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# Sore Losers? A Reexamination of the Frustration-Aggression Hypothesis for Colocated Video Game Play

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The impact of video game play on player aggression continues to be debated within the academic literature. Most of the studies in this area have focused on game content as the independent variable, whereas the social context of gaming is largely neglected. This article presents an experimental study (*N* = 76) on the effects of game outcome and trash-talking in a competitive colocated multiplayer sports video game on aggressive behavior. The results indicate that an unfavorable outcome (i.e., losing) can increase postgame aggression, whereas trash-talking by the opponent had no such effect. We also tested the frustration-aggression hypothesis for video games and found that the effect of losing on aggressive behavior is mediated by negative affect. The results suggest that the frustration–aggression hypothesis can be applied to the use of digital games and that game characteristics alone are not sufficient to explain effects on aggression.

*Keywords:* video games, aggression, frustration, competition

Since the earliest publications on this topic in the 1980s (Cooper & Mackie, 1986; Dominick, 1984), the body of literature on the relationship between violence and digital games and aggression has grown substantially. Despite the long tradition of research in this area, there is still an ongoing debate about the magnitude and implications of the effects of digital games on aggression. One reason for this may be that most of the experimental and correlational studies have focused on the contents of video games as causes of aggression. Other potentially influential factors, such as the mechanics (game play, controls, etc.) and (social) context of playing, have received considerably less attention (Gentile, 2011). The social context of digital games has been particularly neglected in research on aggression (Schmierbach, 2010; Southwell & Doyle, 2004; Williams, 2005). This is troublesome, as digital games, just like their nondigital counterparts, are both interactive and social media (Cole & Griffiths, 2007; Gajadhar, de Kort, & Ijsselsteijn, 2009; Lenhart et al., 2008) and the interaction with other human players can strongly shape the player experiences. As Schmierbach (2010) noted, multiplayer experiences have become a mode of play that is almost as common as solo gaming today. According to data from the Entertainment Software Association, 65% of the US gamers frequently played with other gamers in person in 2011 (Entertainment Software Association, 2011), and data from a representative German survey shows that in the same year, 57% of the gamers regularly played with others in person, that is, colocated, and 38% played with others online (Quandt, Festl, & Scharkow, 2011). In view of

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these data, it is not surprising that Velez, Mahood, Ewoldsen, and Moyer-Gusé (2012) suggest that "the popularity and frequency of these multiplayer games warrant a new look into the social context of video games" (p. 2).

Several studies have addressed the role of social interaction in the context of digital games and aggression (Adachi & Willoughby, 2011b; Anderson & Carnagey, 2009; Anderson & Morrow, 1995; de Kort & Ijsselsteijn, 2008; Eastin, 2006, 2007; Ewoldsen et al., 2012; Schmierbach, 2010; Velez et al., 2012; Williams & Clippinger, 2002). All of these studies, however, looked at the impact of different modes of interaction (usually cooperation vs. competition) and, hence, at game features rather than the course and outcome of the social interaction. Other studies have treated (verbal) interactions in and around digital games as manifestations, but not as causes of aggression (Eastin, 2007; Peña & Hancock, 2006). The interactions with other players and their outcomes can, however, also be thought of as independent variables that influence emotional and behavioral reactions during and after the game.

The purpose of this article is to explore how competitive interactions between players and their outcomes affect negative emotional experiences and aggressive behavior. Building on the reformulation of the frustration–aggression hypothesis (Dollard, Doob, Miller, Mowrer, & Sears, 1939) by Berkowitz (1989), we conducted an experimental study to test whether winning or losing in a competitive sports video game and the verbal interaction with a colocated opponent affect aggressive behavior and whether this effect is mediated by negative affect.

**The Frustration–Aggression Hypothesis**

The frustration–aggression hypothesis was originally formulated by Dollard et al. in 1939, stating that "the occurrence of aggressive behavior always presupposes the existence of frustration" and "the existence of frustration always leads to some form of aggression" (p. 1). The strong assumption that frustration always leads to aggression was later qualified by Miller (1941), who noted that "frustration produces instigations to a number of different types of response, one of which is an instigation to some form of aggression" (p. 338). To understand the original frustration–aggression hypothesis, it is important to note that its authors defined frustration not as an emotional experience, but as "an interference with the occurrence of an instigated goal-response" (Dollard et al., 1939, p. 7). By this definition, a frustration is an event or action that complicates or obviates the accomplishment of a subjectively relevant task. In 1989, Berkowitz proposed a reformulation of the original hypothesis, suggesting that "(f)rustrations are aversive events and generate aggressive inclinations only to the extent that they produce negative affect" (p. 71). Berkowitz stressed that "any kind of negative affect (. . .) will produce aggressive inclinations" (p. 71). He also added that there are other sources of aggressive inclinations, such as insults. There is a robust body of empirical research supporting the hypothesis that frustrations generate negative affect, which, in turn, can lead to or increase aggression (Berkowitz, 1989; for a more recent overview see Marcus-Newhall, Pedersen, Carlson, & Miller, 2000).

One potential source of frustration is the competition between two or more parties (Deutsch, 1949). Although competition can also be fun and rewarding, the possibility of losing to a competitor introduces the risk of aversive emotional experiences. According to Berkowitz (1989) "(c)ompetitive encounters are at least partly frustrating as the contestants block each other's attempts to reach the disputed goal and threaten each other with a total loss" (p. 66). Games in which the success of one competitor necessitates the failure of another are likely to cause negative emotional reactions and, thus, increase the likelihood or intensity of aggressive reactions of the party that fails to achieve its goal. Hence, many seminal studies on the frustration-aggression hypothesis used game scenarios as sources of frustration and the punishment of coplayers or competitors as measures of aggression (Nelson, Gelfand, & Hartmann, 1969; Worchel, Andreoli, & Folger, 1977; Sherif, Harvey, White, Hood, & Sherif, 1961). The results of these studies indicate that the actions of both competitors and team mates in a game can be sources of frustrations that increase aggressive tendencies, especially toward the sources of these frustrations.

## Digital Games and Aggressive Behavior

The majority of experimental studies on the effects of violent digital games on aggressive behavior have focused—often exclusively— on violent content (Williams, 2005). Digital games, however, are complex media stimuli that usually differ from one another in more respects than just violent content. Adachi and Willoughby (2011a), for example, list pace of action, difficulty, and competitiveness as potentially influential factors in addition to violent content. Regarding the dimension of competitiveness, studies by Anderson and Morrow (1995), Carnagey and Anderson (2005), and Schmierbach (2010) consistently found that more competitive games or game modes lead to a higher postgame aggression. Adachi and Willoughby (2011b) matched the games they used for difficulty and pace of action and compared the effects of violent content and competitiveness on postgame aggressive behavior. They found that the competitiveness of the games they used and not their violent content was responsible for an increase in aggressive behavior. By contrast, Anderson and Carnagey (2009) matched the games they used in their study on the dimension of competitiveness and found that the violent content of the highly competitive sports games they used still caused an increase in aggressive behavior. Taken together, the results of these studies suggest that violent content alone is insufficient to explain the effects of digital games on aggression.

Although previous studies on the effects of competitiveness on aggression could show that the game mode has an influence on aggression (Adachi & Willoughby, 2011b; Anderson & Morrow, 1995; Carnagey & Anderson, 2005; Schmierbach, 2010), the actual outcome of a game has received little attention in this line of research. As losing in a digital game typically represents an aversive event that can impair enjoyment (Jin, 2012; Schmierbach, Xu, Oeldorf-Hirsch, & Dardis, 2012) and increase state hostility (Shafer, 2012), we expected the outcome of the game to also have an effect on postgame aggression.

***H1:*** *Losing in a competitive colocated video game will increase postgame aggressive behavior*

Several studies have suggested that playing against a human opponent elicits stronger emotional reactions than playing against the computer (Gajadhar et al., 2009; Mandryk & Inkpen, 2004; Ravaja et al., 2006). Depending on its course and outcome, the interaction with other players can evoke both positive and negative emotional responses during and after game play. One source of negative emotions and possible aggressive inclinations in multiplayer interactions can be unpleasant verbal interactions with others, such as flaming or trash-talking (Eastin, 2007). As previous research (Ewoldsen et al., 2012; Velez et al., 2012) has shown that cooperative video game play can increase cooperative behavior in subsequent interactions, we assumed that a similar mechanism can be assumed for hostile interactions, meaning that an unpleasant competitive interaction can increase the inclination to (re-)act aggressively.

***H2:*** *Trash-talking by an opponent will increase postgame aggressive behavior*

## Digital Games and Frustration

Playing digital games is not always enjoyable. If the challenges presented in a game (repeatedly) exceed a player's skills, they can be frustrations according to Dollard et al.'s (1939) definition of the term. Because the feeling of effectance has been shown to be one of the major prerequisites of enjoyment in digital games (Klimmt, Hartmann, & Frey, 2007), anything that interferes with this experience can lead to aversive emotions. In solo play, frustrations are caused by a mismatch of player skills and the demands of the game, whereas the experience of frustrations in a multiplayer game also depends on the performance and behavior of coplayers and/or opponents (Schmierbach, 2010).

Despite its relevance for explaining aggressive behavior, frustration has only been considered in a few studies on the effects of digital games. Anderson et al. (2004) matched the games they used in their study on several dimensions, including frustration. Velez et al. (2012) also compared ratings of frustration for their different conditions using the same game, but found no effect of game mode (cooperative vs. competitive) or opponent type (ingroup vs.

outgroup). In a study by Anderson and Carnagey (2009), the authors controlled for frustration when comparing the effects of different violent games on emotional states. Supporting the notion of Adachi and Willoughby (2011a) that game characteristics are often confounded, the study by Anderson and Carnagey (2009) showed that the violent games they used were also rated higher on difficulty, frustration, and action. A study by Valadez and Ferguson (2012) even found no effect of violent video games on aggression after controlling for competition and frustration induced by game difficulty. Ivory and Kalyanaraman (2007) found frustration to be the only relevant covariate in their study on the effects of technological advancement and violent content on presence, arousal, involvement, and aggression. This led the authors to emphasize "the importance of frustration as a control measure" (p. 548) and to suggest that "research that intentionally manipulates frustration as an independent variable might prove insightful" (p. 551).

The frustration–aggression hypothesis is mentioned explicitly as a potential explanation for the effects of (violent) digital games by several authors (Eastin, 2006, 2007; Eastin & Griffiths, 2006; Williams & Clippinger, 2000), but only one study actually tested the hypothesis for digital games. Schmierbach (2010) found no mediating effect of frustration on aggressive cognitions in his study on the influence of different game modes. While players in a competitive setting showed more aggressive cognitions than those who played solo or cooperatively, the effect was mediated by aggressive strategizing (i.e., thinking about violent actions), and not by frustration.

[1] However, this study looked at aggressive cognitions, and not at aggressive behavior, and used a violent first-person shooter game. In a footnote, the author notes that "non-violent games may be equally or more 'harmful'" (Schmierbach, 2010, p. 270). The study also focused on game characteristics (the game mode) and did not consider the outcome of the game play (i.e., success or failure). The outcome of a competitive game played against another human player has been investigated in detail in a recent study by Shafer (2012), who found that unfavorable outcomes and competitive situations can increase state hostility and impair enjoyment, especially in player-versus-player situations.

Based on the reformulation of the frustration–aggression hypothesis by Berkowitz (1989) and the results of previous studies on competition in digital games, we expected negative affect to mediate the effect of the game outcome and trash-talking on aggressive behavior.

> ***H3:*** *Negative affect will mediate the effect of the outcome of the game (i.e., winning or losing) on aggressive behavior*
>
> ***H4:*** *Negative affect will mediate the effect of trash-talking on aggressive behavior*

## Method

### Design and Procedure

The study had a 2 X 2 between-subjects design and featured a confederate whose behavior represented the independent variable. The game we chose for this study was the soccer video game *FIFA World Cup 2010*. While Shafer (2012) determined the outcome of the game by asking the participants if they won or lost, we systematically controlled the outcome of the game by using a trained confederate. Depending on the experimental condition, the confederate was instructed to either win or lose against the participant and to either act friendly and helpful or to mildly trash-talk and comment sarcastically on the participant's performance. The trash-talking was rather moderate to create a realistic interaction, as the confederate and the participants did not know each other, and to prevent any danger of participants (physically) assaulting the confederate. For the trash-talk condition, the confederate was provided with a list of phrases that he could use in different situations. For example, the confederate would taunt the other player by saying "Nice pass!" sarcastically when the participant failed to complete a pass or "Oh! This is going to be easy" on scoring a goal. The participants always played against the same male confederate who was trained in playing *FIFA World Cup 2010* before the study.

[1] It should be noted that all of the studies discussed here operationalized frustration as an emotional experience and not as an event as defined by Dollard et al. (1939) and Berkowitz (1989).

On arrival at the laboratory, each participant signed an informed consent and was asked whether he or she had any experience playing *FIFA World Cup 2010* on the Xbox 360 console. If this was not the case, the participant played a practice session against an easy computer opponent for 5 min. The experimenter explained the basic controls and if the participant had any additional questions regarding the controls, the experimenter would answer these during the practice phase.

Following the practice phase, participants played two halves of 5 min each against the confederate in one of the four conditions. After the match, the participants stayed in the laboratory and filled out an online questionnaire including items on the playing experience, basic demographics, video game use, and their emotional state on a computer next to the console gaming area. The confederate was led into an adjacent room and the participants were told that he would fill out the same questionnaire there. The questionnaire was followed by a modified version of the Competitive Reaction Time Task (CRTT; for details see the Materials section). At the end of the experiment, participants were thanked and those who did not participate for course credit received a monetary compensation. All participants were debriefed via e-mail at the end of the data collection phase to avoid an early uncovering of the role of the confederate and the purpose of the study.

**Participants**

Participants were recruited in an introductory communications course and via university mailing lists, posters, and leaflets on and around the campus of a university in the southwest of Germany. Participants signed up for the experiment using the *Cortex* online recruiting tool (Elson & Bente, 2009) and either received course credit (for the introductory course) or a monetary compensation of 10€ (about $13) for their participation. Ninety-one participants took part in this study. The data of 15 participants were excluded from further analysis because of language problems with the questionnaire, participants having suspicions about the purpose of the study, participants knowing the confederate, or a failed experimental manipulation (i.e., a game resulting in a draw). Of the remaining 76 participants whose data were included in the final analyses, 48 were female and 28 were male. The age of the participants in this study ranged from 19 to 36 ($M$ = 22.6, $SD$ = 3.2) years and 63% of the participants were university students.

**Materials**

**Video game and equipment**. Participants played the soccer game *FIFA World Cup 2010* (EA Sports, 2010) against a colocated confederate on an Xbox 360 console connected to a 42-inch TV screen. The game was chosen because it is a nonviolent but highly competitive game with a large player base, especially in Germany. The matches played in the study were always 2 X 5 min in duration and both participant and confederate played with the German national team to avoid an unbalanced game due to differences in the team skills.

**Demographics and video game use.** The postgame questionnaire included questions on the participants' sex, age, and major or profession. Video game use was measured in hours per week.

**Manipulation check.** To test whether the experimental manipulations were successful, the postgame questionnaire also included several items in which participants had to evaluate their opponent in terms of sympathy and skills.

**Negative affect.** Negative affect was measured by four items from the German translation (Krohne, Egloff, Kohlmann, & Tausch, 1996) of the Positive Affect Negative Affect Schedule by Watson, Clark, and Tellegen (1988). Participants indicated on a 5-point scale (ranging from "not at all" to "very much") to what degree they had felt angry, irritated, ashamed, and frustrated when they played *FIFA World Cup 2010*. Three of the four items (angry, irritated, and frustrated) also appear in the State Hostility Scale by Anderson, Deuser, and DeNeve (1995). A latent variable with these four items as observed indicators was treated as the mediator in the final analysis. The short negative affect scale showed a high reliability (Cronbach's alpha = .80).

**Aggressive behavior.** Aggressive behavior was measured with a modified version of the CRTT. For this test, the participants wore head- phones on which the volume was set to the maximum. The volume in the Windows 7 audio settings was set to 50% for all participants. Participants were told that they would play a

reaction time (RT) game against the same person they had played the soccer game with before and that the person who lost a round would be punished by an unpleasant noise blast delivered through the headphones. The experimenter told the participants that they would play against the same person they had played the soccer game with. This was done because Berkowitz (1989) recommended that tests of the frustration–aggression hypothesis should provide the participants with appropriate targets for their aggression and Dollard et al. (1939) observed that the strongest aggressive reactions can be expected to be those directed toward the source of the experienced frustration.

In the RT game, participants had to press the space bar on their keyboard as fast as they could whenever the word "JETZT" (German for "NOW") appeared on the screen. To address the issue of the noise blasts being a potential means to reduce the RT of the opponent (Adachi & Willoughby, 2011b), the cue in the RT task was visual instead of auditory. Participants were asked to choose a duration for the noise blast their opponent would hear in case of losing before each RT trial and were told that their opponent would do the same. The options ranged from 1 to 9 seconds and were selected using the corresponding number keys on the computer keyboard. We excluded the volume setting because Ferguson and Rueda (2009) reported insufficient correlations between duration and intensity in their CRTT validation study and duration (in seconds) was believed to be a more intuitively comprehensible unit for all participants. Our version of the CRTT had 10 rounds, and the number and sequence of winning and losing rounds was the same for all participants (5X win, 5X lose). The duration settings of the simulated opponent were randomized per participant and trial, except for the first trial in which the participant always lost and was punished with a noise blast of 5 seconds. This was done to give the participants an impression of how unpleasant the noise is. Our CRTT version was created using the open-source software *PsychoPy 2* (Peirce, 2007). For our analyses of aggressive behavior we only used the duration setting of the first trial to rule out the possibility that the CRTT (i.e., the simulated opponent's settings) itself instead of the experiences during the *FIFA World Cup* match influenced the (re-)actions of the participants (Bushman & Baumeister, 1998; Bushman, Baumeister, & Philips, 2001).

## Results

### Video Game Use and Manipulation Checks

Our participants played, on average, 2.1 hr/week ($SD$ = 3.7). The male participants in our sample played significantly more ($M$ = 3.87, $SD$ = 3.9) than the female participants ($M$ = 1, $SD$ = 3.17, $t(48) = 3.3$, $p < .05$, $d = .81$).

Four items from the postgame questionnaire were used for the manipulation checks. All of these items were answered on a 5-point scale ranging from "does not apply" (1) to "fully applies" (5). Participants in the lose condition felt significantly less superior to their opponent ($M$ = 1.2, $SD$ = .5) than those in the winning condition ($M$ = 3.0, $SD$ = 1, $t(74) = 10.1$, $p < .001$, $d = 2.4$). They also felt more overstrained by the competition ($M$ = 3.2, $SD$ = 1.3) than participants in the winning condition ($M$ = 2.2, $SD$ = 1.2, $t(74) = 3.5$, $p < .001$, $d = .81$). In the no trash-talk condition, the confederate was judged as significantly more sympathetic ($M$ = 4.6, $SD$ = .5) than in the trash-talk condition ($M$ = 3.8, $SD$ = 1.0, $t(74) = 4.5$, $p < .001$, $d = 1.1$). Respondents were also more interested in playing against the confederate again when he was friendly ($M$ = 4.1, $SD$ = .8) than when he trash-talked ($M$ = 3.3, $SD$ = 1.0, $t(74) = 4$, $p < .001$, $d = .93$).

### Effects of Game Outcome and Verbal Interaction on Postgame Aggression

Our first hypothesis was that the game result (i.e., winning or losing) influences postgame aggression. More specifically, we expected those participants who lost to behave more aggressively in the CRTT. To test this hypothesis we performed an analysis of variance with the duration setting of the first round of the CRTT as the outcome variable and the two experimental conditions as predictors. The main effect of losing on aggressive behavior was small, but significant, $F(1, 72) = 4.2$, $p < .05$, $\omega = .2$. In line with our expectations, participants in the losing condition chose higher duration settings in the first trial of the CRTT ($M$ = 3.3, $SD$ = 2.1) than those who won ($M$ = 2.4, $SD$ = 1.8).

Although those in the trash-talking condition selected higher duration settings ($M$ = 3.1, $SD$ = 2.0) than those in the no-trash-talk condition ($M$ = 2.7, $SD$ = 2.0), this effect was statistically indistinguishable from zero, $F(1, 72) = .85$, $p = .36$, $\omega = 0$. There was no interaction effect between the two treatments. According to these results, Hypothesis 1 can be confirmed, whereas Hypothesis 2 has to be rejected, based on our data.

### Testing the Frustration–Aggression Hypothesis

Hypothesis 3 stated that frustration mediates the effect of game outcome and trash-talking on aggression. To test this hypothesis, a path model was computed using Amos 21.0. As mentioned in the Methods section, negative affect was entered as a latent variable with the four Positive and Negative Affect Schedule items as observed indicators. To control for potential confounds, participant sex and video game use (hours per week) were entered as covariates in the model. The zero-order correlations between all variables used in the structural equation model as well as their means and standard deviations can be found in Table 1.

The $\chi^2$ test for the model fit supported a complete mediation model in which the direct effects of the conditions on aggression were constrained to be zero. The overall fit of the model was excellent according to the criteria suggested by Hu & Bentler (1999): $\chi^2$ ($df$ = 24) = 21.3, $p = .62$; root mean square error of approximation = .00; standardized root mean square residual = .06; comparative fit index = 1.

Losing had a significant effect on the latent variable negative affect ($\beta = .53$, $p < .001$).[1] Trash-talking, however, only had a small and nonsignificant effect on negative affect ($\beta = .13$, $p = .2$). The effect of negative affect on aggression was small, but significant ($\beta = .28$, $p < .05$). The indirect effect of losing on postgame aggression was also significant (bootstrapped bias-corrected 95% confidence interval for the standardized indirect effect: [.01, .33]). There was no significant indirect effect of trash-talking on aggressive behavior. The effects of the covariates participant sex and gaming experience on negative affect and aggression were all small and nonsignificant.

## Discussion

The current results corroborate previous research and provide further support for the contention that factors other than violent content play a role in the effects of digital games on aggression. However, with regard to the frustration–aggression hypothesis, our results slightly differ from those of previous studies. While Barlett, Branch, Rodeheffer, and Harris (2009) and Schmierbach (2010) found aggressive cognitions to be the most important mediator, our study shows that negative affect can mediate the effects of the outcome of a competitive colocated game on aggressive behavior. It is important to keep in mind, however, that the comparability of our own findings and those of previous studies is somewhat limited due to the use of different independent and dependent variables. Schmierbach (2010) examined aggressive cognition as the outcome variable, and not aggressive behavior. Barlett et al. (2009) investigated aggressive behavior, but used a different measure, namely, the Hot Sauce Paradigm (Lieberman, Solomon, Greenberg, & McGregor, 1999), and looked at aggressive and not negative affect as a potential mediator. In addition, Schmierbach (2010) used a violent first-person shooter, and Barlett et al. (2009) compared the effects of a violent fighting game and a nonviolent tennis game. The latter study also had participants only play in solo mode. It is, hence, likely that parts of the differences in the findings of these studies and our own can be attributed to differences in the respective methods.

It may also be that game contents, game mode, and the interaction with other players operate through different mechanisms. Whereas coplayer or opponent behavior increases aggressive inclinations via negative affect, game mode might, for example, increase aggression through priming of aggression-related concepts (Anderson & Morrow, 1995). Through a priming lens the effects found in our study may also be seen as mirroring those by Ewoldsen et al. (2012) and Velez et al. (2012), who found that

[1] We also estimated the same model with the margin of victory (i.e., goals scored by the confederate minus goals scored by the participant) instead of the dichotomous win/lose variable and obtained nearly identical results in terms of effect size and statistical significance.

Table 1
*Correlations and Descriptives for all Variables Used in the Structural Equation Model*

| | Variable name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Losing | — | -.03 | .38** | .38** | .09 | .50** | .23* | -.03 | .02 |
| 2. | Trash-talk | | — | .09 | -.03 | .05 | .13 | .10 | -.01 | .06 |
| 3. | Angry | | | — | .47** | .35** | .62** | .24* | -.05 | -.06 |
| 4. | Ashamed | | | | — | .44** | .74** | .15 | .04 | -.09 |
| 5. | Irritated | | | | | — | .34** | .11 | .16 | -.20 |
| 6. | Frustrated | | | | | | — | .27* | .08 | -.09 |
| 7. | Aggression[a] | | | | | | | — | .18 | -.08 |
| 8. | Participant sex[b] | | | | | | | | — | -.38** |
| 9. | VG use[c] | | | | | | | | | — |
| M | | 0.51 | 0.53 | 1.32 | 1.58 | 1.34 | 1.63 | 2.87 | 0.63 | 2.10 |
| SD | | 0.50 | 0.50 | 0.68 | 0.93 | 0.78 | 0.98 | 2.00 | 0.49 | 3.70 |

[a] Duration setting in the first CRTT trial. [b] Male = 0, female = 1, [c] Video game use in hours per week.
* $p \leq .05$ ** $p \leq .01$.

cooperative video game play increased cooperative behavior in an unrelated task: If prosocial (cooperative) gaming increases prosocial (cooperative) behavior, antisocial (competitive) play may increase antisocial (in this case aggressive) behavior. To properly test this assumption, however, we would need to compare a cooperative and a competitive game (mode) and ideally also measure the activation of cooperative, competitive, and aggression-related concepts, for example, through word recognition or completion tests. Furthermore, the differences we found for the outcome of the game indicate that competition is not the only factor influencing aggression in a multiplayer game. A superior opponent who hinders a player from achieving the desired goal of winning is a source of frustration that is better explained by the frustration–aggression hypothesis than by priming.

For short-term effects on aggressive behavior, such as those measured in the present study, excitation transfer (Zillmann, 1988) is another explanatory model besides frustration–aggression and priming. For the case of our study, it may well be that losing against the confederate was more arousing than winning and that the arousal carried over into the CRTT, leading to more aggressive behavior. Although we could not think of a reason why losing should be more arousing than winning, excitation transfer might still help to explain the effect of coplayer behavior or video game play in general. Again, to test this, different study designs would be needed in which games that differ in their level of excitement or a control group that does not play a game are used and measures of psychophysiological reactions are taken before, during, and after game play and during the test of aggressive behavior. If excitation transfer should be tested for multiplayer games, it would also be interesting to provide participants with a different target in the aggression test. This would rule out retaliation as a motive and demonstrate that the effect generalizes to other persons.

The General Aggression Model (Anderson & Bushman, 2002) also posits that aggressive affect can increase the likelihood and intensity of subsequent aggressive behavior. As three of the four items we used for our measure of negative affect also appear in the State Hostility Scale (Anderson et al., 1995), our results support this assumption. The emotional experience of frustration is certainly not the only precursor of aggressive behavior on the affective level (Berkowitz, 1989). However, based on our results, we are convinced that frustration plays a major role in the relationship between video game use and aggression for two reasons: First, separate *t* tests with game outcome as the grouping variable and the individual items of our short negative affect scale as outcome variables showed the strongest effect for the frustration item ($d = 1.43$, $p < .001$). As can be seen in Table 1, frustration also showed the strongest correlation with the aggression score ($\beta = .27$, $p < .05$) of all the aggressive affect items. Second, and more importantly, we were interested in frustration as an event that hinders a player from achieving a desired outcome (win-

ning) according to the definitions by Dollard et al. (1939) and Berkowitz (1989). From this perspective, the frustrating event is a cause of negative affect, which, in turn, intensifies aggressive behavioral tendencies. Frustration as an event belongs to the category of situational variables in the General Aggression Model and our findings lend further support to the notion that these situational variables go beyond game characteristics, such as violent content or game modes (Gentile, 2011). Frustrating events can also be understood as short-term stressors according to the Catalyst Model of Violent Crime (Ferguson et al., 2008).

That we were interested in coplayer behavior and game outcome as frustrating events and also measured frustration as an emotion may seem tautological. Although this was done to ensure a certain degree of comparability with previous work, this certainly is one of the limitations of this study. Another one is the manipulation of trash-talking. That trash-talking did not have an effect may be due to the fact that trash-talking is not a frustration in the strict sense of "an interference with the occurrence of an instigated goal-response" (Dollard et al., 1939, p. 7). Another possible explanation could be that the trash-talking in this study was too mild to have an effect. Because we only used one sports game in our study that two colocated players played against each other, the findings can also not be generalized for other games, genres, or game modes. One might also argue that a soccer game is not completely nonviolent, as players can tackle and injure others. In addition, soccer is a gendered sport that is seen as a predominantly male domain, at least in Germany. A third limitation besides the stimulus material and the operationalization of frustration is the measure of aggressive behavior we employed. Although some authors found evidence for the construct validity of the CRTT (Anderson & Bushman, 1997; Carnagey & Anderson, 2005; Giancola & Chermack, 1998), others have criticized it for a lack of standardization and convergent validity (Ferguson, 2007; Ferguson et al., 2008; Ferguson & Rueda, 2009; Tedeschi & Quigley, 1996). However, by modifying the CRTT for our purposes, we tried to address some of the problems identified in previous studies, and much of the criticism the CRTT received has also been directed at other laboratory measures of aggressive behavior, such as the Hot Sauce Paradigm (Ferguson & Rueda, 2009; Ritter & Eslea, 2005).

As this list of limitations clearly shows, there is a need for further research to investigate the link between frustration and aggression in video game play. To disentangle the relationship of aggressive emotions, thoughts, and behavior, follow-up studies on frustration could measure all of these dimensions. A more complex causal model could, for example, integrate aggressive cognition as an additional mediator of game-induced frustration on aggressive behavior. Using frustration as an independent variable could help in avoiding the problems caused by conceptualizing and measuring it as an emotion. Such a study would have to make sure that participants both want and expect to achieve a certain goal, such as winning a prize, and are then stopped from attaining it. Confederates acting as incompetent coplayers or superior opponents are one way to manipulate frustration. This would also allow for a comparison between cooperation and competition. Another possible variation is the degree of violent game content. Ideally, researchers should use games that differ in their degree of violent content, but are matched on other relevant dimensions, such as pace of action or difficulty (Adachi & Willoughby, 2011a). For studies focusing on nonviolent games, it might make sense to use sports games that are completely nonviolent and less gendered, such as tennis. In terms of gender it would also be worthwhile to explore whether the sex of the coplayer or opponent has an effect on negative affect and aggression. Besides sex, other personological variables such as trait aggression or competitiveness are likely to moderate any influence of game outcome or interaction with other players on aggression.

Apart from aggression, an interesting outcome variable that has not yet been studied with regard to frustration is prosocial behavior. Several studies have shown that playing video games cooperatively can not only reduce the negative impact of violent content (Greitemeyer, Traut-Mattausch, & Osswald, 2012), but also increase prosocial behavior (Ewoldsen et al., 2012; Velez et al., 2012). It would be interesting to see if frustrating gaming experiences, whether they are caused by superior opponents or incompetent coplayers, also affect prosocial behavior. Based on the findings from previous studies, there is reason to assume that

both an unfriendly interaction and an unfavorable outcome are detrimental to subsequent helping behavior or cooperation, especially if the source of the frustration and the target of the helping behavior are the same. Similar to the RT test used in our study, tasks like the modified prisoner's dilemma provide an opportunity to retaliate.

Although there certainly also are other mechanisms at work in the relationship of video game use and aggression and prosocial behavior, our findings and the open questions for follow-up studies suggest that frustration is as an important variable in this equation that warrants further exploration. While it seems that different processes, such as priming or excitation transfer, also play a role for the effects of competitive multiplayer games, we believe that the frustration–aggression hypothesis is a valuable perspective for research on video games and aggression that can help to broaden the theoretical scope and to disambiguate some of the contested findings in this field.

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