Media Violence Use and Aggression Among German Adolescents: Associations and Trajectories of Change in a Three-Wave Longitudinal Study

Barbara Krahé, Robert Busching, and Ingrid Möller
University of Potsdam

To address the longitudinal associations between adolescents’ use of media violence and aggression, 1,715 high school students in Germany participated in 3 measurements over a 2-year period. Self-reported physical aggression and teacher-rated overall aggression were the outcome variables. A destructive testing approach showed that media violence predicted both self-reported physical aggression and teacher-rated aggression over 24 months, controlling for initial aggression as well as several sociodemographic and psychological covariates. Nonviolent media use was unrelated to self-reported or teacher-rated aggression. Latent growth mixture modeling identified 3 trajectories of use - stable low, stable high, and desistance - and parallel trajectories of self-reported physical aggression were found. Participants in the stable high group scored higher on aggressive behavior at the first wave than did stable low users. Desisters differed significantly from stable high users by showing a decrease in aggressive behavior over time. The findings are discussed in terms of the unique role of media violence use as a risk factor for adolescent aggression.

Keywords: media violence, aggressive behavior, longitudinal study, adolescence, trajectories

Whether exposure to violent media is a risk factor for aggression in individual development is a contentious issue in public debate and has led to intense controversy in academic discourse (e.g., Bushman, Rothstein, & Anderson, 2010; Ferguson & Kilburn, 2010; Huesmann, 2010). A recent meta-analysis by Anderson et al. (2010) focusing on violent video games included 12 longitudinal studies, with a total of 4,526 participants. These studies met a set of best-practice criteria and produced an effect size of $r = .20$ between violent video game use and aggressive behavior over time. Ferguson (2007) identified an effect size of $r = .15$ for the link between violent video game use and aggression in nonexperimental studies. For TV violence, the meta-analysis by Anderson and Bushman (2002) yielded an average effect size from longitudinal studies of $r = .17$. Meta-analyses using criminal violence as an outcome variable have produced smaller effect sizes (e.g., Ferguson & Kilburn, 2009; Savage & Yancey, 2008), leading their authors to dispute the claim that media violence use may increase the risk of aggression. However, restricting the analysis to criminal forms of violence ignores the potential role of violent media use in explaining a wide range of aggressive behaviors below the threshold of criminal violence that represent a significant public health issue. Moreover, the failure to find significant effects of violent media use on criminal forms of violent behavior may be due, at least partly, to various methodological problems related to the definition and reporting of criminal violence, and to a lack of statistical power for detecting effects for outcomes with low frequencies of occurrence.

The present study adds to the international literature on the long-term associations between media violence use and aggression by present-
ing data from a large sample of German adolescents who took part in three measurements over the course of 2 years. In addition to media violence use, further risk factors of aggression, such as low academic achievement and low empathy, were included to be able to identify the unique contribution of violent media use to the prediction of aggressive behavior over time.

Longitudinal studies enable researchers to test two alternative directional hypotheses of the relationship between media violence and aggression: (a) that exposure to violent media makes users more aggressive (the “socialization hypothesis”), or (b) that more aggressive individuals are more strongly attracted by violent media (the “selection hypothesis”). Both directional pathways can, in principle, operate concurrently and/or reinforce each other over time, as reflected in the “downward spiral” model proposed by Slater, Henry, Swaim, and Anderson (2003). In a large sample of early adolescents who were measured 4 times over a 2-year period, Slater et al. (2003) found that use of violent media predicted increases in aggression at subsequent points in time, whereas aggressiveness predicted a preference for violent media only concurrently but not over time.

Longitudinal studies from the United States have found significant pathways from media violence use to aggression over time across a range of media, including movies, TV, video games, music, and comic books (see meta-analyses by Anderson et al., 2010, for video games, and by Bushman & Huesmann, 2006, for TV, movies, video games, and comic books). This research, spanning developmental periods from preschool age (Ostrov, Gentile, & Crick, 2006) to adolescence (Slater et al., 2003), identified habitual media violence use as a significant predictor of aggression over time. Extending the time frame into adulthood, Huesmann, Moise-Titus, Podolski, and Eron (2003) found that TV violence viewing at age 10 predicted aggression measured 15 years later, controlling for a number of other risk factors of aggression. No evidence was found for the reverse pathway from early aggression to subsequent TV-violence viewing.

Evidence from Europe is more limited but has produced similar findings. In Germany, a study with 12- to 14-year-olds found that Time 1 (T1) violent video game use was significantly linked to aggression (β = .18) and delinquency (β = .29) at Time 2 (T2), 2 years later, controlling for other potential risk factors such as poor school climate and parents’ use of physical violence (Hopf, Huber, & Weiβ, 2008). A further study with German adolescents by Möller and Krahe (2009) covered a period of 30 months and considered both physical and relational aggression. Controlling for T1 physical aggression, a significant path was found from violent video game use to physical aggression 30 months later. This finding supports the “socialization hypothesis” of violent video game play. There was no support for the “selection hypothesis,” as aggression at T1 was unrelated to violent video game use at T2. There was also no evidence of a crossover link between video game violence, which is typically physical in nature, and relational aggression, which is behavior aimed at damaging the target person’s social relationships (Crick & Grotpe-
ter, 1995).

Similar findings are reported from a study with Dutch adolescents by Lemmens, Valken-
burg, and Peter (2011) covering a period of 6 months. The cross-lagged path from violent video game use at T1 to self-reported aggression at T2 was significant (β = .09), whereas the path from T1 aggression to T2 violent video game use was not (β = .06). Although girls used violent games much less than did boys, the paths from violent video game use to aggression did not differ significantly between the gender groups.

Finally, another study with German adolescents by Staude-Müller (2011) produced somewhat different results. Following sixth and seventh graders over a period of 12 months, he found no significant path from T1 violent video game play to T2 aggression. The significant reverse path from T1 aggression to T2 violent video game play disappeared when further predictors were included in the analysis.

Three key mechanisms have been identified to explain the pathway from media violence use to aggression: observational learning, development of aggressive scripts, and emotional habituation to the pain and suffering of others. Observational learning refers to the acquisition of cognitive structures that promote specific behaviors as a result of observing others perform those or similar behaviors (Bandura, 1977). Watching media characters behave in a violent fashion can trigger a process of observational
learning in which a new cognitive and behavioral repertoire is acquired, particularly if the violent action is presented as successful or legitimate (Smith et al., 2004). The second key mechanism is the development of aggressive scripts. Scripts consist of stored knowledge structures about how the person should behave in particular situations and what the likely outcome of those behaviors would be. Specific experiences from situations in which aggressive behavior was observed, enacted, or experienced in the past are integrated into a script, that is, a cognitive representation of possible behaviors, including their normative evaluation, from which the person will choose when encountering similar situations in the future (Huesmann, 1998). Scripts provide a basis for deciding when aggression is a successful and/or appropriate behavioral response. For example, they may specify that it is acceptable to retaliate with physical aggression when provoked by a peer but not when angered by an adult. More aggressive individuals are assumed to have encoded a wider repertoire of aggressive scripts and to be more likely to draw on aggressive than nonaggressive scripts when evaluating behavioral options. As part of the process of script learning, repeated observation of violence in the media shapes users’ aggressive scripts in terms of generalized beliefs about when aggressive behavior should be shown and when it is normatively acceptable. The more often an aggressive script has been enacted with positive consequences for the actor, the more firmly it becomes engrained in the person’s cognitive and behavioral repertoire and the more easily it is retrieved on subsequent occasions. The third mechanism by which media violence is thought to affect aggression is reduced empathy. According to the General Aggression Model (GAM) by Anderson and Bushman (2001), repeated confrontation with violence in the media reduces emotional responsiveness to the observation of violence through a process of habituation. Viewers get used to seeing others suffer and being killed in virtual reality and may respond with less empathy to the plight of others in the real world. Funk, Baldacci, Pasold, and Baumgardner (2004) found a negative relationship between playing violent video games and empathy in a sample of elementary school children. Bartholow, Sestir, and Davis (2005) reported significant negative links between video game violence exposure and empathy, as well as between empathy and aggression, in their sample of male undergraduates. Thus, there is evidence to suggest that habitual use of violent media decreases the emotional sensitivity to the suffering of others, which, in turn, disinhibits aggressive behavior (Funk, 2005).

The Current Study

Based on the theorizing and research outlined above, our study examined the associations between adolescents’ exposure to violent media contents and their subsequent aggressive behavior over three data waves in a 2-year period, including a range of established correlates and risk factors of aggression. Data were collected from a large sample of adolescents in Germany so that our findings can also speak to the generalizability of results obtained in studies conducted in the United States. Given the paucity of longitudinal studies on the media violence-aggression link in adolescence, particularly from countries other than the United States, replicating the findings from earlier longitudinal studies is a critical task. Significant associations between media violence and aggression were reported in previous papers cross-sectionally at T1 and longitudinally from T1 media use to T2 aggression (Krahé & Möller, 2010, 2011). The current paper draws on three data waves over a 2-year period, enabling us to examine trajectories of media violence use in relation to patterns of change in aggressive behavior, using both self-reports and teacher ratings as measures of aggression. Three issues were addressed in the current study, as described in the following three sections.

Media Violence Use as a Unique Predictor of Physical Aggression Over Time

We predicted that media violence use at T1 would be a unique predictor of self-rated and teacher-rated aggression at Time 3 (T3) over and above other established risk factors of aggression, notably the normative acceptance of aggression (Huesmann, 1998), low empathy (Funk, 2005), and low academic achievement (Boxer, Huesmann, Bushman, O’Brien, & Moceri, 2009; Gentile, Lynch, Linder, & Walsh, 2004), and controlling for the stability of aggression over time as well as for sociodemo-
graphic and context variables, such as gender, type of school, nonviolent media use, and parental monitoring. This hypothesis reflects the “socialization hypothesis” described in the introduction.

A destructive testing approach was used to examine this prediction. This approach examines the strength of the relation between media violence use and aggression by adding relevant covariates to the analysis to see if the relation is broken when the additional variables are included (Anderson & Anderson, 1996). To address the issue of content specificity, a measure of nonviolent media use was included in the analyses. A parallel set of destructive testing analyses tested the “selection hypothesis”, posulating that individuals with higher initial levels of aggression at T1 would be particularly inclined to use violent media at T3.

**Moderating Variables**

To examine whether habitual use of violent media would be more strongly linked to aggression for some users than for others, the interactions between T1 media violence use and the further predictors were included in addition to the variables considered in the destructive testing analyses predicting T3 aggression. Examining trait aggression as a moderator, some studies found highly aggressive individuals to be more affected by exposure to violent media stimuli, others found no differences as a function of trait aggression, and yet others found less aggressive individuals to be more adversely affected (see Anderson et al., 2003, for a summary). Our previous findings, based on self-reports at two data waves over a 12-month period, showed that media violence use was more strongly related to aggressive behavior among users low on trait aggression (Krahé & Möller, 2010). The present analyses go beyond these earlier findings by using a wider range of potential moderators, covering a 24-month period, and including teacher ratings as an additional measure of aggressive behavior.

Gender may be considered another potential moderator of media violence effects on aggressive behavior. Past research found substantial gender differences in the preference for violent media contents, with males being far more attracted by, and exposed to, media violence than females (Kirsh, 2006). There is also evidence of greater male than female physical aggression (Archer, 2004). This does not necessarily suggest, however, that males and females also differ in their susceptibility to media violence. Evidence from longitudinal studies has produced mixed results on this issue. In the Columbia TV Violence Study, preference for TV violence at age 8 predicted aggression at age 18 for boys but not for girls (Huesmann & Miller, 1994). In contrast, Huesmann et al. (2003) found similar relationships between media violence use and physical aggression for both genders, a finding corroborated by meta-analytic evidence from longitudinal studies (e.g., Anderson et al., 2010). On this basis, we examined whether the specified links of media violence use with aggression would be different for boys and girls.

**Patterns of Violent Media Use Over Time**

Following participants over three data waves enabled us to examine the hypothesis that changes of media violence use would be linked to parallel changes of aggression over time. Longitudinal studies including only two data waves are unable to identify patterns of change. The few available studies extending over more than two data waves have used differences in earlier exposure to media violence to predict differences in aggressive behavior at a later point in time (e.g., Slater et al., 2003; see, however, Gentile et al., 2011, for an analysis of trajectories of pathological video game use). Although these analyses consider both concurrent and lagged effects of media violence use on aggression, they fail to address the systematic differences in stability or variability in trajectories of use and their covariation with patterns of aggression. For example, individuals with high initial levels of media violence use who remain high users throughout the study period might be distinguished from those users who start from an equally high level but then decline in the course of time, and comparing the two groups in terms of their patterns of aggressive behavior might show parallel trajectories. To our knowledge, the present study is the first to use latent growth mixture modeling to identify distinct trajectories of media violence use and relate them to patterns of aggressive behavior over time. It was explored whether the psychological and contextual variables measured at T1 could...
be used to predict trajectories of media violence use, and whether, in turn, the trajectories of media violence use predicted trajectories of aggression over the same period. Specifically, three questions were addressed: (a) Are there distinct patterns of media violence use over time in the present sample? (b) What are the predictors of these distinct patterns? (c) Is there a covariation in media use and aggression over time?

Method

Sample

The sample consisted of 1,715 secondary school students (881 female and 834 male) from 93 classes in 14 schools in different districts of Berlin, Germany, who participated in three waves of data collection over a period of 2 years. Students were in seventh or eighth grade at the beginning of the study. The mean age of the sample was 13.4 years ($SD = .87$) at the first wave of data collection (T1), 14.5 years ($SD = .94$) at the second wave (T2), and 15.4 years ($SD = .89$) at the third wave (T3). The majority of participants were German nationals (75.1%), 10.4% were Turkish nationals, 7.0% had a dual citizenship, and the remaining participants came from a range of different countries. Berlin has a three-tier secondary school system, with schools varying in terms of academic orientation: schools leading to basic qualification (Hauptschulabschluss), vocational qualification (Realschulabschluss), or university entrance qualification (Abitur). Schools from all types of secondary schools were recruited for the study. The present sample is part of a larger longitudinal-experimental study that combined the analysis of the media violence-aggression link over time with an experimental intervention designed to reduce media violence use and aggression (Möller, Krahé, Busching, & Krause, 2012; see Farrington, 2006, for longitudinal-experimental designs). None of the participants were exposed to the intervention.

Approval for the study and all materials used was obtained from the university ethics committee as well as from the school regulating body overseeing the participating schools. Active consent was obtained from all participants and additionally from parents of the students under the age of 14 years, in compliance with the general consent regulations for school-based research in Berlin. Response rates were very high, with no more than one or two students per class not participating.

Measures

Habitual use of violent and nonviolent media. At each data wave, participants were provided with genre lists for movies, TV series, and video games, as described in Krahé and Möller (2010). Ten movie genres, 10 TV genres, and 11 video game genres were presented, each exemplified by a specific title popular at the time of data collection. The 10 movie genres were (a) adventure, (b) action, (c) horror/slasher, (d) comedies, (e) military and war, (f) crime thrillers, (g) romantic fiction, (h) martial arts, (i) science fiction, and (j) cartoon/animation films. The 10 TV series genres were (a) adventure, (b) action, (c) hospital series, (d) comedy, (e) daily soaps, (f) family series, (g) crime thrillers, (h) mystery, (i) science fiction, and (j) cartoon/animation series. For video games, 11 genres were presented: (a) action adventure, (b) construction strategy, (c) classic adventure, (d) military strategy, (e) genre mix (a combination of shooter and racing games), (f) beat-em-ups, (g) role playing games, (h) shooters; (i) simulations, (j) sports games, and (k) survival horror games.

For each item on the lists, participants were asked to indicate how frequently they used the respective genre on a 5-point scale ranging from 0 (never) to 4 (very often). Media experts were recruited at T1 to rate each genre in terms of violent content. Experts were provided with a definition of "violent content" and instructed to rate the level of violence typically characteristic of each genre, using a 5-point scale from 1 (nonviolent) to 5 (very violent), as described by Krahé and Möller (2010). Interrater agreement, as indicated by Kendall’s $W$, was $w = .87, p < .01$, for movies; $w = .75, p = .01$, for TV series; and $w = .92, p < .01$, for video games. On that basis, a mean violence score was calculated across experts for each genre.

To arrive at a measure of media violence use, those genres that contained some measure of violence, as reflected in expert violence ratings of higher than 2 on the 5-point scale, were selected. This was true for eight movie genres, six TV series genres, and seven video game
genres, that is, 21 genres in total. Participants’ frequency ratings for each of the selected genres were multiplied by the average violence rating of that genre obtained from the expert raters. The resulting product scores were then averaged across the 21 genres to yield a total measure of media violence use. The remaining 10 genres that had obtained expert violence ratings of less than or equal to 2 were combined into an overall index of nonviolent media use.

**Aggressive behavior.** Two measures were used to operationalize aggression as the critical outcome variable. The first measure elicited self-reports of physical aggression from the participants, using two items from Björkqvist, Österman, and Kaukiainen (1992) and three items from Möller and Krahé (2009). Example items are, “I have pushed another person” and “I have kicked another person.” Participants were asked to rate how often they had shown the respective behavior in the past 6 months, using a 5-point scale from 0 (never) to 4 (very often). Teacher reports of aggression were used as the second outcome measure. For each participant, a single-item aggression rating was obtained from the class teacher in response to the question: “How often does this student behave in an aggressive way toward others?” Ratings were made on a 5-point scale ranging from 0 (never) to 4 (very often). Teachers were asked to make these ratings based on the student’s behavior in the last school term, that is, in the last 6 months. The same measures of aggression were used at each data wave.

**Empathy.** Six items based on the “affective empathy” subscale of the Basic Empathy Scale (BES) by Jolliffe and Farrington (2006) were used to measure empathy. An example item is, “When a friend of mine is upset, it really affects me.” Responses were made on a 5-point scale from 0 (not at all true) to 4 (exactly true).

**Normative acceptance of aggression.** Normative acceptance of aggression was measured with a vignette describing a provocation scenario based on Möller and Krahé (2009). Following the scenario, a list of five possible reactions was presented and participants were asked to indicate how acceptable it would be for them to respond in that particular way in the situation. Two items represented physical aggression (e.g., “to kick and push him/her”) and three responses reflected relational aggression (e.g., “to spread rumors about him/her”). Responses were made on a 4-point scale ranging from 0 (not at all ok) to 3 (totally ok).

**Parental monitoring of media use.** Two items addressed parents’ monitoring of participants’ use of violent media: (a) “How often have your parents barred you from watching a certain TV program or movie because they thought it was too violent?” and (b) “How often have your parents barred you from playing a certain video game because they thought it was too violent?” A 5-point response scale was used ranging from 0 (never) to 4 (very often). Parental monitoring was assessed at T1 and T2 only.

**Academic achievement.** As a measure of school achievement, teachers provided information about the grades obtained by each participant on his or her latest school report in three core subjects (German, mathematics, and English). A 6-point grading scale is customary in German schools: (1) very good, (2) good, (3) satisfactory, (4) sufficient, (5) not sufficient, and (6) inadequate, so lower values indicate better performance. The grades of 5 and 6 count as failed. Grades were averaged across the three subjects to provide an overall measure of academic achievement, with lower means indicating higher achievement.

**Procedure**

All measures were administered by trained project staff during normal class hours and were completed in group sessions. The media violence use measure was always presented first, as it was most closely related to the theme of the study (i.e., a study on adolescents’ media use) as described to the participants. In addition, class teachers provided aggression ratings and information of participants’ grades.

**Results**

Students were nested in classes and the intra-class coefficients (ICC), displayed in Table 1, indicated the need to account for class-level variance. Therefore, appropriate complex sample models were specified (see Muthén & Satorka, 1995). All participants who took part in at least two measurements were included in the analysis. This strategy is preferable over the restriction to participants who completed all three measurements because it reduces bias due
A multiple imputation approach was used to deal with missing data. The procedure followed the recommendation of van Buuren and Groothuis-Oudshoorn (2011). Forty different imputed data sets were created using a Gibbs-Sampler with chained equations. All chains showed good convergence after 20 iterations.

Descriptive Statistics and Correlations

The means and standard deviations for all measures along with information about internal consistency are presented in Table 1. All measures showed good reliability. Conceptually, the measures showed high internal consistency, as the different genres and media could be used independently of one another and the index presented a cumulative measure of use (Anderson, Gentile, & Buckley, 2007, p. 99). Nevertheless, the alphas for violent media use are substantial, suggesting that preferences for violent media contents show a consistent pattern across genres. The alphas for nonviolent media use were lower, which was to be expected given the greater heterogeneity of this measure across genres and types of media.

Multivariate ANOVAs revealed significant gender differences on all variables. The means are displayed in Table 1. Boys obtained higher scores on the measures of media violence use, nonviolent media use, parental monitoring, and aggressive behavior and aggressive norms. Girls scored higher on the empathy measure and had better grades.

The zero-order correlations of all variables at T1, presented separately for boys and girls, are shown in Table 2. For both genders, media violence use showed positive links with physical aggression, teacher-rated aggression, aggressive norms, and parental monitoring, and a negative link with academic achievement. Nonviolent media use was also positively correlated with both measures of aggression at the bivariate level. Multivariate ANOVAs revealed significant gender differences on all variables at T1. The zero-order correlations in Table 2. For both genders, girls scored higher on the empathy measure and had better grades.
Media Violence Use as a Unique Predictor of Aggression Over Time

To examine the hypothesis that violent media use is a unique longitudinal predictor of aggression over and above other established risk factors of aggression, a destructive testing approach was used. In this approach, the strength of the relation between media violence use and aggression is examined by adding relevant covariates to the analysis to see if the relation is broken when additional variables are included (Anderson & Anderson, 1996). Hierarchical regression analyses were computed with the Mplus 6.11 software (Muthén & Muthén, 2007), using self-rated physical aggression at T3 and teacher-rated aggression at T3 as criterion variables. The hierarchical structure of the data (1,715 students nested within 93 classrooms) was taken into account by a complex modeling approach (using class membership as a cluster variable). Additionally, MLR estimation was employed that provides standard errors and test statistics that are robust to non-normality (see Muthén & Satorra, 1995).

The first set of analyses was conducted to examine the “socialization hypotheses”, stipulating that the use of violent media would predict later aggression. Two hierarchical regression analyses were performed with T3 self-ratings of physical aggression and T3 teacher-rated aggression as criteria. Media violence use at T1 was entered in Step 1, followed by T1 aggression (self- or teacher-rated) in Step 2. Sociodemographic and contextual variables (gender, cohort, school type, academic achievement, and parental monitoring), as well as non-violent media use, were entered in Step 3; psychological predictors (normative acceptance of aggression, empathy) in Step 4; and the interaction terms of media violence use and the covariates in Step 5. T1 media violence use, on its own, was a significant predictor of both self-rated physical aggression and teacher-rated aggression in Step 1, and it remained a significant predictor of both outcome measures in the final step, as shown in Table 3. Nonviolent media use was unrelated to aggression, indicating that the increase in aggression was dependent on the violent content of the media stimuli. In combination, the findings support the hypothesis that violent media use is a unique predictor of later aggression, even when considered in conjunction with a range of other established sociodemographic correlates and psychological risk factors.

A parallel set of destructive testing analyses examined the “selection hypothesis,” postulating that higher initial levels of aggression would be associated with greater use of violent media over time. Both self-rated physical aggression and teacher-rated aggression at T1 predicted T3 media violence use in Step 1 of the analysis, but the link

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Table 2

T1 Zero-Order Correlations

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<td>1</td>
<td>Media violence use</td>
<td>1</td>
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<td>-.03</td>
<td>.26***</td>
<td>.29***</td>
</tr>
<tr>
<td>2</td>
<td>Nonviolent media use</td>
<td>.42***</td>
<td>1</td>
<td>.13*</td>
<td>.23***</td>
<td>.23***</td>
<td>.14***</td>
<td>.03</td>
</tr>
<tr>
<td>3</td>
<td>Self-reported physical aggression</td>
<td>.36***</td>
<td>.15***</td>
<td>1</td>
<td>-.11*</td>
<td>-.11*</td>
<td>.45***</td>
<td>.16***</td>
</tr>
<tr>
<td>4</td>
<td>Teacher-rated aggression</td>
<td>.21***</td>
<td>.15***</td>
<td>.29***</td>
<td>1</td>
<td>-.03</td>
<td>.22***</td>
<td>.24***</td>
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<tr>
<td>5</td>
<td>Empathy</td>
<td>.00</td>
<td>.17***</td>
<td>-.09*</td>
<td>-.01</td>
<td>1</td>
<td>-.09*</td>
<td>-.14***</td>
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<tr>
<td>6</td>
<td>Aggressive norms</td>
<td>.28***</td>
<td>.14***</td>
<td>.37***</td>
<td>.21***</td>
<td>.05</td>
<td>1</td>
<td>-.12**</td>
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<tr>
<td>7</td>
<td>Academic achievement</td>
<td>.18***</td>
<td>.00</td>
<td>.18***</td>
<td>.19***</td>
<td>-.09</td>
<td>.07</td>
<td>1</td>
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<td>.12***</td>
<td>.07</td>
<td>.05</td>
<td>-.04</td>
<td>-.02</td>
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* p < .05. ** p < .01. *** p < .001.

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As participants were recruited from both seventh- and eighth-grade classes, cohort was included in the analysis. Preliminary MANOVAs for the three data waves showed few cohort effects that did not affect the critical aggression-related outcome measures at T3. Nonetheless, cohort was included as a covariate in the analyses reported here. There were some differences as a function of school type, and school type was therefore also included in the analysis.
was broken in Step 2 when T1 media violence use was entered into the analysis. Therefore, there is no evidence that participants with higher initial levels of aggression report greater use of violent media 2 years later.

**Moderating Variables**

To examine the role of potential moderators of the path from media violence use to aggression over time, particularly the initial level of aggression and gender, the interaction terms of T1 media violence use and all other T1 variables (physical aggression, gender, academic achievement, type of school, school cohort, nonviolent media use, parental monitoring, aggressive norms, and empathy) were included in the final step of the destructive testing analysis displayed in Table 3. None of the interaction terms were significant, indicating that higher media violence use at T1 predicted self-reported and teacher-rated aggression 2 years later, irrespective of the presence of other potential demographic and psychological predictors of aggression.

### Patterns of Media Violence Use Over Time

Multiple observations are required for identifying patterns of media violence use, and the present study meets this requirement by providing data from three waves. This database enabled us to address three questions: (1) Are there distinct patterns of media violence use over time in the present sample? (2) What are significant predictors of these distinct patterns? (3) Is there a covariation of media use and aggression over time? Regarding the first question, latent growth mixture modeling suggested a three-group solution based on the LMR-Test (Tofighi & Enders, 2008). As shown in Figure 1, Group 1 (“stable low users”) displayed consistently low levels of media violence use and comprised 64.9% of participants (37.8% of the boys and 90.6% of the girls). Group 2 (“stable high users”) was characterized by stable high
levels of media violence use and included 30.9% of participants (55.4% of the boys and 7.7% of the girls). Finally, Group 3 (“desisters”) had high levels of media violence use at T1 and then showed a decline at T2 and T3. This group comprised 4.2% of the total sample (6.8% of the boys and 1.7% of the girls). The gender difference in the composition of the groups was highly significant, \( X^2 (11) = 526.10, p < .001. \)

To identify potential predictors of the three different trajectories, a multinomial logistic regression analysis was conducted, comparing the groups on the T1 variables included in the destructive testing analyses (as listed in Table 3). The findings are shown in Table 4. Stable high users differed from stable low users in that they scored higher on nonviolent media use, parental monitoring, and physical aggression; lower on empathy; and were more likely to come from a less academically oriented school. Desisters differed from stable low users by scoring higher on nonviolent media use, parental monitoring, and normative acceptance of aggression, and lower on empathy. They were also more likely to be in the older cohort. Finally, desisters differed significantly from stable high users by scoring higher on nonviolent media use, lower on academic achievement, and being more likely to come from the older cohort.

Latent slope analysis was used to compare the three groups in terms of their patterns of aggression over the three waves. The trajectories of self-reported physical aggression for the three user groups are presented in Figure 2. The analysis yielded a significant difference between the high and low users in their initial level of aggression, \( t(\text{intercept}) = 2.23, p < .05 \), controlling for all T1 covariates (see Table 3). The intercept difference between the desisters and the stable high user group was nonsignificant, and the intercept difference between the desisters and the stable low users was marginally significant, \( t(\text{intercept}) = 1.66, p < .10 \). This finding should be interpreted against the small size of the desister

Figure 1. Trajectories of media violence use over time. Group 1: Stable low users; Group 2: Stable high users; Group 3: Desisters.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Stable high users versus Stable low users</th>
<th>Desisters versus Stable low users</th>
<th>Desisters versus Stable high users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>OR</td>
</tr>
<tr>
<td>Academic achievement</td>
<td>-0.01</td>
<td>0.07</td>
<td>0.98</td>
</tr>
<tr>
<td>School type</td>
<td>-0.28***</td>
<td>0.07</td>
<td>0.46</td>
</tr>
<tr>
<td>School Type × Achievement</td>
<td>0.09</td>
<td>0.09</td>
<td>1.24</td>
</tr>
<tr>
<td>School cohort</td>
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<td>0.06</td>
<td>1.15</td>
</tr>
<tr>
<td>Parental monitoring</td>
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<td>0.06</td>
<td>1.28</td>
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<td>Nonviolent media use</td>
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<td>0.05</td>
<td>1.46</td>
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<tr>
<td>Empathy</td>
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<td>0.52</td>
</tr>
<tr>
<td>Aggressive norms</td>
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<td>0.06</td>
<td>1.15</td>
</tr>
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<td>Self-rated physical aggression</td>
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<td>1.48</td>
</tr>
<tr>
<td>Teacher-rated aggression</td>
<td>0.08</td>
<td>0.06</td>
<td>1.11</td>
</tr>
</tbody>
</table>

\* \( p < .05 \). \** \( p < .01 \). \*** \( p < .001 \).
group and the resulting loss of power for this comparison. The pattern of change is indicated by the slope, representing the Time × Group Membership interaction. As shown in Figure 2, participants whose use of violent media decreased from T1 to T3 also showed a decline in aggressive behavior that differed significantly from the pattern found for the stable high user group, t(slope) = −2.29, p < .05. The pattern of change for the desisters did not differ significantly from the stable low group, t(slope) = −1.53, p > .10. At T3, the stable high group reported significantly higher physical aggression than did the stable low group (b = −0.37, t = 5.38, p < .001) and the desister group (b = −0.41, t = 2.9, p < .01). The desisters and the stable low group did not differ in physical aggression at T3. For teacher-rated aggression, no significant differences on intercepts or slopes were found between the three groups.

**Discussion**

To address the long-term associations of habitual use of violent media with aggression, this study assessed a large sample of adolescents in Germany in three waves over a period of 2 years. In addition to measures of media use and aggressive behavior, a range of sociodemo-

[Image: Figure 2. Trajectories of self-rated physical aggression as a function of trajectories of violent media use.]
of aggressive scripts, both of which see the effects as specific to violent content.

The destructive testing analyses supported the assumption of a directional path from media violence use to later aggression, as stipulated by the “socialization hypothesis.” It did not produce evidence of a path from earlier aggression to later media violence use, as proposed by the “selection hypothesis.” The bivariate association between T1 aggression and T3 media violence use was broken as soon as T1 media violence use was entered in the analysis. This finding is in line with previous longitudinal studies (Huesmann et al., 2003; Lemmens et al., 2011; Möller & Krahe, 2009).

The second issue referred to possible moderators of the longitudinal path from media violence use to aggression. In the present data, there was no evidence of moderator effects. The link between T1 media violence use and T3 aggression was unaffected by gender and other sociodemographic or contextual variables, such as parental control, and school achievement, or by psychological constructs such as initial trait aggression, empathy, or normative beliefs about aggression at the beginning of the 2-year period. The interactive effect of media violence use and initial level of aggression that was found for the period from T1 to T2 in an earlier analysis (Krahé & Möller, 2010) was no longer apparent in the more extensive period covered by the present analysis. Over the 12-month period, media violence was more strongly related to aggression in participants with lower initial aggression scores. This meant that by T2, participants who were initially less aggressive but used a lot of violent media had approached the aggression levels of those who had already scored high on aggression at T1 (and who had also used more violent media at T1, as reflected in a significant positive correlation between aggression and media violence use). This move of the initially less aggressive individuals with high media violence use toward the aggression levels displayed by those with high starting levels of aggression may explain why T1 aggression was no longer a significant moderator of the path from T1 media violence use to aggression at T3.

Finally, the claim that media violence use is a risk factor for later aggression was addressed by examining the covariation of patterns of media violence use and aggression over the three waves. Based on latent mixture growth curve modeling, three groups of users were identified in the present sample. The largest user group, consisting of about two-thirds of participants, showed low levels of media violence use at T1 and remained at low levels 12 and 24 months later. Almost all the girls in the sample fell into this group. A second, smaller group, comprising about 30% of the sample, showed consistently high levels of violent media use. About half of the boys and no more than 7% of the girls fell into this group. The third trajectory was characterized by a high level of violent media use at T1 that declined over the 2-year period. This group of “desisters” comprised about 7% of the boys and under 2% of the girls.

Examining whether the variables included in our study would be able to predict membership in the three groups, it was found that compared, with stable low users, both stable high users and desisters used more nonviolent media, had lower empathy scores, and were more closely monitored by their parents regarding the use of violent media at the beginning of the study. In addition, high users scored higher on T1 aggression than did low users and were less likely to come from academically oriented schools. Stable high media violence users also differed significantly from desisters in that they showed less use of nonviolent media at T1, lower academic achievement, and were more likely to come from the younger grade cohort.

When using membership in the trajectory groups to predict both the starting level (intercept) of aggressive behavior at T1 and the change over time (slope), only the self-report measure of physical aggression yielded significant results. Stable high users had significantly higher starting levels of aggression than did stable low users of media violence, and they were still significantly more aggressive at T3. Desisters also scored higher than the stable low-user group on initial aggression, but the difference was only marginally significant. Desisters differed significantly from the stable high user group in their change in aggression over time, as indicated by a significant difference in slope. Whereas those who were stable in their high use of media violence over the three data waves also showed stability at a relatively high level of aggression, the desisters showed a decrease in aggression that paralleled their decrease in media violence use. No difference was found be-
tween the desisters and the stable low users in the patterns of aggressive behavior from T1 to T3. These findings suggest that an initially high level of violent media use that is part of a general attraction to entertainment media (accompanied by higher levels of nonviolent media use) is likely to decrease over time and does not present a risk factor for later aggression. By contrast, a selective interest in violent media, not accompanied by a concurrent interest in nonviolent media, displayed at a younger age is more likely to remain stable over time and lead to higher levels of aggression, even controlling for initial levels of aggression and a range of covariates. If confirmed by other studies, this finding could provide a clue for the early identification of dysfunctional patterns of violent media use with regard to the risk of increased aggression.

We believe our study has several strengths. It included a large sample of students representing the full range of secondary schools varying in academic orientation. Participants were followed over three measurements in the course of 2 years, enabling us to identify patterns of stability or change in both media violence use and aggression. A number of alternative predictors of aggression were assessed to establish the unique role of media violence use as a risk factor for aggression. Teacher ratings of aggression were collected to provide an independent source of data. State-of-the-art complex sample models and latent growth mixture modeling were used to test the predictions and to identify trajectories of media violence use that could be used to identify problematic user patterns with regard to the risk of aggression. In combination, these features strengthen the proposition that long-term use of violent media may have a causal influence on the development and persistence of aggressive behavior patterns in adolescents. The destructive testing approach employed in our study demonstrated that the path from media violence use to aggression over time held up against a large number of competing variables, including starting levels of aggression, thus corroborating the impact of media violence use by ruling out plausible alternative explanations (see also Anderson et al., 2007, p. 22, on establishing causal effects of media violence on aggression).

At the same time, the limitations of this study need to be acknowledged. First, the majority of measures in the study were based on self-reports, entailing the problem of shared method variance. Teacher ratings of aggression complemented self-ratings but were made only on a single-item measure that was worded in general terms, therefore leaving more room for interpretation than the behaviorally specific items of the self-report measure. The obtained findings were generally stronger for self-reported physical aggression than for teacher ratings of aggression. Second, although significant, the effect sizes found between media violence use and aggression were small by conventional standards. Media violence use at T1 accounted for 3% of the variance in self-rated physical aggression and for 2% of the variance in teacher-rated aggression measured 24 months later. However, these figures controlled for many additional predictor variables included in the destructive testing analysis. Sales figures and user surveys across the world demonstrate that media depicting or affording violent action are highly popular and widely-used forms of entertainment, not least in childhood and adolescence. Therefore, even small effect sizes translate into substantial differences in aggressive behavior that may be attributed to the use of violent media (Rosenthal, 1990), particularly when a large number of alternative predictors are taken into account.

Despite these limitations, the present study joins a growing body of research in the international literature addressing the long-term implications of violent media use for aggression among children and adolescents. Although it is clear that violent media use is but one of many risk factors of aggression, our findings show that the effects of exposure to violent media stimuli are discernible over a 2-year period, even when a range of potential other risk factors are considered simultaneously. At the same time, the present findings provide some tentative clues for distinguishing a preoccupation with violent media that is dysfunctional with regard to increasing the risk of aggression from a more general enhanced interest in the use of media in a small group of users that may give way to preferences for other forms of leisure activities in the course of adolescent development.
References


