Media Violence and the General Aggression Model

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The General Aggression Model (GAM) is a meta-theory that considers the role of personal and situational variables on aggressive behavior, ranging from the biological to the cultural. Possible mediating variables include internal states (e.g., aggressive thoughts, angry feelings, increased physiological arousal) and the results of appraisal and decision processes (automatic and controlled). In this article, we focus on one situational variable—exposure to violent media—and how it can influence a wide array of cognitive, developmental, emotional, and social processes that can increase likelihood of aggression. Previous research has shown that exposure to violent media can increase aggression through all three internal state paths, and by increasing hostile appraisals. In this article, we use GAM as a theoretical framework to explain a wide variety of violent media effects. We also add some clarifications and extensions to GAM that research in the past 15 years has shown to be needed in the model. We also suggest new research directions in the media violence domain that we believe will be especially useful in the future.

> "There is nothing so useful as a good theory."
>
> — Kurt Lewin (1951)

We believe that the General Aggression Model (GAM) is "useful" and is a "good theory" for explaining violent media effects. Our goal in this article is to use GAM to summarize what is currently known about how exposure to media violence influences those who consume it. More specifically, we focus on screen

violence (i.e., any violence shown on a screen, no matter how small or large). The vast majority of this research, of course, has come from studies of television, movies, and video games.

We frame the empirical literature on media violence effects in terms of GAM, for three main reasons. First, we have never fully explicated the implications of GAM for understanding media violence affects. Second, we have not previously described the implications of recent developments in the media violence literature for expanding and revising GAM. Third, a number of researchers in the media violence domain have made inaccurate claims about what kinds of evidence support or contradict GAM.

It is especially fitting that this article appears in the *Journal of Social Issues* in the context of our recent joint selection for the 2017 Kurt Lewin award by the Society for the Psychological Study of Social Issues (SPSSI), for "outstanding contributions to the development and integration of psychological research and social action." We thank SPSSI for this high honor and for this opportunity to further aid in the development of understanding violent media effects, and aid psychologists and others to develop ways of reducing the potential negative effects.

GAM Misconceptions

Let's begin with a few misconceptions about GAM and the media violence research literature. First, GAM is not and it never has been a model specifically designed to account for media violence effects. It is a general model designed to account for aggressive behavior. Although that should be apparent from its name, a number of researchers, especially those skeptical of violent media effects, continue to ignore the general character of the model.

Second, and related to the first point, is the fact that GAM includes the theoretical basics of earlier psychological theories that have been applied to understand aggression and violence. It was specifically designed to encapsulate social learning theory, script theory, cognitive neoassociation theory, excitation transfer theory, social information processing theory, and also the cognitive/behavioral processes underlying systematic desensitization therapy. The impetus for creating GAM came from the realization that there are several excellent research literatures— each relevant to understanding aggression—that say many of the same things, do so in domain-specific language, and rarely communicate with each other. The primary initial goals of developing GAM were: (1) to integrate these various theories and literatures using more general terms and concepts, and (2) to do so in a simplified and graphic way to make it easier for scholars in diverse domains (e.g., clinical/counseling, developmental, social, personality, criminology) to communicate with each other. Basically, GAM is a general bio-social-cognitive model of how various complex processes combine to influence the likelihood that

aggressive behavior will be enacted. Thus, the research bases of all of these prior models are also relevant to GAM.

Third, GAM also includes group processes, developmental psychology, personality development, attitudes, beliefs, stereotypes, and prejudice (to name a few). It is a dynamic theory that is concerned with how life experiences—in combination with biological and individual differences—create knowledge structures that are the basis of personality, and how these knowledge structures influence affect, cognition, and arousal in specific social encounters to influence the likelihood of aggressive or nonaggressive behavior. Thus, concepts such as efficacy and outcome expectations (social learning theory), spreading activation and priming effects (cognitive neoassociation theory), automatization with practice (basic cognitive psychology), script development and use (script theory) observational learning, cognitive biases, and so on all fit within GAM. The effects of the social environment are also key in this model. For example, a child who behaves aggressively immediately after playing the violent video game *Call of Duty* influences the immediate social environment that he or she inhabits, but that social environment in turn responds to this aggressive action, and those responses (e.g., punishment, reward) influence the child's expectancies and beliefs about the efficacy of aggressive behavior.

GAM can also be used to explain violence (DeWall & Anderson, 2011; DeWall, Anderson, & Bushman, 2011), which is a subset of aggression. *Aggression* is typically defined as any behavior intended to harm another person who doesn't want to be harmed (Anderson & Bushman, 2002; Baron & Richardson, 1994). *Violence* is typically defined as any behavior intended to cause extreme physical harm to another person who does not want to be harmed, such as injury or death (Bushman & Huesmann, 2010). Thus, all violent acts are aggressive, but only acts intended to cause extreme physical harm are classified as violent.

In sum, this article uses GAM to specifically focus on: (1) what is generally known about media violence effects, including short and long-term effects, conceptual pathways from media violence exposure to immediate (short-term) effects, and conceptual pathways from repeated media violence exposure to more stable (long-term) effects; (2) recent advances suggesting additional pathways from media violence exposure to various short and long-term effects, including executive control and impulsivity changes, brain imaging studies, and fight-or-flight hormone studies.

A Brief Overview of the GAM

History of GAM

The development of GAM goes back several decades and began with what was originally called the *General Affective Aggression Model* (Anderson, Deuser,
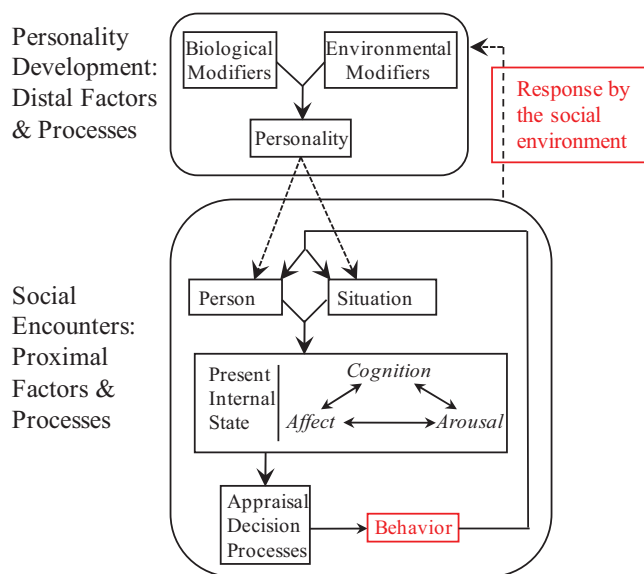
Fig. 1. Overview of the General Aggression Model.
Note. Responses by the social environment mediate between social encounters (sometimes called *episodes*) and personality. Social environments that strongly discourage aggression (by failing to reward it, or actively punishing it) can mitigate the effects of situational variables that tend to instigate aggression. Adapted from Anderson and Bushman (2002). Reprinted by permission. [Color figure can be viewed at wileyonlinelibrary.com]

& DeNeve, 1995), which was used in articles through 2000 (Anderson & Dill, 2000; Lindsay & Anderson, 2000). The General Affective Aggression Model was used to explain the effects of pain, gun images, and violent media on aggression. Indeed, that work was our first to explicitly include the role of the social environment's response to an instance of aggressive behavior (see Anderson & Dill, 2000; Figure 1). By that time, it was becoming apparent that the basics of that model applied not just to affect-based aggression, but to other forms of aggression as well. Thus, while preparing our 2002 *Annual Review of Psychology* chapter on human aggression, we further developed the model and renamed it the GAM (Anderson & Bushman, 2002). The first use of that term actually appeared in our 2001 meta-analysis of violent video game effects (Anderson & Bushman, 2001), although the *Annual Review* chapter had been completed first.

Although readers who are interested in the development of GAM might want to read the earlier articles, those who are more interested in the contemporary state of the model and of its applicability to media violence effects are encouraged to focus on the 2002 *Annual Review of Psychology* chapter and on later developments (e.g., Allen, Anderson, & Bushman, 2018; Anderson & Carnagey, 2004; Anderson

& Huesmann, 2003; DeWall, Anderson, & Bushman, 2011; Gilbert, Daffern, & Anderson, in press; Warburton & Anderson, 2015; Warburton & Anderson, in press).

Overview of GAM

Figure 1 displays an overview of GAM. The two major components of the model, "personality development" and "social encounters," illustrate the differences between relatively stable distal long-term risk factors and processes versus more temporary short-term proximal risk factors and processes. Furthermore, Figure 1 illustrates how these two major systems reciprocally influence each other. We have added to the figure a new box labeled "Response by the social environment" to highlight how and where the social environment mediates between the outcome of a particular social encounter and long-term changes in the more stable aspects of the individual—*personality*. This is not a change to the general aggression model, but writings by some aggression scholars illustrate that we need to be more explicit about these interchanges between the target individuals and their social world. Indeed, this response by the social environment is one area in which more research is needed in the media violence domain.

Figure 2 lists a number of risk factors that have been identified by numerous scholars in the aggression and violence fields over the past few decades. The

Proximal Causal Factors		Distal Causal Factors
Person	**Situation**	**Environmental modifiers**
Aggression scripts	Alcohol & other drugs	Antisocial peers
Attitudes towards violence	Bad moods	Cultural norms, teachings
Cultural stereotypes	Diffusion of responsibility	Deprivation
Dehumanization of others	Frustration	Difficult life conditions
Displacement of responsibility	Noise	Exposure to violent media
Hostile biases	Other Provocations	Group conflict
Long-term goals	Pain/discomfort	Maladaptive families/parenting
Low agreeableness	Social context (bar, church...)	Victimization
Moral justification of violence	Social Exclusion	Violent neighborhood
Narcissism	Social stress	**Biological modifiers**
Normative beliefs	Threatening/fearful stimuli	ADD/ADHD
Poor impulse control	Uncomfortable temperature	Impulsivity deficits
Psychopathy	Violent media	Low arousal
Self-efficacy beliefs	Weapons	Low serotonin
Self-image (tough, strong...)	Witnessed violence	Other genetic risk factors
Unstable high self-esteem		Poor Executive Function
		Various Hormones

Fig. 2. Some examples of proximate causal factors (person and situation) and of distal causal factors (environmental and biological) for heightened aggression.

proximate causal factors are those that may be present in the current social encounter. As illustrated in Figures 1 and 2, such proximate factors include many that are relatively stable aspects of the person and are therefore brought to the current situation by the person. Traditionally, these have been thought of as personality traits, attitudes, belief systems, emotional propensities, and so on. The situational causal factors are those that are a part of the situation itself. They include things like recent violent media exposure, provocations, pain, social exclusion, hot temperature, and so on. Many situational causal factors can be (and have been) manipulated in experimental studies.

The distal causal factors are generally fairly stable factors that influence the broad category of *personality* (i.e., the person factors listed under *Proximate Causal Factors*). Most distal causal factors can be categorized as being aspects of the environment or as biological aspects. The latter might be based on genetics, gene by environment interactions, or even by some environmental factors alone. For example, high exposure to lead in utero or postnatally can lead to harmful effects on cognitive executive functioning and impulsivity. For both types of distal causal factors—environmental modifiers as well as biological modifiers—major changes in personality (broadly defined) can lead to fairly stable changes in the propensity to act aggressively.

Combined, Figures 1 and 2 illustrate how repeated social encounters that have identical or very similar characteristics and outcomes can, over time, lead to stable individual differences (e.g., dispositions, attitudes, beliefs, personality traits). The person then brings those individual differences into new social encounters as proximal person factors.

Individual differences in life experiences can influence the course of interaction within a specific social encounter. For example, one study found that hunting rifles do not prime aggressive thoughts in individuals who grew up in a household that hunted (Bartholow, Anderson, Carnagey, & Benjamin, 2005). Hunters associate hunting rifles with concepts other than aggression, such as sport, food, or family time. Thus, the *weapons effect* differs for hunters and nonhunters.

Several longitudinal studies show that exposure to violent media as a child predicts aggressive and violent behavior many years later as an adult. In one such study, children exposed to violent media at ages 8 to 10 were nearly twice as likely to have assaulted their spouses 15 years later as young adults (Huesmann, Moise-Titus, Podolski, & Eron, 2003).

Figure 3 presents a more detailed view of the decision processes that mediate between the initial stages of a social encounter and the behavioral response to that situation. First, there is an immediate initial appraisal of whether the situation is dangerous, threatening, or warrants aggression. This initial appraisal might lead directly to an automatic or impulsive behavior, or it might lead to a reappraisal. If the initial appraisal is judged to be unsatisfactory and if the person has sufficient time and cognitive resources, reappraisal occurs (Barlett & Anderson, 2011).
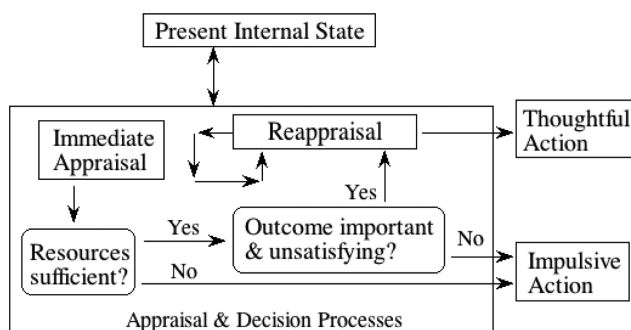
Fig. 3. Immediate appraisal (relatively automatic) and reappraisal (requires some resources) processes. Adapted from Anderson and Bushman (2002). Reprinted by permission.

During reappraisal, the person considers alternative explanations of the situation and alternative behavioral options. When the appraisal is judged to be satisfactory, or when time or resources become insufficient, the appraisal process terminates and the person engages in a behavior that is consistent with (and therefore is primed by) the most recently completed appraisal. This completes one cycle. For most normal people, under normal circumstances, thoughtful action tends to be less aggressive than impulsive action. However, sometimes the circumstances or individual differences (e.g., trait rumination, expectancies about aggression) lead to more aggressive action after careful thought than would have occurred without reappraisal, such as when one ruminates about violent actions in video games (Bushman & Gibson, 2011) or about perceived provocations (Bushman, Bonacci, Pedersen, Vasquez, & Miller, 2005).

Figure 4 illustrates several ways in which life experiences, labeled biosocial interactions, can influence personality development. The six types of aggression-related knowledge structures illustrated in Figure 4 are not intended to be all inclusive, as some scholars have suggested. Rather, they are illustrative of *some* major aspects of what we call aggressive personality. For this article, we've added "brain structure and function" to the figure because we regard this as an important factor that can influence the development of an aggressive personality. For example, research has shown that violent media exposure reduces prefrontal cortex activity (e.g., Hummer, Kronenberger, Wang, & Mathews, in press). Higher order cognitive functions governed by the prefrontal cortex are associated with less aggression (Bartholow, 2018).

Figure 4 also illustrates how such changes in personality influence the likelihood of aggressive behavior emerging in the present situation. It does so in two different ways. First, it influences the person variables that are routinely brought into social encounters. Second, it influences situational variables themselves. For example, changes in personality can lead to systematic changes in the kinds of
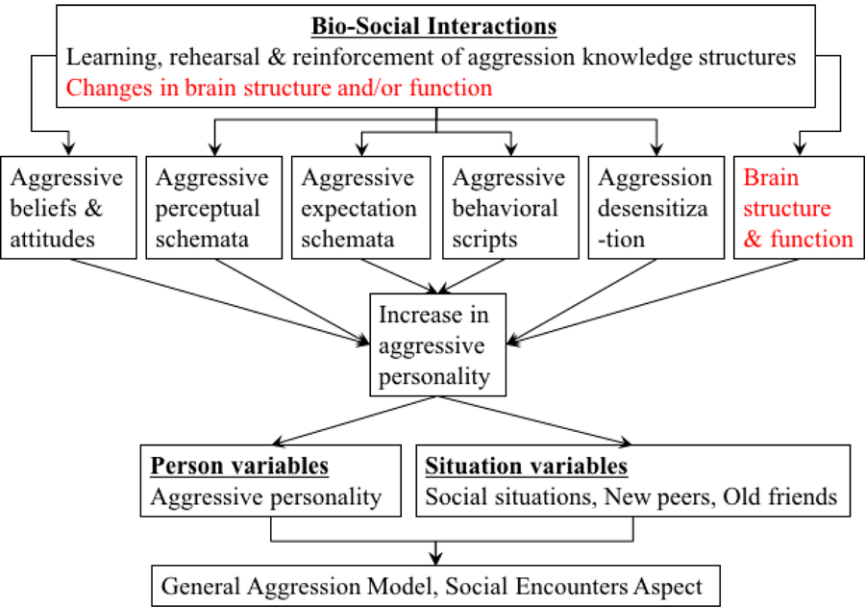
Fig. 4. Personality development aspect of the General Aggression Model. Adapted from Anderson and Bushman (2002). Reprinted by permission. [Color figure can be viewed at wileyonlinelibrary.com]

situations that a person seeks out or encounters, changes in the type of people encountered in those situations, and even systematic changes in the behaviors of old friends.

Changes to GAM

As noted earlier, it has become apparent that two modifications to our original theoretical statements and figures would be helpful. First, it is important to more explicitly highlight the role of the social environment when trying to understand how a particular risk factor may influence a particular person who occupies a particular social environment. Although the domain-specific applications of GAM (e.g., pain, weapons effect, violent media) already do this, the lack of explicit statements to that effect in our prior work may have contributed to the failure of some scholars to fully appreciate this. Social learning theory may be the most obvious source of theoretical concepts and empirical studies illustrating the important role that the social environment plays. However, so do script theory, social information processing theory, and other social cognitive theories. Rather than generate a whole new set of concepts and a correspondingly complex figure, for the present article we simply modified Figure 1 to include a reference to the importance of the social environment's response to the individual's behavior.

Second, it is becoming clear that life experiences can change the brain and its functional properties, and can do so in ways that are relevant to aggression. For example, there is growing evidence that early exposure to fast-paced electronic screen images, such as are common in television shows and video games, can lead to changes in parts of the brain associated with executive control, as well as the function of impulse control. Thus, we've added this new path to the Figure 4 illustration of personality development.

Media Violence and Aggression: Well-Known Paths

The primary focus of this article is to show how GAM can be used to explain and predict the various ways that exposure to violence in the media can lead to increases in aggression. The psychological processes that underlie media-related aggression can be divided into those that produce immediate, but transient, short-term effects on aggressive behavior, and those that produce more delayed, but enduring, long-term effects on aggressive behavior (e.g., Bushman & Huesmann, 2006).

Explaining Short-Term Violent Media Effects

Short-term increases in aggressive behavior following exposure to violent media are mainly due to three psychological processes: (1) the priming or activation of already existing aggressive knowledge structures (including scripts), (2) simple mimicking of aggressive behavior, and (3) changes in physiological arousal stimulated by media violence.

Priming.   Neuroscientists and cognitive psychologists posit that the human mind acts as an associative network that consists of nodes and links. The nodes represent concepts, and the links represent associations among concepts. Thoughts, feelings, and behavioral tendencies are linked together in memory in associative networks. Sets of strongly linked concepts are often called knowledge structures. Exposure to a stimulus can activate (i.e., bring into awareness) or prime related concepts in memory (Fiske & Taylor, 1991). Once a concept has been activated, it is more accessible in memory. The more accessible a concept, the more likely it is to be used to process and interpret social information (e.g., Bruner, 1957). Once a stimulus primes a concept in memory, the activation spreads along network links to associated concepts and more complex knowledge structures as well. In other words, exposure to a stimulus can prime related concepts, ideas, and emotions in a person's memory, even without the person being aware of it (e.g., Bargh & Pietromonaco, 1982). For example, exposure to violent media can engender a complex of associations consisting of aggressive ideas, emotions related to aggression (e.g., anger), and the impetus for aggressive actions (Berkowitz, 1990).

One particularly interesting type of knowledge structure is a *script*. In films and plays, scripts tell actors what to say and do. In memory, scripts help define situations and guide behavior. Scripts can be learned by direct experience, by merely imaging a sequence of events, or by observing others, including media characters (Bandura, Ross, & Ross, 1963). For example, repeated experience with restaurants leads to a knowledge structure (or set of knowledge structures) that includes what happens when, to whom, and under what circumstances upon entering a restaurant—in short, a script. Once learned, the script helps the person to understand similar situations, and guides their behavior: A person first selects a script from memory to represent the situation, and then assumes a role in the script and behaves accordingly (Fiske & Taylor, 1991; Schank & Abelson, 1977). The same process of script learning, development, and use applies to aggression-related scripts and media violence (Huesmann, 1986). For example, pornography use has been linked to risky sexual scripts and coercive sexual behavior (e.g., Tomaszewska & Krahé, 2016).

Mimicry.   Human and primate young have an innate tendency to mimic whomever they observe (e.g., Hurley & Chatter, 2004; Meltzoff & Moore, 2000). Thus, children who observe media characters perform an aggressive behavior are more likely to do the same aggressive behavior immediately after observing it (Bandura, 1997). Theoretically, the more similar children think they and the observed model are, the more readily mimicry will take place, but the mimicry mechanism is so powerful that even fantasy media characters can be imitated by young children. In addition, young children under about age 7 have difficulty distinguishing between reality and fantasy (e.g., Davies, 1997). Thus, young children should be about equally likely to imitate real and fantasy media characters. Mimicry happens with older children and adults too (Chartrand & van Baaren, 2009). From an evolutionary perspective, mimicry has physical survival value (e.g., Lakin, Jefferis, Cheng, & Chartrand, 2003). Mimicry happens spontaneously and very often is nonconscious.

Arousal.   Violence depicted in the mass media often consists of action-packed scenes that increase physiological arousal (e.g., heart rate, blood pressure). There are at least four possible ways that arousal can increase aggression in the short term. First, high levels of arousal may be experienced as aversive (e.g., Mendelson, Thurston, & Kubzansky, 2008), and may therefore stimulate aggression in the same way as other aversive stimuli (Berkowitz, 1989). Second, arousal narrows our span of attention (Easterbrook, 1959). If aggressive cues are salient in the situation, then people will focus most of their attention on the aggressive cues, which will facilitate aggression. Third, high arousal generated by exposure to violent media can make any dominant response tendency more likely to be carried out in the short run. Thus, an individual with aggressive tendencies is even more

likely to behave aggressively when they are physiologically aroused (e.g., Geen & O'Neal, 1969). Fourth, high arousal generated by exposure to violent media may be misattributed to other stimuli that generate arousal, such as provocations. This process is called *excitation transfer* because the arousal transfers from an initial stimulus to subsequent stimulus (Zillmann, 1979). Thus, a provoked individual may be even more likely to behave aggressively when they are physiologically aroused (e.g., Zillmann, Katcher, & Milavsky, 1972). Exciting and stimulating scenes in the mass media may make aggressive behavior more likely immediately afterwards because of the arousal they create.

Explaining Long-Term Violent Media Effects

Research shows that long-term increases in aggressive behavior are mainly due to two psychological processes: (1) observational learning, and (2) desensitization of emotional processes.

Observational learning.   Observational learning (also called vicarious learning, social learning, and modeling) is learning that occurs by watching a model (Bandura, 1997). The model can be a parent, sibling, peer, teacher, or even a media character. Observational learning is a powerful extension of mimicry in which logical induction and abstraction are used to encode complex representations in memory. Whereas short-term mimicry requires only one exposure to an observed behavior, long-term observational learning usually requires repeated exposures. Interestingly, much research has shown that nonhuman primates learn by observation, and can even learn the rules of rock-paper-scissors from video screens (Gao, Su, Tomonaga, & Matsuzawa, 2017).

In general, the more that the child's attention is focused on the model's behavior, the fewer the number of repetitions are required. However, numerous other factors besides attention affect the extent to which observational learning affects behavioral performance. If the actor is rewarded for a behavior, the child is more likely to imitate that behavior; if the actor is punished for a behavior, the child is less likely to imitate that behavior (e.g., Bussey & Perry, 1976). Of course, the child (or adolescent or adult) can learn a punished modeled behavior without enacting it immediately. The observed punishment merely inhibits enactment under the conditions in which the punishment occurred; it may be enacted under different conditions. In the mass media, actors are often rewarded and rarely punished for behaving aggressively (e.g., National Television Violence Study, 1996).

Children are also more likely to imitate similar models (Rosekrans, 1967), models they identify with (e.g., Huesmann & Eron, 1986), and models that possess valued characteristics, such as heroes (e.g., Hicks, 1968). Similarly, through repeated exposure to violent media, children develop normative beliefs that

aggression is appropriate, and they acquire social scripts for how and when to be-have aggressively (Huesmann & Guerra, 1997). Longitudinal studies have shown that early exposure to TV violence in childhood is related to having normative beliefs more accepting of violence even 15 years later in young adulthood (Huesmann et al., 2003).

One less-studied aspect of observational learning concerns the role of interpretation by the observer. Similar to cognitive response theory in the attitudes domain, the effect of an exposure to screen violence on various downstream variables is mediated by how the viewer responds to the exposure, emotionally and cognitively. Some scenes of violence inspire internal cognitive and emotional responses that support aggressive and violent behavior, such as when the hero shoots the villain, thereby saving innocents. This is a very common theme in entertainment violence, even when the hero is an antihero. Other scenes of violence may inspire horror and aversion in most viewers. For example, the opening D-Day invasion scene in *Saving Private Ryan* may inspire both strong negative emotional reactions and anti-war cognitions in most viewers. Such a reaction could, in theory, result in a lessening of aggressive tendencies, at least in some types of viewers on some types of aggression-related behaviors (e.g., willingness to vote in favor of political candidates who support war). At the same time, the desensitization aspect of that same scene might increase long-term aggressive tendencies in most viewers. There are also individual differences in how people respond to the same violent scenes. Some people are attracted to violence, whereas other are repulsed by it (Pond et al., 2012).

Desensitization. Desensitization is the process through which a person's emotional reactions to some stimulus habituate and diminish over time with repeated exposures to that stimulus (Wolpe, 1958). For example, most people have innate negative emotional responses to observing blood and gore, as evidenced by increased physiological arousal and self-reports of discomfort that often accompany such exposure. However, with repeated exposure, these negative emotional responses habituate and people become "used to" seeing it. It is adaptive for some individuals within society to become desensitized to images and smells of blood and gore. For example, desensitization to the distressing sights, sounds, and smells of surgery is necessary for medical students to eventually become effective surgeons; vomiting into a patient's chest cavity cannot lead to a good outcome. Similarly, desensitization to battlefield horrors is necessary for soldiers to be effective in combat. However, desensitization to blood, gore, and screams of pain and distress is maladaptive for most people in a civilized society. Repeated exposure to violence in the media can lead people to become numb to the pain and suffering of others. Indeed, violent media scenes do become less arousing over time (Cline, Croft, & Courrier, 1973). People who are habitually exposed to violent media can become less sympathetic to victims of violence (e.g., Linz, Donnerstein, &

Adams, 1989). Even brief exposure to video game violence causes at least temporary physiological desensitization to violent scenes (Carnagey, Anderson, & Bushman, 2007). The reduced empathy for victims of violence can cause people to be less helpful to violence victims in the real world (e.g., Bushman & Anderson, 2009; Drabman & Thomas, 1974; Prot et al., 2014).

The effect of violent video games on empathy is especially concerning. Empathy involves imagining others' perspectives and feeling care and concern for them (Davis, 1983). Empathy is especially important when it comes to promoting prosocial behaviors, such as helping, cooperating, and sharing (Batson, 2011). Although viewers of violent television and film have the choice of taking the perspective of the killer or the victim, players of violent video games are typically forced to take the perspective of the killer. Players have the same visual perspective as the killer in first-person shooter games. The player controls the actions of the violent character from a more distant visual perspective in third-person games. Research has shown that people are more likely to behave aggressively themselves when they identify with a violent video game character (e.g., Konijn, Nije Bijvank, & Bushman, 2007).

Some Consequences of Repeated Exposure to Media Violence

Smoking one cigarette will not give a person lung cancer. But smoking a pack or more of cigarettes a day, for years on end greatly increases the risk. It is the cumulative effects of smoking that pose the greatest health risk. Likewise, it is the cumulative effects of violent media exposure that pose the greatest risks to increasing aggressive and violent behavior. For example, repeated exposure to violent media biases people's world-views so they come to believe that the world is a hostile place where people are out to get them. This leads people to attribute more hostility to the ambiguous actions of others (e.g., Anderson, Gentile, & Buckley, 2007, Study 3; Dodge, 1985), which in turn increases the likelihood of aggression (e.g., Dodge, Pettit, & Bates, 1995). A recent meta-analysis of 37 studies involving over 10,000 participants found that exposure to violent media is linked to hostile world views (Bushman, 2016).

Figure 5 depicts the effects of repeated exposure to violent media on the likelihood of an initial ambiguous provocation escalating to an aggressive response. The short-term and long-term processes described in preceding paragraphs are depicted in Figure 5. A recent exposure increases the immediate accessibility of aggressive cognitions by priming existing knowledge structures. Repeated exposure to media violence increases their chronic accessibility by over-learning processes. Having aggressive thoughts accessible in memory can increase the likelihood of aggressive behavior in three ways, by increasing the likelihood of: (1) making a hostile attribution; (2) generating aggressive behavioral options; and (3) selecting/enacting an aggressive option.
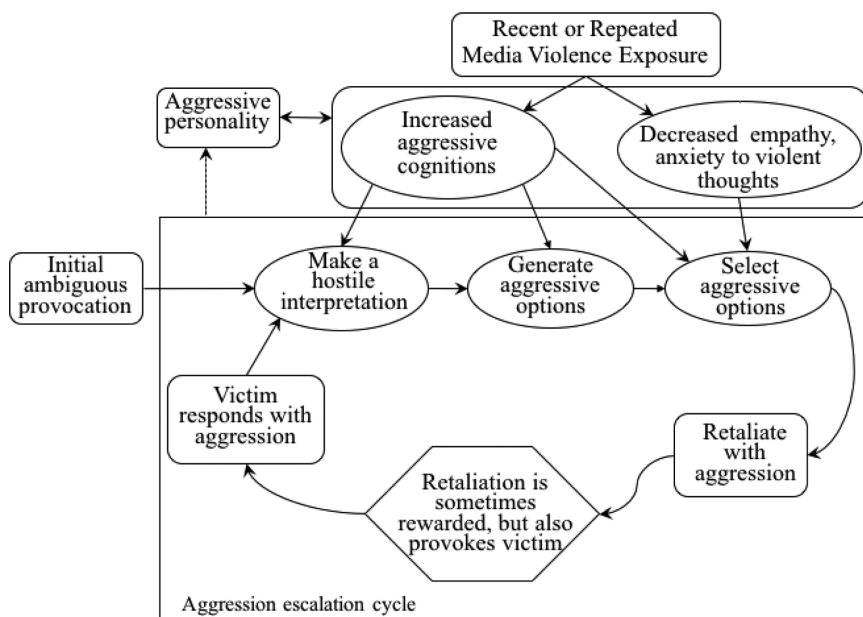
Fig. 5. How repeated exposure to media violence increases aggression to an ambiguous situational provocation, instigates an aggression escalation cycle, and further affects aggressive personality.
Note. Depending on how the victim responds and how the individual interprets that response (e.g., was it aggressive, did my aggressive act work or backfire . . .), the dynamics of the situation can increase or decrease the likelihood of future aggression.

Similarly, both recent and repeated exposure to media violence decrease empathy and anxiety in response to seeing or thinking about violence. This can lead to increased aggression by reducing one of the common brakes upon aggressive action. In Figure 5, we've shown this as operating through the "selecting aggressive options" path, but it might well operate earlier as well, such as by increasing the likelihood of hostile bias and/or of generating aggressive script options.

Numerous studies support this view of how both short-term and repeated exposure to violent screen media increase aggression. For example, a recent cross-sectional study found that such exposure was positively associated with aggression across seven countries (Australia, China, Croatia, Germany, Japan, Romania, United States; Anderson et al., 2017). Importantly, this effect was partially mediated by aggressive cognitions and by empathy. Quite a few longitudinal studies have now been conducted on violent media-related aggression, finding similar long-term effects mediated by aggressive cognition and aggressive affect measured in several different ways (e.g., Boxer, Huesmann, Bushman, O'Brien, & Moceri, 2009; Krahé & Möller, 2004, 2010; Möller, & Krahé, 2009; Shibuya, Sakamoto, Ihori, & Yukawa, 2004)

When an aggressive script is retrieved from memory and used to guide retaliatory behavior, even if the aggressive retaliation is successful, it is likely to provoke the target, who is likely to respond in an aggressive manner. Thus, the aggression cycle continues, in a downward spiral (Slater, Henry, Swaim, & Anderson, 2003). Being caught in such a downward spiral on repeated occasions can lead to a more aggressive personality.

Media Violence and Aggression: New and Understudied Paths

In this section, we briefly describe some additional ways in which exposure to violent media might increase aggression. These all have some empirical support, but all could use additional research attention.

Socialization Effects

As children and adolescents become more aggressive, their relationships with their peers, parents, and teachers change. Nonaggressive children tend to avoid and exclude them, family interactions become more negative, and teachers have poorer interactions with them. This can lead to a change in who they interact with, such as an increase in associating with other outcasts, often other aggressive children. The first longitudinal study of violent video game effects found that high exposure to violent games early in the school year was associated with peer rejection later in the school year (Anderson et al., 2007, Study 3).

In general, there is a reciprocal relation between peer rejection and aggression (Leary, Twenge, & Quinlivan, 2006). Specifically, children who are rejected by peers tend to be more aggressive. The relationship between peer rejection and exposure to violent media might also be reciprocal. Indeed, that same longitudinal study (Anderson et al., 2007, Study 3) also found that violent video game exposure early in the school year led to increased physical aggression later in the year even after controlling for early physical aggression. This violent video game effect on physical aggression was partially mediated by increased hostile attribution bias. In addition, violent video game exposure was negatively associated with prosocial behavior, positively associated with hostile attribution bias, and positively associated with peer rejection.

Interestingly, experimental research has shown that being rejected by peers increases attraction to violent media in children and adolescents (Gabbiadini & Riva, in press; Plaisier & Konjin, 2013). Furthermore, briefly playing a violent video game increases aggressive inclinations in middle school children, especially those who have just been socially excluded (Gabbiadini & Riva, in press).

In short, there are both theoretical and empirical reasons to hypothesize complex reciprocal relations among media violence exposure, aggressive behavior, peer rejection, and changes in peer groups. Some of these relations may be

mediated by changes in hostile attribution biases, empathy, beliefs and attitudes towards aggression or other personality changes. But, considerably more research is needed, with complex designs and very large sample sizes, to fully examine the possibilities. Such research would allow the field to answer important questions, such as: Can we trace media violence effects through changes in friendship patterns, parent relationships, and teacher relationships from childhood to adulthood behaviors?

School Performance

There is evidence that high involvement with entertainment media (not just violent media) leads to poor school performance (e.g., grades, teacher-rated attention problems). For example, one study (Gentile, Lynch, Linder, & Walsh, 2004) found significant negative correlations between adolescents' grades and three measures of media consumption: total television time, total video game time, and violent video game exposure. Path analyses found of the video game effects found both a significant direct effect of total video game time on grades and an indirect effect of violent video game exposure on grades mediated by hostility. Other studies with various age groups also have found significant negative correlations between screen time (e.g., TV, movies, video games) and school grades (e.g., Anderson & Dill, 2000, Study 1, college students; Anderson et al., 2007, Study 2, high school students). In most studies, it appears that it is not violent content per se that leads to poor school performance, but rather the total amount of time spent on entertainment media; this may be the result of entertainment media displacing study time (Rideout, Roberts, & Foehr, 2005).

Longitudinal studies have also found strong evidence that screen time leads to later poor school performance, and that such effects are partially mediated by impulse and attention problems, displacement of activities away from school work, and sleep deficits (e.g., Gentile, Berch, Choo, Khoo, & Walsh, 2017; Graber, Nichols, Lynne, Brooks-Gunn, & Botvin, 2006; Swing, Gentile, Anderson, & Walsh, 2010). A few studies have found unique links between screen violence and real world (e.g., school) attention and impulsivity problems (Swing & Anderson, 2014). There is even an experimental study on screen time and school performance (Weis & Cerankosky, 2010), in which 6- to 9-year-old boys were randomly assigned to receive a free video game console either at the beginning of the 4-month long study or after the study was completed. It found that receipt of the console caused a significant decline in school performance.

Other pathways from media consumption to poor school performance include sleep deprivation (Barlett, Gentile, Barlett, Eisenmann, & Walsh, 2012) and what has recently been called internet gaming disorder (Gentile, 2009). In one longitudinal study (Barlett et al., 2012), over 1300 elementary school children were assessed at three time points over a 13-month period. Screen time was

positively associated with attention problems in school both directly and indirectly through sleep disturbances. Another study of a representative sample of over 1,100 American youth ages 8 through 18 found that about 8% of gamers (who constituted 88% of the total sample) exhibited pathological patterns of video game play (Gentile, 2009). Furthermore, those classified as pathological gamers performed significantly worse in school than nonpathological gamers.

Why is school performance important in the context of this article on media violence effects on aggression and violence? Does high exposure to *violent* screen media lead to increased risk of aggression through poor school performance? At present, the answer to the latter question isn't entirely clear. We do know that poor school performance is a significant risk factor for heightened aggression and violence (e.g., U.S. Surgeon General, 2001). High screen violence exposure has been linked to poorer school grades. But we don't know of any large scale longitudinal or experimental intervention studies that have tested the key question of whether there is a unique pathway from violent screen time to poorer school performance to greater aggressive behavior.

Recent research also shows that gamers who are most likely to report internet gaming disorder symptoms are those whose needs are being satisfied by gaming but not by real life (Allen & Anderson, 2018). Still other research suggests that internet gaming addiction is itself at least indirectly linked to heightened aggression (Groves, Gentile, Tapscott, & Lynch, 2015). And gaming addiction is negatively associated with school performance. But, additional research on how all of these factors interrelate, particularly research that helps sort out the most likely causal directions, is sorely needed.

Active Ingredients of Media Violence Effects

Specific instances of media violence vary considerably along many dimensions, including media format (e.g., TV vs. video games), realism, justification of violence, and consequences of portrayed violence, among many others. In some video games the player takes on the role of a criminal, whereas in most games the player is either a normal person or a hero. Furthermore, there are multiple outcome variables that are influenced by violent media, such as beliefs, attitudes, emotional reactions to violence, physiological arousal, hostile appraisals, and aggressive behavior. Theoretically, some features of entertainment media (violent and nonviolent) should have very important effects on some of these outcome variables but not others, whereas other features should have their primary effects on different outcome variables. One example concerns the effects of realistic blood and gore. Frequent exposure to blood and gore in the context of a fun game should lead to greater habituation and desensitization to real blood and gore than should exposure to games that are identical but that don't show blood and gore. Indeed, one should be able to select a series of games that mimic the progression

of feared stimuli used in standard clinical desensitization theory procedures. To some extent, that's what age-based video game rating systems already do.

The point is that it would be useful to develop an organized taxonomy of media characteristics (or features or dimensions) along which various media vary, along with variables that are more or less influenced by each characteristic, in both short and long-term contexts. To further complicate matters, it must be the case that these more contextualized feature/effects relationships will vary somewhat by the age and other characteristics of the media consumer.

Yet another important factor that needs additional attention concerns the context in which the media product is consumed. For example, is a particular game usually played alone, with friends in the same room, with friends across the internet, or with strangers across the internet? Some recent research suggests that context matters (e.g., Velez, Greitemeyer, Whitaker, Ewoldsen, & Bushman, 2016), but more research is needed.

The Brain, Impulsivity, and Executive Function

Desensitization. A number of studies have found associations between screen media use and brain structures or brain functioning in recent years, particularly brain regions associated with impulse control, executive functions, and emotion processing. In one study (Weber, Ritterfeld, & Mathiak, 2006), gamers played the violent video game *Tactical Ops: Assault on Terror* while in the fMRI scanner. Researchers did a frame by frame analysis of game play, dividing it into five meaningful segments (e.g., active/safe; active/fighting and killing). They hypothesized and found that during virtual violence (i.e., those game segments involving violence) 11 of their 13 gamer participants showed suppressed affective areas of the anterior cingulate cortex (ACC). This may well represent the underpinnings of desensitization effects found in other studies (e.g., Carnagey, Anderson, & Bushman, 2007). In another study (Engelhardt, Bartholow, Kerr, & Bushman, 2011), researchers found that low exposure gamers randomly assigned to play a violent game displayed a reduction in the P3 component of the event-related brain potential (ERP) to violent images (indicating physiological desensitization) compared to low exposure gamers assigned to play a nonviolent game. This brain response mediated the effect of video game content (violent vs. nonviolent) on subsequent aggressive behavior. The study also showed that habitual violent game players displayed relatively low P3 responses to violent images regardless of whether they had just played a violent or a nonviolent game, suggesting that repeated reductions in sensitivity to violent images had resulted in a relatively permanent shift in brain function (i.e., chronic desensitization).

Other experimental studies also have found evidence of a link between high media violence exposure and empathic brain function. In one experiment (Guo

et al., 2013) researchers found that exposure to a 5-minute violent video clip reduced activation of anterior insula and anterior midcingulate cortex in response to photos of another person's pain.

Executive control. Other brain studies suggest that violent media can affect measures of executive control. In one experiment (Hummer et al., 2010) researchers found that playing a violent video game (relative to playing a nonviolent video game) for just 30 minutes caused lower activity in the right dorsolateral prefrontal cortex (DLPFC). The DLPFC is involved with executive functioning, including suppression of unwanted thoughts and behaviors. In addition, responses in the DLPFC demonstrated stronger inverse connectivity with precuneus in the nonviolent game players. These results show that playing a violent video game can modulate prefrontal activity during cognitive inhibition.

A recent 3-week training study found that violent video game play reduces prefrontal cortex activity (Hummer et al., in press). In this study, young adult males with limited or no video game experience performed a go/no-go task during fMRI scans for 3 consecutive weeks. After a pretraining baseline scan, participants were randomly assigned to extensively play a violent video game or to avoid all video game play (control) during the subsequent week. After 1 week, inhibition-related activity decreased in right inferior frontal gyrus and right cerebellum in the violent game group, compared to the control group, and self-reported executive functioning problems were higher. A subset of participants in the violent game group who were assigned to a second week of game play had similarly reduced bilateral prefrontal activity during inhibition, relative to the control group. However, participants in the violent game group who were subsequently assigned to avoid game play or to play a cognitive training game during week 2 demonstrated similar overall changes from baseline as the control group (at the end of week 2), suggesting a return to normal brain function.

Nonexperimental studies have found associations between video game habits and brain measures of some types of executive function. For example, in one study ERP indicators of proactive executive control revealed relatively poorer performance by college students who had relatively high levels of gaming experience than those with little gaming experience (Bailey, West, & Anderson, 2010). Another ERP study of college students found that amount of violent video game experience was associated with differences in ERP patterns in the processing of positive, negative, violent and neutral images, such that frequent violent gamers (relative to controls) processed images in a way supportive of violence desensitization (Bailey, West, & Anderson, 2011). Similarly, fMRI studies have found significant correlations between television violence exposure, executive functioning and white matter volume in young adult males (Hummer, Kronenberger, Wang, Anderson, & Mathews, 2014). Yet other studies have found associations between media violence exposure and executive function deficits in adolescents diagnosed

with Disruptive Behavior Disorder and matched controls (Kronenberger et al., 2005).

Impulsivity and related attention problems.   Several cross-sectional studies have linked screen media exposure to impulsivity and attention problems, as was briefly mentioned in the *School Problems* section. For example, one study assessed screen media habits, attention and impulsivity problems, trait aggressive cognition, trait aggressive emotion, and two forms of trait aggression—impulsive and premeditated (Swing & Anderson, 2014). Results showed that both total screen media exposure and violent media exposure uniquely predicted attention/impulsivity problems, which in turn uniquely predicted impulsive aggression. Also, as expected, violent media exposure was positively associated with both trait aggressive cognition and trait aggressive emotion, both of which predicted impulsive and premeditated aggression. Finally, and as expected, the attention/impulsivity factor was only weakly associated with premeditated aggression.

There also are several longitudinal studies of screen exposure and attention problems (e.g., Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; Gentile, Swing, Lim, & Khoo, 2012; Zimmermann & Christakis, 2007). For example, a study of over 1,300 8- to 11-year-olds found that high screen exposure at baseline led to greater teacher-reported attention problems in school 13 months later, even after controlling for earlier attention problems, grade, and sex (Swing et al., 2010). Similarly, Gentile et al. (2012) found that time spent playing video games at Wave 1 led to greater self-reported attention and impulsivity problems at Wave 3, 1 year later, even after controlling for Wave 1 attention/impulsivity problems, age, sex, and race. However, these longitudinal studies did not test whether time spent on violent media was uniquely predictive of later attention/impulsivity problems after controlling for time on nonviolent screen media, nor did they assess the effects of screen media exposure (violent and/or nonviolent) on later aggression.

One recent experimental study found that playing a violent video game triggered the fight-or-flight stress response in children, as indexed by elevated salivary cortisol (Gentile, Bender, & Anderson, 2017). Interestingly, the children who had been randomly assigned to play a violent video game also displayed greater accessibility of aggressive cognitions, as shown by responses to a word completion task.

As with the *School Problems* section, one might ask what this has to do with GAM and the link between screen media violence and aggressive behavior. The answer is that there is an emerging set of studies involving screen exposure, brain function, attention, and impulsivity problems. Many studies link impulsivity, attention problems, and executive control problems with aggressive behavior. A few large scale cross-sectional and longitudinal studies link screen exposure to some of
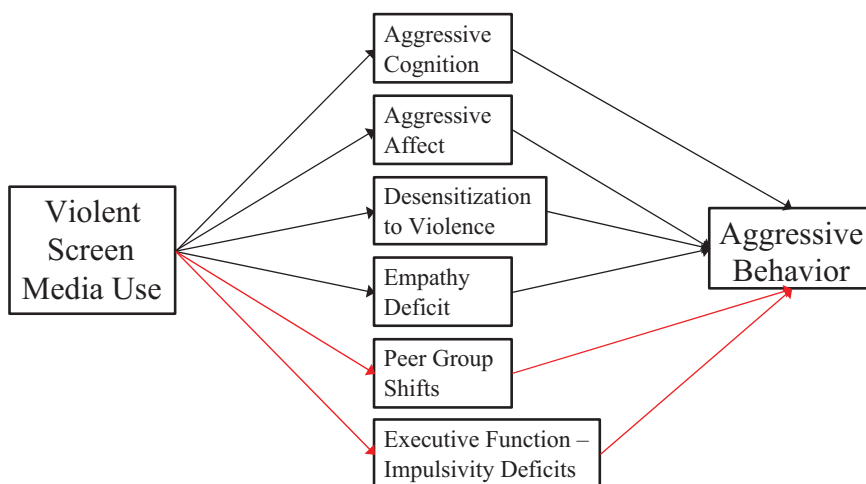
The top four (Black lines) indicate well-established effects.
The bottom two (Red lines) indicate effects that could use additional evaluation.

Fig. 6. Media violence paths to increased aggression. [Color figure can be viewed at wileyonlinelibrary.com]

these problems. What is badly needed are complex large-scale longitudinal and intervention studies that assess multiple aspects of screen media exposure, multiple aspects of brain structure and function, multiple aspects of attention/impulsivity problems, and multiple aspects of aggressive and violent behavior. Until such studies are conducted, the field will not be able to cleanly test the possibility that violent media might play a unique role in creating brain changes that cause attention/impulsivity problems that then increase the likelihood of some types of aggression (most likely, the impulsive/reactive type).

Media Violence, Stereotypes, and Aggression

There has been some research on how media portrayals of women and various minority groups influence stereotypes and behavior towards such groups. One pair of experiments (Saleem & Anderson, 2013) found that brief play of a common stereotypical violent game—in which Arab/Muslim characters are portrayed as enemy terrorists—increased stereotyping and negative implicit and explicit attitudes towards Arab/Muslims. More recently (Saleem, Prot, Anderson, & Lemieux, 2017), three studies (two correlational, one experimental) found that exposure to news stories portraying Muslims as terrorists is positively associated with Americans' support of public policies that harm Muslims domestically (e.g., suspending

Muslim Americans' civil rights) and internationally (e.g., bombing predominantly Muslim countries). The experimental study demonstrated that brief exposure to negative stories causes such anti-Muslim attitude changes, whereas viewing positive stories about Muslims has the opposite short-term effect. A very different type of stereotyping study found that playing a violent video game as a Black player (who necessarily behaves violently) increases racist attitudes toward Black people and also increases aggressive behavior (Yang, Gibson, Lueke, Huesmann, & Bushman, 2014).

There is, of course, a larger literature on screen media effects on attitudes, beliefs, and prejudices toward various outgroups. But there is considerable need for additional research on how violent screen media might affect aggression against outgroups (especially but not exclusively minorities) mediated by changes in stereotypes and prejudices. News media and hate speech in particular seem types of violent screen media in need of additional effects research.

Conclusions

Violence is a dominant theme in both entertainment and news media. Not surprisingly, exposure to violent media can have a number of deleterious effects (e.g., increases in aggression, desensitization, impulsivity, stress, interest in guns among children, negative stereotypes about marginalized groups; decreases in helping, empathy, attention, school performance, civic engagement). It is important to understand why these effects occur. In this article, we have explained how the GAM can explain numerous and varied violent media effects. In Figure 6, we illustrate what we view as the main paths through which media violence exposure can increase aggressive behavior. Most of those paths are well-established by solid research using multiple study designs and methods. Two of the paths, however, need additional high quality research to confirm (or disconfirm) them, and to more clearly explicate the specific psychological processes involved. Other subareas in need of additional research don't really need a new separate path in Figure 6. Findings from additional studies in *stereotyping* subarea would likely fit well with the aggressive cognition and affect paths, and maybe the desensitization and empathy paths. Similarly, the *active ingredients* and the *school performance* subareas don't require paths not already displayed in Figure 6.

We believe that the General Aggression Model can help further such needed basic research, and much-needed research on interventions designed to reduce the harmful effects that are already well understood (e.g., Krahé & Busching, 2015). As the 2017 winners of the Kurt Lewin award, we hope that if Lewin were still alive he would consider the General Aggression Model as a useful theory and a good theory.

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