

Chapter 3

The impact of violent video games: An overview

Craig A Anderson and Wayne A Warburton

Parents often ask about the effects of violent video games on their children and teenagers. In most cases, they note that their “common sense” instinct is that too much exposure to violent video games must have some sort of negative effect on their children, but that they have read in the media that “the jury is still out” on violent media effects or that there is no convincing evidence that violent video game playing is harmful. Confusion around this conflict will often prompt them then to ask: “what does the scientific evidence really say?” In this chapter we show that the common sense view is backed up by a substantial body of recent scientific findings. Helpful and pro-social video game content has great potential for enhancing the lives of children and adolescents, but exposure to anti-social and violent video game content increases the likelihood of a range of negative outcomes, with greater exposure increasing the risk.

Video games have been around for nearly 50 years. Kirsch (2010) notes the first as being *Spacewar* (released in 1962), a game in which two spaceships battle to the death in space. Although the graphics were very simple compared to modern games, the theme of battling to the death is one that has endured through the ensuing five decades.

According to the most recent comprehensive poll by the Kaiser Foundation, American children aged 8–18 play an average of eight hours of video games per week, an increase of over 400 per cent from 1999 (Rideout, Foehr & Roberts, 2010). Playing is heaviest in the 11–14 age group, with boys outplaying girls more than 2.5 hours to 1. A recent study suggests that around 99 per cent of American boys play video games, along with 94 per cent of girls (Lenhart et al, 2008). It is common for US children and adolescents to play more than 20 hours per week

and it is not uncommon for males to play 40 hours or more per week (Bailey, West & Anderson, 2010). On average, Australian 7–18-year-olds played somewhat less than their US counterparts in 2007 (4.7 hours per week: see ACMA, 2007), but this figure could have risen substantially in recent years if Australian children have followed the steep upward trend found in the latest US studies.

The types of games vary, but content analyses by Dill and colleagues (2005) show that the majority of top selling video games and children's favourite games contain violence, and often strong violence. More recently, *Call of Duty: Modern Warfare 2* grossed ~\$USD 550 million in the first five days of its 2009 release, at that time more than any other entertainment product in history (movies included). Next on the list in 2009 was *Grand Theft Auto IV (GTA)*, with ~\$USD 500 million in five days. Even more recently (a year is a long time in the video game world) *Call of Duty: Black Ops* grossed \$USD 360 million in a single day, breaking all records (Ortutay, 2010). According to Wikipedia, the massive multiplayer online game (MMOG) *World of Warcraft* has more than 12 million online subscribers and thus currently grosses more than \$USD 180 million per month (at \$15 per month per player). *GTA*, which is rated M17+ in the United States and involves such activities as going on murderous rampages, having sex with prostitutes and then murdering them to retrieve the money paid, has been played by 56 per cent of United States children aged 8–18 (Rideout et al, 2010). Clearly, a large number of children and adolescents are exposed regularly to video games with high levels of violence and anti-social themes. This makes it important for parents, educators and professionals who work with children to have some knowledge of their effects.

Before turning to the negative effects of violent video games however, it is important to stress that video games can have many helpful benefits. Here are just a few.

Helpful effects of video games

Pain management

Kirsch (2010) notes that various media, including video games, can be used to distract and relax children during painful medical procedures.

Coordination and spatial cognition

A number of studies reveal that video games which require the placement of objects within a screen (such as *Tetris*) can enhance the spatial cognition abilities of players (that is, the ability to mentally arrange and rotate objects in three dimensions). Indeed, video game playing has been linked with a wide array of visual and spatial skills, primarily through practice effects (see Green & Bavelier, 2006; Okagaki & Frensch, 1994; see also Bailey et al, 2010, for a review). In one study by Gopher, Weil and Bareket (1994), the flight performance of Israeli Air Force cadets who had been trained on the Space Fortress II video game was compared with the performance of an untrained group. The trained cadets performed better in almost all aspects of flight performance and as a result the game was incorporated into the Israeli Air Force training program.

Pro-social behaviour

Although this area of study is still in its infancy, there is mounting evidence that video games which model and involve participants in pro-social, helping behaviours can lead to increases in pro-social behaviour in the short and long term. Most notably, Gentile et al (2009) found that elementary school students exposed to pro-social video games were more helpful than those exposed to violent or non-social video games. In a second longitudinal study of Japanese children in grades 5, 8 and 11, exposure to pro-social video games at the start of the study was linked with increased pro-social behaviour some months later, even when the baseline pro-social tendencies of children were statistically removed. In a final study of Singaporean secondary school students, the amount of pro-social video game play experienced was correlated with helping behaviour, cooperation, sharing and empathy. A study by Greitemeyer and Osswald (2009) found that pro-social video game playing led to a short-term reduction in the tendency to see the world as hostile and an immediate reduction in anti-social thoughts.

Education

A considerable literature reveals video games to be a powerful teaching tool (eg, Barlett et al, 2009; Murphy et al, 2002; Swing & Anderson,

2008). They have been used to teach algebra (Corbett et al, 2001), biology (Ybarrondo, 1984), photography (Abrams, 1986), and computer programming (Kahn, 1999), to teach children how to manage diabetes (Lieberman, 2001; 2006) and to teach specific skills using simulators (for example, by Qantas pilots, NASA and the Air Force). Gentile and Gentile (2008) describe the educational advantages of using video games as teaching tools. These include the power of video games to engage children and to “encourage children to persevere in acquiring and mastering a number of skills, to navigate through complex problems and changing environments, and to experiment with different identities until success is achieved” (p 127).

Exercise

There has been a recent explosion in the popularity of video games that promote physical activity and exercise (that is, “Exergames”). Games such as *Wii Sports Heart Rate*; *Wii Fit*; *Wii Play*; *Wii FitPlus*; *Dance, Dance Revolution* and *Just Dance* seem to be part of a recent trend that has seen an increase in the availability and popularity of non-violent, helpful games.

Clearly, video games have considerable potential to enhance the lives of children and adolescents. Unfortunately, excessive video game playing, especially of violent video games, has the potential to impact children in a number of negative ways.

Harmful effects of video games

Video game addiction

In his moving biography, *Unplugged: My Journey into the Dark World of Video Game Addiction*, Ryan Van Cleave describes the way that a violent online game, *World of Warcraft*, dominated his life to such an extent that he was unable to function normally and was driven to the verge of suicide. Video game addiction is now taken so seriously by psychologists and psychiatrists that it was recently considered for inclusion in the fifth edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM) as a diagnosable psychiatric disorder and has been lodged in its appendix to encourage further research. It is clear that many children

play video games at a “pathological” level that causes damage to family, social, school or psychological functioning (see Anderson et al, 2012). For example, it has been found that 8.5 per cent of 8–18-year-old US video game players do so at pathological levels (Gentile, 2009). Similar studies have found figures of 11.9 per cent in Europe (Grusser et al, 2007), 8.7 per cent in Singapore (Choo et al, 2010), 10.3 per cent in China (Peng & Li, 2009) and 4 per cent for 12–18-year-olds in Norway (Johansson & Götestam, 2004), with a further 15.5 per cent “at risk”.

As will be seen in the ensuing sections, the amount that children play video games is very important. Those who play excessively are not only at risk of a number of negative outcomes, they are also much more likely to be playing violent games (see Krahé & Möller, 2004).

Attention deficits

There are some studies linking the amount of time children spend playing video games to attention deficits, impulsivity and hyperactivity (see Bailey et al, 2010; Swing et al, 2010). For example, Gentile (2009) found that adolescents who used video games at pathological levels were nearly three times more likely to be diagnosed with Attention Deficit Disorder or Attention Deficit Hyperactivity Disorder than adolescents who played at non-pathological levels. In a landmark paper, Swing and colleagues (2010) examined the effect of video game playing on attention in elementary school children. They used a longitudinal study that statistically controlled for a range of other factors that could also lead to attention problems and found that amount of time spent playing video games predicted increases in teacher assessments of attention deficits in the children 13 months later. These results suggest that the children’s level of video game playing played a causal role in their subsequent loss of attentional capacity.

Anderson et al (2012) believe that on theoretical grounds some video games should have less effect on attentional problems (for example, those that require controlled thought and planning) and that those which require constant reactive behaviours from players (a common feature of many violent first person shooting games for example) may be more problematic in terms of children developing attentional difficulties.

School performance

It is well established that spending longer hours playing video games is linked with poorer school performance for both children and adolescents (Anderson et al, 2007; Chan & Rabinowitz, 2006; Chiu et al, 2004; Cordes & Miller, 2000; Gentile, 2009; Gentile et al, 2004; Sharif & Sargent, 2006). One explanation for this is a simple displacement of time – hours spent playing video games eats into time that would normally be spent studying and reading. For example, in a study of 1491 youth between 10 and 19, gamers spent 30 per cent less time reading and 34 per cent less time doing homework (Cummings & Vandewater, 2007). It is also possible, however, that children who perform more poorly at school are also more likely to “spend more time playing games, where they may feel a sense of mastery that eludes them at school” (Anderson et al, 2012). Of course, another possibility is the that excessive gaming creates attention deficits, which in turn can lead to poorer school performance.

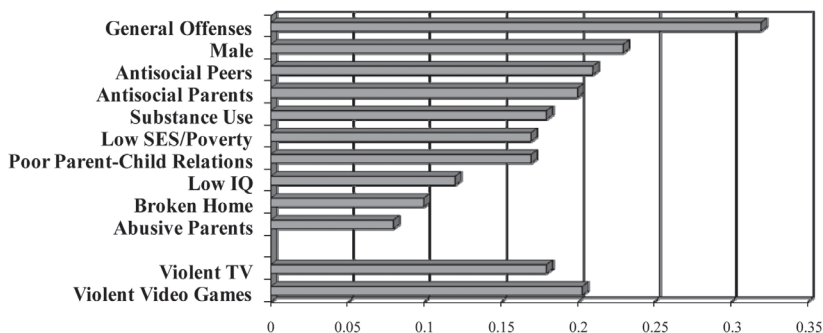
Increased aggression

Should we be concerned about children and adolescents playing violent video games? Can this lead to aggressive behaviour? Over 98 per cent of paediatricians in the United States have considered these questions and believe that excessive violent media exposure has a negative effect on childhood aggression (Gentile et al, 2004). Similarly, there is a consensus amongst the vast majority of violent video game researchers that too much exposure to violent video games increases the likelihood of aggressive thoughts, feelings and behaviours, leads to desensitisation to violence and also leads to decreases in pro-social behaviours and empathy (Anderson et al, 2010; Huesmann, 2010). There are, however, a small number of researchers who dispute this evidence and it seems that the views of this small minority have had a large impact on public perceptions (Anderson & Gentile, 2008; Dill, 2009). In this section of the chapter we will broadly examine the arguments for this view and then review the scientific evidence that does find violent video game effects. In this way, we hope that readers can judge the evidence for themselves.

1. The first argument against violent video game effects is that there is little evidence linking the playing of violent video games to very violent behaviours (such as school shootings). To better understand

this argument it is helpful to reflect on the difference between aggression and violence. In essence, violence is aggressive behaviour that has extreme harm as its goal (Anderson & Bushman, 2002). Thus, all violence is aggression but not all aggression is violence. With this in mind we make four points.

- (a) Ethically it is not possible to use the most powerful methods – experimental manipulations – to test the causal link between violent video games and violence because we cannot rightfully incite people to cause extreme harm in a laboratory. There are, however, ways to test links with aggressive behaviour, which *can* be examined ethically in a laboratory. It is disingenuous to suggest that because there are no experimental studies that randomly assign children to years of playing violent or nonviolent video games and then measure which group commits the most violent crimes, that therefore there are no established negative or anti-social effects. This is like saying that because there are no experimental studies on humans showing that cigarette smoking causes lung cancer, smoking is not a causal risk factor. The causal links between violent video game playing and physical aggression are, in our opinion, well established.
- (b) Cross-sectional (correlational) studies and longitudinal studies of violent video game effects have established significant links to violent behaviour. Several longitudinal studies in particular provide strong evidence that these are causal effects.
- (c) Aggressive behaviour, which can include bullying, hurting other people physically, hurting other people’s property or relationships and hurting people verbally, is a very important social phenomenon in its own right. Aggression does not have to escalate into violence to be harmful and destructive.
- (d) No aggression researchers claim that media violence is the sole or even the most important source of violent behaviour. The most common approach, and the one taken by the authors, is the “risk factor” approach. According to this approach, people can have various risk factors for aggression or violent behaviour (see Figure 1). These might include coming from a violent home, having a violent peer group, high levels of trait aggression, exposure to violent media and a number of other factors. The more risk factors that

Figure 1: Some longitudinal factors for youth violence

Adapted from US Department of Health and Human Services (2001), Bushman and Huesmann (2006) and Anderson et al (2010).

are present for a person, especially when they are present from a young age, the more likely that person is to be aggressive or violent. Strasburger (2009, p 203) notes that:

The research on media violence and its relationship to real-life aggression is clear: young people learn their attitudes about violence at a very young age, and once learned, those attitudes are difficult to change (Anderson et al, 2003; Bushman & Huesmann, 2006). Conservative estimates are that media violence may be causing 10% of real-life violence – not the leading cause by any means, but an unhealthy chunk that we could do something about if we chose to (Strasburger et al, 2009; Comstock & Strasburger, 1990).

We believe that Victor Strasburger is right. Many risk factors for aggression and violence are very hard to deal with as parents, as educators, as professionals and as policy-makers. Media violence, though, is one risk factor that can be controlled and about which action can be taken from the level of the individual home through to the level of State and federal governments. This makes the research on media violence effects particularly important.

2. Detractors of the view that playing violent video games increases the likelihood of aggressive behaviour also criticise the methodology of video game studies and of meta-analyses of these studies. It is to this important scientific evidence that we now turn.

What is a meta-analysis and what evidence do the meta-analyses provide?

A meta-analysis is a statistical technique whereby scientific studies that test the same or a similar hypothesis (for example, that violent video game exposure compared to neutral video game exposure will result in increased aggression) and the same or a similar outcome (for example, aggressive behaviour) are combined to ascertain the strength (“effect size”) of the average finding. To date there have been a number of meta-analyses of the effect of violent video games on aggressive thoughts, feelings and behaviours. In particular, studies by Distinguished Professor Craig Anderson and Dr Chris Ferguson have received a lot of publicity in recent years and it is valuable to compare them.

Dr Ferguson, a vocal critic of the research demonstrating a link between violent video game playing and aggression, along with video game industry representatives, claims that violent video game research is methodologically flawed and that mainstream media violence researchers selectively report biased findings. Dr Ferguson has also suggested that Professor Anderson’s meta-analyses have a “publication bias” that undermines their results. Dr Ferguson cites his own three meta-analyses that examine the question of whether violent video game playing increases subsequent aggression. These examined 24, 17 and 14 published papers, encompassing 25, 21 and 15 separate tests of the same hypothesis respectively (Ferguson 2007a, 2007b; Ferguson & Kilburn, 2009). In total, 4205 and 3602 participants were tested in the first two meta-analyses (the number cannot be determined for the most recent study but is assumed to be lower). Dr Ferguson found a positive relationship between violent video game exposure and aggressive behaviour, with effect sizes of .29, .14 and .15 respectively. He then inappropriately (according to some meta-analysis experts, see Bushman, Rothstein, & Anderson, 2010) “corrected” for publication bias using a controversial statistical procedure called “trim and fill” that reduced these effect sizes. Such a procedure guesses what unpublished studies might be out there and adds these guesses to the averaging procedure. Based on the “corrected” figures, Dr Ferguson concluded there was no effect of violent video games on aggressive behaviour. These three meta-analyses, which use highly overlapping subsets of the same small sample of studies, are

widely cited as the strongest evidence that violent video game playing does not increase the likelihood of aggressive behaviour.

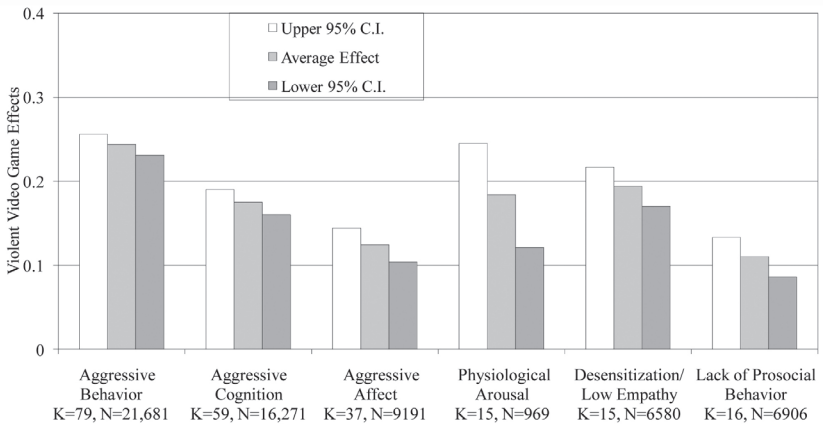
Evidence that playing violent video games does increase the likelihood of aggression comes from many researchers. Professor Anderson and his colleagues have themselves conducted a large number of such studies and have also summarised the available studies in three comprehensive meta-analyses, the first in 2001 (Anderson & Bushman, 2001), the second in 2004 (Anderson et al, 2004) and the most recent in 2010 (Anderson et al, 2010). The latter paper was co-authored by Professor Hannah Rothstein, an expert in meta-analyses and publication bias. This paper detailed major shortcomings in the Ferguson meta-analyses (which failed to include numerous relevant studies) and included all relevant studies then known. Data from 136 articles, 381 separate tests of hypotheses, and across a massive sample of 130,296 participants were analysed. In this large, all-inclusive meta-analysis, research methodology was also examined. Among the many findings was that studies with better research methods tended to find stronger effects of violent video game playing on aggressive behaviour.

We present a summary of the findings in Figure 2 (*over page*). We understand that the concept of effect size is a hard one to grasp without a detailed knowledge of statistical procedures, so we will provide some comparison data afterwards to help readers make sense of the results.

The middle bar shows the effect found, the bars on either side reflect how variable the findings were in the studies tested.

Figure 2 shows several meta-analyses. Each tests a different hypothesis. All hypotheses are tested as outcomes of exposure to violent video games, and these outcomes include aggressive behaviour, aggressive thoughts (cognitions), aggressive feelings (affects), physiological arousal, desensitisation to violence/low empathy and pro-social behaviour. As can be seen, the average effect across these many studies was one whereby exposure to violent video games led to an increase in aggressive behaviours, aggressive thoughts, aggressive feelings and physiological arousal (which is linked to aggressive behaviour), to desensitisation to violence and decreased empathy, and to a reduction in pro-social behaviours.

It is important to note that these findings come from a range of study types – experimental studies in which all participants have

Figure 2: Results of the meta-analysis by Anderson et al 2010

K = number of separate tests of the same hypothesis included in the analysis

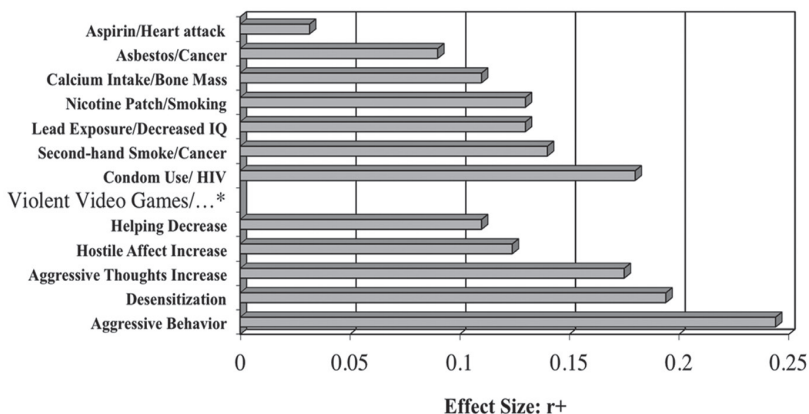
N = number of participants across studies

CI = Confidence Interval, a measure of how variable the data was.

exactly the same experience other than the media type they experience, correlational studies of the links between levels of violent video game playing and various types of aggressive behaviours in real life, and longitudinal studies that follow video game playing patterns and behavioural patterns in the same people over time.

Each study type makes a unique contribution to what we know. Experiments can be used to infer that one thing causes another, but it is harder to generalise these findings to “real life”. Correlational studies involve “real life” behaviours and can test alternative hypotheses, but it is difficult to determine the causal direction of relationships found (that is, whether playing violent games causes aggression or whether aggressive people choose violent games). Longitudinal studies are real world studies and can be used to find whether one thing causes another over time in a person’s life. Some media violence studies have followed the same people for over 40 years (eg, Huesmann et al, 2003) and have very detailed data. Because links between violent video game playing

Figure 3: The comparative effect sizes of violent video game effects and other well known phenomena



* From Best Practices studies, Anderson et al, *Psychological Bulletin*, 2010.

and aggression are found consistently across all three study types, the evidence converges to suggest both a causal link and an effect that is found in the real world.

The Anderson et al (2010) meta-analysis also found that when proper statistical methods are used, there was no evidence of systematic publication bias in the studies. The rather weak evidence of publication bias produced by Dr Ferguson was likely the result of several factors, including failure to use all of the relevant studies and the combining of cross-sectional and experimental studies in the publication bias analysis.

To understand how strong the obtained violent video game effect on aggression is, it can be helpful to get a sense of what the “effect size” numbers actually mean. It is easy to understand that a higher number means a stronger effect, but it is much harder to know how a big a number needs to be before it is considered important. Figure 3 shows some effect sizes for well known phenomena that can be used as points for comparison.

As can be seen from Figure 3, violent video game effects are larger than the effect of eating calcium on bone mass, of asbestos inhalation

on related cancers, of condom use on reducing HIV infection numbers, of taking aspirin on reducing heart attacks and a range of other very important phenomena. Clearly, the size of violent video game effects is large enough to be considered socially important.

A final finding from the Anderson et al (2010) meta-analyses is that the violent video game effects occurred for both males and females, and across low-violence collectivistic Eastern countries (for example, Japan) and high-violence individualistic Western countries (for example, Australia and the United States). This is not a surprising finding, as other reviews have found that violent video games affect people regardless of age, gender, socio-economic status, game genre and game system (Barlett et al, 2009). In fact, to the knowledge of the authors, no group has yet been identified that are immune to the effects of exposure to violent media such as video games (see Anderson et al, 2003).

Perhaps the best brief summary of the evidence presented here is articulated in a statement produced by 13 researchers into violent video game effects (including the authors of this chapter), prepared for an *amicus curiae* (friend of the court) brief for the *Schwarzenegger and Brown v Video Software Dealers Association and Entertainment Software Association* case in the Supreme Court of the United States (Docket # 08-1448). This statement was supported as being accurate by a further 102 well-respected researchers in this area.

Statement on Video Game Violence

Both the American Psychological Association (APA, 2005) and the American Academy of Pediatrics (AAP, 2009) have issued formal statements stating that scientific research on violent video games clearly shows that such games are causally related to later aggressive behavior in children and adolescents. Extensive research has been conducted over many years using all three major types of research designs (experimental, cross-sectional, and longitudinal). Numerous original empirical research studies have been conducted on children and adolescents. Overall, the research data conclude that exposure to violent video games causes an increase in the likelihood of aggressive behavior. The effects are both immediate and long term. Violent video games have measurable and statistically significant effects on both males and females. Theoretically important effects of violent video games have been confirmed by many empirical studies. The effects have been replicated by researchers in different settings and in numerous countries. The psychological processes underlying

such effects are well understood and include: imitation, observational learning, priming of cognitive, emotional and behavioral scripts, physiological arousal, and emotional desensitization. These are general processes that underlie all types of social behavior, not just aggression and violence; they have been confirmed by countless studies outside of the media violence domain. In addition to causing an increase in the likelihood of aggressive behavior, violent video games have also been found to increase aggressive thinking, aggressive feelings, physiological desensitization to violence, and to decrease pro-social behavior.

Importantly, this statement alludes to the psychological processes that are known to underlie the effect of exposure to violent video games on children. These are worth examining in more detail because they also provide some insight as to why the effects of violent video games, compared to other violent media, may be stronger.

The psychology of violent video game effects on children

Most of the explanations related to violent video game effects involve different types of learning. Because of certain features of violent video game playing – interactivity, repetition and the actual playing of the role of aggressor – the effects may be stronger and patterns of behaviour better learned.

Imitation

Humans seem to be hard-wired from birth to imitate others. Recently discovered “mirror neurons” in humans and primates represent one mechanism in the brain that may facilitate this (Caggiano et al, 2009; Gallese et al, 1996; Rizzolati et al, 1996; Umiltà et al, 2001). Imitation has benefits, including the fast learning of important behaviours, and plays a role in human bonding. However, imitation of unhelpful and anti-social behaviours can have clear negative effects for the individual and for society. We know that children will imitate aggressive behaviours, even if the behaviours are totally new to the child and are not seen to be rewarded in any way (Bandura, 1965; 1973; Bandura et al, 1961; 1963a, 1963b).

We also know that children imitate characters from the media they see, with some characters more likely to be imitated than others – those that are attractive, heroic, rewarded for their behaviour or liked, or that have high social status. In violent video games the central characters

often meet several of these criteria. Does this mean, though, that people will copy the behaviours of the characters in very violent games such as *GTA* and others? It is possible. For example, an 18-year-old youth in Thailand stabbed a taxi driver to death trying to “find out if it was as easy in real life to rob a taxi as it was in the game” (Reed, 2008). As a result, *GTA IV* was banned in Thailand. In 2003 William Buckner, 16, and his step-brother Joshua, 14, killed a man and seriously wounded a woman shooting at cars in Tennessee (Calvert, 2003). The boys claimed they were acting out the game *Grand Theft Auto III*. Also in 2003, Devin Moore, an 18-year-old from Alabama, killed three police officers following his arrest for a carjacking. On being re-arrested he is reported to have told police that “Life is like a video game. Everybody’s got to die sometime” (Leung, 2005). Again, the killer told police he was copying behaviour he had learned playing *GTA III*. We are not suggesting that violent video game playing alone was causal in these crimes. As noted earlier, numerous risk factors influence the likelihood of aggressive and violent behaviour, and the most severe forms of violence virtually always require the convergence of many risk factors. Furthermore, it is difficult (perhaps impossible) to identify which risk factors were crucial to any particular aggressive or violent act. Nonetheless, imitation of media violence seems to have played some role in these cases.

There are numerous other stories of aggressive behaviours that seemingly imitate violent video games. These are easily accessed on the internet with a simple search. Clearly, for some violent video game players, simple imitation may play a causal role in some acts of aggression. However there are a number of other factors, also linked with imitation and learned aggression, that may also be important.

Identification

Although media effects can occur without the person identifying with any of the characters they have seen, identifying with an aggressor has been shown to increase the likelihood of adopting aggressive behaviours and attitudes (Cantor, 1994; Huesmann & Eron, 1986; Huesmann et al, 2003). People are more likely to identify with a character who is perceived as similar, heroic and attractive (Hearold, 1986; Heath et al, 1989), and are more likely to identify with and believe realistic portrayals because they are easier to relate to personal experiences (Berkowitz

& Alioto, 1973; Feshback, 1972; Geen, 1975). In violent video games, the player strongly identifies with (and usually takes the role of) the aggressor. The aggressive central character is usually glorified and portrayed as heroic and, in recent years, the portrayal of aggressive characters in video games has become increasingly realistic (Gentile et al, 2007). For these reasons, identification with violent/aggressive characters may be a key way that video games impact on children.

Repetition

It is well established that repetition of behaviours establishes them in memory, increases skill and automates them as learned responses (eg, Gentile & Gentile, 2008). Further, repeating an entire behavioural sequence commits it to memory better than repeating only part of a sequence (Gentile et al, 2007). Violent video games are much more repetitive than other forms of violent media and more often involve the repetition of complete behavioural sequences (Gentile et al, 2007). Players repeat the same behaviours and receive similar rewards throughout the game, experience similar thoughts and feelings during those actions and are exposed to the attitudes espoused in the game implicitly and explicitly (for example, sleeping with prostitutes and then murdering them to retrieve one's money in *GTA* implies misogyny, the acceptance of violence to get what one wants and that human life has little value). Simply put, the repetitive nature of violent video games is ideal for learning aggressive attitudes and scripts for behaviour.

Interactivity

Active participation assists learning as it requires attention, and closely attending to a task assists people to memorise the relevant behaviours and knowledge (Gentile et al, 2007; Gentile & Gentile, 2008). Violent video games are highly interactive, and the recent development of home consoles that allow players to use realistic weapons such as replica guns and swords further increases the level of interactivity and decreases the gap between game playing behaviours and "real world" behaviours. The combination of interactivity and frequent rehearsal is a potent one for learning. In essence, this is a key reason that video games are such powerful tools for teaching pilots, astronauts and soldiers their core skills. These factors give video games tremendous potential for

pro-social pursuits and as learning tools, but have less welcome implications regarding the interactive rehearsal of anti-social and aggressive behaviours.

Lack of negative consequences

Another basic tenet of learning theory, demonstrated across thousands of studies, is that people are more likely to behave in ways that are rewarded and less likely to behave in ways that are punished. In terms of imitation, children imitate aggression they perceive as being rewarded more often than aggression they perceive as resulting in punishment. Interestingly, children will imitate unpunished aggression as often as rewarded aggression (eg, see Bandura, 1973).

With these facts in mind, it is relevant that most acts of violence in video games:

- (a) go unpunished;
- (b) are rewarded (for example, by points, money, status and elevation to higher game levels);
- (c) have unrealistic consequences for the victim.

With relation to the final point, it is important for parents and professionals to note that seeing victims suffer realistic and negative consequences as a result of media violence should *reduce* the likelihood of subsequent aggression because pain cues usually inhibit aggressive behaviour (Baron, 1971a, 1971b, 1979). Also note, however, that in some circumstances pain and suffering cues can increase aggressive behaviour (see Berkowitz, 1993, p 174).

Associative learning

As noted in Chapter 1, the brain is a neural network in which concepts, ideas, feelings and memories are stored and interconnected. The way this network “wires up” depends on what people experience, with paired experiences (such as the smell of fresh coffee, pleasure and a craving for a hot beverage) becoming more strongly wired together the more they are experienced together. This means that people learn to associate one thing with another.

In media generally, and in violent video games especially, many things are frequently paired and thus become “wired” together. For

example, guns are rarely used for any purpose other than violent action. This is why there is a well demonstrated “weapons effect”, whereby the simple sight of a weapon increases the likelihood of aggression if the person has mentally paired a weapon such as a gun with killing or hurting people rather than with a non-aggressive use such as sports shooting (Bartholow et al, 2005; Berkowitz & LePage, 1967; Carlson et al, 1990). This suggests that children who often play video games where there is frequent weapon use for the purpose of killing and hurting others are more likely to be aggressive immediately after playing the game and are more likely to be aggressive when exposed to a weapon of a similar type in real life.

Associative learning also explains why whole sequences of behaviour are learned during video game play and why the acquisition of aggression-related knowledge structures is so important.

Acquisition of aggressive knowledge structures, attitudes and scripts for behaviour

Clearly, violent video games are powerful teachers, but what is the outcome of such learning for the individual child? In essence, the child (and adult for that matter) internalises clusters of associated knowledge about aggressive behaviour (knowledge structures or “schemas”), as well as attitudes about aggressive behaviour and “scripts” for how to behave in certain circumstances.

Schemas and scripts contain knowledge about an aspect of living, mental links to related attitudes, feelings and memories, and a repertoire of associated behaviours. Scripts additionally contain information about how commonly experienced situations “play out” (such as visiting a supermarket) and the typical sequence of behaviours in that situation (entrance at the left of the store, grab a trolley, milk at the back, bread in the second aisle, line up and pay). Schemas and scripts are activated by a trigger (for example, the supermarket logo) and, once active, help to direct our behaviour, often without our being aware of it. Children start to develop schemas about the world as toddlers (and perhaps earlier) and these can sometimes be aggressive in nature.

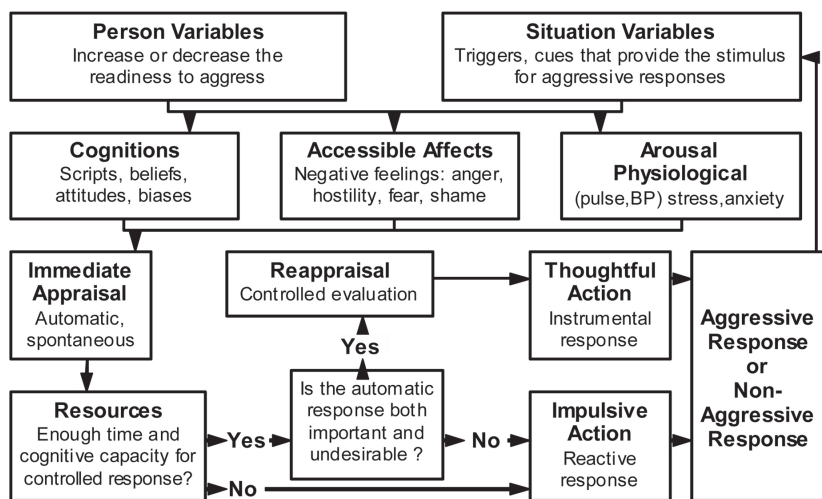
In relation to the development of aggressive knowledge structures and attitudes, there is considerable evidence that exposure to violent media (including violent video games):

- (a) increases attitudes approving of aggressive behaviour as a “normal” social response (Huesmann, 1998);
- (b) increases mental access to scripts for resolving conflict that involve aggressive behaviour and reduces access to conflict-solving scripts that are non-aggressive (Bushman & Anderson, 2002; Huesmann, 1998);
- (c) underpins the attitude that aggression is (1) exciting and (2) increases one’s social status (Groebel, 1998);
- (d) increases the belief that the world is a frightening place (Cantor, 2003; Donnerstein et al, 1994);
- (e) increases a hostile attributional bias whereby ambiguous but innocent behaviours by others are interpreted as deliberately hurtful (Anderson et al, 2010; Möller & Krahé, 2009); and
- (f) increases the likelihood of aggressive behaviour (Anderson et al, 2010).

Regrettably, children are exposed to a lot of violent media. As noted in Chapter 1, by the age of 18, most US children will have seen many tens of thousands of murders and acts of violence on television alone. Heavy playing of violent video games that involve frequently killing of other people or creatures would add greatly to those figures, especially for murders. This means that for a lot of children, violent media influences may result in higher levels of aggressive schemas, fear about the wider world, hostile and anti-social attitudes, and scripts for behaving aggressively, than might otherwise occur without those influences.

Fictitious violence versus real violence

Recent brain imaging studies, in which children’s brain activation patterns are “photographed” by fMRI machines whilst they are experiencing violent media, have shown that even when children know the violence they are watching is fictitious or fantasy violence, their brains respond to the violence as if there was a real threat (Murray et al, 2006; see also Weber et al, 2006). In addition, long-term memory systems were activated, suggesting that this effect could endure beyond the initial exposure. This research suggests that fantasy media violence seems to have a similar impact on children as exposure to realistic media violence.

Figure 4: The General Aggression Model

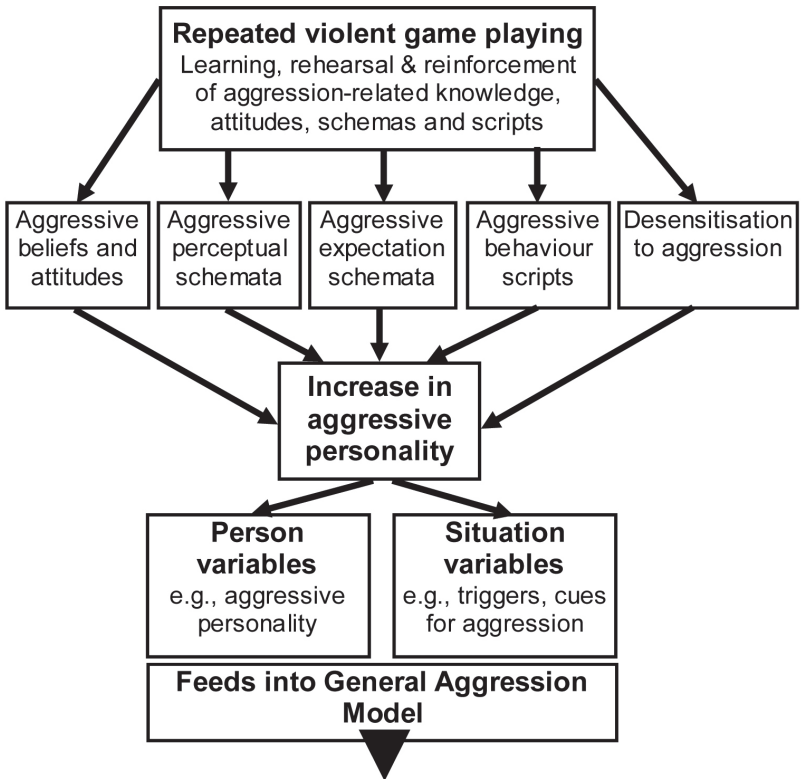
The General Aggression Model

The General Aggression Model (GAM: Anderson & Bushman 2002; DeWall, Anderson & Bushman, in press) provides a theoretically sound and helpful way of understanding how exposure to violent media can increase a person's likelihood of being aggressive in both the short and long term (see Figures 4 and 5).

The GAM is a model of what is happening psychologically during an episode of aggression. In essence the person brings their own readiness to aggress, through their gender, beliefs and attitudes about aggression, personality and other stable factors. Each situation has cues and triggers for aggression, such as the presence of a weapon or an insult. When a person encounters an aggression-triggering situation, various relevant cognitions (memories, beliefs, attitudes, scripts for behaviour) are activated, along with feelings (such as fear and anger) and a level of physiological arousal. Higher levels of arousal make a dominant tendency to act more likely.

As a result of these activated cognitions and feelings, and of the level of arousal, the person has an immediate response. If they are very aroused or if the situation requires immediate action, this will probably be the ultimate response. If the person has the time and cognitive capacity for a more considered response they will evaluate their options and

Figure 5: Ways in which long term exposure to violent video games can increase aggressive cognitions and action tendencies and then feed into episodes of situational aggression



are more likely to make a thought-through response. Either way, the eventual response, which may be aggressive, is enacted, elicits a social response and the episode is encoded into memory. Once in memory, it becomes part of the “person” and can then affect their responses to future situations.

Although “person” characteristics are very important in determining how an individual reacts in a specific situation, the research presented in this chapter reveals that most people, regardless of personal characteristics, are influenced by violent video games. It also reveals that violent video games provide many cues for aggressive behaviour, activate aggressive cognitions and feelings, and can increase levels of arousal. These internal processes can explain why there is also a robust link between violent video game playing and aggressive behaviour.

Over the long term, exposure to the attitudes, ideas and scripts for behaviour in violent video games leads to stable knowledge structures, attitudes, biases in thinking, scripts for conflict resolution and action tendencies that include aggressive behaviour (see Figure 5). In turn, these increase the base level of aggressiveness in that person’s personality and bring the person to an aggression-triggering type of situation with a higher predisposition to aggress.

Between the two models, it is easy to see how playing a video game can lead to aggression in the short term, and how repeated playing can lead to higher levels of aggression in the long term.

Conclusions and advice for parents and professionals working with children

In this chapter we have detailed the evidence that video games can be used for a wide array of helpful purposes, but that there can be many negative consequences for playing violent games, especially when played excessively. This raises an important question: “How do we help children to benefit from video games but escape their negative impacts?”

In Chapter 1 it was noted that the “you are what you eat” principle applies to the way media exposure affects the way the human neural network “wires up” as well as to food consumption. Using the food metaphor can be helpful for parents and professionals when it comes to advising children on how to use media in a beneficial way. Through

school education many children are interested in healthy eating and this can be extended to maintaining a healthy media diet. For example, children could be told that, as with food, there are media that are good to consume regularly (in moderation), media that are for infrequent consumption and media that children should avoid. Helping a child to self-regulate what they watch and hear in the media can be very important to a child's development in this media saturated world. This may involve:

- educating children about media effects generally and about video game effects specifically, so that children can learn to make informed choices;
- helping children to limit their time playing video games;
- encouraging children to play pro-social and educational video games in preference to violent games;
- keeping video game consoles in public areas and out of children's bedrooms; and
- playing video games with your children so that you are aware of their content and can knowledgeably discuss the implications of playing certain types of games and screen out potentially harmful ones.

It is desirable for children to be able use video games for a range of educational and developmental objectives, but to have less exposure to the more harmful impacts. We hope that this chapter has helped to dispel some popular myths about the impact of violent video games on children and adolescents and has clarified for readers how positive outcomes might be achieved.

A Tragic Postscript

*I see MW2 more as a part of my training-simulation than anything else ...
You can more or less completely simulate actual operations*

These were the chilling words with which Anders Behring Breivik referred to the computer game Modern Warfare 2 in a 1500-page manifesto disseminated just hours before he was responsible for the deaths of 76 of his fellow Norwegians (Moses, 2011; Shah, 2011; Townsend & Tisdall, 2011). The 32-year-old male behind the now infamous bombing

of government buildings in Oslo and subsequent shooting massacre on Utoya island on 22 July 2011 made no secret of the fact that playing the violent video games *Modern Warfare 2* and *World of Warcraft* aided him in preparing and executing his attacks. Breivik identified *Modern Warfare 2* as helping him with “target practice” (Shah, 2011) and involvement with *World of Warcraft* as providing sufficient cover for his preparatory activities (Moses, 2011). As a result of the attacks, one of Norway’s biggest retailers, Coop Norway, issued a ban of indefinite duration on these and other violent video games that, at the time of publication, has yet to be lifted (Narcisse, 2011; Navarro, 2011). When considering the impact of violent video games, particularly in light of the Norway atrocities, it should also be noted that video games in which acts of violence are executed in first-person, immersive environments have long been recognised and used by the US military forces as effective in both the training and recruitment of their members (Holguin, 2009; Robson, 2008).

References

- AAP (American Academy of Pediatrics) (2009). Policy Statement—Media Violence. *Pediatrics*, 124, 1495-1503.
- Abrams, A (1986). *Effectiveness of interactive video in teaching basic photography skills*. Paper presented at the Annual convention of the Association for Educational Communication and Technology. Las Vegas, NV, January
- ACMA (Australian Communications and Media Authority) (2007). *Media and communications in Australian families, 2007*. Canberra: Australian Communications and Media Authority. Accessed 14 April 2001, <http://www.acma.gov.au/webwr/_assets/main/lib101058/media_and_society_report_2007.pdf>.
- Anderson, CA, Berkowitz, L, Donnerstein, E, Huesmann, LR, Johnson, J, Linz, D, Malamuth, N, & Wartella, E (2003). The influence of media violence on youth. *Psychological Science in the Public Interest*, 4, 81–110.
- Anderson, CA, & Bushman, BJ (2001). Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science*, 12, 353–359.
- Anderson, CA, & Bushman, BJ (2002). Human aggression. *Annual Review of Psychology*, 53, 27–51.
- Anderson, CA, Carnagey, NL, Flanagan, M, Benjamin, AJ, Eubanks, J, & Valentine, JC (2004). Violent video games: Specific effects of violent content on aggressive thoughts and behavior. *Advances in Experimental Social Psychology*, 36, 199–249.
- Anderson, CA, & Gentile, DA (2008). Media violence, aggression, and public policy. In E Borgida & S Fiske (eds), *Beyond common sense: Psychological science in the courtroom* (pp 281–300). Malden, MA: Blackwell.

- Anderson, CA, Gentile, DA, & Buckley, KE (2007a). *Violent video game effects on children and adolescents: Theory, research, and public policy*. Oxford: Oxford University Press.
- Anderson, CA, Gentile, DA, & Dill, KE (in press). Prosocial, antisocial, and other effects of recreational video games. In DG Singer, & JL Singer (eds), *Handbook of Children and the Media* (2nd ed). Thousand Oaks, CA: Sage.
- Anderson, CA, Shibuya, A, Ihori, N, Swing, EL, Bushman, B, Sakamoto, A, Rothstein, HR, & Saleem, M (2010). Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries. *Psychological Bulletin*, *136*, 151–173.
- APA (American Psychological Association) (2005). *APA calls for reduction of violence in interactive media used by children and adolescents*. Washington DC: American Psychological Association.
- Bailey, K, West, R, & Anderson, CA (2010). A negative association between video game experience and proactive cognitive control. *Psychophysiology*, *47*, 34–42.
- Bandura, A (1965). Influence of models' reinforcement contingencies on the acquisition of imitative responses. *Journal of Personality and Social Psychology*, *1*, 589–595.
- Bandura, A (1973). *Aggression: A social learning analysis*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A, Ross, D, & Ross, SA (1961). Transmission of aggression through imitation of aggressive models. *Journal of Abnormal and Social Psychology*, *63*, 575–582.
- Bandura, A, Ross, D, & Ross, SA (1963a). A comparative test of the status envy, social power, and secondary reinforcement theories of identificatory learning. *Journal of Abnormal and Social Psychology*, *67*, 527–534.
- Bandura, A, Ross, D, & Ross, SA (1963b). Imitation of aggression through imitation of film-mediated aggressive models. *Journal of Abnormal and Social Psychology*, *66*, 3–11.
- Barlett, CP, Anderson, CA, & Swing, EL (2009). Video game effects confirmed, suspected and speculative: A review of the evidence. *Simulation and Gaming*, *40*, 377–403.
- Baron, RA (1971a). Aggression as a function of magnitude of victim's pain cues, level of prior anger arousal, and aggressor-victim similarity. *Journal of Personality and Social Psychology*, *18*, 48–54.
- Baron, RA (1971b). Magnitude of victim's pain cues and level of prior anger arousal as determinants of adult aggressive behavior. *Journal of Personality and Social Psychology*, *17*, 236–243.
- Baron, RA (1979). Effects of victim's pain cues, victim's race, and level of prior instigation upon physical aggression. *Journal of Applied Social Psychology*, *9*, 103–114.
- Bartholow, BD, Anderson, CA, Carnagey, NL, & Benjamin, AJ (2005). Interactive effects of life experience and situational cues on aggression: The weapons priming effect in hunters and nonhunters. *Journal of Experimental Social Psychology*, *41*, 48–60.
- Berkowitz, L (1993). *Aggression: Its causes, consequences, and control*. New York: McGraw-Hill.
- Berkowitz, L, & Alioto, JT (1973). The meaning of an observed event as a determinant of its aggressive consequences. *Journal of Personality and Social Psychology*, *28*, 206–217.
- Berkowitz, L, & LePage, A (1967). Weapons as aggression-eliciting stimuli. *Journal of Personality and Social Psychology*, *7*, 202–207.
- Bushman, BJ, & Anderson, CA (2002). Violent video games and hostile expectations: A test of the general aggression model. *Personality and Social Psychology Bulletin*, *28*, 1679–1686.
- Bushman, BJ, & Huesmann, LR (2006). Short-term and long-term effects of violent media on aggression in children and adults. *Archives of Pediatrics and Adolescent Medicine*, *160*, 348–352.

- Bushman, BJ, Rothstein, HR, & Anderson, CA (2010). Much ado about something: Violent video game effects and a school of red herring: Reply to Ferguson and Kilburn. *Psychological Bulletin*, 136, 182–187.
- Caggiano, V, Fogassi, L, Rizzolatti, G, Their, P, & Casile, A (2009). Mirror neurons differentially encode the peripersonal and extrapersonal space of monkeys. *Science*, 324, 403–406.
- Calvert, J (2003, October 23). *Families sue over GTA III-inspired shooting*. ZDNet News. Accessed 14 April 2011, <<http://www.zdnet.com.au/families-sue-over-gta-iii-inspired-shooting-120280063.htm>>.
- Cantor, J (1994). Fright reactions to mass media. In J Bryant & D Zillmann (eds), *Media effects: Advances in theory and research* (pp 213–245). Hillsdale, NJ: Erlbaum.
- Cantor, J (2003). Media and fear in children and adolescents. In DA Gentile (ed), *Media Violence and Children* (pp 185–203). Westport, Connecticut: Praeger.
- Carlson, M, Marcus-Newhall, A, & Miller, N (1990). Effects of situational aggression cues: A quantitative review. *Journal of Personality and Social Psychology*, 58, 622–633.
- Chan, PA, & Rabinowitz, T (2006). A cross-sectional analysis of video games and attention deficit hyperactivity disorder symptoms in adolescents. *Annals of General Psychiatry*, 5, 16–27.
- Chiu, S-I, Lee, J-Z, & Huang, D-H (2004). Video game addiction in children and teenagers in Taiwan. *CyberPsychology and Behavior*, 7, 571–581.
- Choo, H, Gentile, DA, Sim, T, Li, D, Khoo, A, Liau, AK (2010). Pathological video gaming among Singaporean youth. *Annals of the Academy of Medicine Singapore*, 39, 822–829.
- Comstock G, & Strasburger, VC (1990). Deceptive appearances, television violence and aggressive behaviour – An introduction. *Journal of Adolescent Health Care*, 11, 31–44.
- Corbett, AT, Koedinger, KR, & Hadley, W (2001). Cognitive tutors: From the research classroom to all classrooms. In PS Goodman (ed), *Technology enhanced learning* (pp 235–263). Mahwah, NJ: Lawrence Erlbaum.
- Cordes, C, & Miller, E (2000). *Fool's gold: A critical look at computers in childhood*. College Park, MD: Alliance for Childhood.
- Cummings, HMM, & Vandewater, EAP (2007). Relation of adolescent video game play to time spent in other activities. *Archives of Pediatric and Adolescent Medicine*, 161(7), 684–689.
- DeWall, CN, Anderson, CA, & Bushman, BJ (2011). The general aggression model: Theoretical extensions to violence. *Psychology of Violence*, 1, 245–258.
- Dill, KE (2009). *How fantasy becomes reality: Seeing through media influence*. New York: Oxford University Press.
- Dill, KE, Gentile, DA, Richter, WA, & Dill, JC (2005). Violence, sex, age and race in popular video games: A content analysis. In E Cole & J Henderson-Daniel (eds), *Featuring Females: Feminist Analyses of Media* (pp 115–130). Washington, DC: American Psychological Association.
- Donnerstein, E, Slaby, RG, & Eron, LD (1994). The mass media and youth aggression. In LD Eron, JH Gentry, & P Schlegel (eds), *Reason to hope: A psychosocial perspective on violence and youth* (pp 219–250). Washington DC: American Psychological Association.
- Ferguson, CJ, & Kilburn, J (2009). The public health risks of media violence: A meta-analytic review. *Journal of Pediatrics*, 154, 759–763.

- Feshbach, S (1972). Reality and fantasy in filmed violence. In GA Comstock & EA Rubinstein (eds), *Television and social behavior: A technical report to the Surgeon General's Scientific Advisory Committee on Television and Social Behavior: Vol. 3. Television and adolescent aggressiveness* (DHEW Publication No HSM 72-9058, pp 318-345). Washington, DC: US Government Printing Office.
- Gallese, V, Fadiga, L, Fogassi, L, & Rizzolatti, G (1996). Action recognition in the premotor cortex. *Brain*, 119, 593-609.
- Geen, RG (1975). The meaning of observed violence: Real vs. fictional violence and consequent effects on aggression and emotional arousal. *Journal of Research in Personality*, 9, 270-281.
- Gentile, DA (2009). Pathological video-game use among youth ages 8 to 18: A national study. *Psychological Science*, 20, 594-602.
- Gentile, DA, Anderson, CA, Yukawa, S, Ihori, N, Saleem, M, Ming, LK, Shibuya, A, Liau, AK, Khoo, A, & Sakamoto, A (2009). The effects of prosocial video games on prosocial behaviors: International evidence from correlational, experimental, and longitudinal studies. *Personality and Social Psychology Bulletin*, 35, 752-763.
- Gentile, DA, & Gentile, JR (2008). Violent video games as exemplary teachers: A conceptual analysis. *Journal of Youth and Adolescence*, 9, 127-141.
- Gentile, DA, Oberg, C, Sherwood, NE, Story, M, Walsh, DA, & Hogan, M (2004). Well-child exams in the video age: Pediatricians and the AAP guidelines for children's media use. *Pediatrics*, 114, 1235-1241.
- Gentile, DA, Saleem, M, & Anderson, CA (2007). Public policy and the effects of media violence on children. *Social Issues and Policy Review*, 1, 15-61.
- Gopher, D, Weil, M, & Bareket, T (1994). Transfer of skill from a computer game trainer to flight. *Human Factors*, 36, 387-405.
- Green, CS, & Bavelier, D (2006). Effect of action video games on the spatial distribution of visuospatial attention. *Journal of Experimental Psychology: Human Perception and Performance*, 32, 1465-1478.
- Greitemeyer, T, & Osswald, S (2009). Prosocial video games reduce aggressive cognitions. *Journal of Experimental Social Psychology*, 45, 896-900.
- Groebel, J (1998). *The UNESCO Global Study on Media Violence: A joint project of UNESCO, the World Organization of the Scout Movement and Utrecht University, The Netherlands*. Report presented to the Director General of UNESCO, UNESCO, Paris.
- Grüsser, SM, Thalemann, R, & Griffiths, MD (2007). Excessive computer game playing: Evidence for addiction and aggression? *CyberPsychology and Behavior*, 10, 290-292.
- Hearold, S (1986). A synthesis of 1043 effects of television on social behavior. In G Comstock (ed), *Public communication and behavior* (Vol 1, pp 65-133). New York: Academic Press.
- Heath, L, Bresolin, LB, & Rinaldi, RC (1989). Effects of media violence on children. *Archives of General Psychiatry*, 46, 376-379.
- Holguin, J (2009). *Uncle sam wants video gamers*. CBS News, 11 February. Accessed 27 August 2011, <<http://www.cbsnews.com/stories/2005/02/08/eveningnews/main672455.shtml>>.
- Huesmann, LR (1986). Psychological processes promoting the relation between exposure to media violence and aggressive behavior by the viewer. *Journal of Social Issues*, 42, 125-140.
- Huesmann, LR (1998). The role of social information processing and cognitive schema in the acquisition and maintenance of habitual aggressive behavior. In RG Geen & E Donnerstein (eds), *Human aggression: Theories, research and implications for social policy* (pp 73-109). San Diego CA: Academic Press.

- Huesmann, LR (2010). Nailing the coffin shut on doubts that violent video games stimulate aggression: Comment on Anderson et al (2010). *Psychological Bulletin*, 136, 179–181.
- Huesmann, LR, & Eron, LD (eds) (1986). *Television and the aggressive child: A cross-national comparison*. Hillsdale NJ: Lawrence Erlbaum and Associates.
- Huesmann, LR, Moise-Titus, J, Podolski, C, & Eron, L (2003). Longitudinal relations between children's exposure to TV violence and their aggressive and violent behavior on young adulthood. *Developmental Psychology*, 39, 201–221.
- Huston, AC, Donnerstein, E, Fairchild, H, Feshbach, ND, Katz, PA, Murray, JP, Rubinstein, EA, Wilcox, BL, & Zuckerman, D (1992). *Big world. small screen: The role of television in American Society*. Lincoln: University of Nebraska Press.
- Johansson, A, & Götestam, KG (2004). Problems with computer games without monetary reward: Similarity to pathological gambling. *Psychological Reports*, 95, 641–650.
- Kahn, K (1999). *A computer game to teach programming*. Paper presented at the National Educational Computing Conference, Atlantic City, NJ, June.
- Kirsch, SJ (2010). *Media and youth: A developmental perspective*. Malden MA: Wiley Blackwell.
- Krahé, B, & Möller, I (2004). Playing violent electronic games, hostile attributional style, and aggression-related norms in German adolescents. *Journal of Adolescence*, 27, 53–69.
- Lenhart, A, Kahne, J, Middaugh, E, Macgill, ER, Evans, C, & Vitak, J (2008). *Teens, video games, and civics*. Washington, DC: Pew Internet and American Life Project.
- Leung, R (2005). *Can a video game lead to murder? Did 'Grand Theft Auto' cause one teenager to kill?* CBS News, 17 June. Accessed 14 April 2011, <<http://www.cbsnews.com/stories/2005/06/17/60minutes/main702599.shtml>>.
- Lieberman, DA (2001). Management of chronic pediatric diseases with interactive health games: Theory and research findings. *Journal of Ambulatory Care Management*, 24, 26–38.
- Lieberman, DA (2006). What can we learn from playing video games? In P Vorderer and J Bryant (eds), *Playing video games: Motives, responses, and consequences* (pp 379–397). Mahwah, NJ: Lawrence Erlbaum.
- Möller, I, & Krahé, B (2009). Exposure to violent video games and aggression in German adolescents: A Longitudinal analysis. *Aggressive Behavior*, 35, 75–89.
- Moses, A (2011). *From fantasy to lethal reality: Breivik trained on Modern Warfare game* Sydney Morning Herald Online, 25 July. Accessed 27 August 2011, <<http://www.smh.com.au/digital-life/games/from-fantasy-to-lethal-reality-breivik-trained-on-modern-warfare-game-20110725-1hw41.html>>.
- Murphy, RF, Penuel, WR, Means, B, Korbak, C, Whaley, A, & Allen, JE (2002). *A review of recent evidence on the effectiveness of discrete educational software*. Washington, DC: Planning and Evaluation Service, US Department of Education.
- Narcisse, E (2011). *Norway retail chain pulling violent video games in wake of Breivik killings*. Time – Techland, 1 August. Accessed 27 August 2011, <<http://techland.time.com/2011/08/01/norway-retail-chain-pulling-violent-video-games-in-wake-of-breivik-killings>>.
- Navarro, A (2011). *Norwegian retailer indefinitely bans 'violent video games' even though no one asked*. Giant Bomb, 29 July. Accessed 27 August 2011, <<http://www.giantbomb.com/news/norwegian-retailer-indefinitely-bans-violent-video-games-even-though-no-one-asked/3536/>>.
- Okagaki, L, & Frensch, PA (1994). Effects of interactive entertainment technologies on development. *Journal of Applied Developmental Psychology*, 15, 33–58.
- Ortutay, B (2010). *'Call of Duty: Black Ops' sets earnings record for its 1st day*. TDT News, 12 November. Accessed 8 April 2011, <<http://www.tdtnews.com/story/2010/11/12/70137>>.

- Peng, LH, & Li, X (2009). A survey of Chinese college students addicted to video games. *China Education Innovation Herald*, 28, 111-112.
- Reed, J (2008). *Thailand bans Grand Theft Auto IV*. BBC News Online, 4 August. Accessed 14 April 2011, <http://news.bbc.co.uk/newsbeat/hi/technology/newsid_7540000/7540623.stm>.
- Rhodes, RE, Warburton, DER, & Bredin, SSD (2009). Predicting the effect of interactive video bikes on exercise adherence: An efficacy trial. *Psychology, Health and Medicine*, 14(6), 631-640.
- Rideout, VJ, Foehr, UG, & Roberts, DF (2010). *Generation M2: Media in the lives of 8-18 year olds*. Merlo Park CA: Henry J Kaiser Foundation.
- Rizzolati, G, Fadiga, L, Gallese, V, & Fogassi, L (1996). Premotor cortex and the recognition of motor actions. *Cognitive Brain Research*, 3, 131-141.
- Robson, S (2008). *Not playing around: Army to invest \$50m in combat training games*. Stars and Stripes, 23 November. Accessed 27 August 2011, <<http://www.stripes.com/news/not-playing-around-army-to-invest-50m-in-combat-training-games-1.85595>>.
- Sell, K, Lillie, T, & Taylor, J (2008). Energy expenditure during physically interactive video game playing in male college students with different playing experience. *Journal of American College Health*, 56, 505-511.
- Shah, K (2011). *Oslo killer played video games to 'train'* Tech 2, 28 July. Accessed 27 August 2011, <<http://tech2.in.com/news/general/oslo-killer-played-video-games-to-train/232812>>.
- Sharif, I, & Sargent, JD (2006). Association between television, movie, and video game exposure and school performance. *Pediatrics*, 118(4), e1061-1070.
- Strasburger VC (2009). Why do adolescent health researchers ignore the impact of the media? *Journal of Adolescent Health*, 44, 203-205.
- Strasburger, VC, Wilson, BJ, & Jordan, AB (2009). *Children, adolescents, and the media* (2nd ed). Thousand Oaks, CA: Sage.
- Swing, EL, & Anderson, CA (2008). How and what do video games teach? In T Willoughby & E Wood (eds), *Children's learning in a digital world* (pp 64-84). Oxford, UK: Blackwell.
- Swing, EL, Gentile, DA, Anderson, CA, & Walsh, DA (2010). Television and video game exposure and the development of attention problems. *Pediatrics*, 126, 214-221.
- Townsend, M & Tisdall, S (2011). *Defiant from the dock, Breivik boasts more will die*. The Guardian Online, 25 July. Accessed 27 August 2011, <<http://www.guardian.co.uk/world/2011/jul/25/anders-behring-breivik-terror-cells>>.
- Umilta, MA, Kohler, E, Gallese, V, Fogassi, L, Fadiga, L, Keysers, C, & Rizzolatti, G (2001). I know what you are doing. *Neuron*, 31, 155-165.
- US Department of Health and Human Services (2001). *Youth violence: A report of the Surgeon General*. Rockville, MD: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; Substance Abuse and Mental Health Services Administration, Center for Mental Health Services; and National Institutes of Health, National Institute of Mental Health.
- Weber, R, Ritterfeld, U, & Mathiak, K (2006). Does playing violent video games induce aggression? Empirical evidence of a functional magnetic resonance imaging study. *Media Psychology*, 8, 39-60.
- Ybarrondo, BA (1984). *A study of the effectiveness of computer-assisted instruction in the high school biology classroom*. Idaho (ERIC Document Reproduction Service No Ed265015).