The Infamous relationship between violent video game use and aggression – Uncharted moderators and small effects make it a Far Cry from certain

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In 1978, Judas Priest released the album *Stained Class*. The album contained a version of the song *Better by You, Better Than Me* (originally released by the band Spooky Tooth in 1969). In 1985, after listening to Judas Priest's version of the song, James Vance and Raymond Belknap entered into a pact to end their lives with a 12-gauge shotgun. In 1990, Vance and Belknap's parents engaged a legal team to sue Judas Priest, claiming that subliminal messages in the song had prompted the suicide attempt. This is not the only time that rock 'n' roll has been a target for those seeking to identify a cause for society's ills. For example, Led Zeppelin's *Stairway to Heaven* has been suggested to include back-masked lyrics to convey subliminal, Satanic or drug-related messages (see Vokey & Read, 1985, for a consideration of subliminal message effects in music) and, when seeking an explanation for the 1999 Columbine Shooting, some suggested Marilyn Manson (among others musicians) was to blame (e.g., France, 2009). Moreover, rock 'n' roll is not the only scapegoat: violent films (e.g., Oliver Stone's *Natural Born Killers*), "gangsta rap" (e.g., NWA's *Straight Outta Compton*) and, more recently, violent video games (VVGs) have all at various points in time been targeted as catalysts for the (perceived[1]) downfall of, and increasing levels of violence and aggression within, society. Essentially, when groups of people perceive a societal problem, they look for a cause. Often, it seems, they settle on some form of media.

Concern about the potentially negative consequences of interacting with media, especially recent or evolving media, is not a new phenomenon. From Socrates' warning that writing could reach those with "understanding no less than those who have no business with it" (Plato, cited in Cooper & Hutchinson, 1997 p. 551) to historical accounts of concerns of potential reading addiction or mania (Furedi, 2016), the advent of new media invariably brings with it anxiety about potential adverse consequences. Clearly, it is right that it should do so. The potential harms of any new technology or media should be carefully weighed

[1] We return to this perceived increase in societal violence later in the chapter.

against the potential benefits in order to properly inform users of risks, and, if necessary, to craft appropriate public policy responses.

One contemporary area of concern is whether playing VVGs might increase players' aggression or violence *outside the gaming environment*. Before considering the theoretical and empirical bases for such a claim, it is important to distinguish between two key outcomes: aggression and violence. The terms aggression and violence are often (and, we argue, incorrectly) used synonymously in the literature reporting adverse effects of violent gameplay. This can create confusion relating to the effects of VVG use on post-game behaviours (Anderson & Bushman, 2002; Ferguson & Kilburn, 2010). Aggression describes a wide variety of hostile behaviours (Allen & Anderson, 2017; Anderson & Bushman, 2002). Typically, aggression is motivated by fear or frustration, a desire to produce fear or frustration, or a tendency to place one's interest over others'(Allen & Anderson, 2017; Ramirez & Andreu, 2006). Aggression may be physical, but can also be verbal or relational (i.e., attempting to hurt another by adversely affecting their relationships with other people). Violence is often discussed as a subtype of aggression, typically involving greater intensity and destruction than other forms of aggression, and generally manifesting in an attempt to cause physical harm (Anderson & Bushman, 2001; Reiss & Roth, 1993). Thus, violence can be aggressive, but in many instances, aggression is not violent (Anderson & Bushman, 2002).

The relationship between VVG use and aggression is contentious. Proponents of the link between video game violence and aggression are adamant that the even small effects are important (Anderson & Bushman, 2001; Anderson et al., 2010; Bushman & Anderson, 2002; Huesmann, 2010), and often evoke emotive imagery to drive their points home. For example, it is common practice to frame discussions of this issue with reference to the Sandy Hook and Columbine Shootings (Markey, Markey, & French, 2015). Such case studies are relatively weak forms of evidence, and cannot support causal links between VVGs and aggression.

While citing such exemplars does not invalidate the work of proponents of the aggression-violent game link, those sceptical of the VVG-aggression link also argue that the size of the observed effects are negligible or non-existent (Ferguson, 2015; Ferguson & Kilburn, 2010; Hilgard, Engelhardt, & Rouder, 2017; Markey et al., 2015). While there are plausible (and intuitively appealing) theoretical reasons to expect that playing VVGs may increase aggression, there are also a number of reasons to believe that the relationship is likely to be a complex one. For instance, Bandura (2001) suggests that behavioral modelling following observational learning processes is not synonymous with mimicry, and includes the learning of rules about the appropriateness of particular behaviors for particular circumstances.

In this chapter, we argue, based on the strengths and weaknesses of the available empirical data, two key points about the effects of VVGs on aggression. First, while the evidence suggests there may be a relationship between VVGs and aggression under at least some circumstances, such effects are quite small and unlikely to be a primary cause of real-world aggression. Second, and somewhat more importantly, relatively little is known about the boundary conditions, mediators, and moderators of the relationship between VVGs and aggression. With such a limited understanding, it is difficult to properly characterize the relationship between violent game use and aggression, particularly regarding factors that might suppress or exacerbate the relationship. Demonstrating that a relationship can be observed under some conditions is much less informative than knowing the conditions under which a relationship is more or less likely to emerge. Complex systems of variables in the real world interact in ways we do not yet understand, making it difficult to generalize many of the obtained findings to real world applications.

Experimental Studies

Experimental studies investigating the effects of VVGs on aggression are essential for understanding whether there is a causal link between gameplay and aggression. The typical

experimental study in the field of VVGs follows some general patterns. Participants are randomly assigned to play either a violent or non-violent game for some (usually short) period of time, and are then administered some measure of aggressive cognition, affect, or behavior. When measuring cognition, participants are often asked to complete a series of word-stems which can be completed with either an aggressive or neutral word (e.g., Anderson & Carnagey, 2004; Carnagey & Anderson, 2005). If participants who played the violent (cf. non-violent) game complete a higher proportion of the ambiguous words stems with an aggressive word, this is interpreted as an effect of violent gameplay on cognitive aggression. When measuring aggressive behavior - a far more important dependent measure when trying to generalize to real-world aggression - participants are often asked to administer some aversive stimuli an ostensibly real participant (usually either non-existent or a confederate). Common examples of the aversive stimuli include loud noise blasts (e.g., Anderson & Dill, 2000; Bushman, 1995; Elson, Mohseni, Breuer, Scharkow, & Quandt, 2014; Ferguson, Smith, Miller-Stratton, Fritz, & Heinrich, 2008), chilli jam or wasabi (e.g., Fischer, Kastenmüller, & Greitemeyer, 2010; Sauer, Drummond, & Nova, 2015), or pain in the form of exposure to very cold water (a cold pressor task; e.g., Ferguson et al., 2015). Here, higher administration of the aversive stimuli (i.e., in terms of quantity or duration) is interpreted as an increase in behavioural aggression.

The results of such experimental studies vary somewhat, but one point of agreement seems evident across the field. Meta-analysts have consistently shown that participants tend to show increased aggression following violent gameplay than non-violent gameplay (Anderson & Bushman, 2001; Anderson et al., 2010; Ferguson, 2015; Furuya-Kanamori & Doi, 2016; Hilgard et al., 2017). However, there are important and stark disagreements about the size of this effect, the meaningfulness of this effect, and why such an effect occurs.

In 2010, Anderson et al,'s extensive meta-analysis on the topic showed that, for experimental studies, the average effect of VVG exposure on aggression was about r = .245 (Anderson et al., 2010). Even if we accept this estimate as accurate (and as discussed below, there are good reasons to believe it represents an overestimate as discussed below; Ferguson & Kilburn, 2010; Hilgard et al., 2017), this implies a change of approximately 6% in non-pathological (i.e., persistent, maladaptive, trait) aggression between the participants who played a violent (cf. non-violent) game. Thus, under near perfect laboratory conditions, the effects of VVGs on aggression are small at best (Cohen, 1992).

One of the biggest concerns with the validity of Anderson et al.'s (2010) estimate of the size of the effect of VVGs on aggression is publication bias. Studies reporting statistically significant results are more likely to be published than those reporting statistically non-significant differences (Ferguson, 2007a; Ferguson & Heene, 2012; Rosenthal, 1979). Unsurprisingly, this appears to be true in the field of video game research. In 2017, a reanalysis of the Anderson et al. (2010) meta-analysis correcting for publication bias yielded a substantially lower effect size estimate of r = .13 (Hilgard et al., 2017). Contrary to the earlier estimate by Anderson et al. (2010), such a figure suggests playing a violent (cf. non-violent) video game only accounts for approximately 2% (cf. 6%) of the between-groups difference in non-pathological aggression scores . Moreover, Hilgard et al. (2017) present a range of estimates obtained with different bias-correction methods which further call into question the size of the effect, with *rs* ranging from as low as .02 to .15. Typically, r scores below .1 are considered negligible. Indeed, Hilgard's lowest estimate places the explanatory power of VVGs on aggressive behavior as low as 0.04%, while the largest suggests a mere 2.25% of variance in aggression scores are attributable to exposure to violent (cf. non-violent) games under near-perfect laboratory conditions. Such estimates are similar to an earlier meta-analysis which also corrected for publication bias (Ferguson, 2007b).

For now, given the evidence available, the most prudent conclusion seems to be that, in general, the effects of VVGs on aggression in laboratory studies appear to be negligible to small among the general population (Hilgard et al, 2017).

Applied Studies

Applied studies of the VVG-aggression relationship have also yielded mixed results. Generally, such studies fall into two categories, employing either cross-sectional or longitudinal designs. Cross-sectional studies typically ask about the amount people play violent games, and then gain a measure of aggression, be it self-reported incidents of behavior or a measure of aggressive cognition such as the aforementioned word-stem completion task (e.g., Anderson & Dill, 2000; Ferguson, Garza, Jerabeck, Ramos, & Galindo, 2013). Longitudinal studies follow a specific group of people over time, looking at changes in both the prevalence of VVG use and aggression as measured by the lab-based tasks described earlier, or through self-report measures of the frequency of aggressive behaviors (e.g., Anderson et al., 2008; Ferguson, San Miguel, Garza, & Jerabeck, 2012; Gentile, Lynch, Linder, & Walsh, 2004; Willoughby, Adachi, & Good, 2012).

On average, the VVG-aggression relationship observed in longitudinal studies tends to be smaller than in experimental studies. A meta-analysis estimate - which was not corrected for publication bias - yielded an approximate effect size of $r = .15$, suggesting that a mere 2.25% of variance in non-pathological aggression could be explained by VVG use (Anderson et al, 2010). As mentioned earlier in the chapter however, this estimate is considered by some to be inflated by publication bias (Ferguson et al., 2010). Even if taken as the true effect, there are several important caveats to place on any conclusion about the importance of this effect size. First, compared to other public health issues, the effect appears to be quite small (Ferguson et al., 2010). For example, the effect constitutes less than a fifth of the variance in violent crime explained by gun ownership (Ferguson, et al., 2010).

Moreover, when the outcome of studies is limited to serious violent behaviour (e.g., criminal assualt), the effect declines further to a mere r = .04, an effect so small, most statisticians would consider it negligible (Cohen, 1992; Ferguson & Kilburn, 2010). Thus, even if the reported effect size is valid, longitudinal studies suggest the predictive power of violent gameplay in explaining real-world aggression is low.

In cross-sectional studies, the relationship between VVGs and aggression appears to be stronger. Hilgard et al.'s (2017) reanalysis of Anderson et al.'s (2010) meta-analysis puts the effect size of this relationship at r = .29 - .30 (~9% of variance explained), or a moderate effect. However, given the difficulties in establishing causation associated with cross-sectional data, these designs offer only a relatively weak form of evidence. For example, people with a predisposition toward aggression and violence are more interested in playing VVGs (Przybylski, Ryan, & Rigby, 2009; von Salisch, Vogelgesang, Kristen, & Oppl, 2011), and this is particularly problematic for cross-sectional designs because it is unclear whether it is the violent game use causing the aggression, or the aggression causing the interest in VVGs. As discussed in the theoretical considerations section of the present chapter, people with high levels of aggression or psychoticism might be particularly affected by the violent content of games, further exaggerating the relationship compared to samples more representative of the general population.

Taken together, the experimental and real-world studies suggest that there is, at best, a small effect of playing VVGs on aggression. Indeed, some suggest that the effect is so small that it may be negligible. However, as we discuss later, results also hint that relationships may be stronger in some specialised populations. Numerous moderators (some known, many likely unknown) might influence the presence or absence of the effect, and one must be careful not to confuse the effects of VVGs on vulnerable populations with the effects of the

media in the general population, which, based on the empirical evidence, appears to be relatively small at best.

Theoretical Considerations

Of course, empirical data demonstrating the presence of a relationship is of limited utility in the absence of appropriate psychological theory to explain it. Those who claim that VVGs are associated with increased aggression typically draw upon the General Aggression Model (GAM; Anderson & Bushman, 2002; DeWall, Anderson, & Bushman, 2011) to explain the relationship. In this model, person and situation factors are viewed to contribute to or alter internal cognitive, affective, and arousal states. For VVGs, a particular focus is the cognitive changes brought about by video games. Here, violent actions in video games are considered to prime aggressive knowledge structures (e.g., schemata), Increasing the likelihood that aggressive responses will be activated by stimuli outside the gaming environment. Moreover, proponents of the GAM propose that violent acts in games act as a kind of rehearsal mechanism for violent behavior, strengthening and reinforcing underlying aggressive knowledge structures and increasing the likelihood of violent behaviors (Bushman & Anderson, 2002). Although the GAM was originally intended to explain short-term effects of exposure to violent media, there has been speculation that over time, and through repeated activation, these short-term effects may translate into long-term effects (e.g., Barlett, Anderson, & Swing, 2009). This focus on the short and long-term cognitive changes brought about by VVG use is summarised best by Anderson and Dill (2000, p. 788): “Thus, the danger in exposure to VVGs seems to be in the ideas they teach, and not primarily in the emotions they incite…”.

While the GAM is the predominant theory used to explain a potential relationship between VVG and increased aggression, some have criticised the theory. Although much of the criticism is outside of the scope of the present chapter, several points are worth

mentioning here. First, the GAM is an incredibly broad theory which tends to have nebulous criteria upon which the theory could be disproven or falsified (Ferguson & Dyck, 2012). A theory which predicts the interaction of any situation with any person variable to produce cognitive changes is virtually impossible to falsify (though as we describe later, some researchers have reported evidence which offers serious challenges to the GAM). As falsification criteria are a key component of good scientific practice, the lack of criteria for observations which would disprove the GAM is concerning.

A second concerning criticism of the GAM in our view is the notion that the human brain does not distinguish fiction from reality, and specifically that witnessing or enacting fictionalised violence, for example by playing VVGs, is analogous to witnessing or enacting real-world aggression. This idea does not seem to be supported by work undertaken by developmental psychologists who show that humans learn to distinguish reality from fiction quite early in life (i.e., from 3-5 years old; Corriveau, Kim, Schwalen, & Harris, 2009; Woolley & Van Reet, 2006; for a discussion, see Ferguson & Dyck, 2012), and that observational learning involves developing an appreciation of the importance of context when determining the appropriateness of a behaviour (Bandura, 2001). Further, this idea also exposes a problematic logical contradiction within the GAM. Proponents of the GAM simultaneously view situational factors relating to aggression in media as strong enough to influence internal states, yet situational factors relating to the fictional elements of media as too weak to moderate the impact of this media upon internal states. For a review of concerns about the assumptions and limitations of the GAM, see Ferguson and Dyck (2012).

Assuming that the effects of VVGs are large enough to consider an important predictor of aggression (i.e., the lowest estimates by Hilgard et al., 2017 are incorrect and the true effect exceeds $r = .1$), it remains somewhat unclear why these effects occur. Understanding why effects occur is essential to understanding the generalisability of lab

effects to applied situations and, where necessary, developing strategies to attenuate them. Although the GAM posits that the violent content of games is responsible for increased aggression, others have suggested that competitiveness plays a significant role (Adachi & Willoughby, 2011a, 2011b). Adachi and Willoughby (2011a) equated the competitiveness of a violent and non-violent game and found no differences between them in post-game aggression. Moreover, more (cf. less) competitive games increased aggression irrespective of the amount of violence depicted within them (Adachi and Willoughby, 2011b). Recent evidence further suggests that losing a competitive game can lead to increased aggression amongst players *due to* a general increase in frustration and negative affect (Breuer, Scharkow, & Quandt, 2015). Such effects are difficult for the GAM to explain, since differing levels of in-game violence produced comparable degrees of post-game aggression.. However, others have found divergent effects, with equally competitive games yielding different levels of aggression concordant with the violence depicted within them (Anderson & Carnagey, 2009). Thus, it is difficult to know whether competitiveness and aggression are confounded, contribute to aggression independently, or interact in ways we are yet to understand.

Self-determination theory argues that aggression is caused by the thwarting of one or more of three basic human needs: the need for competence (feeling accomplishment through one's actions), the need for autonomy (personal independence and freedom of choice); and the need for relatedness (a sense of belonging to a community and validation from others; Deci & Ryan, 2000; Ryan & Deci, 2000). When these needs are impeded, it can result in lowered enjoyment and wellbeing, as well as poorer mood (Ryan, Rigby, & Przybylski, 2006). Initial investigations have shown, for instance, that playing games with less intuitive/more difficult controls (i.e., thwarting the need for competence) results in poorer mood than playing games with more intuitive controls (Ryan et al., 2006), and that games

which challenged players' sense of competence increased aggressive thoughts, feelings and behaviors (Przybylski, Deci, Rigby, & Ryan, 2014). Thus, it is possible that at least some of the observed changes in aggression typically attributed to VVG play may in fact be driven by players finding (a) the game difficult to play after typically short familiarization sessions, or (b) that the narrow confines of a laboratory study frustrate their need for autonomy and control.

Emerging evidence from laboratory studies demonstrates that the effects of VVGs on aggression are moderated by a range of factors, some of which are not well accounted for by the GAM. For example, people who play games in which their character (avatar) is customised to look like the player tend to aggress more than those who play as avatars that do not look like them, supposedly due to a tendency for players to identify more with – and therefore be more likely to emulate – the actions of the in-game character (Fischer et al., 2010). Similarly, people who play easily identifiable villains aggress more following VVG play than those playing easily identifiable heroes, perhaps due to the perceived difference in the social acceptability of their in-game actions (Happ, Melzer, & Steffgen, 2013). These contextual effects are, at present, not well understood or accounted for by the GAM. Another recent study showed that players who read a short story implying their character's motivations are heroic aggress less than those read an antiheroic backstory for their character (Sauer et al., 2015). This presents a particularly difficult finding for the GAM to account for. Specifically, although this change in narrative influenced participants' exhibition of aggression after the game, it did not alter the amount of aggression a player exhibited during the game. Thus, although in-game aggression was consistent across players, the narrative structure only influenced the amount of aggression participants exhibited when they finished playing – a direct contradiction to the GAM's assertion that increased aggression exposure in game should be required for increased post-game aggression to occur. Conversely, in this

study, reward structures were able to specifically increase in-game aggression without affecting post-game aggression, again challenging the GAM by showing that increased in-game aggression is not always associated with effects on post-game aggression (Sauer et al., 2015).

Individual differences – players' pre-existing characteristics that might predispose some 'at-risk' populations to be particularly susceptible to the psychological effects of violent media – are likely to be an important moderator of the relationship between VVGs and aggression are the. Specifically, participants with high levels of pre-existing aggressiveness (Engelhardt, Bartholow, & Saults, 2011; Giumetti & Markey, 2007), and psychoticism (Markey & Scherer, 2009) are likely to display greater aggression after playing a VVG than a non-VVG, an effect that does not occur for participants with low pre-existing aggressiveness or psychoticism. This may explain some of the ambiguity in the results produced by empirical investigations into the VVG-aggression relationship. Specifically, the small effect sizes typically observed may represent negligible effects for those with low aggressiveness, psychoticism, or other risk factors averaged with larger effects for these at-risk populations (Giumetti & Markey, 2007; Markey & Scherer, 2009).

These studies suggest that there are hidden moderators to the VVG-aggression relationship that are, at present, poorly understood. This indicates a particularly important field of study. Understanding factors that can increase or inhibit the relationship will better allow us to understand if there are specific situations, populations, or game characteristics that are more likely to result in aggressive outcomes, and to better specify a theoretical model which accounts for the effects of media on human psychology, as well as the boundary conditions under which these effects may occur.

One other important area where our understanding is lacking is whether the small increases in aggression typically observed in lab data are reflected in societal trends in a more

important indicator: violence. That is, even if exposure to VVGs increases aggression in the lab, does this translate to effects on real-world violence?

Societal Trends in Violence

If, as the GAM suggests, exposure to violent media increases aggressive cognitions and behaviours – and, consequently, VVGs contribute meaningfully to interpersonal violence – then one might expect to see a positive relationship between the consumption of VVGs and trends in societal violence. (e.g., violent crime rates). This assumption is expressed in nearly 30% of papers on the topic of violent video games, where authors augment theoretical rationales with reference to serious violent incidents such as the Columbine or Sandy Hook school shootings (Markey, Markey, & French, 2015). It may be intuitively appealing to believe that social issues such as violence may be, at least in in part, caused by VVG's (in part because this would imply clear policy responses to such tragedies). However, it is worth noting that the evidence linking VVG use and school shootings is anecdotal (Markey, Markey & French, 2015). It should be noted that while VVG play has been identified as being used by some violent offenders, many violent offenders have had no exposure to VVG's, and, more importantly, many VVG players are not violent offenders. Indeed, it is important not to neglect the base rates of VVG exposure when discussing such exemplars. Given the fact that an estimated 88% of adolescents play video games at least occasionally (Gentile, 2009), it is somewhat trivial that many offenders have had some exposure to VVG.

As discussed earlier, Anderson et al.'s (2010) meta-analysis estimates the correlation between VVG exposure and aggression to be small ($r \sim .15$). One problem with extrapolating these findings relating to aggression in the lab to real-world violence is that violence represents a relatively small subset of aggressive behaviours. Thus, one would expect the relationship between VVG use and violence to be smaller than the already small relationship between VVG use and aggression.

Researchers have adopted an epidemiological approach to investigate the relationship between crime rates and video game sales, to investigate a potential link between VVG's and societal violence. In general, the results do not support the hypothesis that VVG's are linked to societal violence. Cunningham, Engelstatter, and Ward (2016) found no positive correlations, and in fact, showed a negative relationship between VVG sales and violence rate. Similarly, Markey, Markey, and French (2014) showed small but significant decreases in crime rates with increasing game sales. Further, Ferguson (2015) reported a strong negative relationship between youth violence rates and video game sales between 1996 and 2011. Thus, the available data clearly suggest that increased VVG sales (and exposure to VVG) are not associated with increased societal violence.

In Australia the Guidelines for the Classification of Computer Games (2012) went into effect on January 1st 2013. This was a new rating system for video games which restricted access to certain games based on age by considering violence, sexual themes, drug use, and language; looking at overall impact. This included the R18+ label for items not deemed fit for minors or adolescents and only accessible to those over the age of 18 years. The new system was ostensibly introduced in order to better protect youth and the public (Guidelines for the Classification of Computer Games, 2012). However, one argument against the introduction of an R18+ category was that it would allow for users to be exposed to more severe videogame violence which may provoke violent responses from some individuals making society less safe (for an overview of the debate, see King & Delfabbro, 2010). The introduction of such a system on Jan 1st 2013 creates an unusually neat natural experiment which we can use to observe what difference in societal violence occurred year-to-year following the introduction of the R18+ classification. As can be seen from Figure 1, there appears to be no appreciable changes in crime data. Burglaries continued their

downward trend, homicides remained stable, and while sexual assault trended slightly upward, this was generally concordant with its historical upward trend.

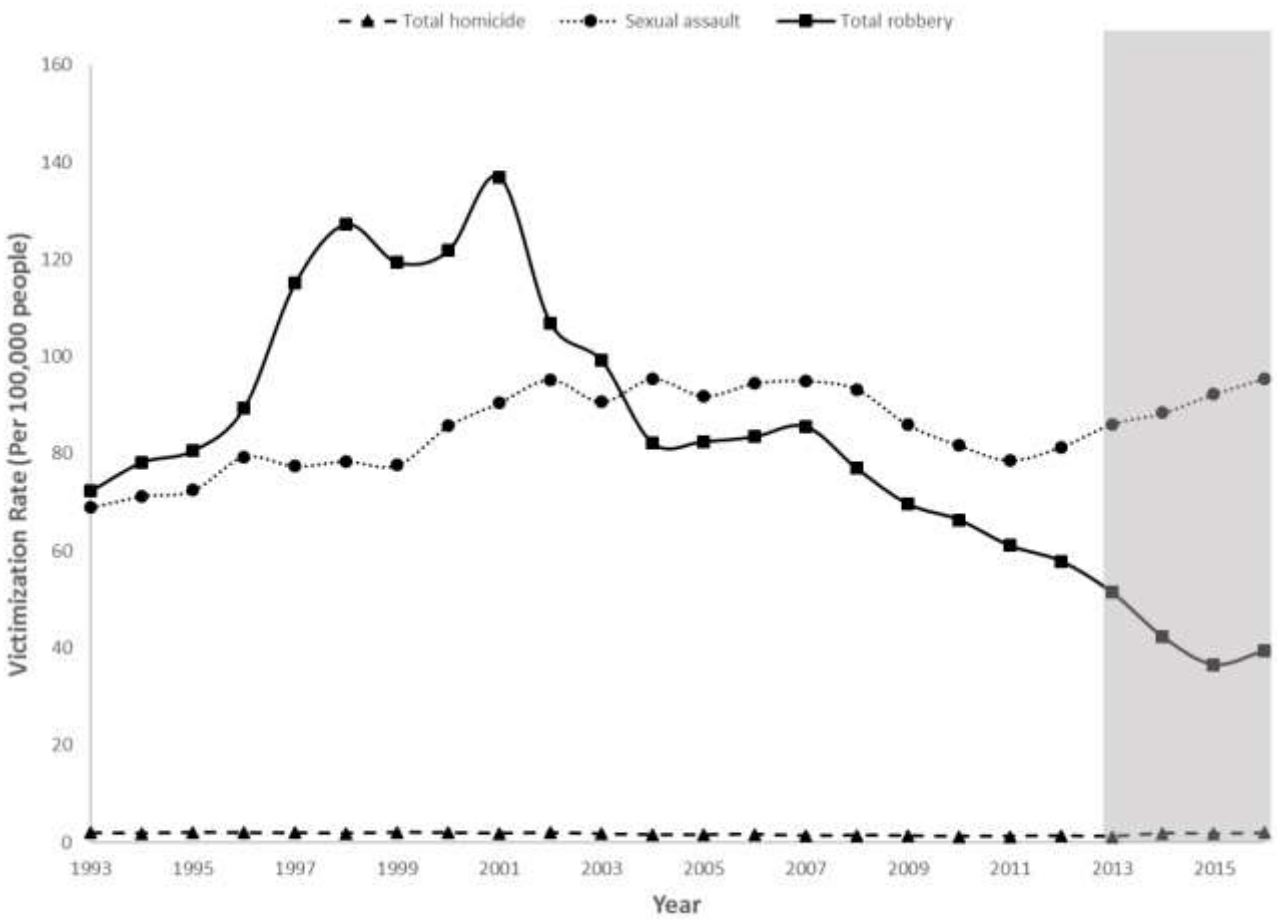

Figure 1. Victimization rate of violent crimes in Australia from 1993 to 2016. Data taken from the Australian Institute of Criminology (AIC, 2017) and the Australian Bureau of Statistics (ABS, 2017). In the four years since the introduction of an R18+ video game (which allowed for the release of both new and previously unclassified games which were not previously able to be legally sold in Australia) classification on Jan 1 2013 (the shaded region), the rate of robbery has continued to substantially decline, while the homicide and related offences rate has remained steady. The only violent offences rate to increase since 2013 is sexual assault, which can clearly be seen to be increasing prior to 2013, and in 2016 is equivalent to historical highs. Bayesian analyses (which should be interpreted cautiously

due to the low number of post-2013 observations) suggest since 2013, it is approximately 7.3 times more likely that robberies were higher before Jan 1, 2013 than after, approximately 2.2 times as likely that homicides were higher before 2013 than after, and only 1.4 times more likely that sexual assaults are higher after 2013 than prior to it. Note that typically, anything less than 3 times as likely is considered anecdotal evidence at best, (Wetzels et al., 2011).

Other considerations

As a final note, when consulting the literature on the VVG-aggression relationship, we must consider the relevant research in the wider context of the current zeitgeist of psychological research. Presently, a large number of "established" psychological effects are being found to be unreliable (Schooler, 2014). There are a variety of reasons for this, but unidentified researcher degrees of freedom and falsification of data have received particular attention (Simmons, Nelson, & Simonsohn, 2011). Unidentified researcher degrees of freedom occur when researchers exclude some cases without fully disclosing the decision rules ahead of time, only report specific analyses that yield significant results, collect additional data after seeing if their initial results are significant, or fail to report analyses, dependent measures, or manipulations (Simmons et al., 2011). Such practices allow researchers substantial opportunity to present nearly any comparison as significant (Simmons et al., 2011). Research estimates that these practices are common, potentially as high as 78% for some practices such as failing to report all dependent measures (John, Loewenstein, & Prelec, 2012). The outright falsification of data is less common, but is still estimated to occur at rates of around 9% (John et al., 2012).

Are these practices present in the field of violent videogame research? With regard to unidentified researcher degrees of freedom, the measures used in many VVG studies are concerning. For instance, the Competitive Reaction Time Task (CRTT) is an often-used

measure of aggression. The CRTT operationalizes aggression as severity and/or duration of noise blasts administered by a participant against an ostensibly real opponent. The CRTT is a methodologically supple measure which can be quantified into a dependent measure in numerous ways, for example, by including the duration of noise blasts in the outcome measure or considering only severity, using only the first trial or an average of 25 trials, or by log transforming the data (Elson, 2016; Elson et al., 2014). Thus, the CRTT has been used inconsistently both across and within publications (Elson, 2016; Elson et al., 2014). Elson (2016) has identified 156 different strategies for quantifying CRTT data across 130 different publications. This inconsistency in the standardization of the measure allows for significant researcher degrees of freedom in how they approach the analysis of CRTT data: for example, by allowing researchers to choose to incorporate duration or not depending on which analysis yields more favourable results. Similarly, a recent reanalysis of a study investigating the effect of sexist video games on empathy toward women (Gabbiadini, Riva, Andrighetto, Volpato, & Bushman, 2016) showed that only one very specific kind of analysis yielded the effects reported in the paper, and reanalysis with simpler but no less appropriate models yielded no such difference (Ferguson & Donnellan, 2017). This issue is, admittedly, only tangentially related to the effects of violent games on aggression per se. However, it further illuminates the potential for effects of undisclosed researcher degrees of freedom in video game research, and the need to exercise judicious caution when considering reported effects based on the CRTT measure.

The video game research literature has also seen papers retracted for irregularities in reported data. In 2017, a paper suggesting that playing VVGs with a gun-shaped controller made people better marksmen in real life was retracted due to irregularities in the data files and missing raw data (Whitaker & Bushman, 2014). Similarly, another paper suggesting a link between cartoon violence and reduced verbal performance was retracted due to

irregularities in the data (Çetin, Wai, Altay, & Bushman, 2016). Although we certainly do not claim that these, or any other researchers in the field, have done anything untoward, the potential for a combination of undisclosed researcher degrees of freedom and retractions due to data irregularities further add to the difficulties associated with of ascertaining whether exposure to VVGs, is a causal influence in aggression and violence.

Conclusion

What does all this mean? Are VVGs good or bad for youth or society? Like proponents of the link between VVGs and aggression, we concur that these questions are far too simplistic (Anderson et al., 2017). There are certainly theoretically-plausible mechanisms through exposure to violent media might contribute to increased cognitive and behavioural aggression (e.g., via social learning mechanisms). However, we have reviewed evidence suggesting that, under many circumstances, the effects of VVG play on post-game aggression are small, or even negligible. Yet, research also suggests that hidden moderators can influence the presence or absence (and strength) of these effects. For instance, highly aggressive individuals seem to show the greatest increases in aggression following violent gameplay (Engelhardt et al., 2011; Giumetti & Markey, 2007), and the context presented for in-game violence seem to influence the presence (or absence) of post-game aggression (e.g., Sauer, Drummond, & Nova, 2015). In sum, if a relationship is present, it is unlikely to be a simple one. Given the difficulties in (a) measuring aggression and (b) accounting for potentially important individual differences in the laboratory, a useful understanding of the relationship is likely to require rigorous lab research combined with real-world data, and interpreted within a suitable theoretical framework. At present, we feel the most responsible conclusion is that the observed effects of violent gameplay on aggression are small in the lab, and negligible when considered in terms of societal violence. However, we do not discount that exposure to violent videogames may have negative consequences for some consumers.

As a field of scientific enquiry, we will be better served by asking not "do VVGs cause aggression?" but "under what circumstances might VVGs lead to an increase in aggression?". Focussing on this latter question will better equip media psychologists to debate what content is and is not appropriate for specific audiences.

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