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Title

Violence in Computer Games and Implicit Aggressiveness—Lessons learned from the "Media Comparison Paradigm"

Abstract

This chapter reviews problems that researchers face when trying to establish computer gamers' aggressiveness who engage with violent content during gameplay. When conducting media comparisons, the comparisons are only valid within "zones of comparability." Either the level of participants' interactivity (i.e., the "syntactics" of what they do) has to be constant across the media type compared, while the media content varies; or the content of specific media (i.e., the "semantics" of what they encounter) should be kept constant, whereas the level of interactivity with the content then varies. Following the General Aggression Model, we provide an overview of own findings of short time effects of violent media on aggressive dispositions as assessed with implicit rather than explicit measures. The findings reveal that factors like the symbolic meaning of simulated actions enacted by virtual game characters as well as the parallel self-activation during gameplay (that is, the degree of self-involvement through [inter-]activity) play major roles in reinforcing automatic associations between the self and aggression, which reside at an implicit level and are known to form dispositions for impulsive aggressive tendencies.

Violence in Computer Games and Implicit Aggressiveness—Lessons learned from the "Media Comparison Paradigm"

Introduction

Computer and video games with violent content, especially games such as first-person shooters, are continually a topic of popular and scientific discourse. With the increasingly realistic display of violence and the training of (simulated) aggressive acts in virtual environments (including 3D), the debate goes on whether these media are likely to increase human aggression or not (Liptak, 2010; Smith, Lachlan, & Tamborini, 2003). (Note that the focus is not whether media make people *violent*, but whether there is an overall *increase in aggressiveness*, that is, the tendency to behave *more aggressively* in everyday behavior than would be the case without exposure to media violence; it is never implied that gamers turn into killers.) This discussion is not new, as already the debate about the exposition to violence in TV and movies has shown (Bushman & Anderson, 2001). In line with psychological theories on aggression and extant empirical evidence, some researchers have arrived at the conclusion that there are negative side-effects of violence exposure in computer games and other types of media. Many a research paper and meta-analysis have demonstrated that playing violent video games can have a non-negligible influence on aggressive behavior and dispositions (e.g., Bushman, Gollwitzer, & Cruz, 2015; Carnagey & Anderson, 2004). Accordingly, there are claims of causality about game players' active engagement with violent media (see Gentile, 2015; Gentile & Bushman, 2012). Nevertheless, there is also skepticism with regard to a mono-causal relationship between exposure to violent media and increases of aggression among computer gamers. In particular, the size of experimental effects and their relevance for everyday behavior remain debated heatedly. Apart from this academic dispute, the quality of original research studies must be scrutinized before one jumps to conclusions. Meta-analyses can only be as valid as the underlying quality of studies allows. In sum, more conclusive evidence is needed, before strong inferences can be drawn, which would allow to settle the debate between opposing scientific camps (e.g., Anderson et al., 2010; Ferguson & Kilburn, 2010).

We argue here that media comparisons require a framework that reminds researchers to avoid, rule out the presence, or at least exclude the explanatory influence, of confounders when different media are compared: the Media Comparison Paradigm. The problem is that different

types of media, as well as different contents presented within the same type of media, are notoriously difficult to compare. A perfect experimental situation where the scientific standard of "all-else-being-equal" fully applies is hard to achieve in media studies. It starts with the observation that not only do violent and nonviolent games often differ in content, but the way participants engage with content: Their level of activity as well as the resulting self-involvement are rarely controlled. This problem is exacerbated when different *types* of media (say, games vs. movies) are compared that differ simultaneously in *content* (say, violent *first*-person shooter vs. violent movie with a *third*-person perspective). Based on our own previous research, we first examine criticisms and alternative explanations that can, and have, been brought forward against existing research. Then, from the angle of the Media Comparison Paradigm, we showcase the role of the content of gameplay for activating aggressive cognitive structures, and we scrutinize activity levels in different types of media as well as self-activation during gameplay. Ruling out general effects of self-presentation and response bias by using objective response-latencies from cognitive sorting-tasks (so-called implicit measures of the aggressive self-concept), we present well-controlled experiments on the media-aggression link that allow to rule out a pivotal role of confounders. We start our endeavor by presenting a commonly known theoretical framework that has been used to theoretically explain (and predict) negative psychological effects from exposure to violent media.

The General Aggression Model

Despite recent scientific attacks (Ferguson & Dyck, 2012), many researchers of media violence effects have historically relied on the perspective of the General Aggression Model (GAM; Allen & Anderson, 2017), as suggested by Anderson and Bushman (2001, 2002), originally based on the general affective aggression model (GAAM; Anderson, 1997; Anderson, Anderson, & Deuser, 1996; Anderson, Deuser, & DeNeve, 1995; Lindsay & Anderson, 2000). The GAM is a dynamic, developmental, and social-cognitive integrative model of human aggression, developed on the basis of appraisal-theoretic assumptions. It integrates years of research as well as findings on short- and long-term effects of exposure to violent media. (The type of media is typically not specified; the model was originally developed for movies with violent content, but is postulated to be valid for other media types such as computer games. The GAM can also be extended to a general learning model that includes prosocial behavior; Gentile et al., 2009; Greitemeyer & Mügge, 2010; Greitmeyer &

Osswald, 2010; Greitemeyer, Osswald, & Brauer, 2010; Prot et al., 2014). The model, depicted for short-time effects (see Figure 1), assumes three stages of information processing that are likely to heighten the risk of aggression after violence exposure. At the heart of human information processing lie three alternative (independent, yet interacting) pathways to aggression: cognition, affect, and physiological arousal.

To elaborate, a person might be confronted with an input stimulus such as media violence. Personological variables (e.g., emotional state, attitudes, cognitive capacity, etc.) serve as input, too, and interact with the situational demands. According to the GAM, exposure to violence leads to a cascade of information processing on three different routes (affect, cognition, and unspecific arousal). This information processing results in the immediate appraisal of the situation and determines the behavioral response. Following Anderson and Bushman (2002), we suggest to clearly distinguish between automatic appraisal on the one hand, which may lead to impulsive behavior in a subsequent social encounter (which a person might be unaware of), or controlled (re-)appraisal on the other hand, which leads to thoughtful actions in the social encounter, but depends on sufficient mental ressources.

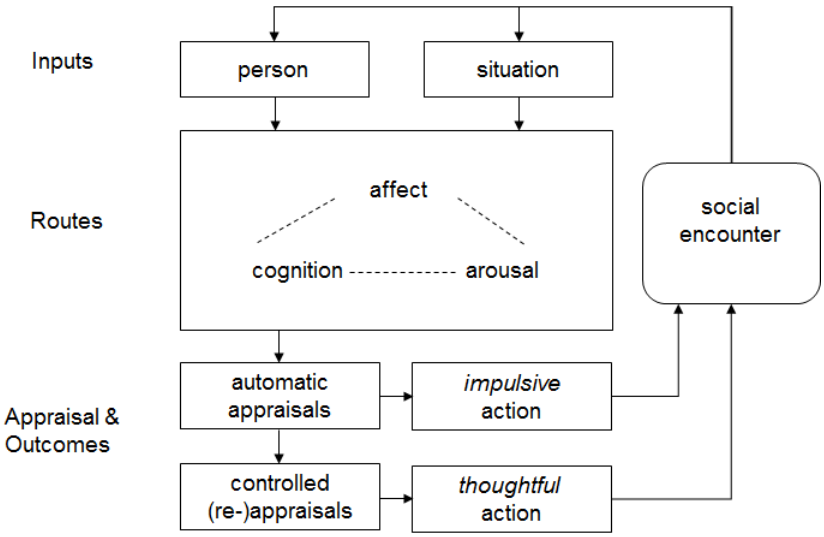

Figure 1. Short-term effects of exposure to violent situations including media stimuli adapted from the GAM and modified for automatic and controlled (re-)appraisals.

Through repeated cyles of exposure to violence a person might learn that aggressive behavior is useful in social encounters, so that the probability to act aggressively increases further in the future. The GAM is consistent with plenty of psychological theories that predict increases

in aggression after (repeated) media violence exposure. Note that not a single psychological theory predicts positive outcomes, neither in the short, nor in the long run—except for the catharsis hypothesis, which suffers from a lack of empirical confirmation until the very day (Bushman, Baumeister, & Stack, 1999). The most important mechanisms for short-term effects are (1) associative priming of existing aggressive beliefs, well-encoded scripts, and angry emotional reactions (Berkowitz, 1993; Dodge & Crick, 1990), (2) emotional arousal upon observation of violence and excitation transfer (Zillmann, 1978), and (3) simple mimicry of aggressive scripts (Huesmann & Kirwil, 2007). Long-term effects (not depicted in Figure 1) are most prominently considered to be a consequence of (1) observational learning of new social scripts, (2) development of beliefs supporting aggression or hostile schemas that accompany expectations in social interactions (Anderson & Godfrey, 1987; Huesmann & Kirwil, 2007), as well as (3) conditioning of aggression-promoting emotions. Long-term emotional desensitization to violent scenes may also occur (Carnagey & Anderson, 2004). Thus, repeated violent gameplay might lead to long-term effects by learning, rehearsal and reinforcement of aggression-related knowledge structures and, thereby, increase aggressive beliefs and attitudes, aggressive perceptual schemata, aggressive expectation schemata, aggressive behavioral scripts, and desensitization towards aggression. Taken together, these changes reflect the development from a peaceful to an aggressive personality (Anderson & Bushman, 2002; Allen & Anderson, 2017).

Current Problems of Research on Media Violence Through the Lens of the Media Comparison Paradigm

Irrespective of years of research, the debate on psychological effects following from violence exposure, on the impact of media consumption on individuals in real life, and on the internal validity of experimental studies rages. Despite a growing number of studies, there is still no consensus among researchers regarding whether media-driven effects are “real.” Some researchers deny that there is clear-cut evidence for the causality of violent media consumption on detrimental psychological effects (see Ferguson & Konijn, 2015). The statistical techniques for meta-analytically estimating effect sizes have also been questioned, as well as the relevance of controlled experiments for inferences on real-world problems (Anderson et al., 2010; Ferguson & Kilburn, 2010).

The foremost problem in primary experimental research on media and aggression is the identification and control of confounders. Confounders interfere not only in natural environments, but also in experimental settings, and they raise doubts even about the psychological measures of aggression and aggressiveness themselves (Elson et al., 2015). For instance, Adachi and Willoughby (2011) recently criticized the use of dependent variables in violent media research that assess competitiveness, but are interpreted as if they reflected aggression (e.g., the "noise-blast paradigm," also called "Competitive Reaction Time Task" [CRTT] or the "Taylor Aggression Paradigm" [TAP]; Epstein & Taylor, 1967; Elson, Mohseni, Breuer, Scharkow, & Quandt, 2014). The criticism here refers to the validity of the interpretation of test scores intended to reflect behavioral indications of aggression: hurtful noise-blasts applied to another human being. It is questionable whether the CRTT is valid for assessing aggression, due to potential confounders in the measurement procedure. The interpretational ambiguity of measures of aggression used to establish media effects matters a lot for the correct interpretation of any observed experimental effects. Ambiguities should neither be neglected or denied; in particular they cannot be overcome by a simple argument from authority ("argumentum ad autoritatem"), for instance, by referring to the CRTT as a "validated standard procedure in experimental lab research on aggression" (Gollwitzer, Rothmund, Klimmt, Nauroth, & Bender, 2014, p. 106).

More criticism with regard to the CRTT comes from Elson et al. (2014). The authors found large differences in experimental effects (effect sizes and significance levels) between different CRTT procedures and analytical approaches. These differences are obtained due to unstandardized use and analysis of the CRTT. They invoke procedural confounders that fluctuate with each application, across different labs, and potentially even within the same lab. These procedures impact on the results and impede sound interpretations of test scores. The volatile use evidently contributes to the conclusion that current scientific practices diminish the credibility and undermine the significance of laboratory research on aggression (see also Elson, Breuer, Van Looy, Kneer, & Quandt, 2015). One remedy might be the standardization of the CRTT setup and data analysis in the future (Brugman et al., 2015).

Another weakness and gateway to confounding is the use of questionable control conditions that hamper the causal attribution of effects. According to a recent literature overview "(...) no study has equated the violent and non-violent video games on competitiveness, difficulty, and pace of action" (Adachi & Willoughby, 2011, p.61), rendering many previous studies on video game effects ambiguous. This criticism pertains to the internal validity of many

experimental designs in the past. Often the materials compared in media research invoke multiple psychological dimensions, obviating clear attribution of causality. Some findings on aggressiveness increases after violence exposure in computer games might as well be explained by differences in mere competition or other factors that differ between violent games and nonviolent conditions.

The study by Uhlmann and Swanson (2004) may serve as an example. Theirs was one of the first studies to use an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) in video game research. It brought seminal evidence that playing a first-person shooter leads to an increase in implicit aggressiveness, a determinant of automatic aggressive tendencies. While the study can be lauded for being among the first to use an implicit measure in research on violence in media, nevertheless, some methodological flaws undermine the conclusiveness of the evidence presented. As a neutral control group was lacking, their finding does not allow to conclude—as suggested—that the violent game eventually increased aggressive cognitions; rather playing the control game may have caused participants to become more peaceful. In addition, the authors compared the nonviolent game "Mahjongg" to the violent game "Doom", a first-person shooter, thereby confounding the violent and nonviolent content with task differences, elicited physiological arousal, and involvement during gameplay. Both games differed strongly with regard to task complexity, competition with virtual opponents, excitation, and frustration resulting from losing game trials. Physiological arousal differences may also have affected the measurement of response speed in the implicit measure in an unhelpful manner (see below). Taken together, missing equivalence of game genres prohibits inferring a causal link (see Anderson et al., 2004).

A potent confounder in the research about the relationship between violent media and aggression then appears to be gamers' self-paced activity and the accompanying physiological arousal when playing video games. Because unspecific arousal is an independent ingredient in the mix of causal factors leading to increases of aggressiveness according to the GAM (see above), arousal differences between conditions with active and passive media types (e.g., games vs. movies) undermine the interpretation of effects as aggressiveness increases due to exposure to *violence* specifically. Even within the same type of media (e.g., computer games), the control condition may involve the participant much less than the experimental condition. This can lead to arousal differences that mimic harmful effects of violence exposure, but are transitory and harmless with regard to changes in aggressive dispositions.

The study by Fischer, Kastenmüller, and Greitemeyer (2010) may serve as another example. These colleagues showed that the effect of violence exposure on aggression was markedly strengthened if participants strongly identified with their video game character. Generally, participants administered more hurtful hot-sauce to a fellow participant after an aggressive game (boxing) than after a non-aggressive game (bowling), and hot sauce is deemed a better indicator of aggressive behavior than the criticized CRTT. Furthermore, in each condition half of the participants used personalized virtual players that mirrored participants' gender and physical appearance. In line with a self-activation account, participants playing with self-created avatars applied more hot-sauce than those who had used non-personalized characters, despite both groups playing the same game. Once the amplified similarity in appearance allowed a participant to identify more strongly with the virtual character, the violent game had the profoundest effect on players' aggression. When running a mediation analysis, retrospectively reported self-activation during gameplay purportedly mediated the relationship between personalized vs. non-personalized violent games and aggression (Fischer et al., 2010). The interpretational ambiguity of this study stems from the fact that the measure which was meant to assess self-activation was susceptible to arousal differences emerging between experimental conditions. Mere arousal could have been the driver of both the general effects and the specific mediational pattern, yet such an account would be different from the hypothesized heightened involvement of the *self* when using avatars that resemble the players.

To summarize, fundamental problems in research on the consumption of violent media may undermine the interpretation of dependent and independent variables. This is particularly likely to be the case whenever experimental conditions compare different game genres that require different gamer behavior. Consequently, the impact of different games and/or game types on psychological variables is confounded with other factors, the comparison of experimental conditions is hampered, and the experiments cannot be said to be internally valid. The risk is highest whenever only one stimulus is sampled per psychological treatment or experimental condition ("*N*=1"-problem; Wells & Windschitl, 1999).

To overcome the confounder dilemma in experimental media research, we suggest to use a framework which we refer to as the *Media Comparison Paradigm* (Zumbach & Bluemke, submitted; see Figure 2). The paradigm accepts that media comparisons are notoriously difficult, and suggests that they can only be valid within "zones of comparability." Types of media differ in many regards, as do often media contents or how participants interact with media or content presented. While the influence of a single factor has to be clearly established

as a prerequisite for sound interpretation of any effects, potentially detrimental confounders such as arousal differences have to be ruled out at the same time—if not by experimental design, then by controlling them at later stages (e.g., statistically), which necessitates that confounders be anticipated and measured in the course of the experiment.

For conclusions to be stringently drawn, the window of opportunity for theoretically relevant alternative explanations needs to be as small as possible. When engaging with different experimental conditions, either the level of interactivity (i.e., the "syntactics" of what participants do) has to be constant, while different content is being compared; alternatively the content of specific media (i.e., the "semantics") has to be kept constant, while the level of interactivity varies (see also Elson et al., 2015). Comparing content across different types of media (say, movie sequences vs gameplay) requires at least approximately equivalent conditions, in which the most important confounders are controlled; not all the potentially relevant aspects can always be controlled (such as whether "screams" occur rather by movie actors or computer gamers). Yet, valid comparisons require ruling out blatant confounders, so that reasonable zones of comparability can be established. The Media Comparison Paradigm provides a heuristic, meant to help overcome some of the before-mentioned problems in research on violent video games and their impact on human aggression and aggressive dispositions.

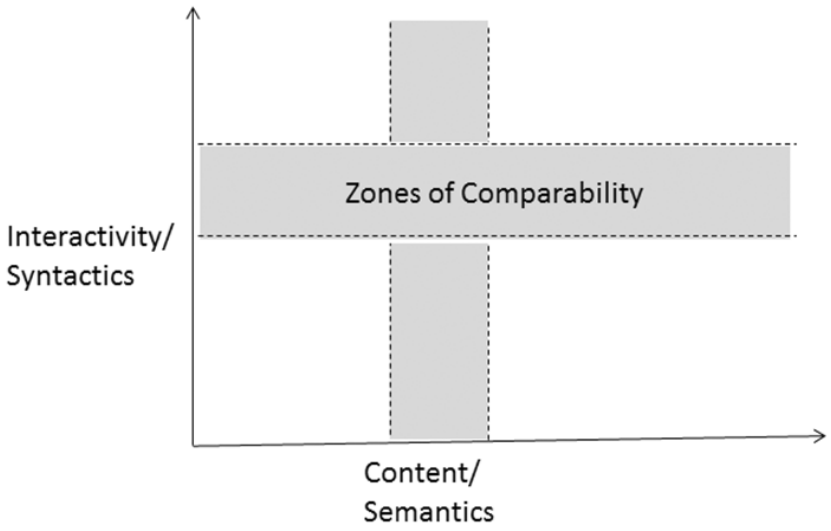

Figure 2. Illustration of the Media Comparison Paradigm.

Before reflecting on the Media Comparison Paradigm's relevance, we present how to best address some measurement issues due to lack of introspection and social desirability biases in the assessment of aggressive dispositions. We suggest to analyze the effects with the help of *implicit* measures of aggression—an approach we pursue through all our research presented here.

Implicit Measures of Aggressiveness in Research on Violent Media

Since Schneider and Shiffrin (1977), the distinction between automatic and controlled processes has become quite common. Huesmann (1998) applied the distinction between automatic and controlled processing to aggressive behavior. Also, the GAM (see above) distinguishes between outcomes that either represent impulsive behavior or rather thoughtful action. The most extensive application of automatic processes to social behavior in general has been laid out in the reflective-impulsive model (RIM; Strack & Deutsch, 2004). The RIM stands in the recent tradition of social-cognition research and allows for the mutual influence of two cognitive systems in producing human behavior: one associative and one reflective system, yet interconnections between both systems exist. That automatic processes can be held at least partly responsible for the emergence of aggressive behavior is not a new insight (Todorov & Bargh, 2002). Situational priming of mental constructs in the range of few hundred milliseconds, even below the subliminal threshold, reliably biases people's perceptions of ambiguous behavior, and it can guide the selection of behavioral options (Berkowitz, 2008; Dodge & Crick, 1990; Zelli, Huesmann, & Cervone, 1995). The RIM summarizes many findings on human automaticity, and it can also be applied to *predicting* humans' aggressive tendencies (Banse, Schmidt, & Imhoff, 2017).

What is less obvious from our discussion so far is how each of the reflective and impulsive pathways that the RIM presupposes can be predicted. Automatic associations can be conceived of as dispositions to behavior. Borrowing the metaphor of "spreading activation" in semantic networks, associations efficiently predispose humans to the spontaneous selection of behavioral scripts. Importantly, behavioral impulses can be at variance with one's personally endorsed standards, or social norms, and this may be the case even without the person being aware of it. Whether deliberate reflection or impulses will determine behavior depends on the cognitive capacity and motivational resources for self-regulation, which themselves might be

impaired due to temporal or chronic influences (Baumeister, Muraven, & Tice, 2000; DeWall, Baumeister, Stillman, & Gailliot, 2007; Fazio & Olson, 2014). Forecasting human behavior in automatic behavioral domains is mostly based on *implicit* measurement procedures, which serve as indicators of—at least somewhat stable—interindividual dispositions (Gawronski & Payne, 2010; Gawronski, Morrison, Phills, & Galdi, 2017; Lemmer et al., 2015).

Obviously, aggression does not always reflect *actions* in line with one's conscious reasoning or *explicitly endorsed attitude* towards aggression and violence. A substantial part of aggressive behavior is carried out in the absence of cognitive resources or in situations where people lack behavioral control (e.g., after alcohol consumption or provocation; Richetin, Richardson, & Mason, 2010). Those dispositions that relate to less controlled aspects of human behavior, rather than deliberate behavior and intended actions, may be addressed by the term “implicit personality” (Banse & Greenwald, 2007; Perugini & Banse, 2007). Implicit measures are particularly suited to uncover the processes how playing violent and nonviolent video games affects (also gamers’) automatic cognitions (Bluemke & Teige-Mocigemba, 2015). These measures represent behavior-based assessment; they are based on experimental tasks and indirectly infer a psychological attribute, or an aspect of the self-concept of a person (Bluemke & Friese, 2012), from observable behavior such as response speed in (computerized) sorting tasks (Bluemke & Zumbach, 2012; De Cuyper et al., 2017). In line with previous reasoning, these implicit measures tap into automatic dispositions that play a key role in spontaneous and impulsive aggressive tendencies (Banse, Messer, & Fischer, 2015; Lemmer et al., 2015), both in the short and long run (Richetin & Richardson, 2008).

Implicit measures have been developed that tap into automatic associations taking place in the range of a few hundred milliseconds (Fazio & Olson, 2003). Explicit measures, which are based on deliberation and reappraisals, mainly predict behavior under reflective control, whereas implicit measures predominantly predict impulsive tendencies and behavior in less-controlled situations (Friese, Hofmann, & Wänke, 2008). The latter finding does not contradict the idea that clever explicit measurement procedures can likewise uncover automatic influences in a broad sense. Behavior is the product of both types of processes to a sizable extent, and the situation is responsible for moderating their relative impact (Hofmann, Friese, & Strack, 2009).

We suggest that implicit measurement techniques are a useful addendum to the agenda of aggression research (Bluemke & Teige-Mocigemba, 2015). When we combine the idea of associative networks and priming procedures within the domain of aggression, assessing

differences in people's aggressive impulses becomes feasible. Assuming automatic aggressive dispositions and using implicit measures to detect them is in line with recent calls to integrate neo-associationistic approaches into models that explain and predict aggression (Bluemke & Zumbach, 2012). In doing so, both classic theoretical and newer paradigms are combined (Berkowitz, 2008; Bushman, 1998; Dodge, 2008; Pahlavan, 2008).

In contrast to traditional explicit measures such as questionnaires, implicit measures do not rely on conscious self-report, but on the measurement of hard-to-fake and hard-to-control spontaneous associations (for limits, see Fiedler & Bluemke, 2005). They typically draw on reaction-times in categorization tasks within a few hundreds of milliseconds, that is, within the fraction of a second where also automaticity effects can be observed. A major advantage of implicit measures is their lower susceptibility to response distortions, social desirability, and other biasing factors such as low levels of introspection (Banse et al., 2017; Degner, Wentura, & Rothermund, 2006). Crucially, due to the limited time for responding, information processing in implicit measures differs distinctively from responding to a questionnaire so that both types of measures display their merits, particularly when predicting different kinds of behavior: Dissociations between implicit and explicit measures in predicting impulsive and controlled behavior typically result (Asendorpf, Banse, & Mücke, 2002; Hofmann, Rauch, & Gawronski, 2007). Also treatments can affect the associative and reflective level independently (Gawronski & Bodenhausen, 2007). Implicit measures serve as predictors of impulsive aggression which cannot be explained by self-report and observer ratings (Banse et al., 2015; Gollwitzer, Banse, Eisenbach, & Naumann, 2007).

Heavy players of violent video games may claim to be immune to side-effects, and at the reflective level this may hold, but at the associative level the picture may look quite different. Predominantly automatic associations and impulsive behavior, rather than intentions and deliberate behavior, might be altered in violent computer games. The notion that gamers regularly deny increases in aggression after violence exposure (e.g., Bender, Rothmund, & Gollwitzer, 2013) may also be explained in part by lack of introspection into automatic precursors of behavior, which then manifests in a relative dissociation between explicit and implicit measures of aggressiveness (Bluemke & Zumbach, 2007; 2012). Uhlmann and Swanson (2004) observed exactly such a predicted increase of aggressive cognition, denied by the participants, after 10 minutes of playing a violent computer game in the lab, when aggressiveness was measured objectively via response latencies in an IAT.

Yet, as we have shown, media comparisons are notoriously difficult. To analyze the impact of violent computer games on implicit aggressiveness, and to support the evidence on a possible causal link between exposure to violence and increases in implicit aggression in a more conclusive manner, we conducted several studies following the Media Comparison Paradigm, three of which address some of the problems of the aforementioned studies. The idea was to control for confounders in the independent variables by staying within zones of comparability, but also to use as dependent variable the IAT as a robust measure for implicit aggressiveness.

The Link Between Playing Violent Computer Games and Implicit Aggressiveness: Evidence from own Research

The first study empirically controlled confounding variables in (non-)violent media comparisons (Bluemke, Friedrich, & Zumbach, 2010). In a replication attempt of Uhlmann and Swanson's (2004) study, we controlled the competitiveness, the difficulty, and the pace of action across game conditions. Three different versions of a computer game were developed for this experimental purpose (see Figure 3). All three versions required participants to initiate the same movements, namely to move the mouse pointer to objects appearing randomly on screen and to click them within a given time interval. By successfully clicking the objects, gamers were awarded credit points. When gamers missed the object or exceeded the time limit, the computer "won" the trial instead of the participant. The mission was to beat the computer. This comparable game scenario kept the behavior constant (the "syntactics" of the gameplay), while only the content (the "semantics") varied. Thus, the environmental context, the mouse gestures, and the physiological arousal—as indicated by heart rate (HR) and galvanic skin response (GSR)—were comparable. Only the symbolic meaning attached to the mouse pointer varied: In the "violent" game condition virtual enemy soldiers had to be shot, whereas in the "nonviolent/peaceful" condition sunflowers had to be watered, and an additional (nonviolent) control condition simply required clicking colored triangles. Hence, the comparison took place in a zone of comparability.

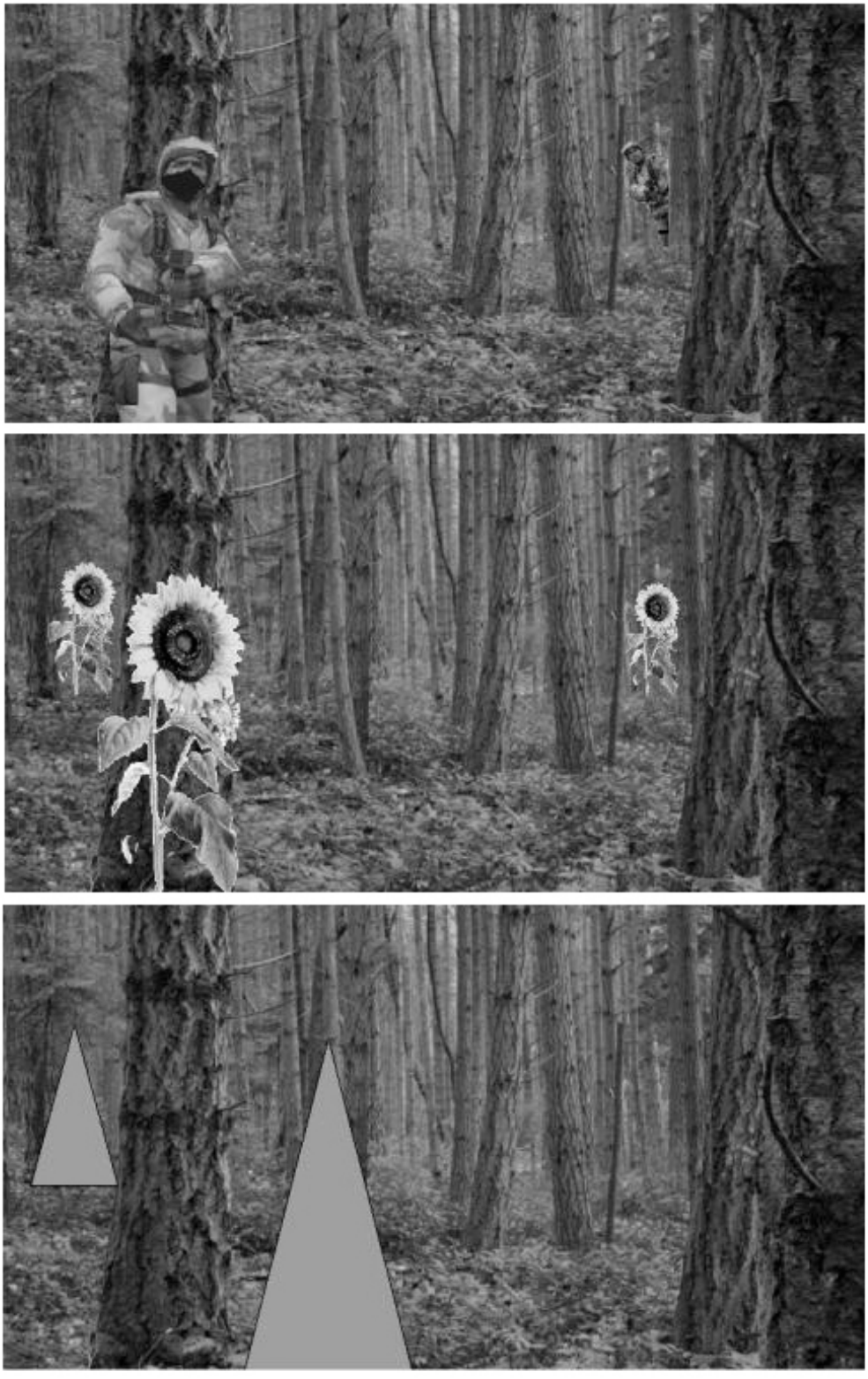

Figure 3. One computer game used for analyzing short-time effects of exposure to three different game contents.

According to questionnaires, explicit aggressiveness did not change after five minutes of playing, yet an IAT assessing the automatic aggressive self-concept (Aggressiveness-IAT, or Agg-IAT) was capable of detecting a causal influence on dispositions of impulsive aggressiveness in a pretest-posttest design. This Agg-IAT reflected changes in automatic aggressiveness dispositions after exposure to computer games. From a dual-process perspective, the Agg-IAT is a measure, based on objective reaction-times, that can predict the impulsive pathway to aggression rather than the deliberate route, especially when self-control is generally low or temporally exhausted (Denson, Capper, Oaten, Friese, & Schofield, 2011; Richetin & Richardson, 2008; Richetin et al., 2010; Teubel, Banse, Asendorpf, & Schnabel, 2011). The fact that a mere five minutes of violent game play altered the aggressive self-concept—at least temporarily—is compatible with the notion that self-activation potentially plays a major role in shaping automatic precursors of aggressiveness during gameplay.

However, this study did not investigate the involvement of the self, which acts as the central memory structure (Markus & Kunda, 1986) and also as a point of reference in Agg-IATs. Depending on the situation, various self-related aspects can become activated in memory, say, aggressive behavioral scripts, which subsequently govern people's behavior (Kawakami et al., 2012). The experimental conditions may have primed participants quite blatantly with specific content, such as peaceful actions (watering sunflowers) or aggressive actions (shooting enemies), without actually involving the self. Also in Fischer and colleagues' (2010) study on the role of the self-activation as a function of personalized avatars, an alternative interpretation exists for the supposed role of self-activation in violent media effects: unspecific arousal was left uncontrolled, which may act as a confounder. In a subsequent study (Zumbach & Bluemke, 2018), we ruled out this problem along the lines of the Media Comparison Paradigm. Here we kept the storyline the same (the "semantics"), but varied the level of personal activity required when encountering the media. Participants in one condition had to passively watch a 3-minute violent scene from the movie "The Matrix." In another condition, the same scene was reenacted by the participants in a Matrix-inspired first-person shooter game. Keeping the violent content (shooting at Matrix-guards), the weaponry, the atmosphere including the musical score (orginal score from the movie) as well as the post-experimental arousal constant prior to assessing Agg-IAT scores, the comparison took place in a zone of comparability. The findings suggested that the higher the level of self-activation while being exposed to the same violent media content, the stronger the changes in aggressive dispositions as assessed with an Agg-IAT. Ruling out confounders from previous research, unspecific arousal was not responsible for the observed short-term increases in aggressive

dispositions. Despite a rather short intervention—three minutes of gameplay or watching a three-minute movie scene—the Agg-IAT revealed an effect of self-activation on implicit aggressiveness, as evident in a stronger association between self and aggressive behaviors after violence exposure when participants had enagaged actively with the content. Explicit measures did not detect the same kind influence.

Due to the IAT's sensitivity to participants' involvement in game content, a third study examined the influence of the game realism (Zumbach, Seitz & Bluemke, 2015). Realism is suspected to nourish aggressiveness increases due to exposure to media violence (Barlett & Rodeheffer, 2009; Krcmar, Farrar, & McGloin, 2011; McGloin, Farrar, & Fishlock, 2015). We compared a standard 2D representation of a ten-minute gameplay of Call of Duty - Modern Warfare © to its 3D representation realized by shutter-goggles in a lab experiment. Note that the gaming content was exactly the same, as was the behavior and level of activity required from participants. Consequently, this experiment took place in a more than suitable zone of comparability. Higher degree of realism of media violence was hypothesized to impact stronger on players' Agg-IAT scores in the pretest-posttest design. According to an explicit questionnaire on aggressiveness, participants reported having becoming more peaceful after violence exposure, presumably an outcome of blatant faking and caution in studies on violent computer games (Bender et al., 2013). By contrast, the Agg-IAT indicated once more that the association between self and aggressive behavior had become stronger after violence exposure, confirming the unique utility of IATs in research on media violence. Contrary to the hypothesis, however, the 3D visualization mode did not strengthen this association any further. As the experimental conditions were on par with regard to semantics and syntactics, blatant confounders cannot be held responsible for the lack of evidence on game realism. Instead, the Agg-IAT showed that the relation between self and aggressive behaviors was strengthened independent of how realistic gameplay was.

Summary and Conclusion

In this chapter, the debate about the consequences of playing violent computer or video games has been expanded on the importance of using implicit measures of aggressiveness to tap into automatic aspects of the implicit self-concept known to be a precursor of aggressive impulses. While different positions still clash, claiming that there either is a link or no link between violent computer gameplay and human aggression, we argue here that the repercussions even

of short-time exposition to violent media content *can* be measured and, in that sense – yes, there is an established link. Nevertheless, current research does not suggest that this effect, which can be observed on implicit measures, will also reliably emerge on explicit measures of aggressiveness. Whether or not the same link can be demonstrated for explicit measures depends on whether researchers successfully face several methodological challenges and are willing to dig deeper into this research area. One open question is how short-term effects on an implicit level condensate to long-term changes, and whether any of the long-term changes inform respondents' self-concept when they take explicit questionnaires on aggressiveness.

This chapter also encountered the question why the scientific debate on media violence and aggression is still far from being settled. One major problem for the scientific discourse and the interpretation of the relevant body of research is (the doubtful or lacking control of) confounding in experimental research, either at the level of dependent or independent variables. Our contribution provides two solutions. At the level of independent variables, the Media Comparison Paradigm offers a solid framework inspiring stricter control of different gameplay actions and/or the content provided within media such as computer games. At the level of dependent variables, the use of reliable and valid measures is recommended. We suggest using implicit measures, as these are currently rather absent from research on violent media exposure. In a series of experiments in line with our suggestions, we bundled the evidence for a direct impact of playing violent video games on impulsive aggressive dispositions. To be clear, this impact does not necessarily imply that cumulative short-time effects invariably lead to long-time changes or an overall aggressive personality. As of now, this link has not even been investigated systematically. This link remains hypothetical, until future longitudinal research scrutinizes and clarifies its substance.

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