

Article

Longitudinal Effects of Violent Media Usage on Aggressive Behavior—The Significance of Empathy

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Abstract: The aim of this study was to thoroughly investigate the link between violent media consumption and aggressive behavior. Using a large longitudinal student sample, the role of empathy as a possible mediator of this relationship was of special interest. Data were drawn from wave three to five of the *Berlin Longitudinal Study Media*, a four-year longitudinal control group study with 1207 school children. Participants completed measures of media usage (violent content of TV and computer games), aggressive behavior perpetration, and empathy. The average age of participants was 10.4 years at Time 1 and 12.4 years at Time 3. Half of the study sample was male (50%). Trivariate structural equation modeling using three measurement times were conducted for assessing the role of empathy as a mediator of the longitudinal relationship between the usage of violent media content and aggressive behavior. For male students empathic skills were shown to unfold a key mediating role between problematic media usage and aggressive behavior.

Keywords: media violence; aggressive behavior; empathy; longitudinal study; mediation analysis

1. Introduction

It is well known that television programs as well as video games often contain violent content [1–3]. With the increasing spread of the Internet and digital media in the past decade, a shift from television

to the use of interactive media, as in video-sharing websites and video games could be observed [4]. Research further indicates that violent content, although in most countries only suitable for adult audiences, is also used by minors to a large extent [4–6]. With the presence of violent content on the Internet, access to this content by minors is even less restricted.

Regarding violent media effects, there is an ongoing controversial public and scientific debate on the (causal) effects of violent media consumption on aggression. On the one hand, several meta-analytic reviews could systematically show—for different age groups—that there is a positive association between the consumption of violent media content and various constructs of aggression, such as aggressive behavior, aggressive cognition, aggressive affect, violent behavior, desensitization, lack of empathy and lack of pro-social behavior [7–11]. Observed associations were shown to be in the small to medium range ($r = 0.15$ to $r = 0.31$, *Cohen's d* = 0.30 to *Cohen's d* = 0.65; (e.g., [7–9]; for an overview see [12])), with the weakest effects for explicitly violent behavior. On the other hand, there are other meta-analytic reviews that question the reliability of these results due to publication bias and conclude that there is little support that media violence is associated with higher aggression [13–16]. Mean observed associations were shown to be in a small range ($r = 0.08$) in these reviews (e.g., [15]).

One reason for these diverging meta-analytic results might be the fact that media violence is by far not the only risk factor for aggression: For example, experienced personal victimization (cf. [17,18]), delinquent peers (cf. [19,20]), trait aggression (cf. [21,22]), empathy (cf. [23,24]), impulsivity (cf. [25,26]), gender (cf. [18,27]), school environment (cf. [28]) as well as parenting style and parental media usage (cf. [29]) are all supposed to be of interest as well. The more so, as most of them interact with a specific media usage behavior and possibly moderate (for trait aggression, cf. [28,30]) or mediate (for empathy or trait hostility, cf. [23]) the negative effect of violent media consumption on aggression.

In addition, there is still a scarcity of more recent longitudinal studies (starting in 2000) with a child or adolescent population that would truly allow untangling the causality of the relationship between violent media content consumption and constructs of aggression. Especially those studies with study intervals longer than one year and more than two measurements are very rare (2 measurements: ≤ 1 year: [28,31–36], games only [37]; 2 years: [38], games only [39,40]; > 5 years: [41], TV only [42–45]; > 2 measurements: ≤ 1 year: [46], games only [47]; 2 years: [17,48]; > 5 years: TV only [49]). Furthermore, those longitudinal studies which have been conducted are also diverse in their findings: Some show long-term causal effects of repeated violent media exposure on aggression (e.g., [47]); others report the opposite, *i.e.*, a selection effect (e.g., [36]). With regard to longitudinal studies with German child or adolescent samples (all four with two measurements), three studies provide cross-lagged evidence for a causal effect of violent media consumption on aggression [28,38,40], and one provides cross-lagged evidence for a selection effect [36]. Hopf and colleagues [38] could show with $N = 314$ fifth to seventh graders that media violence at time 1 was a significant predictor of violent behavior at school at time 2 (two years later). In two studies by Mödler and Krahe [40] with $N = 143$ and Krahe and Mödler [28] with $N = 1,237$ seventh and eighth graders, video game violence exposure at time 1 was linked to physical aggression at time 2 (30 months later, 12 months later), whereas the opposite paths were non-significant. In a study by von Salisch and colleagues [36] with $N = 324$ third and fourth graders, however, children who were rated as openly aggressive at time 1 showed a higher preference for violent computer games at time 2 (12 months later), whereas the opposite path from violent computer game preference to aggression, indicating a causal effect, was non-significant.

An integrative framework for explaining short- and long-term as well as cognitive, emotional and behavioral effects of violent media content consumption is offered by the *General Aggression Model (GAM)* by Anderson and colleagues [10,11,50], which combines several earlier explanatory models of aggression [51–56]. According to the *GAM*, as a short-term effect of violent media usage there is a higher probability of violent behavior caused by a change in appraisal and decision processes due to an aggression-like state with aggressive cognitions, aggressive affect and arousal during violent media usage. Long-term effects, caused by processes of learning, rehearsal and reinforcement of aggression-related knowledge structures in repeated reception phases of violent media content over a longer period of time, are: aggressive beliefs and attitudes, aggressive perceptual schemata, a hostile attribution bias, aggressive behavior scripts, and desensitization to fictional and real-life violence.

Regarding possible negative effects of violent media usage, various studies also focused on just the latter processes of desensitization and reduced empathic behavior (especially in real-life violence situations). According to the *GAM* [10,11,50], both outcomes can be considered as long-term effects of violent media exposure (cf. [7,28]), although especially in the case of desensitization, small short-term effects might also be observable [7]. Desensitization to violence and changes in empathic skills can be understood as a reduction of physiological and emotional responses to new fictional and real-life scenes of violence as well as a lower empathic reaction to victims of violence, which in turn reduces the level of inhibition of aggressive behavior [7,57]. Based on this understanding, aggression and violence are increasingly regarded as legitimate and as an effective way of attaining one's ends [58].

The assumption of reduced emotional responses to real life violence due to media violence in the sense of desensitization is supported by various experimental research results. In a quasi-experimental study with $N = 39$ participants by Bartholow and colleagues [59], for example, habitual users of media violence showed decreased emotional reactions to pictures of real-life violence, even after controlling for trait aggression. In an experimental study with $N = 257$ participants by Carnegey and colleagues [60], 20 min of violent video game use caused lower emotional reactions as indicated by a lower heart rate and a lower galvanic skin response in confrontation with filmed real-life violence. More recently, Krahé and colleagues [61] found effects of physiological desensitization in habitual media violence users compared with participants with a lower violent media usage in a quasi-experimental study with $N = 303$ participants.

Evidence for the effect of violent media usage on reduced empathy, however, could primarily be drawn from cross-sectional and longitudinal studies. In a cross-sectional study with $N = 150$ elementary school children, Funk and colleagues [62], for example, found that children with a higher violent video game consumption showed reduced empathy. Bartholow and colleagues [23] report in their cross-sectional study with $N = 200$ male undergraduates (study 1) a significant link between violent video game exposure and lower empathy. In addition, empathy was shown to partially mediate the effect of violent video game exposure on aggression. Both effects, *i.e.*, causal and mediating effect, could also be replicated in an experimental study using a subsample of $N = 92$ participants (study 2). In the above mentioned short-term longitudinal study by Krahé and Möller [28], media violence at time 1 was also linked to lower empathy at time 2, whereas the opposite path from empathy at time 1 to media violence usage at time 2 was non-significant. Unfortunately, as the authors note, due to only two measurements being available, the role of empathy as a mediator of the relationship between media

violence and aggression could not be tested properly. This restriction, in fact, applies to all other longitudinal studies with only two measurements (see above) testing any mediating effect.

In the current paper, we want to address this research gap. The link between violent media consumption and aggressive behavior is thoroughly investigated in a large population of children and adolescents using a longitudinal design with three measurements. We focus on the longitudinal effects of media violence on self-reported real-life aggressive behavior. Having three measurements, we want to explicitly focus on the role of empathy as a possible mediator of this relationship. The following research questions are to be answered:

- (1) Is there a significant longitudinal relationship between violent media consumption and aggressive behavior?
- (2) Is the relationship between violent media consumption and aggressive behavior significantly mediated by empathy?

2. Method

2.1. Sample

The *Berlin Longitudinal Study Media* is a four-year longitudinal control group study with 1207 school children (3rd–6th grade) representative of the (federal) state of Berlin. After study approval by the state school authorities (*Berliner Senatsverwaltung für Bildung, Jugend und Sport*), all classes with $n > 15$ were selected for sampling (24,352 children in 1009 classes) from the overall population of 1042 Berlin third grade classes (status May 2005: 24,714 children). Eighty classes from different schools were drawn randomly, 47 of which participated in the longitudinal study (1129 children). A total of 943 children participated at t1 (84% participation), 846 at t2 (88%), 835 at t3 (87%), 827 at t4 (83%) and a total of 806 at t5 (79%; for further details see [5,12,63]). Twenty primary school classes with 554 children were randomly assigned to school-based media lessons (intervention group; for details on the intervention see [5,12,63,64]). Twenty further classes with 512 children served as a control group. The remaining seven classes served as baseline classes (only t1, t4, t5).

Only children from the intervention and control classes, for whom data were available at t3, t4 or t5 and at least for two measurement occasions, were included in the sample, thus resulting in a total $n = 724$. All baseline classes ($n = 7$; 141 students) were excluded from the analyses due to missing data at t3. Analyses were restricted to t3–t5, as aggressive behavior was assessed at t3 for the first time.

The average age of participants was 10.4 years at t3 and 12.4 years at t5. Half of the study sample was male (50%) and 28.6% of the children came from immigrant communities. Of the children, 13.3% had a lower educational background as assessed by their parents, 36.9% a medium and 49.8% a high educational background (for further details on the assignment of educational background see [5]).

2.2. Measures

2.2.1. Media Usage

For wider contextualization, lifetime prevalence of violent media content consumption was queried by the following four questions: “Have you ever played computer games rated 16?”, “Have you ever

played computer games rated 18?”, “Have you ever watched films rated 16?” and “Have you ever watched films rated 18?” (two-point scale: no = 0, yes = 1). All four questions were followed by the supplement “If yes: How often within the last four weeks?” (four-point scale: not at all = 0, 1–2 times = 1, 3–6 times = 2, more often = 3). The answer “no” to the introductory question was also coded as “not at all = 0” for the last four weeks. Separately for computer games and films, violent content consumption games (VC1) and violent content consumption films (VC2) was defined as the highest numerical response on the supplement in the two categories “rated 16” and “rated 18” (SPSS function max.1, range 0–3).

2.2.2. Aggressive Behavior

Aggressive behavior from the offender’s perspective for the school context as well as the context outside school [65–67] was assessed via self-report at t3, t4 and t5, starting from 4th grade. For the context outside school, students were asked: “Concerning behavior which can happen outside school. Have you ever done one of the following things? (two-point scale: no = 0, yes = 1). If yes: How often within the last twelve months?” (open response). The following four incidents were queried with regard to aggressive behavior: “Deliberately hurt another child with the result that it cried or was injured”, “Threatened another child so that it handed over something to you”, “Deliberately damaged windows, telephone booths, street lights or similar things” and “Played with fire or set something on fire”. Aggressive behavior perpetration outside school (AB1) was defined as the sum score of these four incidents (range 0–4).

School violence perpetration was queried for the last four weeks preceding the interview by the following items (four-point scale: never, once or twice, three to six times, more often): “Sometimes trouble occurs at school and on the way to school. How often have you done one of the following things within the last four weeks (introduction)”; “I have hit or kicked another student, not for fun”, “I have broken some of another student’s stuff on purpose”, “I have forced another student to do something he/she did not want to do”. Aggressive behavior perpetration at school (AB2) was defined as the sum score of the dichotomized (no = 0, yes = 1) responses to these three incidents (range 0–3), whereas “never” was recoded to no and “once or twice”, “three to six times” and “more often” to yes.

2.2.3. Empathy

A German inventory (IVE; adapted from Eyesenck’s I₆, [68]) for children at the age of 9–14 was used to assess empathy [69] at t3, t4 and t5. Due to time constraints, a short scale of 4 out of 16 items was constructed, consisting of the following four items (two-point scale: no = 0, yes = 1): “It troubles me when I see that someone is laughed at” (Em1), “It is hard for me to see someone cry” (Em2), “I often feel compassion for people who are worse off than me” (Em3) and “I feel bad for students who are picked on often” (Em4). High values on this scale stand for pronounced empathy (*Cronbachs* $\alpha_{t3} = 0.74$, *Cronbachs* $\alpha_{t4} = 0.79$, *Cronbachs* $\alpha_{t5} = 0.74$; (for further scale characteristics see [12])).

2.3. Procedure

After obtaining written parental consent, a four-hour paper-pencil interview spread over two consecutive days was completed within the classroom setting on five occasions (t1: November 2005, t2: May 2006, t3: May 2007, t4: May 2008, t5: May 2009). The interviews were conducted by trained interviewers (Bachelor or Master students of psychology). For longitudinal identification, every single student was assigned a unique numeric code which stayed with the school over the study period.

2.4. Data Analysis

In the following, t3 (fourth grade) will be referred to as Time 1, t4 (fifth grade) as Time 2 and t5 (sixth grade) as Time 3. For treating missing data (missing values per variable: 4.7%–14.5%), chained equation modeling [70] was used with the following variables (Time 1, Time 2, Time 3): gender, violent content computer games (VC1), violent content films (VC2), aggressive behavior perpetration outside school (AB1), aggressive behavior perpetration at school (AB2), and empathy (Em1, Em2, Em3, Em4). Predictive mean matching was used for correcting (e.g., only real values were computed). We used the R package “mice” (Multivariate Imputation by Chained Equations; [71]) for this procedure.

To test for changes over time and gender differences, repeated measures (Time 1, Time 2, Time 3) ANOVAs were computed for all included variables using IBM SPSS 19.

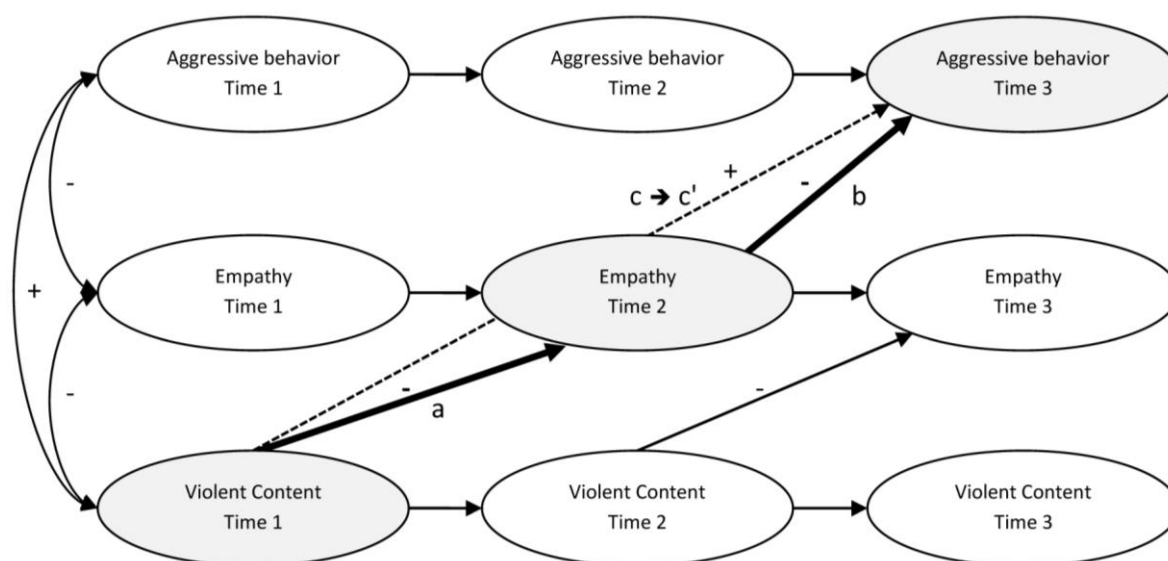
The multi-level structure of the data (level 1: measurement time, level 2: individual, level 3: class) was assessed using STATA (Version SE 10). The intra-class-correlation (ICC) was 0.024 at level 3, *i.e.*, at the maximum 2.4% of the variance of aggressive behavior could be explained by characteristics of the class context in this model (cf. [72,73]). Introducing variables of social and cultural capital (educational background, prosperity, migration background) reduced the conditional ICC to 1.9% [74]. Considering this small maximum variance being explained at level 3, the multi-level structure was not introduced in structural equation modeling.

To assess the role of empathy as a mediator of the longitudinal relationship between the usage of violent media content and aggressive behavior, trivariate structural equation modeling according to Valkenburg and Peter (cf. [75,76]) was conducted using three measurement times. For all three constructs, latent variables estimated from manifest indicators were used. Weak measurement invariance was tested by constraining the estimate factor loadings to be equal across groups using multi-group factor analyses across time points (group 1 = Time 1; group 2 = Time 2; group 3 = Time 3). As noted by Chen [77], the commonly used chi-square difference test of nested models is almost always significant in large samples and is highly sensitive to departures from multivariate normality. Thus, we used differences in CFI to compare different stages of measurement invariance. A cut-off value of $\Delta\text{CFI} > 0.01$ as recommended by Chen [77] for weak invariance was used. Results indicate weak measurement invariance ($\Delta\text{CFI} = 0.003$). In equation modeling, measurement equivalence over time was ensured by restricting the paths of identical manifest variables of Time 1, Time 2 and Time 3. Furthermore, correlated errors of measurement between identical manifest variables were assumed to account for their inter-correlations over time (Time 1, Time 2, Time 3) [78]. The model was calculated using maximum likelihood estimations. Level of significance was estimated using bootstrap (BC-CI

95%) with $K = 1,000$ bootstrap samples [79]. Estimations were controlled for study group. Analyses were realized using IBM SPSS Amos 21 [80].

The hypothesized mediation model of empathy, violent content consumption and aggressive behavior is depicted in Figure 1. First, it is assumed that violent content consumption, empathy and aggressive behavior are all three correlated at Time 1. Second, all three constructs have a certain stability over time. Third, violent content consumption at Time 1 is assumed to have a negative influence on empathy at Time 2 (a). Fourth, empathy at Time 2 is predicted to have a negative influence on aggressive behavior at Time 3 (b). Fifth, if empathy completely mediates the significant path from violent content consumption to aggressive behavior (c), the path from violent content consumption at Time 1 on aggressive behavior at Time 3 (c') will be statistically non-significant.

Figure 1. Hypothesized mediation model of empathy, violent content consumption and aggressive behavior.



3. Results

3.1. Descriptive Statistics

Table 1 shows means and standard deviations (total and separated by gender) of all manifest variables for Time 1, Time 2 and Time 3. Regarding violent content, boys had markedly higher mean scores than girls for both video games and films, indicating a higher intensity of violent content consumption. Beyond that, there was, as expected, an overall increase in the consumption of violent content over time. With respect to aggressive behavior, male students were significantly more frequently offenders outside school as well as at school at all three measurement occasions. The overall rate of violence perpetration decreased from Time 1 to Time 3 outside school and increased from Time 1 to Time 3 at school. Both changes were caused only by the reported rates of the boys, whereas girls' rates are rather stable over time. Overall, the mean scores of empathy (Em1–Em4) decreased slightly from Time 1 to Time 3. At all three measurements, boys showed lower scores of empathy.

Table 1. Descriptive statistics.

	<i>M(SD)</i>									ANOVA
	Time 1			Time 2			Time 3			
	total	boys	girls	total	boys	girls	total	boys	girls	
<i>Media usage</i>										
Violent content VG (VC1)	0.59 (0.50)	0.96 (1.17)	0.22 (0.57)	0.59 (0.49)	0.99 (1.14)	0.20 (0.57)	0.77 (0.46)	1.30 (1.24)	0.24 (0.61)	t, g, t*g
Violent content TV (VC2)	0.64 (0.94)	0.87 (1.06)	0.42 (0.74)	0.63 (0.89)	0.87 (1.03)	0.38 (0.67)	0.95 (1.02)	1.25 (1.11)	0.65 (0.82)	t, g
<i>Aggressive behavior</i>										
Perpetration outside school (AB1)	0.33 (0.70)	0.49 (0.86)	0.17 (0.45)	0.32 (0.68)	0.49 (0.82)	0.15 (0.44)	0.26 (0.64)	0.36 (0.78)	0.17 (0.45)	t, g, t*g
Perpetration at school (AB2)	0.19 (0.49)	0.29 (0.59)	0.09 (0.34)	0.15 (0.46)	0.23 (0.57)	0.07 (0.29)	0.27 (0.60)	0.41 (0.72)	0.12 (0.41)	t, g, t*g
<i>Empathy</i>										
Em1	0.77 (0.42)	0.69 (0.47)	0.85 (0.36)	0.77 (0.41)	0.70 (0.46)	0.87 (0.34)	0.75 (0.44)	0.63 (0.48)	0.87 (0.34)	g
Em2	0.71 (0.45)	0.58 (0.50)	0.86 (0.37)	0.73 (0.45)	0.65 (0.48)	0.81 (0.39)	0.68 (0.47)	0.52 (0.50)	0.83 (0.38)	t, g, t*g
Em3	0.80 (0.40)	0.74 (0.44)	0.91 (0.34)	0.82 (0.39)	0.73 (0.44)	0.90 (0.30)	0.78 (0.42)	0.70 (0.46)	0.85 (0.36)	g
Em4	0.83 (0.39)	0.74 (0.44)	0.91 (0.28)	0.78 (0.42)	0.68 (0.47)	0.88 (0.33)	0.75 (0.43)	0.66 (0.47)	0.83 (0.37)	t, g

Note: VG = Video Games. t = significant main effect time (t3, t4, t5; $p < 0.05$); g = significant main effect gender ($p < 0.05$); t*g = significant interaction time (t3, t4, t5) by gender ($p < 0.05$).

3.2. Zero Order Correlations

The zero order correlation matrix of all manifest variables, which are included in structural equation modeling of Figure 2, can be found split by gender in Table 2, presented for Time 1, Time 2, and Time 3. First, longitudinal correlations between manifest variables of violent content were of medium to large size for male ($0.28 \leq r \leq 0.61$) and of small to medium size for female ($0.19 \leq r \leq 0.47$) students; longitudinal correlations between manifest variables of empathy were of small to medium size for male ($0.16 \leq r \leq 0.43$) and female ($0.03^{n.s.} \leq r \leq 0.35$) students; longitudinal correlations between manifest variables of aggressive behavior were of small to medium size for male ($0.04^{n.s.} \leq r \leq 0.44$) and female ($0.15 \leq r \leq 0.41$) students as well. Second, for male students, mostly significant, small size, negative cross-sectional correlations ($-0.06^{n.s.} \leq r \leq -0.26$) could be observed between variables of violent content and empathy for Time 1, Time 2, and Time 3. This was not the case for female students with mostly non-significant associations. Third, for male and female students, there were small negative longitudinal correlations between variables of violent content and empathy (measured at a later point in time; $-0.02^{n.s.} \leq r \leq -0.19$), which were mostly significant for male but not for female students; the same is true for correlations between variables of empathy and violent content at a later point in time (male: $-0.08^{n.s.} \leq r \leq -0.23$; female: $-0.02^{n.s.} \leq r \leq -0.15$). Fourth, significant small size cross-sectional correlations could be seen between variables of violent content and aggressive behavior for male ($0.16 \leq r \leq 0.28$) as well as female ($0.04^{n.s.} \leq r \leq 0.26$) students.

Table 2. Zero order correlations.

	Time 1								Time 2								Time 3							
	VC1	VC2	Em1	Em2	Em3	Em4	AB1	AB2	VC1	VC2	Em1	Em2	Em3	Em4	AB1	AB2	VC1	VC2	Em1	Em2	Em3	Em4	AB1	AB2
Time 1																								
VC1	-	.473	.020	.063	-.085	.037	.179	.202	.425	.317	-.061	-.077	-.075	-.106	.185	.193	.345	.269	-.075	-.120	.042	-.111	.071	.202
VC2	.640	-	-.038	-.023	-.160	-.075	.202	.129	.260	.360	-.099	-.074	-.069	-.180	.156	.103	.189	.373	-.110	-.136	-.016	-.060	.084	.217
Em1	-.127	-.164	-	.339	.322	.324	-.184	-.105	.000	-.017	.261	.158	.133	.075	.044	.045	-.007	-.110	.193	.175	.057	.138	-.064	-.060
Em2	-.056	-.065	.443	-	.317	.239	-.009	-.036	.016	.044	.234	.288	.105	.141	.081	.047	.021	.063	.032	.312	.032	.093	-.009	.036
Em3	-.146	-.242	.432	.431	-	.303	-.088	-.127	-.105	-.147	.155	.072	.240	.100	.082	.091	-.030	-.062	.107	.081	.152	.063	.002	-.100
Em4	-.168	-.158	.486	.418	.421	-	.050	-.085	.005	.048	.251	.143	.216	.212	.086	.038	.027	.032	.079	.146	.143	.201	-.037	-.050
AB1	.209	.164	-.039	.003	-.080	-.080	-	.277	.155	.157	-.092	-.038	-.099	-.070	.269	.193	.138	.130	-.056	-.064	-.036	-.068	.153	.177
AB2	.236	.214	-.040	.004	-.119	-.130	.430	-	.132	.156	-.059	-.049	-.040	-.095	.274	.270	.143	.069	-.083	-.156	-.043	-.094	.151	.370
Time 2																								
VC1	.540	.429	-.127	-.102	-.089	-.156	.116	.112	-	.362	-.066	-.102	-.060	-.080	.225	.189	.470	.226	-.066	-.143	-.033	-.147	.035	.254
VC2	.481	.488	-.152	-.078	-.230	-.181	.146	.156	.605	-	-.068	-.033	-.065	-.153	.255	.140	.330	.455	-.129	-.117	.020	-.100	.120	.142
Em1	-.061	-.140	.328	.322	.340	.271	-.144	-.042	-.138	-.168	-	.427	.406	.478	-.032	-.023	-.006	-.079	.327	.281	.225	.264	.017	-.043
Em2	-.023	-.126	.249	.320	.296	.257	-.103	-.031	-.139	-.169	.446	-	.274	.353	-.054	-.105	-.071	-.049	.242	.359	.148	.102	.009	.026
Em3	-.103	-.189	.239	.297	.392	.392	-.061	-.066	-.193	-.176	.542	.529	-	.293	.013	.014	.013	-.034	.245	.116	.345	.267	-.059	-.123
Em4	-.112	-.188	.294	.282	.337	.337	-.167	-.071	-.193	-.263	.596	.544	.535	-	-.045	-.148	-.006	-.099	.104	.284	.200	.289	-.013	-.096
AB1	.180	.241	-.009	-.049	-.135	-.089	.377	.227	.165	.244	-.228	-.140	-.237	-.178	-	.336	.185	.104	-.032	-.080	-.014	-.152	.411	.237
AB2	.157	.195	-.076	-.178	-.235	-.157	.180	.326	.251	.186	-.224	-.195	-.214	-.234	.345	-	.160	.122	.005	-.126	.016	-.129	.278	.258
Time 3																								
VC1	.454	.276	-.150	-.107	-.151	-.217	.185	.118	.613	.545	-.153	-.217	-.231	-.188	.208	.164	-	.459	-.127	-.101	-.026	-.044	.108	.326
VC2	.382	.430	-.166	-.081	-.065	-.167	.135	.082	.520	.481	-.125	-.186	-.139	-.156	.209	.150	.590	-	-.129	-.059	-.048	-.174	.183	.186
Em1	-.068	-.103	.301	.219	.187	.226	-.089	.031	-.178	-.189	.397	.391	.339	.395	-.195	-.114	-.259	-.204	-	.216	.339	.373	-.037	-.043
Em2	-.088	-.116	.169	.251	.219	.156	-.048	-.014	-.063	-.114	.362	.312	.261	.328	-.168	-.031	-.186	-.113	.447	-	.350	.296	-.097	-.065
Em3	-.092	-.059	.156	.175	.238	.238	-.088	-.069	-.171	-.143	.291	.292	.374	.298	-.134	-.198	-.229	-.199	.421	.400	-	.397	-.070	-.065
Em4	-.092	-.068	.284	.301	.276	.303	-.073	-.036	-.166	-.132	.431	.309	.326	.357	-.216	-.168	-.221	-.121	.550	.460	.442	-	-.251	-.049
AB1	.084	.141	-.087	-.096	-.096	-.088	.167	.046	.119	.190	-.183	-.080	-.118	-.116	.443	.210	.202	.182	-.153	-.226	-.151	-.251	-	.207
AB2	.170	.134	-.020	-.003	-.044	-.053	.230	.145	.144	.179	-.244	-.106	-.120	-.208	.430	.280	.275	.231	-.214	-.192	-.184	-.205	.411	-

Note: Above the diagonal = female. Below the diagonal = male. VC1 = Violent content consumption computer games. VC2 = Violent content consumption films. Em1 = ‘It troubles me when I see that someone is laughed at’. Em2 = ‘It is hard for me to see someone cry’. Em3 = ‘I often feel compassion for people who are worse off than me’. Em4 = ‘I feel bad for students who are picked on often’. AB1 = Violent behavior perpetration outside school. AB2 = Violent behavior perpetration at school. If not marked differently, all correlations $p < .05$.

Grey and italics = non-significant.

Fifth, longitudinal correlations between variables of violent content and aggressive behavior at a later point in time were of small size for male ($0.08^{n.s.} \leq r \leq 0.24$) and of small to medium size for female ($0.07^{n.s.} \leq r \leq 0.33$) students; longitudinal correlations between aggressive behavior and violent content were of small size for male ($0.08^{n.s.} \leq r \leq 0.21$) as well as female ($0.07^{n.s.} \leq r \leq 0.19$) students. Sixth, for male students, mostly significant, small, negative, cross-sectional correlations ($-0.04^{n.s.} \leq r \leq -0.25$) could be found between variables of empathy and aggressive behavior; for female students these associations were mostly non-significant ($-0.01^{n.s.} \leq r \leq -0.25$). Seventh, for male students, there were mostly non-significant, small, negative longitudinal correlations between variables of empathy and aggressive behavior at a later point in time ($-0.01^{n.s.} \leq r \leq -0.24$). For female students, there was only one significant association. The same is true for associations between variables of aggressive behavior and empathy at a later point in time, with only four significant associations for female students. In sum, the observed associations were stronger for male than for female students with a more coherent picture for males.

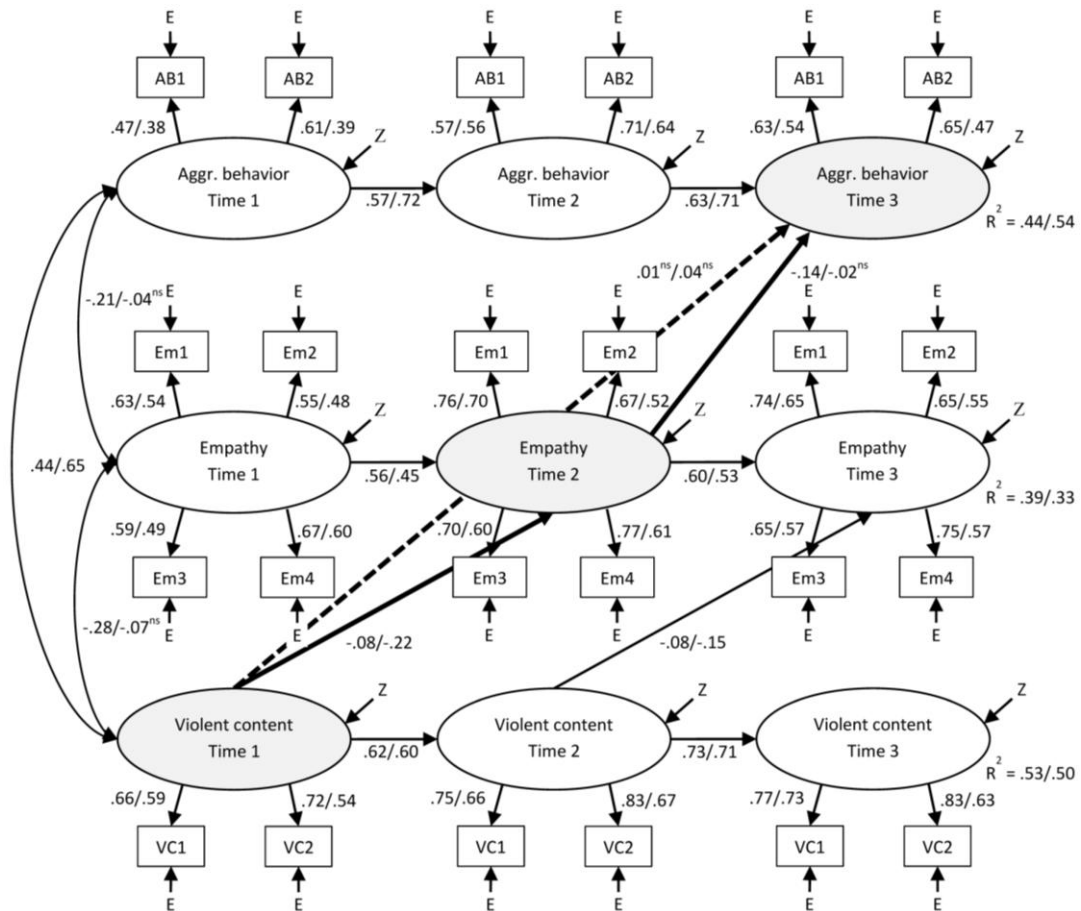
3.3. Longitudinal Mediator Analyses

The mediation model of Figure 1 (no additional paths included, not controlling for gender) showed an acceptable model fit ($\chi^2 = 770.41$ (252, $N = 724$), $CFI = 0.91$, $RMSEA = 0.05$ (90% CI: 0.049, 0.058), $SRMR = 0.07$). The included variables explained 51% of the variance of violent behavior at Time 3. Due to the observed gender differences in the conducted repeated measures ANOVAs as well as the cross-sectional and longitudinal correlational analyses, we decided to further examine the influence of gender in our mediation model. We first tested for weak measurement invariance using multi-group factor analyses constraining for time and gender (group 1 = male; group 2 = female); differences in CFI were used to compare the multi-group with the total sample model. Results indicate no measurement invariance for gender ($\Delta CFI = 0.05$). Due to the apparent gender differences in measurement and the related missing comparability of paths in the multi-group framework, we performed two additional model calculations; separate for male and female students (see Figure 2, all included paths displayed).

The hypothesized mediation model of Figure 1 also showed an acceptable model fit for the male subsample ($\chi^2 = 506.97$ (252, $N = 362$), $CFI = 0.91$, $RMSEA = 0.05$ (90% CI: 0.046, 0.060), $SRMR = 0.08$; 44% explained variance of violent behavior at Time 3). First, violent content and empathy ($\phi = -0.28$, [BC-CI 95%: -0.323 , -0.222 ; $p < 0.01$]), empathy and aggressive behavior ($\phi = -0.21$, (BC-CI 95%: -0.279 , -0.126 ; $p < 0.01$)), as well as violent content and aggressive behavior ($\phi = 0.44$, (BC-CI 95%: 0.351 , 0.527 ; $p < 0.01$)) were all significantly correlated at Time 1. Second, all three constructs showed a certain stability over time. Third, violent content consumption at Time 1 had a significant negative influence on empathy at Time 2 (a), $\beta = -0.08$ (BC-CI 95%: -0.125 , -0.026 ; $p < 0.01$). Fourth, empathy at Time 2 had a significant influence on aggressive behavior at Time 3 (b), $\beta = -0.14$ [BC-CI 95%: -0.200 , -0.077 ; $p < 0.01$]. Fifth, the path from violent content consumption at Time 1 on aggressive behavior at Time 3 (c') was statistically non-significant ($\beta = 0.01$, (BC-CI 95%: -0.054 , 0.065 ; $p = 0.84$)). C was $\beta = 0.25$ (BC-CI 95%: 0.182 , 0.360 ; $p < 0.01$) in a model without any additional explanatory variables (BC-CI 95% with

$K = 1,000$ bootstrap samples; $\chi^2 = 4.382$ (3, $N = 362$), $CFI = 0.99$, $RMSEA = 0.04$ (90% CI: 0.000, 0.102), $SRMR = 0.01$), thus indicating a complete mediation by empathy.

Figure 2. Observed mediation model of empathy, violent content consumption and aggressive behavior by gender (male/female).



Note: Male/female. All standardized parameters. If not marked differently, all paths at least $p < 0.01$.

The model for the female subsample showed an overall comparable model fit ($\chi^2 = 475.61$ (252, $N = 362$), $CFI = 0.88$, $RMSEA = 0.05$ (90% CI: 0.043, 0.056), $SRMR = 0.06$; 54% explained variance of violent behavior at Time 3), but a pattern of results departing from the hypothesized mediation model of Figure 1. First, only violent content and aggressive behavior ($\phi = 0.65$, (BC-CI 95%: 0.526, 0.778; $p < 0.01$)) were significantly correlated at Time 1; violent content and empathy ($\phi = -0.07$, (BC-CI 95%: -0.161 , 0.010; $p = 0.08$)), empathy and aggressive behavior ($\phi = -0.04$, (BC-CI 95%: -0.181 , 0.032; $p = 0.29$)). Second, in line with the hypothesized mediation model, all three constructs showed certain stability over time; with lower stabilities for empathy and higher stabilities for aggressive behavior compared to the male subsample. Third, violent content consumption at Time 1 had again a significant negative influence on empathy at Time 2 (a), $\beta = -0.22$ (BC-CI 95%: -0.269 , -0.175 ; $p < 0.01$). Fourth, differing from our assumptions, empathy at Time 2 had no significant influence on aggressive behavior at Time 3 (b), $\beta = -0.02$ (BC-CI 95%: -0.086 , 0.030; $p = 0.35$). Fifth, the path from violent content consumption at Time 1 on aggressive behavior at Time 3 was again statistically non-significant (c'), $\beta = 0.04$, (BC-CI 95%: -0.137 , 0.223; $p = 0.64$). Hence, for the female subsample no mediation by empathy of the longitudinal relationship between violent media

content consumption and aggressive behavior can be observed (Significant path c ($\beta = 0.42$ (BC-CI 95%: 0.246, 0.605; $p < 0.01$)); model fit (BC-CI 95% with $K = 1,000$ bootstrap samples): $\chi^2 = 0.80$ (3, $N = 362$), $CFI = 1.0.$, $RMSEA = 0.00$ (90% CI: 0.000, 0.049), $SRMR = 0.01$).

4. Discussion

4.1. Summary of Findings and Theoretical Implications

The aim of this study was to thoroughly investigate the link between violent media consumption and aggressive behavior. Using a large longitudinal student sample, the role of empathy as a possible mediator of this relationship was of special interest. For the recorded variables of aggressive behavior, slightly higher prevalence rates compared to a representative nationwide school survey [67] using a similar questionnaire for assessing aggressive behavior could be observed for the *Berlin Longitudinal Study Media*—as was to be expected for a metropolis (act of violence: 23% vs. 15%; damage to property: 9% vs. 7%; theft: 7% vs. 4%). Similar gender differences in aggressive behavior to those reported in the nationwide survey [67] were found in the present data. The observed higher rate of violence perpetration of boys (cf. [18,27]), the observed higher preference of boys for violent media content (cf. [5,28]) as well as the observed lower empathic scores of boys (cf. [28,62]) have been repeatedly documented.

Bivariate cross-sectional and longitudinal correlational analyses showed a result pattern comparable to previous studies, with significant associations between higher violent media content consumption and lower empathy (cf. [23,28]), between lower empathy and a higher rate of aggressive behavior (cf. [23,24]), and between higher violent content consumption and a higher rate of aggressive behavior (cf. [17,18]). Effect sizes were shown to lie within the range of meta-analytic results reported in the introduction [7–9]. Concerning gender differences, our analyses produced mixed results: They are in line with meta-analytic evidence (cf. [7,8,81]) for the link between violent content consumption and aggressive behavior, revealing no gender differences. They dissent from meta-analytic evidence (cf. [7,8,81]), however, with regard to the associations of violent content and empathy as well as empathy and aggression, which are less pronounced and often non-significant for the female subsample.

The conducted trivariate structural equation modeling, assessing the role of empathy as a mediator of the observed longitudinal relationship between violent media content consumption and aggressive behavior, showed a full mediation of this relationship by empathy for the male, but not the female subsample. To our knowledge, this is the first study to demonstrate this mediation effect with longitudinal data using three measurements (cf. [23,28]). There are several possible explanations for gender differences in the mediation effect: First, female students showed overall lower scores in aggressive behavior and violent content consumption as well as higher scores in empathy, possibly indicating either a threshold effect of empathy or a varying proneness to (mediating) media effects. Second, those few female students in the sample with aggressive behavior at Time 1 were more stable in their behavior over time (cf. [82,83]); for male students more variation could be observed. Thus aggressive behavior at Time 3 can be explained by earlier aggressive behavior to a larger extent for female than for male students. Although having found no mediation effect for the female subsample, structural equation modeling still produced significant results: First, violent content consumption and a

higher rate of aggressive behavior were highly correlated at Time 1 (and even more marked for females than for males, $z = 4.06$). Second, violent media content consumption was causally related to lower empathy.

One explanatory framework for the mediating effect of empathy is given by the long-term components of the *GAM* by Anderson and colleagues [10,11,50] and the independent explanatory pathway of habituation or desensitization to media violence: repeated reception phases of violent media content over a longer period of time lead to aggressive beliefs and attitudes, aggressive perceptual schemata, a hostile attribution bias, aggressive behavior scripts, and a desensitization to violence via processes of learning, rehearsal and reinforcement of aggression-related knowledge structures. A second explanatory framework is given by the *downward spiral model* of Slater and colleagues [17,48]. This explains the relationship between the consumption of violent media content and aggressive behavior as an interaction between predispositions and violent media content usage; both are not mutually exclusive and can jointly have negative, antisocial and destructive consequences. Empathy might be one of these key mediating predispositions.

Results of additional analyses not reported here (cf. [12,84]) also showed lower scores of empathy to be associated with higher media usage times [85]. For explaining this relationship, a hypothesis of time displacement could be assumed [63,84]: Children who spend many hours a day in digital worlds, only interacting there with media characters or other user's avatars, seem to have an underdeveloped ability of empathy independently of the chosen content. Para-social relationships with computer characters and avatars would thus appear an ineffective substitute for social interactions in the real world, which form the basis of developing empathic skills—insofar as they displace human relationships, face-to-face communication and interaction to a great extent. Taken together, empathic abilities seem to unfold a key mediating role between a problematic media usage, with regard to content and time, and variables of social coexistence.

We do not want to go as far as Carnagey and colleagues [60] and fear the danger of an increasing, unnoticeable overall desensitization to violence through (as just shown, not only) violent media content consumption. There are too many personal and environmental variables of equivalent or greater explanatory power involved. This is also true for empathy, and all these variables interact with each other [12]. Yet, applying the *GAM* by Anderson and colleagues [10,11,50], desensitization is just one of five possible pathways from violent media content consumption to increased aggressive behavior. If one also considers related changes in values, norms and attitudes, however, deeper reflection is needed. Last but not least, violent media content consumption is the variable which could be most easily targeted and influenced as compared to many others. Formulated as a question: Is violent media content consumption necessarily part of an overall deviant lifestyle [86], thus acting as a reinforcer of related values, norms and attitudes?

4.2. Limitations and Future Research

In spite of having identified a causal relationship between violent content consumption and empathy and having identified the role of empathy as a mediator of the relationship between violent media consumption and aggressive behavior for the male subsample, there are certain limitations to the presented results (cf. [87]). First, evidence is restricted to those variables that have been included in the

study and the analysis. Other variables of possibly equivalent or higher predictive power, e.g., trait aggression, for which there is longitudinal evidence of moderating the relationship between violent content consumption and physical aggression [28], might alter the presented results. Second, having drawn a representative sample of primary grade school children in the state of Berlin, the presented results are strictly speaking representative only of Berlin children in this age group. Third, having assessed all variables of interest via self-report, some results might differ if other instruments or procedures, such as peer-nomination, had been used instead. Nevertheless, having these limitations in mind, the present study added further longitudinal evidence for the influence of violent media consumption on aggressive behavior, which in this study is fully mediated by empathy for the male subsample. By this means, the significance of empathy was shown. In future studies, the observed relationships and gender differences need to be validated, also with different populations and older age groups. Furthermore, this should be realized more frequently in longitudinal studies using more than two times of measurement.

5. Conclusions

The questions of how and under what premises media usage can promote aggressive behavior remains a complex as well as controversially discussed issue in research. This is partially due to the fact that most possible risk factors of aggression interact with a specific media usage behavior and possibly moderate or mediate the negative effect of violent media consumption on aggression. This study was the first to examine the role of empathy as a mediator of the relationship between violent media content usage and aggressive behavior using three measurement times. Empathy was shown to fully mediate this relationship in the male subsample. In future studies, emphasis should be placed on conducting longitudinal studies with at least three times of measurement to ensure that possible mediating pathways can be revealed.

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Author Contributions

Conceived, designed and conducted the study: Thomas Mößle and Florian Rehbein. Analyzed the data: Thomas Mößle and Sören Kliem. Wrote the manuscript: Thomas Mößle. Commented on the manuscript: Florian Rehbein and Sören Kliem. Provided intellectual input: Florian Rehbein and Sören Kliem.

Conflicts of Interest

The authors declare no conflict of interest.

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