Introduction

There is a simple reason why the global advertising industry was worth more than half a trillion dollars in 2016.1 Advertising can both explicitly and implicitly change the way individuals think, feel and behave.2 This is also true of other multi-billion dollar media-based industries such as Hollywood, commercial television, training simulators3 and educational media4. This is not particularly controversial; media producers rely on such effects to be profitable, and the underlying psychological mechanisms are quite well understood.5-6

It is somewhat surprising then, that the scientific findings for violent video games, a media product that seems to impact people through the same psychological mechanisms as these other media7, are viewed by some as controversial. A small, but very vocal group of people, including some academics, consistently refute the evidence that playing violent video games can have any negative impacts on the player. This group suggest that the meta-analyses for violent game studies are subject to publication bias, that experimental designs in this field typically have serious flaws, and note that while video game violence consumption has

Take Home Messages

✔ As with other forms of media (advertising, educational media, training videos and simulators) violent video games impact the way individuals think, feel and behave.

✔ Research converges to show that playing violent video games can increase aggressive behaviour and desensitise players to violence in the short-term and long-term, and can decrease empathy and prosocial behaviour.

✔ Violent video game play is one risk factor for aggression that is reducible.

✔ Aiming for a healthy media diet and effective parental monitoring can be helpful strategies for managing violent video game use.
risen, societal violence has fallen. Active scholars in the field have responded to these arguments, noting weaknesses in logic, and demonstrating that while there may be issues with some research papers, the meta-analyses and scientific findings, together, provide strong and consistent evidence that playing violent games can have a negative impact on players.\textsuperscript{9,11} Whilst it is beyond the scope of this monograph to detail the arguments from either side, I would encourage those who are interested to read papers from both perspectives and draw their own conclusions.

I note this controversy right at the start because I think it is important to be clear about my own position and to note there are some academics who dispute it. My own belief is that violent video games do impact the way players think, feel and behave, in much the same way that other media influences people. Along with most active researchers in the field, I accept as valid the scientific evidence demonstrating that exposure to violent video games can increase aggressive behaviour and desensitise players to violence and the suffering of others in the short-term and long-term. It can also cause people to be more fearful and reduce prosocial behaviour and empathy.

Before I detail this evidence, however, it is important to put these findings in context.

A Risk Factor Approach

No reputable media violence researcher would ever claim that violent media exposure is ever necessary or sufficient to cause a person to be moderately aggressive or violent. Such behaviour requires the confluence of a number of risk factors (e.g. harsh, disconnected parenting; impulsivity; delinquent peers) that are not sufficiently moderated by relevant protective factors (e.g. warm, appropriately authoritative parenting; conflict resolution skills; empathy). From this perspective, violent media exposure is viewed as just one of many possible risk factors for aggression and violence.\textsuperscript{12,13} However, this does not make the effect of media violence or video game violence trivial. Acts of everyday aggression such as bullying, saying cruel things, or sabotaging people’s relationships, are still important because they occur frequently, hurt people, and have a negative impact on the victim.\textsuperscript{14}

In addition, the effect sizes typically found for the impact of violent media on aggression, while small-moderate, compare with those for other risk factors for aggression that are considered important. For example, in a recent study across seven nations, we found that media violence contributed 23\% of the variance in aggressive behaviour measured, compared to 28\% for peer delinquency, 17\% for peer victimisation, 11\% for living in a criminal neighbourhood and 9\% for abusive parenting.\textsuperscript{15} In another analysis, the size of the effect of violent video game playing on youth aggression was similar to the effect size for antisocial peers, antisocial parents, substance use, poverty and poor parent-child relations.\textsuperscript{16} Together, these studies suggest that while exposure to violent media and violent video games is just one risk factor for aggression, it is still a significant contributor, and more important, one that parents, professionals and policy makers can do something about.\textsuperscript{17}

The Types of Research that Have Been Done

Research examining the impact of violent video games has been undertaken across a wide range of methodologies and populations, and the number of individuals tested is substantial. The two biggest meta-analyses of the impact of violent video games\textsuperscript{18-19} examined studies to 2010 and 2014 respectively. They looked at 473 unique tests of violent video game effects, across 187,625 unique participants. These included a large number of experimental studies and cross-sectional/correlational studies, as well as some longitudinal studies. Since 2014, there have been many further studies, and I know of at least twenty-three longitudinal studies to date that have examined the effects of violent game play on aggressive behaviour over time (a soon to be published meta-analysis will show a consistent longitudinal effect overall). The experimental studies have used a wide range of outcome measures, including multiple laboratory measures of aggression, aggressive cognition and aggressive affect. The cross-sectional studies have examined populations with a range of ages, cultural and socio-economic backgrounds, large numbers of both males and females, and have used a wide range of measures of aggression, personality, background, mental health, media use and violent game play. In the last decade, there have also been a significant number of brain imaging studies. Together, the findings across all methodologies are remarkably consistent.

The Research Findings

The finding with the most research evidence to date is that playing violent games increases aggressive behaviour in both the short-term and long-term.\textsuperscript{7,16-25} The short-term effects are both mild and
short-lived. For ethical reasons, only mild forms of aggression can be studied in a laboratory: How much hot sauce one would make someone eat; how much aversive noise one would make someone listen to; and how long one would hold someone’s hand in icy water (among others). The willingness to hurt another person in such a way is increased for only about ten to fifteen minutes after playing a violent game, an amount of time in line with typical neural activation. These effects are robust, and consistently replicated. Importantly, longitudinal studies and studies of long-term effects tend to suggest that these effects are also cumulative, with individuals who are exposed to greater amounts of video game violence also more likely to think and behave more aggressively over time.21-25

Brain imaging studies show consistently that while playing a violent video game, there is less activity in parts of the brain associated with impulse control, executive functions, and managing emotions. For example violent game play reduces activity in the right dorsolateral prefrontal cortex,26 right inferior frontal gyrus and right cerebellum,27 and is linked with reduced executive function in both functional magnetic resonance imaging (fMRI)27 and electroencephalogram (EEG)23 studies. This accords with other studies showing that violent media viewing is linked with less activity in the pre-frontal cortex29-30 and poor executive functioning.31-32 Brain imaging studies have also shown associations between media violence exposure and increased activation in the right hemisphere (where negative emotions are predominantly processed),29 activation of the limbic system, starting with the amygdala,29 and structural changes in the brain. These changes include reduced left lateral orbitofrontal cortex density33 and reduced white matter.31 A recent study has also shown that players of action video games who use non-spatial memory strategies display reductions in hippocampal grey matter over time.34

Brain imaging studies also demonstrate that violent media exposure desensitises individuals to violence and the suffering of others in both the short-term and long-term. Exposure to media violence initially produces fear, disgust and other avoidance-related motivational states.35 This emotional arousal shows in the brain as activation in the limbic system, most notably the amygdala. Various MRI and EEG studies show evidence of emotional desensitisation to violence and the suffering of others through attenuated limbic system activity and P3 event-related potentials.32 This is not only demonstrated in the short-term; a number of brain imaging studies show that desensitisation to violence can become a habitual
response. For example, a fMRI study by Gentile et al. found that heavy users of non-violent games showed elevated limbic activity while playing a violent video game, but habitual players of violent games had reduced limbic activity while playing. This is a finding that suggests heavy consumers of violent games may manage their emotional responses by partially reducing activity in their emotion centres.

Exposure to violent video games is also linked with subtle but measurable changes to the way players think and feel. Meta-analyses by Anderson et al. and Greitemeyer and Mugge show that playing violent games is linked with increases in aggressive cognition, aggressive affect and physiological arousal, and decreases in empathy and prosocial behaviour (see Figure 1).

![Figure 1: Results of meta-analyses by Anderson et al. (2010) and Greitemeyer and Mugge (2014) showing effect sizes of violent video game play on various aggression-related variables. The later analysis uses no studies from the earlier analysis. Over 187,000 participants were tested across these studies.](image)

**Underlying Psychological Processes**

A number of explanations have been put forward for what is happening within the individual during violent game play that facilitates later aggression. In terms of brain function, two key factors are reductions in executive functions, including inhibitory control, and desensitisation to violence and the suffering of others.

The former can facilitate aggression by reducing self-regulatory capacity to inhibit aggression, while the latter can do the same by reducing empathy and concern for others. Both these factors can also inhibit aggression.

In terms of psychological processes, people can learn aggressive behaviour through the three well-established forms of human learning, and these processes can clearly also be applied to learning from violent video games. In associative learning (think of Pavlov’s dogs) people mentally link things that happen together in experience, so that when one of those things happens, the linked thing is also expected to happen. In operant conditioning (think of rats pressing a bar to get food), people are more likely to do things that have been rewarded or were pleasurable in the past, and to avoid behaviours that have previously been punished or resulted in an adverse outcome. In social learning, people imitate the behaviours of others such as their parents, friends or other ‘models’, especially models who are attractive, admired, high status, similar to the individual or who are rewarded in some way for their behaviour. Because violent games typically involve repetitive violent actions in multiple situations that bring in-game rewards, there is much scope to associate a wide variety of cues with aggression, to find aggression rewarding, and to copy violent role models within the game, as well as to copy admired players of the game.

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The most well-regarded modern theory of aggression, the General Aggression Model, is built around the assumption that the human brain includes an associative neural network of nodes (groups of neurones) that encode and later recognise concepts, feelings, memories and sensory inputs. When a person has any sort of experience, this network activates the relevant nodes, bringing closer to consciousness, or into consciousness, the relevant constructs. Things that occur together literally become wired together, so activating one node will often also activate related nodes, bringing to mind related concepts and memories. Knowledge structures form when a complex experience happens repeatedly and a wide range of nodes become connected. These typically include concepts, feelings, memories and behavioural scripts experienced during commonly enacted situations, such as shopping at a supermarket, eating at a restaurant or going to a children’s birthday party.

Aggressive behaviour may result when cues and triggers that are linked to aggressive thoughts or feelings or scripts for behaviour in an individual’s neural network are activated. Furthermore, physiological arousal may make aggression more likely, because it
reduces inhibitory control and increases the likelihood of acting on an aggressive impulse.38

Violent games are arousing, contain many triggers and cues for aggression, elicit aggressive cognitions and affects,18,19 and contain scripts for aggressive behaviour that are often repeated across a range of in-game situations. Thus a player of violent games is likely to have aggression-related concepts and knowledge structures activated while playing (leading to short-term aggression), while also rewiring their neural network to include more aggressive concepts and knowledge structures (leading to longer-term increases in aggressive tendencies).

Implications and Advice for Professionals Who Work with Children

Many children, more often males, are aggressive at levels that concern their parents, schools, psychologists and doctors. This may be apparent as part of conduct disorder, delinquency, bullying/cyberbullying, or a pattern of externalising behaviours. It is helpful for professionals who work with children to be aware that violent video games are a risk factor for aggression that can be managed more easily than other risk factors that are hard or very difficult to change (e.g. gender, socio-economic status, local neighbourhood). In addition, violent video games may contribute to aggressive (and other) problems more for some children than for others (see the inset for warning signs and indicators). When such problems become apparent, parents often look to medical and health professionals for guidance on how to manage them. There are several simple strategies parents can use to better manage their children’s video game use.

Firstly, aim for a healthy media diet overall. The principles are just the same as for a food diet: Moderation in amount; more of the healthy stuff; less of the unhealthy stuff and make sure the content is appropriate at the child’s age.19

In my view, a ‘moderate amount’ for school aged children/teens is somewhere around, on average, two hours per day of recreational screen media, including video games. Such limits may work better when children have some say in how they are structured. For example, a child may have fifteen hours of recreational screen use a week, but can nominate how they spend it, perhaps in long sessions or several shorter sessions.

Because the short-term effects of violent video games tend to be mild and short-lived, and because protective factors (such as warm parenting and good conflict resolution in the household) reduce the impact of playing violent games, playing somewhat violent games from time to time is usually not problematic. The key is to aim for more educational and prosocial game content, and less violent and/or antisocial content. A warning though, extremely violent games can have a powerful impact on children and teens, even in small doses.

Determining the age appropriateness of video games is not always easy, because ratings and labels often do not provide parents and players with adequate information. The best way to get a sense of what is right for a child is to play/study the game yourself. Be aware that children under seven or eight, who have less capacity for abstract thinking, may tend to find the obvious characteristics of a game upsetting or frightening. For example, young children will tend to be scared of a character who looks deformed or grotesque, even if that character is kind. It should also be noted that children and teens do not have fully developed neural mechanisms to manage their emotions,40 and often require more emotional support than is commonly assumed when emotionally impacted by media such as video games.

Secondly, active parental involvement in children’s media use has been shown to be beneficial.20 In one large longitudinal study,41 greater parental monitoring of children’s media use was linked to less screen time and less violent media exposure, and these in turn were linked to lower body mass index (BMI), more sleep, better school performance, less aggression and more prosocial behaviour. Such involvement is much more effective if it goes beyond simply knowing what media children are using. It becomes an active mediation, where the parent knows, discusses and interacts with their child’s media, and models healthy media use themselves.20

WARNING SIGNS AND INDICATORS OF PROBLEMS ASSOCIATED WITH VIOLENT VIDEO GAME PLAY

✔ Becomes aggressive or irritable after playing a video game (a few times or often)
✔ Becomes angry or aggressive when the parent asks the child to stop playing (a few times or often)
✔ Talks a lot about violent themes (including game content) between games; has violent fantasies
✔ Increasingly aggressive in everyday life
✔ Sometimes imitates aggressive content from a video game during non-video-game play
✔ Develops an unhealthy fascination for weapons, murder, death
✔ Video game content seems to be frightening to the child: nightmares; sleep disturbances; anxiety; fear and/or distress related to video game content
✔ A noticeable increase in hostile attitudes and/or beliefs that aggression is a normal way to resolve conflict, and beliefs that the world is a scary place where others cannot be trusted.

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Thirdly, as much as possible, try to keep screens and consoles out of children’s bedrooms, and aim for a screen-free time before bedtime. Two hours is optimal, but lesser amounts are also beneficial.

Finally, overplaying of violent games is linked with a range of physically undesirable outcomes: Sleep deprivation, increased BMI, gross motor deficits; postural and other musculoskeletal problems. It is important to encourage regular breaks, good posture and a healthy lifestyle to offset the sedentary nature of game play. Some guidelines for healthy video game play are available online, and are a handy resource to help parents manage children playing violent video games within their households.

Further Reading


References


35. Cantor J. 'Mummy, I'm scared'. How TV and movies frighten children and what we can do to protect them. San Diego CA: Harvest/Harcourt; 1998.


