effects perspective.

The general aggression model (GAM; e.g., Anderson & Bushman, 2002; Anderson & Carnagey, 2004; Anderson & Huesmann, 2003; Barlett & Anderson, 2013; DeWall, Anderson, & Bushman, 2011) has guided a large amount of research in the media violence domain, including research on violent video game effects (e.g., Anderson & Dill, 2000; Möller & Krahe, 2009). The GAM integrates key ideas from a number of more specific models of aggression (e.g., Bandura, 1973, 1983; Berkowitz, 1984; Huesmann, 1986, 1998) and provides a holistic framework for understanding how social, personological, and biological factors interact to bring about aggressive behavior. GAM can be used to understand both short-term effects of media violence on aggression in the immediate situation and long-term processes that aid the development of an aggressive personality. An overview of both the long-term and short-term processes in GAM is shown in Figure 7.1. According to GAM, media violence can increase the likelihood of aggression in the short term through its influence on a person's present internal state, which includes affective, cognitive, and arousal states. For example, playing a violent video game can prime aggressive thoughts, increase hostile affect, and create physiological arousal. In turn, internal state variables affect appraisal and decision making processes. Decision making can result either in impulsive or in thoughtful action, which can be aggressive or nonaggressive. For example, if provoked immediately after playing a violent game, the likelihood of choosing an aggressive response is increased due to heightened arousal and primed aggressive thoughts and feelings. Factors that increase the accessibility of aggressive thoughts or feelings tend to increase the likelihood of aggressive behavior emerging from the decision process. Once a behavioral response has been chosen, this feeds back into the situation and can influence later thoughts, feelings, and actions. Over time, the outcomes of each encounter can exert an influence on one's personality (e.g., strengthening habitual patterns of responding), creating
a feedback loop. Through this cycle, repeated long-term exposure to media violence leads to the development and rehearsal of aggressive knowledge structures, causing harmful consequences such as more positive attitudes toward violence, greater expectations of aggression by others, hostile attribution bias, and desensitization to violence (Carnagey & Anderson, 2003).

The general learning model (GLM; Buckley & Anderson, 2006; Gentile et al., 2009; Gentile, Groves, & Gentile, 2014; Maier & Gentile, 2012; Swing & Anderson, 2008) incorporates multiple domain-specific learning theories into one larger meta-theory. The GLM describes how multiple learning mechanisms (e.g., habituation, classical conditioning, observational learning, etc.) can work both serially and in parallel to produce learning outcomes from any experience (Gentile, Groves, & Gentile, 2014). In the long term, the GLM describes how beliefs, attitudes, and affective traits (such as trait empathy and trait hostility) can be changed and developed as a result of learning experiences. The developmental and learning processes posited by GLM can be applied not only to aggression, but to any kind of social behavior. For example, much of the empirical support for GLM comes from the literature on media effects on prosocial behavior and helping (e.g., Bushman & Anderson, 2009; Gentile et al., 2009; Greitemeyer, 2009; Greitemeyer & Osswald, 2009, 2010).

The five dimensions of video game effects approach (Gentile, 2011; Gentile & Stone, 2005; Khoo & Gentile, 2007; Stone & Gentile, 2008) posits that video games can affect players on at least five different dimensions—amount of play, content, context, structure, and mechanics. Each dimension can produce
specific types of effects. The amount of play can produce effects regardless of game content by displacing time players spend in other activities. The amount of game play has been associated with lower academic performance (Chan & Rabinowitz, 2006; Sharif & Sargent, 2006), risk of childhood obesity (Berkey et al., 2000), and gaming addiction (Gentile, 2009; Gentile et al., 2011). Game content has been shown to lead to content-specific learning. Educational games have been successfully used to teach a number of school subjects (Corbett, Koedinger, & Hadley, 2001). Violent video games have been shown to increase aggression (Anderson et al., 2010), whereas prosocial video games have been shown to increase empathy and helping (Greitemeyer & Osswald, 2010). The context of video game play may moderate effects of other game characteristics on specific outcomes. For example, it is possible that playing a game with friends may change the way video game content affects players (Anderson, Gentile, & Dill, 2012). The way a video game is structured and displayed on a screen may significantly affect visuospatial processing. For example, a number of studies have demonstrated that playing fast-paced video games may have positive effects on a number of visual and spatial skills, such as faster visual reaction times, and improved target localization and mental rotation (Achtman, Green, & Bavelier, 2008; Green & Bavelier, 2003, 2007). Finally, game mechanics can lead to improvements in specific motor skills. For example, video game play experience has been shown to predict surgical skill among laparoscopic surgeons (Rosser et al., 2007). Exercise games have been successfully used in physical therapy (Betker et al., 2006; Deutsch et al., 2008). Because research on video game effects has often been contentious, this approach is useful for helping to explain why different studies appear to find different types of effects. Many findings that initially appear contradictory are often focused on different levels of analysis, and are in fact complementary when examined through this dimensional approach.

VIOLENT VIDEO GAME EFFECTS

Much of the research done on video game effects has focused on the effects of violent video games on aggression. Findings from experimental studies, correlational studies, longitudinal studies, as well as a number of meta-analyses confirm that violent video game play can increase aggressive cognitions, affect, and behavior both in immediate and long-term contexts (e.g., Anderson & Dill, 2000; Anderson, Gentile, & Buckley, 2007; Anderson et al., 2010). More recent research has also shown that violent video game play leads to desensitization to violence (Bartholow, Bushman, & Sestir, 2005), diminished empathy, and a lower likelihood of prosocial behavior (Bushman & Anderson, 2009).

Experimental studies have been used to demonstrate causal relationships between violent video game play and aggression in the short-term. Laboratory
experiments have shown that even a brief episode of violent video game play leads to more aggressive thoughts (e.g., Anderson & Dill, 2000), hostile affect (e.g., Carnagey & Anderson, 2005) and an increased likelihood of aggressive behavior (e.g., Konijn, Bijvank and Bushman, 2007). Correlational studies make it possible to examine associations between violent video game exposure and real-world aggression. Findings from correlational studies show that violent video game effects found in the laboratory generalize to real-life situations. For example, greater amounts of violent video game play in real life are significantly associated with more positive attitudes toward violence (e.g., Funk et al., 2004), higher trait hostility (e.g., Anderson, Gentle, & Buckley, 2007), and an increased likelihood of involvement in physical fights (e.g., Gentile, Lynch, Linder, & Walsh, 2004). Longitudinal studies can be used to determine long-term relations between violent video game play and aggression. For example, one study tracked a sample of adolescents over a period of two years and showed violent video game play to be a significant predictor of later violence and delinquency, even after controlling for relevant covariates (Hopf, Huber, & Weib, 2008).

Each research design contributes to the study of video game effects on aggression and strong causal conclusions depend on consistent results across all types of designs (Abelson, 1995; Swing & Anderson, 2010). Different types of research designs make different methodological assumptions, so when a result is repeatedly shown using different designs, we can be confident that it is not just a byproduct of methodological flaws. Testing a hypothesis using different methodologies and in different contexts allows researchers to triangulate, with the hope of identifying a true causal factor (Anderson, 1989). Scientific confidence can be increased by aggregating results from different studies using meta-analytic techniques.

The most comprehensive meta-analysis of violent video game effects on aggression and related variables to date was conducted by Anderson and colleagues (2010). This meta-analytic review included 136 research papers with 381 effect size estimates involving more than 130,000 participants. The sample consisted of both published and unpublished studies and included studies from both Eastern and Western cultures. Main findings from this meta-analysis based on the subsample of studies that met all the best practices criteria (the “best raw” sample in Anderson et al., 2010) are shown in Figure 7.2. Playing violent video games was shown to increase the likelihood of physically aggressive behavior, aggressive thinking, aggressive affect, and physiological arousal. Violent video game exposure was also shown result in desensitization/low empathy and a decreased likelihood of prosocial behavior. Significant effects of violent video games on all six outcomes were found both for men and for women and for samples from both Eastern and Western cultures. Importantly, the pattern of results for different outcomes was consistent across all three types of research designs (experimental, cross-sectional, and longitudinal).
These findings represent strong evidence that exposure to violent video games is a causal risk factor for increased aggressive behavior, aggressive cognition, and aggressive affect, and for decreased empathy and prosocial behavior. Are the effect sizes large enough to be considered important? Because aggression is influenced by a large number of risk factors, no single factor can explain more than a small fraction of variability in aggression (Anderson & Huesmann, 2003). However, when effects accumulate across time and when a large proportion of the population is exposed to a risk factor, even small effects can have large practical consequences (Abelson, 1985). In fact, the obtained effect size of violent video games on aggression (longitudinal effect after controlling for sex and earlier levels of aggression, $r^+ = .152$) is in the same range as the effects of substance use, abusive parents, and poverty on aggression (U.S. Department of Health and Human Services, 2001).

In our view, findings from the extensive meta-analysis by Anderson and colleagues (2010) provide conclusive proof that violent video game play has both short-term and long-term influences on aggression and related variables. However, the topic of media violence effects on aggression is still under debate both by popular culture scholars (Jenkins, 2006) and researchers in the field.
of psychology (e.g., Ferguson & Kilburn, 2010). Several smaller meta-analytic reviews of the effects of violent video games on aggression (e.g., Ferguson, 2007a, 2007b) seem to show nonsignificant findings contradictory to those of Anderson et al. (2010). However, a careful examination of findings from these meta-analyses reveals that the data tend to agree for both proponents and critics of video game research, but they interpret the results differently (see Table 7.1). A recent study found that traditional approaches to analysis may actually underestimate the size of the effect of violent media (Gentile & Bushman, 2012). This same study, however, also demonstrated that media violence deserves neither special concern nor special denial as a risk factor for aggression—it acts similarly to other known risk factors, and by itself is not sufficient to cause serious aggressive acts.

CRITICS AND PROONENTS OF VIOLENT VIDEO GAME RESEARCH: POINTS OF AGREEMENT

Seven meta-analyses of violent video games have been published (Anderson, 2004; Anderson & Bushman, 2001; Anderson et al., 2004; Anderson et al., 2010; Ferguson, 2007a, 2007b; Sherry, 2001). There are two fascinating aspects of these meta-analyses. First, although they vary greatly in terms of how many studies they include, they find almost identical effect sizes for violent video games on aggressive thoughts, feelings, and behaviors (Table 7.1). The empirically defined effect sizes are in the small to moderate range. Second, although they find almost identical effect sizes, Sherry and Ferguson interpret the effect as unimportant, whereas Anderson and colleagues interpret it as highly important. It is certainly normal for scientists to differ in their interpretations of empirical data, and that has definitely been the case with the data with regard to violent video games. Nonetheless, the numbers are empirically derived, and all of these meta-analyses seem to agree with each other.

It is also interesting that although these authors appear to disagree with regard to how to interpret the link between violent game exposure and aggressive behavior, they do not disagree about the other effects. That is, although Ferguson (2007a, p. 479) feels that the evidence on violent games and aggressive behaviors is not compelling, he believes that the effects on aggressive thoughts, prosocial behaviors, and physiological arousal “appear to be more sound.”

Note that well-tested psychological theories agree that media can influence our thoughts and feelings, and thoughts and feelings are related to behaviors. Our summary at this point, then, is that much of the disagreement about the effects of violent video games is more apparent than real. Meta-analyses agree that there is a nonzero relation between violent gaming and aggressive thoughts,
Table 7.1 Effect Size Findings from Seven Meta-Analytic Reviews of Violent Video Game Effects on Aggression and Related Variables

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<tbody>
<tr>
<td>Number of independent estimates</td>
<td>54</td>
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<td>86</td>
<td>55</td>
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<tr>
<td>Number of participants</td>
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<td>1,716</td>
<td>11,014</td>
<td>15,491</td>
<td>4,205</td>
<td>3,602</td>
<td>130,295</td>
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<td>Aggressive thoughts</td>
<td>.27</td>
<td>-</td>
<td>.24</td>
<td>.31/.24*</td>
<td>.25</td>
<td>-</td>
<td>.16</td>
</tr>
<tr>
<td>Physiological arousal</td>
<td>.22</td>
<td>-</td>
<td>.16</td>
<td>.22</td>
<td>.27</td>
<td>-</td>
<td>.18</td>
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<tr>
<td>Aggressive feelings</td>
<td>.18</td>
<td>-</td>
<td>.16</td>
<td>.29/.16*</td>
<td>-</td>
<td>-</td>
<td>.14</td>
</tr>
<tr>
<td>Prosocial behaviors</td>
<td>-.16</td>
<td>-</td>
<td>-.21</td>
<td>-.25/-30*</td>
<td>-.30</td>
<td>-</td>
<td>-.10</td>
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*Studies split into experimental and correlational studies, and no overall estimate was given; The first number shown in each cell (e.g., .29) is the empirically derived estimate, whereas the second number (e.g., .15) is the theoretically derived estimate revised to account for potential publication bias.

feelings, arousal, and behaviors. It is also clear that the effect is not overwhelming—these are generally small to moderate effect sizes. This also fits well with existing theory and data about aggression—aggression is multicausal, and therefore no single environmental factor should overwhelm all others (including genetic, personality, and situational factors).

**ATTENTION PROBLEMS AND EXECUTIVE FUNCTIONS**

Recent research has linked video game playing with greater attention problems and several conceptually related abilities (i.e., impulsiveness, self-control, executive functioning, and cognitive control). This body of research remains considerably smaller than research on other negative outcomes, such as aggression, and the strength of evidence for a causal effect is more limited. Nonetheless, the
evidence to date is consistent with negative effects of video game exposure on attention problems and other related variables.

Several cross-sectional studies have found that children and adolescents who play more video games also tend to have more attention problems (e.g., Chan & Rabinowitz, 2006). Furthermore, longitudinal studies have found that video game exposure is related to greater subsequent attention problems, even when earlier attention problems are statistically controlled for (Gentile, Swing, Lim, & Khoo, 2012; Swing, Gentile, Anderson, & Walsh, 2010). This suggests that the link between video game playing and attention problems is not simply the result of those with attention problems being more attracted to video games. These studies have also ruled out a number of alternative variables, such as sex, age, race, and socioeconomic status. We are not aware of any experimental studies to date testing the effect of repeated video game exposure on attention problems. Thus, though most of the evidence so far is consistent with a causal effect of video games on attention problems, it remains possible that some alternative variable not yet tested accounts for this association.

The extent to which specific video game dimensions matter beyond the overall amount of video game exposure is less clear. Violent video game playing is related to greater attention problems (Hastings et al., 2009). This violent content link seems to explain some unique variance beyond the overall hours of video game playing (Gentile et al., 2012). However, when initial attention problems are also controlled for, only overall time spent playing video games remains a uniquely significant predictor of attention problems. Future research may clarify these mixed findings regarding violent content. Additionally, the possibility that other video game dimensions (e.g., fast pacing) are specifically linked to attention problems needs to be investigated.

Several studies have also found certain executive functions to be impaired by video game playing (e.g., Kirsh, Olczak, & Mounts, 2005; Mathews et al., 2005). Participants experimentally assigned to play a violent video game performed worse on an emotional Stroop task compared to those assigned to play a nonviolent video game (Kirsh et al., 2005). Specifically, those who played a violent video game were less able to ignore the meaning of emotion-related words in a color-naming Stroop task. Another study found that proactive cognitive control, a type of executive function involving the maintenance of information in working memory, is lower in habitual violent video game players compared with nonviolent video game players (Bailey, West, & Anderson, 2010).

THEORETICAL EXPLANATIONS

How these apparent video game effects on attention problems and related outcomes are explained depends to some extent on whether certain video game...
dimensions, such as violent content or fast pacing, are thought to underlie the effects. To the extent that the number of hours spent playing video games best predicts attention problems, this would support the displacement hypothesis (i.e., that this effect results from the displacement of time away from tasks that contribute to the development of sustained attention and impulse control; Gentile et al., 2012). American children and adolescents (ages 8–18) spend approximately 7.5 hours per day with various forms of electronic media, which makes a considerable amount of displacement of other activities plausible (Rideout, Foehr, & Roberts, 2010). To the extent that video games and other forms of electronic media do not lead to the development of impulse control and sustained attention, their use may cut into time that otherwise would have been spent on activities that would have improved these abilities.

Alternatively, if violent content, fast pacing, or other video game dimensions play a particularly important role in the negative effects of video games on attention problems, this would support the excitement hypothesis (Gentile et al., 2012). That is, video games that are exciting and contain a number of cues that naturally attract attention (e.g., violence, rapid movement, flashing lights) might lead a person to be less able to focus in contexts that lack these features. For example, school classrooms and work environments typically require individuals to direct their attention in a purposeful way without much guidance from external stimuli. Those who have spent a great deal of time playing action-packed video games may be more reliant on external cues and less able to direct their attention based on goals or expectations, leading to greater distraction or decreased persistence.

SCHOOL PERFORMANCE

A number of studies have documented a significant negative association between the amount of time spent with screen-based media (television, movies, and video games) and school performance (e.g., Anderson & Dill, 2000; Chan & Rabinowitz, 2006; Cordes & Miller, 2000; Gentile, 2009; Sharif & Sargent, 2006). For example, a recent survey done on a large, nationally representative sample of American children and adolescents found that nearly half (47%) of heavy media users get poor grades, compared to 23% of light media users (Rideout, Foehr, & Roberts, 2010). A longitudinal study of elementary school children showed that total screen time significantly predicts poorer grades later in the school year, even while controlling for other relevant covariates (Anderson Gentile, & Buckley, 2007).

Why is media use associated with poorer grades? The displacement hypothesis posits that electronic media can negatively influence school performance by displacing time that would have been spent in other educational activities (such as reading and homework; Gentile et al., 2004). There has been some empirical
support for this hypothesis. For example, adolescent video gamers have been found to spend 30% less time reading and 34% less time doing homework than nongamers (Cummings & Vandewater, 2007). However, it is also possible that children who have trouble at school choose to spend more time playing video games in order to experience feelings of mastery or that attention problems cause both preference for video games and poorer school performance (Gentile, 2009). More research is needed in this area to explore other mechanisms that might also contribute to the link between media use and school performance.

**VIDEO GAME ADDICTION**

There are now scores of studies looking at what is being called pathological gaming or video game "addiction." Many researchers define pathological use of video games in the same way as pathological gambling, focusing on damage to family, social, school, occupational, and psychological functioning (Sim, Gentile, Bricolo, Serpelloni, & Gulamoydeen, 2012). 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 (Sim et al., 2012). Currently, video game addiction is not classified as a formal disorder in the Diagnostic and Statistic Manual of Mental Disorders (DSM). The category of "internet use gaming disorder" has been in the appendix of the new DSM-V with the goal of encouraging further research in this area (American Psychiatric Association, 2013).

Overall, studies examining pathological video gaming show good reliability and validity (Gentile, Coyne, & Bricolo, 2013). Regarding the prevalence, one national study conducted in the United States with a sample of 1,100 youth found that 8.5% of youth gamers could be classified as pathological (Gentile, 2009). Similar percentages are found in several other countries, including 8.7% in Singapore (Choo et al., 2010), 10.3% (Peng & Li, 2009) and 10.8% (Lam, Peng, Mai, & Jing, 2009) in China, 8.0% in Australia (Porter, Starcevic, Berle, & Fenech, 2010), 11.9% in Germany (Grüsser, Thalemann, & Griffiths, 2007), and 7.5% in Taiwan (Ko, Yen, Yen, Lin, & Yang, 2007). These studies have not used a common methodology or definition, however, so each estimate of prevalence should be considered to be preliminary (although it is interesting that the percentages are so similar, given the vast differences in methods and populations).

Pathological gamers show patterns of comorbidity similar to those found in other addictions. Researchers have measured other clinical disorders and have found that pathological technology users often show comorbidity with psychiatric disorders (e.g., Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000). Shapira and colleagues (2003) summarized those studies and noted that the most typical comorbid or primary disorders were mood disorders, substance use disorders, anxiety disorders, impulse control disorders, and personality disorders. Other
studies have found that pathological use is also comorbid with ADHD and anxiety/depression (e.g., Gentile, 2009; Gentile et al., 2011). Most of the studies that have looked at potential outcomes of pathological use have found significant problems, such as poorer school performance, insomnia, suicidal thoughts, financial problems, and more relationship problems (Gentile Coyne, & Bricolo, 2013).

A question that is just beginning to be answered is whether pathological gaming is a problem in its own right, or whether it is simply symptomatic of other problems (such as depression). Longitudinal studies are needed to answer this question. To date, only one longitudinal study of pathological gaming has been published (although there has been one on pathological internet use; Lam & Peng, 2010). In it, 3,034 Singaporean children and adolescents were followed across two years, testing whether variables such as depression and poor school performance are predictors of or are predicted by pathological video gaming (Gentile et al., 2011). Because of the large sample size, the researchers were able to classify gamers into four types: those who never were pathological gamers across the two years, those who became pathological gamers, those who were pathological gamers at the start but stopped being pathological, and those who were and stayed pathological gamers. Somewhat surprisingly, depression became worse if youth became pathological gamers. Furthermore, anxiety, social phobia, and school performance also became worse after becoming a pathological gamer. Additionally, if children stopped being pathological gamers, their depression, anxiety, social phobia, and school performance all improved. This pattern suggests that these are likely to be outcomes of pathological technology use rather than predictors of it. At a minimum, it suggests that these conditions are truly comorbid, such that they can influence each other. The fact that depression, anxiety and social phobia worsened after becoming a pathological gamer supports the idea that pathological gaming is a distinct mental health disorder rather than being just a symptom of other conditions. On the other hand, it is likely that such mental health issues have reciprocal relationships and share common risk factors.

At the time of this writing, the early research on pathological gaming appears to suggest that it is highly similar to other addictions in its pattern of comorbidity and outcomes. Additional research is clearly needed to determine its etiology, risk factors, and course, as well as the best approaches for treatment.

Positive Video Game Effects

**VISUAL-SPATIAL SKILLS**

Playing video games has been associated with performance superiority and improvement on many visual and spatial tasks. Specific visual-spatial skills
and tasks that incorporate those skills can be improved through games that require the player to practice extracting spatial information from the screen. Positive effects of video game play on visual-spatial skills have been found both in correlational studies (e.g., Green & Bavelier, 2003) and experimental studies (e.g., Okagaki & Frensch, 1994). Gamers have been found to outperform nongamers on a number of visual and spatial tasks, demonstrating faster visual reaction times and improved target localization and mental rotation (Green & Bavelier, 2003; Achtman, Green, & Bavelier, 2008; Green & Bavelier, 2007). Experimental studies have shown that only 10 hours of video game play can improve spatial attention and mental rotation (Feng, Spence, & Pratt, 2007; Green & Bavelier, 2003). It should be noted that most studies that have found video game effects on visual-spatial skills have used fast-paced video games, which are typically violent. This serves as a reminder that video games do not conform to a good-bad dichotomy—they engender many effects that can be both positive and negative.

NONVIOLENT VIDEO GAME EFFECTS

Prosocial Video Games

Prosocial video games are centered on helping other game characters, distinct from hero-centered violent video games in which the player's character kills (or helps another character kill) enemies. In the laboratory, prosocial video game play has been shown to reduce aggressive thoughts, feelings, and behavior while increasing prosocial thoughts, empathy, and helping behavior (Narvaez, Mattan, MacMichael, & Squillace, 2008; Sestir & Bartholow, 2010; Anderson et al. 2012). Several studies have reported long-term effects of prosocial video game play, finding increases in cooperation, sharing, empathy, and helping behavior in adolescents (Gentile et al., 2009) and increases in prosocial behavior among children (Sestir & Bartholow, 2010). Playing prosocial games not only increases prosocial behavior but also decreases aggression. Research by Greitemeyer and Osswald (2009) found that even a brief prosocial gaming experience leads to a decrease in the hostile expectation bias (a tendency to perceive other people's provocative actions as hostile instead of accidental) and in the accessibility of antisocial thoughts.

Educational Video Games

Educational video games have been found to be effective teaching aids in a wide range of domains. Video games reinforce the student's behavior often, are engaging enough for the student to play the games on multiple occasions, provide clear objectives, and require active involvement (Gentile and Gentile, 2008). Educational video games have been successfully used to teach students a
number of school subjects, such as mathematics, reading, and biology (Murphy, Penuel, Means, Korbak, & Whaley, 2001; Corbett, Koedinger, & Hadley, 2001). Employers have also recognized the power of the video games to teach and have incorporated games to teach employees needed job skills. For example, Volvo has used an online game to train car salesmen (Entertainment Software Association, 2011b).

Educational video games can also be used to explain health conditions and encourage healthier lifestyles. A number of studies have shown video games to be effective teaching tools for helping youth understand health conditions such as cancer and diabetes (Brown et al., 1997; Kato, Cole, Bradlyn, & Pollock, 2008; Lieberman, 2001). These games can also bring about behavioral change. For example, after six months of playing a video game on diabetes self-management, diabetic youth decreased their number of visits to the emergency room as compared to those in the control condition (Lieberman, 2001).

**Exergames**

Exergames can be classified as interactive video games that require some type of exercise to play. These games can take the form of traditional exercise, such as yoga or boxing, or can incorporate movement through more creative means, such as dodging a ball or jumping over an obstacle. Exergame research has focused on three areas: energy expenditure, activity time, and activity preference. The excitement provided by exergames contributes to all three areas, enabling players to get into the game and expend more energy, to play the game longer and with more frequency over time, and to prefer exergames over traditional exercise (Biddiss & Irwin, 2010; Graf, Pratt, Hester, & Short, 2009; Mellecker & McManus, 2008). Klein and Simmers (2009) found that even those with a low motivation to exercise were still willing to engage in an exergame. In a period in which American children spend more than six hours a day watching television and playing video games (Rideout, Foehr, & Roberts, 2010), it’s no wonder that the preference for exergames in children has caused enthusiasm in parents and pediatricians alike. These video games do more than contribute to physical fitness; they contribute to psychological health as well. In a study conducted by Rosenberg et al. (2010), senior citizens living in a community had an increased quality of life and exhibited improvement in subsyndromal depression after only three months of playing Wii sports.

**Conclusions and Unanswered Questions**

Video games are at the center of a public debate concerning what is beneficial or harmful to children and adolescents. Views expressed in this debate have
often been extreme, either idealizing or vilifying video games. Critics of video games, such as now-disbarred attorney Jack Thompson, have called video games "murder simulators" and pointed to violent video games as clear causes of school shootings (e.g., Cavalli, 2008). On the other hand, the Entertainment Software Association recognizes only positive outcomes of video game play (such as positive influences of video games on perceptual skills) and discounts the existence of any harmful effects (e.g., Entertainment Software Association, 2011a). The critics and the proponents tend to ignore research evidence supporting the views of the opposing camp and label video games as clearly "good" or "bad."

In contrast, the research findings reviewed in this chapter lead to the conclusion that video game effects are complex and are better understood in terms of multiple dimensions than a good or bad dichotomy. Significant effects of video game play have been demonstrated in a wide range of domains. Some of these effects are desired by parents, such as the effect of prosocial video games on empathy and helping (Greitemeyer & Osswald, 2010). Other video game effects are worrisome to parents, such as the effects of violent video games on aggression (e.g., Anderson & Dill, 2000), although it should be noted that this is a desired effect by the armed services who train soldiers with violent video games. Even a single game can have multiple effects on a person, some of which are harmful and some of which are beneficial (e.g., a violent game which improves visuospatial functioning, but which also increases the risk of physical aggression).

The rapid growth in research on video game effects has greatly improve our understanding of how video games influence players. Effects of violent video games on aggression and related variables have received an especially large amount of attention and are now fairly well understood (Anderson et al., 2010). Other areas of research are newer and still contain a number of unanswered questions that need to be addressed. More research is needed to increase our understanding of how prosocial video games exert their effects on empathy and helping, to explore video game effects on attention and cognitive control, and to increase our knowledge of symptoms and consequences of gaming addiction. Given the large proportion of children and adolescents who play video games, increasing our understanding of both positive and negative video game effects is a relevant research topic that has important implications for public policy debates, for theory development, and for planning potential intervention strategies designed to increase positive effects and reduce negative effects of playing video games.

Notes

1. The term attention problems refers to problems associated with attention disorders, such as attention-deficit/hyperactivity disorder. These problems are generally assessed as a continuous variable, rather than a diagnostic category. Attention problems should not
be confused with "visual attention." Attention problems include difficulty in sustained effortful processing and impulse control, whereas visual attention refers to fast and accurate extraction or processing of information from the visual field.

2. However, video game playing increasing attention problems and attention problems increasing video game playing are not mutually exclusive possibilities. Indeed, Gentile et al. (2012) found evidence for bidirectional causality between these variables.

References


