Enter the Matrix:

Does Self-Activation Really Matter For Aggressiveness After Violence Exposure?

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Abstract

Media 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, while the content might vary, or the content of specific media (i.e., the “semantics” of what they encounter) has to be kept constant, while the level of interactivity with the content might vary. The present experiment varied the level of interactivity: Participants watched a violent scene from the movie “The Matrix” or re-enacted the same scene in a Matrix-inspired first-person shooter game. Using the same violent content (shooting at Matrix-guards), our results suggest: The higher the level of self-activation while being exposed to violent media content, the stronger the changes in aggressive dispositions as assessed with an aggressive self-concept Implicit Association Test. Ruling out confounders from previous research, unspecific arousal was not responsible for the obtained short-term increases in aggressive dispositions.

Key Words

Aggression, Aggressive Self-Concept, Implicit Association, Self-Activation

Highlights

- Self-activation moderates the impact of violent content on aggressiveness increases
- Media studies require control of interactivity and content to be conclusive

Introduction

Measurement confounds often undermine the conclusiveness of research by allowing alternative interpretations. This effectively nourishes criticism, and it ultimately prevents societal action. For instance, in a U.S. Supreme Court ruling from June 2011, the majority of the court was not convinced that a link between exposure to violent video games and harmful effects on minors existed. As a consequence, a law that aimed at protecting minors from media violence was overturned.[2] In the debate on media violence exposure effects, scientists themselves have repeatedly called for more conclusive evidence, before strong conclusions are warranted (e.g., Anderson et al., 2010; Ferguson & Kilburn, 2010). Our research deals with a framework that can guide researchers to avoid confounders, the Media Comparison Paradigm. Using prominent previous research as a starting point, we critically reexamine the claimed causalilty of the self during video game players' active engagement with violent media (cf. Gentile, 2015).

Problems of Media Research

Confounders in Media Violence Research. Adachi and Willoughby (2011) recently criticized the use of dependent variables that assess competitiveness rather than aggression (e.g., the so-called "noise-blast paradigm", sometimes also called "Competitive Reaction Time Task" [CRTT] or "Taylor Aggression Paradigm" [TAP]; Epstein & Taylor, 1967; Elson, Mohseni, Breuer, Scharkow, & Quandt, 2014). Their first criticism calls the validity of aggression measures, due to potential confounders in the dependent variables, into question. Furthermore, according to their literature overview "no study has equated the violent and non-violent video games on competitiveness, difficulty, and pace of action" (p.61), rendering many studies on video game effects ambiguous. This second criticism pertains to the internal validity of experimental designs more generally.

Elson et al. (2014) also criticized the aggression measures used in media research, raising specific doubts about the Competitive Reaction Time Task (CRTT). They found large

differences in significance levels and effect sizes between different CRTT procedures and analyses. These differences, based on unstandardized use and analysis, invoke procedural confounders that fluctuate with each application. They impact on the results and impede sound interpretations. According to Elson and colleagues, the current practices diminish the credibility and significance of laboratory research on aggression (see also Elson, Breuer, Van Looy, Kneer, & Quandt, 2015). Standardizing the CRTT setup and trial analysis may improve its future utility (Brugman et al., 2015).

DeCamp (2015) discussed real-life confounders pertaining to measures of aggression in violent media research. Her analysis of the impact of violent media use on aggressive behavior, especially when combined with other causal factors (e.g., observing violence at home, sensation seeking, ethnicity, etc.), revealed that the status of playing violent video games had only little or no predictive value in real life (but see Gentile & Bushman, 2012, for a combined risk factor analysis). Unfortunately, among the dependent measures that DeCamp investigated were “weapon carrying”, “gun carrying”, and “hitting”. These indicators fall at the more extreme end of everyday behavior, resulting in low base rates for being observed, and they do not inform us about psychological variables or aggressive dispositions, the lurking readiness to act aggressively in any form at some point. Nevertheless, her research shows that many factors impact on violent behavior, and research has to be scrutinized to avoid confounders before solid conclusion can be drawn (see also Elson et al., 2015).

To work towards a resolution of the confounder dilemma, Bluemke, Friedrich, and Zumbach (2010) had empirically controlled confounding variables in (non-)violent media comparisons. In a replication attempt of Uhlmann and Swanson’s (2004) study, they kept the competitiveness, the difficulty, and the pace of action at the same level. They showed that violent and peaceful video games can indeed by held responsible for changes in aggressive dispositions even when confounders are eliminated or controlled. In their study, an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) on the automatic aggressive

self-concept reflected aggressiveness changes after exposure to computer games. From a dual-process perspective, this aggressiveness-IAT is a measure, based on objective reaction-times, that predicts the impulsive pathway to aggression, rather than the deliberate route, especially when self-control is generally low or temporally exhausted (Bluemke & Friese, 2012; Bluemke & Teige-Mocigemba, 2015; Bluemke & Zumbach, 2012; Denson, Capper, Oaten, Friese, & Schofield, 2011; Richetin & Richardson, 2008; Richetin, Richardson, & Mason, 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 game play. However, this study did not investigate the causal nature of the involvement of the self, which acts as the central memory structure in IATs on the aggressive self-concept.

Confounders in Research on Self-Activation through Video Games. Fischer, Kastenmüller, and Greitemeyer (2010) addressed the question whether self-activation moderates the impact of violence exposure. They 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). (Hot sauce is potentially 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, or *alter ego*, then the violent game had the profoundest effect on players' aggression. Self-reported self-activation purportedly mediated the relationship between

personalized vs. non-personalized violent games and aggression (Fischer et al., 2010). While the use of hot sauce as a behavioral measure, as recommended by Adachi and Willoughby (2011), is potentially better than the use of the criticized CRTT, several questions remain.

A Useful Framework for Media Comparisons

Valid Media Comparisons. According to the Media Comparison Paradigm (cf. Bluemke et al., 2010; see Figure 1), media comparisons are only valid within "zones of comparability" so that the causal influence of a single factor can clearly be established. Either the level of interactivity (i.e. the "syntactics" of what participants do) has to be constant while different content is being compared, or the content of specific media (i.e., the "semantics") has to be kept constant while the level of interactivity might vary (see also Elson et al., 2015).

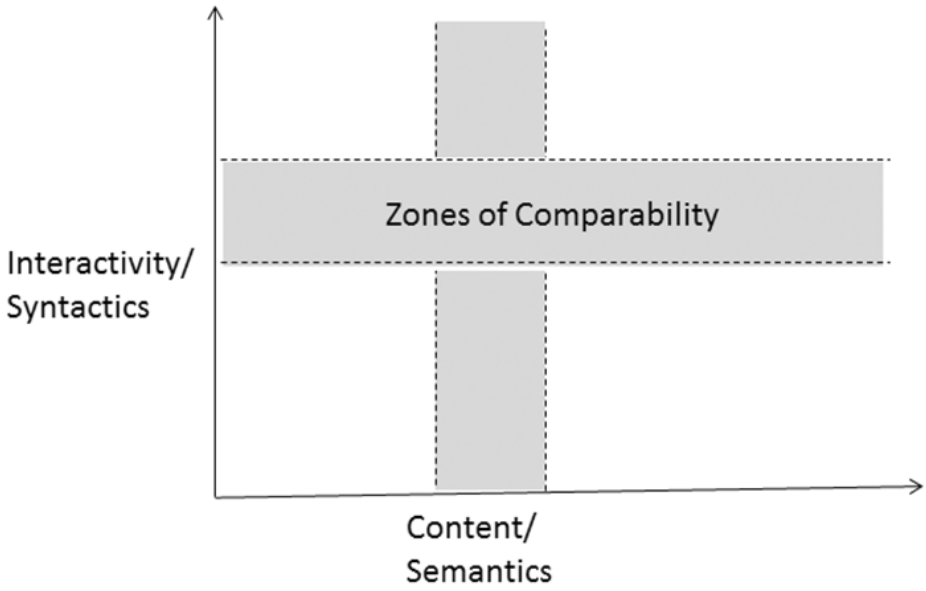

Figure 1. Illustration of the Media Comparison Paradigm.

By not keeping either syntactics or semantics constant, the ostensible replication of the violence-exposure effect in Fisher et al.'s (2010) study may stem from differences between

peaceful and violent games other than violent content: Participants were exposed to different types of games, the activity of the games differed as did the pace of actions (cf. Adachi & Willoughby, 2011; Bluemke et al., 2010; Elson et al., 2015). If mere arousal drove the main outcomes (e.g., due to competitiveness or action differences), personalized characters may have temporally intensified arousal (e.g., due to the novelty of personalized characters), rather than involved self-activation that would be necessary to change individuals' aggressive dispositions. The findings are ambiguous, because the General Aggression Model (Anderson & Dill, 2000) acknowledges arousal as a sufficient but transient causal factor leading to aggression in social situations (cf. Zillman, 1978), yet unspecific arousal was not controlled. Instead, there is a high likelihood that it contributed to the observed effects.

Specifically the reported mediational analysis does *not* clarify the underlying process. Self-activation was measured "by asking participants how awake, strong, attentive, active, upset and motivated they felt" (Fischer et al., 2010, p.193). Such an instrument is actually less reminiscent of a scale for assessing self-activation than it is of a scale for *activity* and *potency* in general —two dimensions that, apart from valence, underlie the semantics of adjectives (Osgood, Tannenbaum, & Suci, 1957). As the scale focused on active/passive and strong/weak connotations, responses on the purported measure of self-activation may have reflected *unspecific arousal* rather than the involvement of the self (Russell, 1978, 1980). Such an alternative interpretation accounts for the mediational link established between the experimental manipulation and the subsequent aggression, and it puts a question mark behind the self-activation account.

Overview & Hypotheses

To clarify the role of self-activation in video game effects, which our previous study did not investigate (Bluemke et al., 2010), and to overcome the ambiguities in Fischer et al.'s (2010) outcomes and pertinent conclusions, we ran a new experiment. By manipulating interactivity but keeping the media content comparable, our experiment took place in a zone of

comparability. One experimental group watched violent content taken from the movie Matrix passively, whereas others engaged actively with the same content by playing a shooter game that re-enacted the Matrix plot (see Figure 2).

Figure 2. Scene from the movie Matrix (upper panel) and comparable scene from the first-person shooter game Matrix (lower panel).

The two conditions reflected the same scene and type of armed violence, but only one required participants' active participation. A third group simply read an article with neutral content. Self-activation should increase from reading to watching to playing. This self-activation should become evident on an implicit measure specifically capturing the association between self and aggressive behaviors, the Agg-IAT (Banse, Messer, & Fischer,

2015). We also hypothesized aggressiveness increases when participants were passively exposed to media violence. Merely observing violence also increases aggressiveness in the short and long run (e.g., Anderson et al., 2003; Coyne, 2016; Gentile et al., 2011).

Nevertheless, players' activity is likely to heighten self-activation, resulting in even stronger Agg-IAT changes. Recent research has shown that the more players are immersed into gameplay, the higher the impact on psychological variables. Lull and Bushman (2016) studied the impact of violent and non-violent gameplay within the same game. The degree of simulated reality was additionally modified by comparing three-dimensional vs two-dimensional gameplay. The outcomes showed that the three-dimensional condition was related to an increase in anger in the violent gameplay condition. The authors assumed that the *psychological presence* experienced by the players mediated this relationship, with presence amplifying the effects of violent video gameplay.

In line with this reasoning, we hypothesized for our study that playing a violent game *oneself* may lead to a higher degree of presence than just observing violent scenes carried out by movie protagonists. We assume that *self-activation* is an underlying mechanism that interacts with the violent content, resulting in the subsequent changes of aggressive dispositions and increased likelihood of aggression. If self-activation indeed moderates the violence exposure–aggression link, as suggested by Fischer and others (2010), then playing violent games is likely to alter the aggressive self-concept more than does passively watching the violent movie, and definitely more so than simply reading a magazine. In other words, any self-involvement in exposure to violence should be reflected in different adjustments of the aggressive self-concept after active, passive, or no violence exposure.

Method

Participants and Design

Ninety students at the University of Salzburg (62.2% females; M_{age} = 24.66 yrs., SD = 6.13) participated in exchange for course credit. They were randomly allocated into an experimental condition, either the article-reading control group, the Matrix-movie group, or the Matrix-game group. Implicit and explicit measures of aggressiveness were taken before and after the treatment. Data on skin conductance were sampled before, during, and after treatment.

Experimental Procedure and Materials

After informed consent, participants provided socio-demographic information. Then, the experimenter attached electrodes to participants' left middle and ring fingers to collect electrodermal activity parameters as they completed the explicit aggressiveness questionnaire. Next, participants worked on an implicit aggressiveness measure. Then, as a three-minute treatment, control participants read an article on autism, while one experimental group watched a violent scene from the movie Matrix passively, whereas the other group played a first-person shooter game with the same scene. Finally, explicit and implicit aggressiveness were measured a second time. The procedure took about 30 minutes, including debriefing.

Explicit Aggressiveness. Buss and Perry's (1992) Aggression Questionnaire (BPAQ) with 27-items and a five-point rating scale format (ranging from "I fully agree" to "I do not agree at all") assessed facets ranging from physical and verbal aggression to anger and hostility (German version by von Collani & Werner, 2005). BPAQ sum-scores at pretest and posttest were reliable, Cronbach's α_1 = .86, $CI_{90\%}$ = .82–.89, and α_2 = .87, $CI_{90\%}$ = .83–.90.

Implicit Aggressiveness. The aggressive self-concept IAT assessed the sorting speed of stimulus words in a double-barreled sorting-task. We used a five-block IAT structure and the stimuli reported by Bluemke et al. (2010). First, the discrimination of aggressive and peaceful attribute words (20 trials) and the discrimination of self and other target words (20 trials) were practiced. Then, critical blocks combined attribute and target words (80 trials), with self+peaceful (other+aggressive) first, and self+aggressive (other+peaceful) second. Between the two critical blocks, participants practiced the inverted target category positions (40 trials).

IAT effects were computed as D_5-difference scores that subtract the latency in the critical self+peaceful (other+aggressive) block from the latency in the critical self+aggressive (other+peaceful) block (Greenwald, Nosek, & Banaji, 2003). Lower IAT scores imply comparatively quicker associations between self+aggressive, hence reflect more aggressive self-concepts. If one accepts zero IAT effect as indicating equally strong associations between self+aggressive and self+peaceful, then - on average - peaceful self-concepts resulted. IAT effects were reliable (Spearman-Brown corrected odd-even reliability), r_1 = .73, $CI_{90\%}$ = .61–.81, and r_2 = .71, $CI_{90\%}$ = .59–.80.

Physiological Measure. Skin conductance (CASSY Lab) was assessed before and after treatment when participants filled in the BPAQ, and also during the treatment phase. Five seconds at the beginning and the end of each period were discarded. The average skin conductance level in each phase served as a proxy for arousal (in µS). Data from three participants were lost during game play. They were excluded from further analyses.

Results

Pretest Aggressiveness. Running a 3 (experimental condition: control, movie, game) x 2 (gender: male, female) ANOVA showed that participants in the experimental conditions tended to differ in explicit aggressiveness prior to any treatment, M = 2.38 [2.29–2.53], SD = 0.42, $F(2, 84) = 2.54$, p = .085, η_p^2 = .057. Consequently, BPAQ pretest scores qualified as a covariate for the analysis of posttest aggressiveness. Men and women did not differ, Ms = 2.40 vs. 2.37, SDs = 0.34 vs. 0.46, $F < 1$. Also, the condition × gender interaction was far from significant, $F(2, 84) = 1.09$, p = .34, η_p^2 = .025.

With regard to pretest IAT scores, no stringent differences were found between the groups, M = 0.50 [0.46–0.52], SD = 0.36, $F(2, 84) = 1.17$, p = .32, η_p^2 = .027. However, men clearly had lower IAT scores, speaking to a less peaceful (more aggressive) self-concept, Ms = 0.38 vs. 0.57, SDs = 0.37 vs. 0.34, $F(1, 84) = 6.55$, p = .012, η_p^2 = .072. The condition × gender

interaction was not significant, $F(2, 84) = 1.36$, $p = .26$, $\eta_p^2 = .031$. When individuals reported higher explicit aggressiveness, they also had a more aggressive implicit self-concept, reflected in a negative relationship between BPAQ and IAT scores, $r = -.32$, $p = .002$.

Physiological Arousal. As expected, actively playing a violent game increased arousal (cf. Bluemke et al., 2010). During treatment, skin conductance was higher for active players than for passive viewers and control participants, contrast weights $\lambda = (+1, 0, -1)$, $t(84) = 2.06$, $p = .021$ (one-tailed), $r_{\text{effect-size}} = .22$ (see Figure 3).

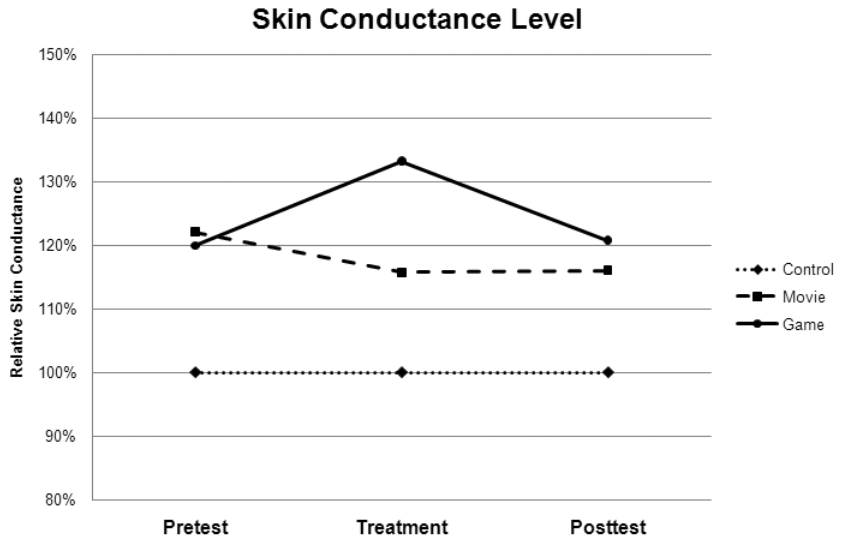

Figure 3. Changes in physiological arousal (skin conductance) in three groups across the experimental procedure, calibrated at the level of the control group (100%).

No such differences existed at pretest and posttest, ts < 1.45, ps > .15. Though higher skin conductance is compatible with self-involvement of active players during treatment, it could simply reflect stronger psychomotor activity so first of all the physiological measure supports the idea of an effective gaming manipulation. At the same time the scores at posttest do suggest that posttest arousal differences—which could have interfered with the measurement of implicit dispositions in principle—did not exist in our study.

Posttest Aggressiveness. Implicit aggressiveness was analyzed by an ANOVA of pretest-posttest IAT change scores (ΔD_5), which take pre-existing group differences into account (cf.

Bluemke et al., 2010). Apart from the experimental condition and participant sex as between-subject factors, we controlled for the unexpected pre-experimental differences in explicit aggressiveness by including BPAQ as a covariate. Implicit aggressiveness varied as a function of treatment condition, $F(2, 83) = 3.08$, $p = .051$, $\eta_p^2 = .069$. Active players showed the strongest increase in implicit aggressiveness – almost by a quarter standard deviation, $\Delta D_5 = .24$ (see Figure 4). A planned contrast across the three conditions reflected the expected linear trend, $t(87) = 1.85$, $p = 0.34$ (one-tailed), $r_{\text{effect-size}} = .19$, with contrast weights $\lambda = (+1, 0, -1)$ for the game, movie, and control group, respectively. Neither participant sex, nor its interaction with treatment, impacted on IAT change scores, Fs < 1, $\eta_p^2 < .013$. Aside from this, the BPAQ covariate tended to relate weakly to IAT change scores, $F(1, 83) = 2.80$, $p = .10$, $\eta_p^2 = .033$. Yet, arousal changes from pretest to posttest did not mediate the changes in implicit aggressiveness, all $|r|$s < .11, ps > .32.

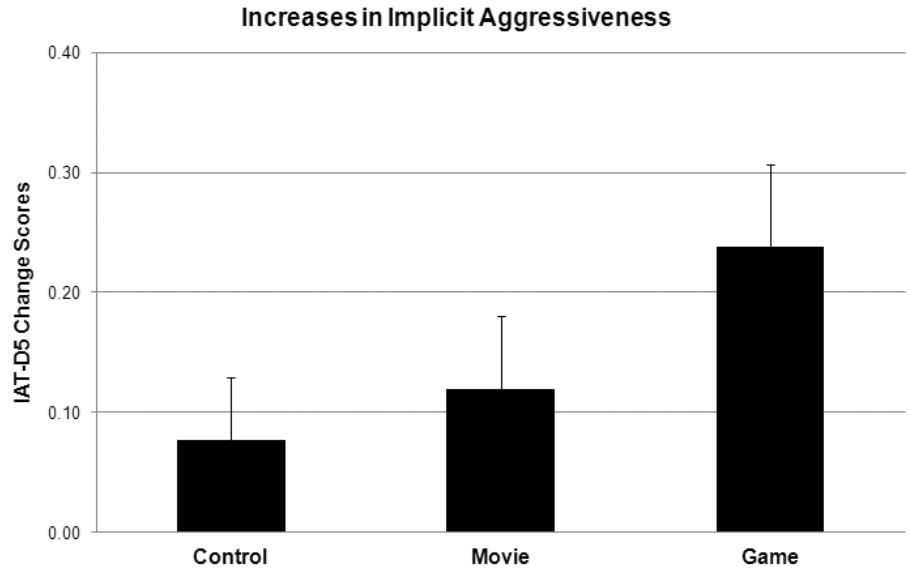

Figure 4. Pre/posttest changes of implicit aggressiveness in a reading control group, a movie-watching group, and a game-playing group. Higher scores represent increases in implicit aggressiveness (i.e., lower D_5-scores).

No comparable impact of treatment condition was observed when we analyzed BPAQ change scores, $F < 1$. A comparison of test-retest reliabilities confirmed that aggressiveness shifts were specific for the implicit level, retest-*r*s = .54, $CI_{90\%}$ =.40–.65, and .95, $CI_{90\%}$ = .93–.97, *p*s < .001, for IAT and BPAQ, respectively. IAT scores showed less stability than BPAQ scores, even when corrected for attenuation at pretest and posttest, r_{adj} = .75, $CI_{90\%}$ = .66–.82.

Discussion and Conclusions

Playing the Matrix-scene involved participants more strongly than merely *watching* it. Both conditions led to increasingly aggressive self-concepts, yet more so for the active player group. Blatant content differences, however, cannot account for this finding. Likewise, arousal can be ruled out to have hampered the cognitive capacity or psychomotor processes required for solving the IAT response-compatibility task. Our data support the conclusion that self-activation is a moderator of the harmful effects of violence exposure: Due to stronger self-activation, game playing participants associated themselves faster with aggressive (relative to peaceful) stimuli than any other group. Unlike Fischer and colleagues (2010), we can rule out that arousal during treatment, or enduring pretest-posttest arousal differences, mediated the changes in implicit aggressiveness.

In terms of mechanisms, our findings support the idea that being actively engaged with violent behavior, rather than passively watching others' violent actions, changes self-related associations known to form dispositions of aggressive impulses. Temporarily, physiological arousal was higher in the game condition than in the video condition. We assume that, indeed, immersion into the combat scene was actively driven by the player becoming part of the game itself (cf. Lull & Bushman, 2016). This might be the key factor for a higher degree of self-activation in active gaming conditions, leading to a stronger memory link between the action-related scripts and self-related knowledge structures. Thus, the stronger the self was actively involved during violence exposure, the stronger were the changes of the aggressive self-

concept due to violence exposure. Consequently, implicit aggressiveness as measured with the IAT was highest in the active game condition, yet also higher in the passive video condition than in the control group. We note here that any such differences were not reflected in the typical measures. Questionnaires such as the BPAQ are known for displaying high trait stability, whereas about half of the Agg-IAT variance is known to reflect situational (state) variance amenable to treatment effects (Lemmer, Gollwitzer, Schiller, Strohmeier, Banse, & Spiel, 2015). Explicit measures are likely to detect differences in long-term effects of exposure to violent media once they have sunk into the accessible part of the self-concept. The IAT, by comparison, is more sensitive to short-time effects. The link between short- and long-term effects is an issue still open on the research agenda, especially with regard to frequent playing. The forming and strengthening of stable self-aggressive schemata in memory will likely be based on repeated encounters of single violent episodes (as suggested by the GAAM; Anderson & Bushman, 2002).

We followed the Media Comparison Paradigm, which provides a heuristic for reflecting on valid methodology and suitable research paradigms in media violence and aggression. Criticism on research regarding the violent media-aggression link that focuses on a lack of comparability of different media can be debilitated by keeping media content and media interactivity under experimental control. Although strict control may come at the cost of reduced external validity, we agree with Elson et al. (2015) who postulated that confounding variables have to be controlled more often, and more strictly, especially if we are to test the causality of mechanisms hypothesized to underlie changes in aggressive dispositions. With the current design we controlled for pace by keeping the content (or semantics) constant. Control variables like the physiological data provided a manipulation check and, at the same time, ruled out an alternative explantion in terms of mere physiological arousal hampering IAT sorting performance. Future research will profit from stringent comparisons when

examining long-term effects of media reception on implicit and explicit measures of aggressiveness and behavioral measures of aggression.

Taken together, the present findings are in line with recent research on media violence concluding that violent media use may indeed foster dispositions of aggression (cf. Bushman et al., 2015; Hoffman, 2014). As the underlying mechanisms such as self-activation become clearer, it is still necessary to identify conditions that affect some consumers of violent content more than others. It will become crucial to understand which factors consolidate, or rather block, the transition from any short-term associations to long-term effects of exposure to violent media.

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Figure Captions

Figure 1. Illustration of the Media Comparison Paradigm.

Figure 2. Scene from the movie Matrix (upper panel) and comparable scene from the first-person shooter game Matrix (lower panel).

Figure 3. Changes in physiological arousal (skin conductance) in three groups across the experimental procedure, calibrated at the level of the control group (100%).

Figure 4. Pre/posttest changes of implicit aggressiveness in a reading control group, a movie-watching group, and a game-playing group. Higher scores represent increases in implicit aggressiveness (i.e., lower D_5-scores).

Footnotes

[1] Both authors contributed equally to this study.

[2] In delivering the opinion of the Supreme Court on the case of Brown (formerly Schwarzenegger) vs. Entertainment Merchants Association, Justice Scalia said: “These studies have been rejected by every court to consider them, and with good reason: They do not prove that violent videogames cause minors to act aggressively” (see http://www.supremecourt.gov/opinions/10pdf/08-1448.pdf).