

# Effects of Violent Video Games on Aggressive Behaviors Among Children: The Role of Anger and Trait Aggression in China

Qian Zhang (✉ [zhq@swu.edu.cn](mailto:zhq@swu.edu.cn))

Southwest University

JingJin Tian

Southwest University

LunChao Chen

Southwest University

Yi Cao

Southwest University

---

## Research Article

**Keywords:** violent video games, aggressive behaviors, trait aggression, anger, children

**Posted Date:** January 6th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-139260/v1>

**License:**  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

The current study examined the violent video game effect on aggressive behaviors and the potential role of anger and trait aggression among Chinese children ( $n = 248$ ;  $M_{age} = 6.09$ ,  $SD = 0.21$ ). Half of them were randomly assigned to play a violent or a neutral video game for 20 minutes. Results showed that brief exposure of children to a violent video game produced a small but significant increases in aggressive behaviors. More specifically, males exhibited more aggressive behaviors than females in the violent game condition. Moderation analysis suggested that the violent video game effect on aggression was not moderated by trait aggression, but this effect was mediated by increased anger (especially for males). These findings indicated that males who were exposed to a violent video game might be regarded as the key group to reduce aggression by training to vent their anger. Results are interpreted within and support the framework of the General Aggression Model (GAM).

## 1. Introduction

Aggression refers to a type of behavior directed toward another individual that is carried out with the proximate intent to cause harm (Anderson, 2002). In particular, the perpetrator must ensure that the behavior would harm the target (Geen, 2001). In laboratory settings, artificial measures of aggression are used for children due to ethical reasons. In the present study, aggressive behavior is operationally defined as the level of hot sauce powder that children intentionally select for stranger in the picture.

### 1.1 Theories of aggression

To date, General Aggression Model (GAM), Self-Determination Theory (SDT) and Catalyst Model (CM) are common theoretical models to explain the causes and consequences of aggression. The GAM, a useful domain-specific theoretical framework, considers the influence of personal (i.e., trait aggression, attitudes, genetic predispositions, sex) and situational factors (e.g., games, films, songs) on aggressive behavior through mediating variables of cognition, affect, and arousal. All three of these mediating variables (internal states) lead to a decision process, which causes aggressive behaviors (Anderson & Bushman, 2018). The SDT is a broad theory of human personality and motivation concerned with how the individual interacts with and depends on the social environment. The SDT outlines how these self-determined motivations influence social and cognitive performance, and well-being (Ryan & Deci, 2017). The CM that details that family community, school, media violence and peer violence may be related to increased aggression, but not cause such aggression (Elson & Ferguson, 2014). In the current article, we focus on one situational variable—exposure to a violent video game—and how it influences internal state (e.g., anger) to increase the likelihood of aggression. Thus, we attempt to use the GAM as the theoretical framework to explain the violent video game effects on kindergartners.

### 1.2 Children and violent video games

Today, many young children are increasingly playing video games through their parents' smart-phones or tablets (Rideout, 2017). Exploring how violent content used in games for young children provides much-

needed information about whether the violent video games that is connected to how young children behave. Further, such information can help improve future video games by highlighting potential gaps in game design as well as provide educators with references to help select high-quality video games for learning. Thus, an ever growing number of kindergartners are playing video games, making our topic of violent video game effects relevant and timely. Specifically, longitudinal evidence suggests that violent video games exposure is an important independent predictor which contributes to aggression in children and adolescents (Teng, Nie, Guo, Zhang, Q., Liu, & Bushman, 2019; Tian, Gao, Wang, & Gao, 2020). As a child psychology researcher, we are more concerned about kindergartners who often use violent video games, track these kids who play video games, guide them to develop good game habits, and cooperate with parents to manage their gaming behavior reasonably.

### *1.3 Violent video games and aggressive behavior*

So far, the relationship between violent video games and aggressive behavior has been debated. A group of researchers who's work indicates a positive game violence-aggression link (Anderson et al., 2017; Chang & Bushman, 2019; Greitemeyer, 2019). However, critics have failed to find such causal link, and they argue that the conclusion of the above scholars is a publication bias (Ferguson, 2007). The critics contend that violent video game exposure can not promote aggression, or even the violent video game effect is null. Thus, critics state that some of game-aggression works are known to be false positives due to questionable researcher practices that are not replicated when reexamined (Ferguson & Wang, 2019; Mccarthy, Coley, Wagner, Zengel, & Basham, 2016; Przybylski & Weinstein, 2019). What's more, critics claim that the GAM is an inappropriate theoretical model of aggression because many studies have failed to support this model, and there assume Self-Determination Theory (SDT) and Catalyst Model (CM) are better theoretical framework (Ferguson & Dyck, 2012; Ferguson & Kilburn, 2010). The counter-research tends to portray links between violence in games and aggression as uncertain based on the evidence to the contrary. Thus, we may suggest being more cautious in asserting causal claims from prior literature. To our understanding, the relation between violent game play and aggression in kindergartners does not depend on whether the violent game effect exists, but on how such effect does occur.

### *1.4 Trait aggression, gender, and aggressive behavior*

Previous research findings have shown that individuals with high trait-aggression display more aggressive behavior than those with low trait-aggression (Anderson & Bushman, 2002; Teng, Nie, Guo, Zhang, Liu, & Bushman, 2019). Media violence is positively correlated with aggressive behaviors of individuals with high trait aggression (Anderson, 1997; Bushman, 1995; Marshall & Brown, 2006). Besides, there are significant gender differences in the violent game effects on aggressive behavior (Bartholow & Anderson, 2002; Hoeft, Watson, Kesler, Bettinger, & Reiss, 2008). Specifically, boys show more aggressive bias than girls when they are rewarded in a violent video game condition (Carnagey & Anderson, 2005; Cross & Campbell, 2012; Smith & Waterman, 2005). Thus, trait aggression and gender are potential moderators of aggressive behavior in regards to violent video games.

### *1.5 Anger as a potential mediator of aggressive behavior*

Anger is an important predictor of subsequent aggression by playing violent video games (Anderson & Bushman, 2002; Berkowitz, 1990; Giumetti & Markey, 2007; Petikas, 2013; Yao, Zhou, Li, & Gao, 2019). Nonetheless, a few researchers are skeptical of the key hypothesis that anger causes aggression (Geen, 2001). Noticeably, repeated exposure to violent video games enhances hostile feeling and aggressive behavior (Allen, Anderson, & Bushman, 2018). Given that aggression-related knowledge rehearsal structures are primed by anger, aggressive behavior is likely to be energized by increased anger. In many cases, individuals spill out anger and aggressive behavior when he/she is frustrated (Breuer & Elson, 2017; Dollard, Doob, Miller, Mowrer, Sears, & Faris, 1939). As such, frustration may induce anger, which, in turn, may lead to aggressive behavior outcomes. Thus, anger may become a mediator of aggressive behavior under the condition of violent video games.

### *1.6 The present study*

One goal of this study is to conduct a conceptual replication of violent video game effects on aggression in children across gender. A second objective is to provide experimental evidences at one potential moderating variable of violent game effect—trait aggression. The final objective is to look at one potential mediating variable of violent game effect—anger. On the basis of GAM and previous findings, our study proposes the following hypotheses:

**Hypothesis 1:** *Playing a violent video game will lead to more aggressive behavior than playing a neutral video game.*

**Hypothesis 2:** *Trait aggression and gender will moderate the violent video game effect on aggressive behavior.*

**Hypothesis 3:** *Anger will mediate the violent video game effect on aggressive behavior.*

## **2. Methods**

### *2.1 Participants*

The Research Ethics Committee of Southwest University approved the study. The participants were 248 children (50% females;  $M_{age} = 6.09$ ,  $SD = 0.21$ ) recruited from two Chinese kindergartens in Chongqing, Southwest of China. Participants were all of Han ethnicity. Half of them ( $n = 124$ ; 50% females) were randomly assigned to play a 20-min violent video game (treatment group), and the other half ( $n = 124$ ; 50% females) were randomly assigned to play a 20-min neutral video game (control group). No participant failed to complete the experiment. We obtained written and informed consent from all participants and their parents. Participants completed a battery of questionnaires in the form of oral self-report, including the Brief Aggression Questionnaire (BAQ), Anger Sub-scale of BPAQ. Then they completed the Hot Sauce Paradigm (HSP) in the quiet halls of kindergarten.

### *2.2 Experimental design*

Participants were randomly assigned to one of 4 conditions in a 2 (game: violent vs. neutral) x 2 (gender: males vs. females) between-subjects experimental design (A randomized control study). The independent variables were game and gender, and the dependent variables were anger and aggressive behavior (setting levels of hot sauce powder).

## *2.3 Materials*

### 2.3.1 Video games

We chose two video games “Street Fighter II” and “Tetris” as the materials for children to play. Street Fighter II is a Japanese fighting game. Players can choose one of the characters to fight against the opponents, and use the blood content to represent the lifeline of the game character. The game characters come from different countries (e.g., USA, Russia, China) and all of them have unique killing skills. Tetris is a Russia puzzle game. Different shapes of plates are made up of small squares, which fall from the top of the screen one by one. Players can make them spell one or several pieces at the bottom of the screen by adjusting the position and direction of the plates. These complete bars will disappear immediately, making place for the newly fallen plates, and players will be rewarded with corresponding points. These blocks that have not been eliminated are piling up. Once they reach the top of the screen, players lose the game.

We invited 10 game developers, 10 kindergarten teachers, 10 child psychologists and 10 parents to assess the violent degree of the two games with a scale anchored 5-point score (1 = low, 5 = high) to be carefully matched on variables in terms of the following criteria: (1)Pleasure, (2)Interest, (3)Violent Content, (4)Violent Scene, (5)Difficulty, (6)Familiarity, (7)Excitement, and (8)Action (Adachi & Willoughby, 2011). Half of them played Street Fighter II or Tetris for 20 minutes. An independent sample *t*-test was used to compare the violent degree of the two video games. The results showed that the rating score of Street Fighter II was significantly higher than that of Tetris in terms of Violent Content and Violent Scene. However, there is no significant difference in Pleasure, Difficulty, Familiarity, Interest, Excitement, and Action (see Table 1). Based on the criteria that media violence mainly depends violent content and violent scene (Anderson & Dill, 2000), we therefore select Street Fighter II and Tetris as the violent video game and the neutral video game, respectively.

Table 1.

The rating results of violent degree of video games ( $N = 40$ ).

Criteria	Street Fighter II $M \pm SD$	Tetris $M \pm SD$	$t$	$d$
Pleasure	4.20 $\pm$ 0.70	4.25 $\pm$ 0.44	-0.27	-0.09
Interest	4.20 $\pm$ 0.77	3.40 $\pm$ 1.19	0.63	0.20
Content	4.30 $\pm$ 0.86	2.40 $\pm$ 0.99	6.45***	2.04
Scene	4.65 $\pm$ 0.49	1.90 $\pm$ 1.52	7.71***	2.44
Difficulty	2.75 $\pm$ 1.16	2.70 $\pm$ 0.86	0.15	0.05
Familiarity	4.30 $\pm$ 1.17	4.45 $\pm$ 0.83	-0.47	-0.15
Excitement	4.00 $\pm$ 1.34	2.85 $\pm$ 1.63	1.23	0.39
Action	4.45 $\pm$ 0.69	4.10 $\pm$ 0.91	1.37	0.43

Note. \*  $p < 0.05$ , \*\*\*  $p < 0.001$ .

### 2.3.2 Trait aggression

Trait aggression (TA) was measured by the Brief Aggression Questionnaire (BAQ; Webster et al., 2015). We used a self-reported method to assess trait aggression of kindergartners because of their limited literacy (i.e., The experimenter asked questions orally and the subjects answered them orally). BAQ is a 12-item standardized scale, including physical aggression (e.g., if someone hurts me, I will hurt back), verbal aggression (e.g., when someone hurts me, I will tell him what I think), anger (e.g., I cannot control my temper) and hostility (e.g., I often feel that my partner calls me a nickname behind my back). It was a Likert 5-point scale (1 = very disagree, 5 = very agree). In the present study, the Cronbach's alpha of total scale was 0.98, and the total score was used.

### 2.3.3 Anger

We used the sub-scale of anger from Buss-Perry Aggression Questionnaire (BPAQ; items 1, 5, 7, 8, 9, 15, 19, 23, 28) to measure levels of anger (Buss & Perry, 1992). We also used a self-reported method to assess anger of kindergartners after they played the assigned game. The sub-scale of anger was anchored five points (1 = very disagree, 5 = very agree). The internal consistency reliability coefficient of anger sub-scale of BPAQ was 0.83. In the present study, the Anger Sub-scale showed a good internal consistency reliability (Cronbach's  $\alpha = 0.97$ ).

### 2.3.4 Aggressive behavior

The hot sauce paradigm (HSP), an artificial/proxy measure of aggression, was used to measure kindergartner's aggressive behavior in laboratory settings due to ethical reasons. Specifically, the

experimenter showed participants a picture of a child who was very uncomfortable when eating peppers. However, participants were required to choose spoons of hot sauce powder from zero spoon (no aggressive behavior = zero points) to five spoons (aggressive behavior = 5 points) for the child in the picture to eat. The specific spoon of hot sauce participants chose for the child was a measure of aggressive behavior. The more spoons the participants chose for the child in the picture, the more aggressive the participants were. Previous research has shown that this experimental paradigm is positively correlated with the trait aggression scores measured by Buss-Perry Aggression Questionnaire and has good reliability and validity (Adachi, 2015; Sun & Liu, 2019).

#### 2.4. Procedure

Following the selection of the participants, the subjects and their parents signed the informed consent forms and agreed to participate in the experiment. Participants were then asked to complete BAQ to measure trait aggression. Afterwards, participants were randomly assigned to play an assigned violent or a neutral game for 20 minutes. 62 males played a violent video game, while 62 males played a neutral video game; 62 females played a violent video game, while 62 females played a neutral video game. Then experimental assistants interviewed with the participants about their anger using anger sub-scale of BPAQ. Finally, each participant completed the HSP and received a nice gift for participation. No participants expressed any suspicion during debriefing process by a post-experimental interview.

### 3. Results

#### 3.1 Descriptive statistics

Table 2 summarizes the means, standard deviations, and the cell sample sizes of aggressive behavior across 4 conditions.

Table 2.

Means and standard deviations of aggressive behavior ( $N = 248$ ).

Game	Males	$N$	Females	$N$
	$M \pm SD$		$M \pm SD$	
Violent	2.71 $\pm$ 0.66	62	2.39 $\pm$ 0.64	62
Neutral	2.32 $\pm$ 0.57	62	2.42 $\pm$ 0.53	62
Total	2.52 $\pm$ 0.64	124	2.40 $\pm$ 0.58	124

#### 3.2 Analysis of variance on anger

We used a 2 x 2 analysis of variance (ANOVA) to test the violent video game effects on anger in 4 conditions. The main effect of game on anger was significant. Playing a violent video game caused more anger than playing a neutral video game [ $M = 3.87$  ( $SD = 0.10$ ) versus  $M = 2.25$  ( $SD = 0.10$ );  $F(1,244) = 121.63$ ,  $p < 0.001$ ,  $d = 1.41$ , part.  $\eta^2 = 0.33$ ]. However, the main effect of gender on anger was non-significant [ $F(1,244) = 1.89$ ,  $p = 0.17$ ,  $d = 0.18$ , part.  $\eta^2 = 0.008$ ]. In addition, the game x gender interaction on anger was non-significant [ $F(1,244) = 0.05$ ,  $p = 0.83$ ,  $d = 0.03$ , part.  $\eta^2 < 0.001$ ].

### 3.3 ANOVA on aggressive behaviors

To test Hypotheses 1 and 2, we used a 2 x 2 ANOVA to test the violent video effects on aggressive behavior. The main effect of game on aggressive behavior was small but significant. Playing a violent video game led to more aggressive behavior than playing a neutral video game [ $M = 2.55$  ( $SD = 0.05$ ) versus  $M = 2.37$  ( $SD = 0.05$ );  $F(1,244) = 5.40$ ,  $p = 0.02$ ,  $d = 0.30$ , part.  $\eta^2 = 0.02$ ]. However, the main effect of gender on aggressive behavior was not significant [ $F(1,244) = 2.19$ ,  $p = 0.14$ ,  $d = 0.19$ , part.  $\eta^2 = 0.009$ ]. In addition, the game x gender interaction on aggressive behavior was significant [ $F(1,244) = 7.55$ ,  $p = 0.006$ ,  $d = 0.35$ , part.  $\eta^2 = 0.03$ ]. A simple effect analysis indicated that males reported more aggressive behavior than females in the violent video game condition [ $M = 2.71$  ( $SD = 0.08$ ) versus  $M = 2.39$  ( $SD = 0.08$ );  $F(1,244) = 8.93$ ,  $p = 0.003$ ,  $d = 0.38$ , part.  $\eta^2 = 0.04$ ], whereas no significant gender effects were found in the neutral video game condition [ $M = 2.32$  ( $SD = 0.08$ ) versus  $M = 2.42$  ( $SD = 0.08$ );  $F(1,244) = 0.80$ ,  $p = 0.37$ ,  $d = 0.11$ , part.  $\eta^2 = 0.003$ ] (Fig. 1).

### 3.4 Trait aggression as a moderator of aggressive behavior

To test Hypothesis 2 that trait aggression is a potential moderator of violent video game effect on aggressive behaviors, we run a moderation analysis by conducting the PROCESS macro 3.0 (Model 1) of SPSS 21.0 with all data standardized. In this model, violent video game is entered as a predictor, trait aggression (continuous variable) is the moderator, aggressive behavior is the outcome variable, and gender is controlled as a covariate (because of significant game x gender interaction). The results show that the moderating effect of trait aggression is not significant ( $F(1,243) = 0.14$ ,  $\beta = 0.02$ ;  $SE = 0.06$ , 95% CI = [-0.10, 0.15]) (see Table 3).

Table 3.

Testing the moderation effect of violent video games on aggression (standardized coefficients).

Outcome	Predictors	R <sup>2</sup>	F	$\beta$	t	95% CI
Aggressive behaviors	VVG	0.03	2.03	0.15	2.31*	(0.02; 0.27)
	TA			0.05	0.80	(-0.07; 0.18)
	VVG x TA			0.02	0.38	(-0.10; 0.15)
	Gender			-0.18	-1.46	(-0.43; 0.06)

Abbreviation: CI, confidence interval; VVG, violent video games; TA, trait aggression.

\* $p < 0.05$ .

### 3.5 Anger as a mediator of aggressive behavior

Given that violent video game exposure increases anger and aggressive behavior, we further test whether anger can mediate the violent game effect. A single mediator model and bootstrapping [adjusted bootstrap samples 5000 times, 95% Confidence Interval (CI)] are used to assess the indirect effect of game on aggressive behavior (Hayes & Preacher, 2014; MacKinnon & Fairchild, 2009). Gender is controlled as a covariate because of significant game x gender interaction on aggressive behavior. Given that the correlation between anger and average number of hot sauce spoons was significant [ $r = 0.21$ ,  $p = 0.001$ ], anger was a likely mediation candidate.

As shown in Fig. 2, the direct effect of violent video games on aggressive behavior was non-significant ( $\beta = 0.04$ ,  $SE = 0.08$ , 95% CI: [-0.11; 0.19]). However, violent video games significantly predicted anger ( $\beta = 0.58$ ,  $SE = 0.05$ , 95% CI: [0.47; 0.68]), anger significantly predicted aggressive behavior ( $\beta = 0.19$ ,  $SE = 0.08$ , 95% CI: [0.04; 0.34]). As a result, the violent game effect was wholly mediated through increased anger ( $\beta = 0.11$ ,  $SE = 0.04$ , 95% CI: [0.02; 0.19]).

Specifically, we further test whether anger mediates the violent video game effect on aggressive behavior for males and females. The direct effect of violent video games on aggressive behavior was non-significant for males ( $\beta = 0.18$ ,  $SE = 0.11$ , 95%CI: [-0.04; 0.39]) and females ( $\beta = -0.11$ ,  $SE = 0.10$ , 95%CI: [-0.32; 0.10]). Violent video games significantly predicted anger for males ( $\beta = 0.57$ ,  $SE = 0.07$ , 95% CI: [0.43; 0.71]) and females,  $\beta = 0.59$ ,  $SE = 0.08$ , 95% CI: [0.44; 0.74]. Anger significantly predicted aggressive behavior for males ( $\beta = 0.25$ ,  $SE = 0.11$ , 95% CI: [0.02; 0.47]), but not for females ( $\beta = 0.14$ ,  $SE = 0.10$ , 95% CI: [-0.06; 0.34]). As a result, the violent video game effect was wholly mediated through increased anger for males ( $\beta = 0.14$ ,  $SE = 0.06$ , 95% CI: [0.02; 0.27]), but not for females ( $\beta = 0.08$ ,  $SE = 0.06$ , 95% CI: [-0.03; 0.20])(Fig. 3).

## 4. Discussion

As expected, our results support Hypothesis 1, which suggests that brief exposure to a violent video game produces a small but significant increase in aggressive behavior. As such, the result of a positive game violence-aggression linkage is consistent with previous researches that violent video game exposure was associated with high levels of aggression (Gao, Weng, Zhou, & Yu, 2017; Hasan, Bègue, Scharnow, & Bushman, 2013; Teng, Nie, Guo, Zhang, Liu, & Bushman, 2019; Yao, Zhou, Li, & Gao, 2019). Why do kindergartners in a violent video game condition show more anger and aggressive behavior than those in a neutral video game condition? Perhaps kindergartners display a delayed imitation of aggressive behavior from the violent game characters to form rehearsed knowledge structures, and thus causes later aggressive behavior (more spoons of hot sauce). Besides, exposure to violent video games may reduce the empathy and morality to result in gamer's aggression (Harenski, Antonenko, Shane, & Kiehl, 2008;

Zhen, Xie, Zhang, Wang, & Li, 2011). The finding suggests that policy makers may consider establishing a policy to assess and classify the level of violence in video games played by kindergartners. Educators and parents may prevent kindergartners from being exposed to violent video games to prevent their possible aggressive behaviors.

Our results support Hypothesis 2, which suggests that gender is a moderator of aggressive behavior. The finding replicates previous study that boys are more sensitive to aggression than girls (Smith & Waterman, 2005). Males are more likely to solve interpersonal conflicts by resorting to violence (e.g., bullying, perpetration), whilst females have more empathetic concern and sensitivity of moral cognition than males in the face of violence (Jolliffe & Farrington, 2006; Toussaint & Webb, 2005). In addition, males are more aggressive than females because males involve more physical activity than females during childhood (Archer, 2009; Anderson, Buckley, & Carnagey, 2008; Carlo, Raffaelli, Laible, & Meyer, 1999). The finding suggests that educators should care more about the violent video game effects on males than females. Specifically, educators and parents may guide males how to choose suitable game types, and pay more attention to male violent game users. Contrary to Hypothesis 2, our study has found that trait aggression cannot moderate the violent game effect on aggression. The finding is consistent with previous literature that the violent game effect is not moderated by trait aggression (Anderson et al., 2010; Gentile, Li, Khoo, Prot, & Anderson, 2014; Teng, Nie, Zhu, & Guo, 2020). Thus, trait aggression may not be considered as a necessary factor to intervene kindergarten's aggression in the condition of violent video games.

Our results support Hypothesis 3, which suggests that the violent game effect on aggressive behavior is mediated by increased anger. Thus the anger-aggression link may reinforce the positive game violence-aggression link. This finding is consistent with prior cognitive-neoassociationistic analysis that anger is related to aggression (Berkowitz, 1990; Giumetti & Markey, 2007; Petikas, 2013). The possible reason is that violent video games arouse aggressive affect to cause aggression, at least when being provoked (as they are in this experimental design). In particular, the mediation effect of anger on aggressive behavior is especially significant for males, indicating that males may be more easily aroused anger than females under the context of violent video games. Given that the game x gender interaction and mediating effect were significant for males, educators may teach males in kindergarten how to vent anger in order to alleviate aggressive behavior after violent video game exposure.

The findings of the experimental study provides some useful information on the question of how playing a violent video game increases aggression across gender by recruiting a non-Western children sample. The experimental method and randomization of participants does allow us to draw causal inferences. The causal relationship can be claimed as a strong point of our study. In addition, the mediating role of anger indicates that reducing exposure to violent video games and reasonably venting anger may be effective intervention measures to reduce aggressive behavior of kindergartners (especially for males). Anger (internal state) mediates the violent video game effects on aggression in Chinese kindergartners, which also supports the GAM as an effective theoretical model.

Despite the strengths discussed above, the present study has several limitations as follows. First, the similar age sample (6-year-olds) may limit the generalizability of the finding to other age groups. Future experimental study may consider expanding the age range to improve the external validity. Second, we have made claims that play a violent video game leads to increased aggression, especially for males. However, the label of aggression is often associated with acts of physical aggression, verbal aggression, and relational aggression. While the hot sauce paradigm is interesting and is an ethical way of measuring “aggression” in the lab, it really only infers aggressive behavior. So far, there are hardly studies can suggest that this task is related to observed or self-reported physical or relational aggression in the real world. Thus perhaps it is an overstatement to suggest that playing a violent video game leads to aggression in real life settings. More caution is needed when interpreting the findings related to “aggressive behavior” in the hot sauce paradigm. The potential lack of ecological validity between the hot sauce paradigm in the laboratory and aggressive behavior in the real world should be specifically addressed in future research. Third, although the BAQ and Anger Sub-scale have good reliability, they may not be suitable for the measurement of kindergartners in China. Researchers may be skeptical of the reliability of six-year-olds filling out self-report measures of aggression and anger or, for that matter, understanding the hot sauce paradigm may be questioned. Therefore, we may consider the development of Chinese kindergartner’s anger and trait aggression scale in the form of oral report to avoid potential cultural differences. Besides, perhaps the novelty to theoretical contribution is limited in this field because dozens of studies have addressed the issue concerning the impact of violent video games on aggressive behavior in Western adults, although these findings have been controversial.

## **5. Conclusion**

In closing, our findings suggest that short-term exposure to violent video games may constitute an important situational contributor to increases in aggressive behavior, especially for males. To some extent, violent video game exposure may be a risk factor for aggression in Chinese kindergartners. In addition, the violent video game effect on aggression was mediated by increased anger, especially for males. This study further expands the understanding of the mechanisms underlying violent video game effect on aggressive behavior in Chinese kindergartners by the role of anger, and its findings are novel and interesting. Our experimental work provides an important piece of this knowledge. Findings support the general aggression model (GAM) and provide useful information for policy and practice. For example, educators and parents may prompt children to train to vent their anger in an appropriate way to decrease aggression. Specifically, males may be regarded as the key group in the reduction and prevention of aggression under the context of violent video games. To this end, the current experiment offers a foundation for future work in this field.

## **Declarations**

### **Author Contributions**

QZ, YC, LC and JT conceived and designed the experiments. QZ, LC and JT performed the experiments. QZ and YC analyzed the data. QZ, YC, LC and JT wrote the draft. All authors reviewed the manuscript.

## Acknowledgments

This work was supported by National Social Science Foundation of China (Grant no. 17CSH006), the Grant of Chongqing University Teachers and students' Ideological and Political Work Research and Consultation Center (20SZYZZD005), the Grant of Planned Social Sciences in Chongqing (2017YBJY085), and the Major Grant of Basic Education Quality Monitoring Collaborative Innovation Center in China (2020-06-005-BZPK01). We thank the parents, children, and teachers who participated in this study.

## Conflict of Interest

The authors declare that they have no conflict of interest to disclose.

## Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The Research Ethics Committee of Southwest University approved the study.

## Informed Consent

Informed consent was obtained from all parents and informed assent was obtained from all children included in the experiment.

## Data Availability Statement

All data generated during this study are included in this published article [and its supplementary information files].

## References

1. Adachi, P. J. C. (2015). Demolishing the competition: The association between competitive video game play and aggression among adolescents and young adults. *Journal of Ecclesiastical History*, 52(3), 409–433. <https://doi.org/10.1017/S0022046901008636>
2. Adachi, P. J. C., & Willoughby, T. (2011). The effect of violent video games on aggression: Is it more than just the violence? *Aggression and Violent Behavior*, 16(1), 55–62. <https://doi.org/10.1016/j.avb.2010.12.002>
3. Allen, J. J., Anderson, C. A., & Bushman, B. J. (2018). The general aggression model. *Current Opinion in Psychology*, 19(2), 75–80. <https://doi.org/10.1016/j.copsy.2017.03.034>

4. Anderson, C. A. (1997). Effects of violent movies and trait hostility on hostile feelings and aggressive thoughts. *Aggressive Behavior, 23*(3), 161–178. [https://doi.org/10.1002/\(SICI\)1098-2337\(1997\)23:3<161::AID-AB2>3.0.CO;2-P](https://doi.org/10.1002/(SICI)1098-2337(1997)23:3<161::AID-AB2>3.0.CO;2-P)
5. Anderson, C. A. (2002). Violent video games and aggressive thoughts, feelings, and behaviors. In S. L. Calvert, A. B. Jordan, & R. R. Cocking (Eds.), *Children in the digital age: Influences of electronic media on development* (pp. 101–119). Praeger Publishers/Greenwood Publishing Group.
6. Anderson, C. A., Buckley, K. E., & Carnagey, N. L. (2008). Creating your own hostile environment: A laboratory examination of trait aggressiveness and the violence escalation cycle. *Personality and Social Psychology Bulletin, 34*(4), 462–473. <https://doi.org/10.1177/0146167207311282>
7. Anderson, C. A., & Bushman, B. J. (2018). Media violence and the General Aggression Model. *Journal of Social Issues, 74*(2), 386–413. <https://doi.org/10.1111/josi.12275>
8. Anderson, C. A., & Dill, K. E. (2000). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. *Journal of Personality and Social Psychology, 78*(4), 772–790. <https://doi.org/10.1037//0022-3514.78.4.772>
9. Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., & Saleem, M. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: A meta-analytic review. *Psychological Bulletin, 136*(2), 151–173. <https://doi.org/10.1037/a0018251>
10. Anderson, C. A., Suzuki, K., Swing, E. L., Groves, C. L., Gentile, D. A., Prot, S., Lam C. P., Sakamoto, A., Horiuchi, Y., Krahe, B., Jelic, M., Liu, Q. W., Toma, R., Warburton, W. A., Zhang, X. M., Tajima, S., Qing, F., & Petrescu, P. (2017). Media violence and other aggression risk factors in seven nations. *Personality and Social Psychology Bulletin, 43*(7), 986–998. <https://doi.org/10.1177/0146167217703064>
11. Archer, J. (2009). Does sexual selection explain human sex differences in aggression? *Behavioral and Brain Sciences, 32*(3–4), 249–266. <https://doi.org/10.1017/S0140525X09990951>
12. Bartholow, B. D., & Anderson, C. A. (2002). Effects of violent video game on aggressive behavior: Potential sex differences. *Journal of Experimental Social Psychology, 38*, 283–290. <https://doi.org/10.1006/jesp.2001.1502>
13. Berkowitz, L. (1990). On the formation and regulation of anger and aggression: A cognitive-neoassociationistic analysis. *American Psychologist, 45*(4), 494–503. <https://doi.org/10.1037/0003-066X.45.4.494>
14. Boutwell, B. B., Franklin, C. A., Barnes, J. C., & Beaver, K. M. (2011). Physical punishment and childhood aggression: The role of gender and gene–environment interplay. *Aggressive Behavior, 37*(6), 559–568. <https://doi.org/10.1002/ab.20409>
15. Breuer, J., & Elson, M. (2017). *Frustration-aggression theory*. The Wiley handbook of violence and aggression. John Wiley & Sons, Ltd.
16. Bushman, B. J. (1995). Moderating role of trait aggressiveness in the effects of violent media on aggression. *Journal of Personality and Social Psychology, 69*(5), 950–960. <https://doi.org/10.1037//0022-3514.69.5.950>

17. Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, *63*(3), 452–459. <https://doi.org/10.1037/0022-3514.63.3.452>
18. Carlo, G., Raffaelli, M., Laible, D. J., & Meyer, K. A. (1999). Why are girls less physically aggressive than boys? Personality and parenting mediators of physical aggression. *Sex Roles*, *40*(9-10), 711–729. <https://doi.org/10.1023/A:1018856601513>
19. Carnagey, N. L., & Anderson, C. A. (2005). The effects of reward and punishment in violent video games on aggressive affect, cognition, and behavior. *Psychological Science*, *16*(11), 882–889. <https://doi.org/10.1111/j.1467-9280.2005.01632.x>
20. Chang, J. H., & Bushman, B. J. (2019). Effect of exposure to gun violence in video games on children's dangerous behavior with real guns: A randomized clinical trial. *JAMA*, *2*, e194319. <https://doi.org/10.1001/jamanetworkopen.2019.4319>
21. Cross, C. P., & Campbell, A. (2012). The effects of intimacy and target sex on direct aggression: Further evidence. *Aggressive Behavior*, *38*, 272–280. <https://doi.org/10.1002/ab.21430>
22. Dollard, J., Doob, L. W., Miller, N. E., Mowrer, O. H., Sears, R. W., & Faris, E. (1939). Frustration and aggression. *American Journal of Sociology*, *92*(7), 1654–1667. <https://doi.org/10.1037/10022-000>
23. Elson, M., & Ferguson, C. J. (2014). Does doing media violence research make one aggressive? The ideological rigidity of social-cognitive theories of media violence and a response to Bushman and Huesmann (2013), Krahe (2013), and Warburton (2013). *European Psychologist*, *19*(1), 68–75. <https://doi.org/10.1027/1016-9040/a000185>
24. Gentile, D. A., Li, D., Khoo, A., Prot, S., & Anderson, C. A. (2014). Mediators and moderators of long-term effects of violent video games on aggressive behavior: Practice, thinking, and action. *JAMA Pediatrics*, *168*(5), 450–457. <https://doi.org/10.1001/jamapediatrics.2014.63>
25. Ferguson, C. J. (2007). Evidence for publication bias in video game violence effects literature: A meta-analytic review. *Aggression and Violent Behavior*, *12*(4), 470–482. <https://doi.org/10.1016/j.avb.2007.01.001>
26. Ferguson, C. J., & Dyck, D. (2012). Paradigm change in aggression research: The time has come to retire the general aggression model. *Aggression and Violent Behavior*, *17*(3), 220–228. <https://doi.org/10.1016/j.avb.2012.02.007>
27. Ferguson, C. J., & Kilburn, J. (2010). Much ado about nothing: The misestimation and overinterpretation of violent video game effects in Eastern and Western nations: Comment on Anderson et al. (2010). *Psychological Bulletin*, *136*(2), 174–178. <https://doi.org/10.1037/a0018566>
28. Ferguson, C. J., & Wang, J. C. (2019). Aggressive video games are not a risk factor for future aggression in youth: A longitudinal study. *Journal of Youth and Adolescence*, *48*(8), 1439–1451. <https://doi.org/10.1007/s10964-019-01069-0>
29. Gao, X. M., Weng, L., Zhou, Y., & Yu, H. (2017). The Influence of empathy and morality of violent video game characters on gamers' aggression. *Frontiers in Psychology*, *8*, 1863–1870. <https://doi.org/10.3389/fpsyg.2017.01863>
30. Geen, R. G. (2001). *Human aggression (2nd ed.)*. Taylor & Francis.

31. Giumetti, G. W., & Markey, P. M. (2007). Violent video games and anger as predictors of aggression. *Journal of Research in Personality, 41*(6), 1234–1243. <https://doi.org/10.1016/j.jrp.2007.02.005>
32. Greitemeyer, T. (2019). The contagious impact of playing violent video games on aggression: Longitudinal evidence. *Aggressive Behavior, 45*(6), 635–642. <https://doi.org/10.1002/ab.21857>
33. Harenski, C. L., Antonenko, O., Shane, M. S., & Kiehl, K. A. (2008). Gender differences in neural mechanisms underlying moral sensitivity. *Social Cognitive and Affective Neuroscience, 3*(4), 313–321. <https://doi.org/10.1093/scan/nsn026>
34. Hasan, Y., Bègue, L., Scharnow, M., & Bushman, B. J. (2013). The more you play, the more aggressive you become: A long-term experimental study of cumulative violent video game effects on hostile expectations and aggressive behavior. *Journal of Experimental Social Psychology, 49*(2), 224–227. <https://doi.org/10.1016/j.jesp.2012.10.016>
35. Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology, 67*(3), 451–470. <https://doi.org/10.1111/bmsp.12028>
36. Hoeft, F., Watson, C., Kesler, S., Bettinger, K., & Reiss, A. (2008). Gender differences in the mesocorticolimbic system during computer game-play. *Journal of Psychiatric Research, 42*(4), 253–258. <https://doi.org/10.1016/j.jpsychires.2007.11.010>
37. Jolliffe, D., & Farrington, D. P. (2006). Examining the relationship between low empathy and bullying. *Aggressive Behavior, 32*(6), 540–550. <https://doi.org/10.1002/ab.20154>
38. MacKinnon, D. P., & Fairchild, A. J. (2009). Current directions in mediation analysis. *Current Directions in Psychological Science, 18*(1), 16–20. <https://doi.org/10.1111/j.1467-8721.2009.01598.x>
39. Marshall, M. A., & Brown, J. D. (2006). Trait aggressiveness and situational provocation: A test of the traits as situational sensitivities (TASS) model. *Personality and Social Psychology Bulletin, 32*(8), 1100–1113. <https://doi.org/10.1177/0146167206288488>
40. Mccarthy, R. J., Coley, S. L., Wagner, M. F., Zengel, B., & Basham, A. (2016). Does playing video games with violent content temporarily increase aggressive inclinations? a pre-registered experimental study. *Journal of Experimental Social Psychology, 67*(11), 13–19. <https://doi.org/10.1016/j.jesp.2015.10.009>
41. Petikas, N. C. (2013). *Effects of pro-social video games on state anger and helping behavior. Dissertations and Theses.* Hofstra University, ProQuest Dissertations Publishing.
42. Przybylski, A. K., & Weinstein, N. (2019). Violent video game engagement is not associated with adolescents' aggressive behaviour: Evidence from a registered report. *Royal Society open science, 6*(2), 171474. <https://doi.org/10.1098/rsos.171474>
43. Rideout, V. (2017). *The common sense census: Media use by kids age zero to eight.* San Francisco, CA: Common sense media.
44. Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness.* The Guilford Press.

45. Smith, P., & Waterman, M. (2005). Sex differences in processing aggression words using the emotional Stroop task. *Aggressive Behavior, 31*(3), 271–282. <https://doi.org/10.1002/ab.20071>
46. Sun, J. Y., & Liu, Y. L. (2019). The effect of competitive context on player's cooperative tendency and aggressive tendency in the non-violent video game. *Psychological Development and Education, 35*(1), 32–39. <https://doi.org/10.16187/j.cnki.issn1001-4918.2019.01.04>
47. Teng, Z. J., Nie, Q., Guo, C., Zhang, Q., Liu, Y. L., & Bushman, B. J. (2019). A longitudinal study of link between exposure to violent video games and aggression in Chinese adolescents: The mediating role of moral disengagement. *Developmental Psychology, 55*(1), 184–195. <https://doi.org/10.1037/dev0000624>
48. Teng, Z. J., Nie, Q., Zhu, Z. G., & Guo, C. (2020). Violent video game exposure and (Cyber)bullying perpetration among Chinese youth: The moderating role of trait aggression and moral identity. *Computers in Human Behavior, 104*(3), 106–115. <https://doi.org/10.1016/j.chb.2019.106193>
49. Tian, Y., Gao, M., Wang, P., & Gao, F. (2020). The effects of violent video games and shyness on individuals' aggressive behaviors. *Aggressive Behavior, 46*(1), 16–24. <https://doi.org/10.1002/ab.21869>
50. Toussaint, L., & Webb, J. R. (2005). Gender differences in the relationship between empathy and forgiveness. *The Journal of Social Psychology, 145*, 673–685. <https://doi.org/10.3200/SOCP.145.6.673-686>
51. Webster, G. D., Dewall, C. N., Pond, R. S., Deckman, T., Jonason, P. K., & Le, B. M., et al. (2015). The brief aggression questionnaire: Structure, validity, reliability, and generalizability. *Journal of Personality Assessment, 97*(6), 1–12. <https://doi.org/10.1080/00223891.2015.1044093>
52. Yao, M. Y., Zhou, Y. H., Li, J. Y., & Gao, X. M. (2019). Violent video games exposure and aggression: The role of moral disengagement, anger, hostility, and disinhibition. *Aggressive Behavior, 45*(6), 662–670. <https://doi.org/10.1002/ab.21860>
53. Zhen, S. J., Xie, H. L., Zhang, W., Wang, S. J., & Li, D. P. (2011). Exposure to violent computer games and Chinese adolescents' physical aggression: The role of beliefs about aggression, hostile expectations, and empathy. *Computers in Human Behavior, 27*(5), 1675–1687. <https://doi.org/10.1016/j.chb.2011.02.006>

## Figures

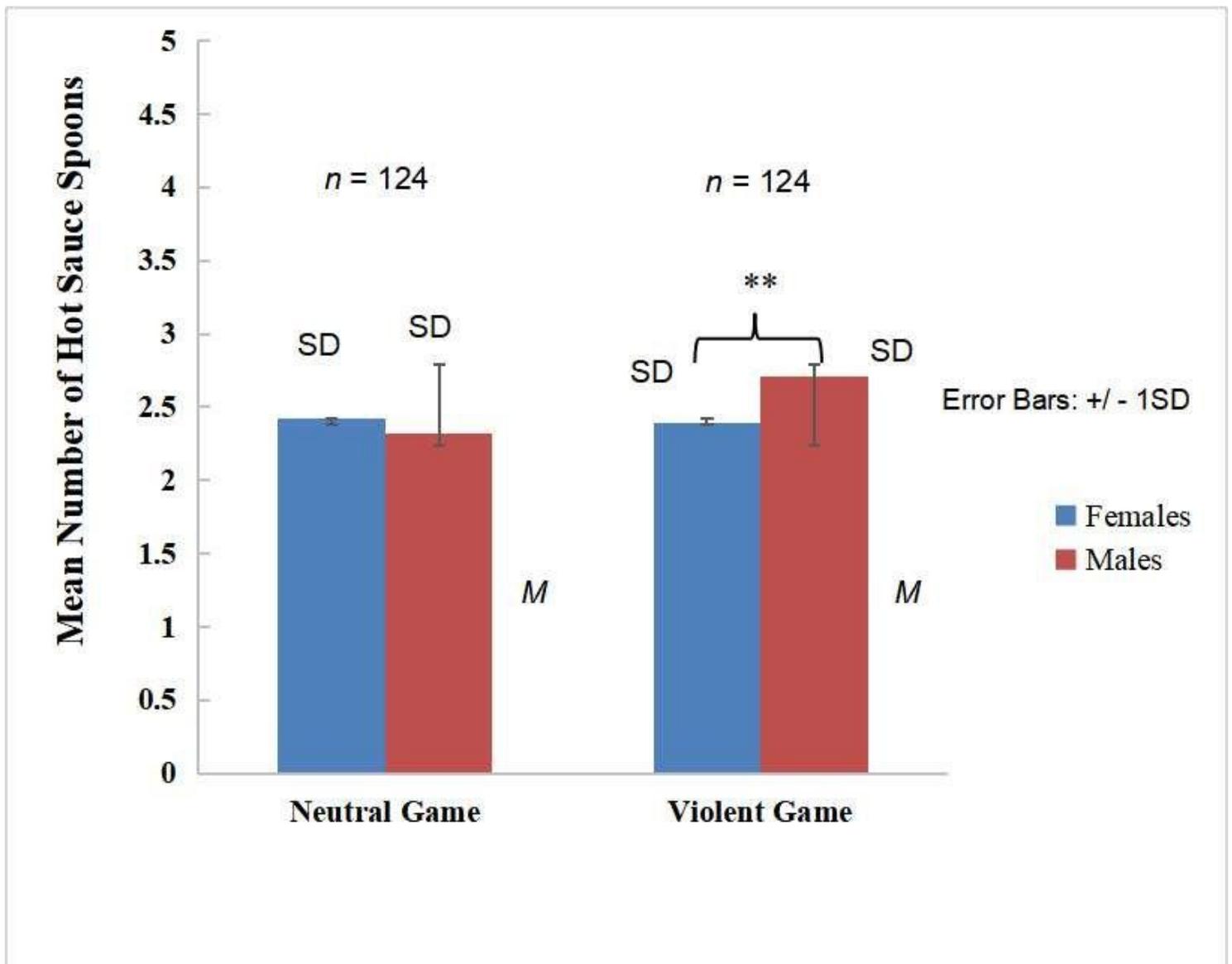
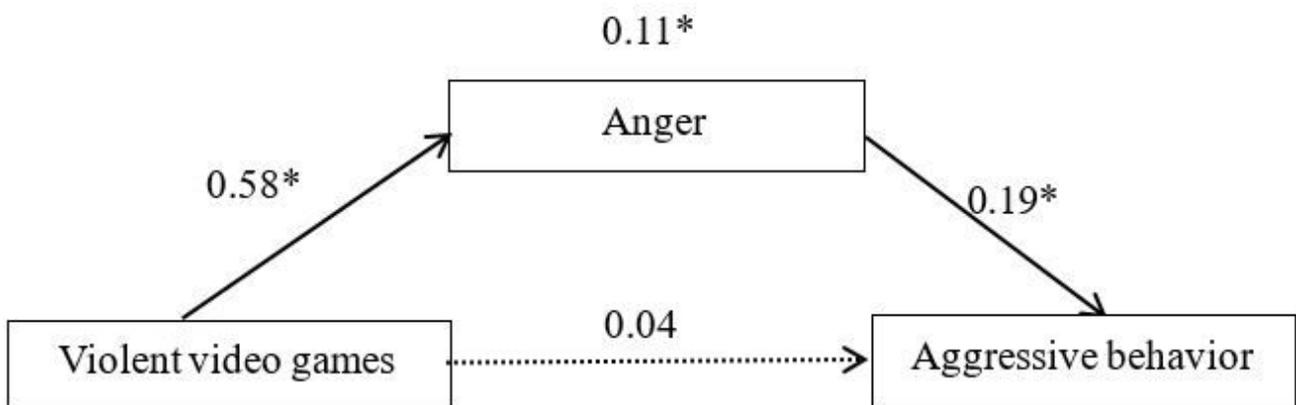


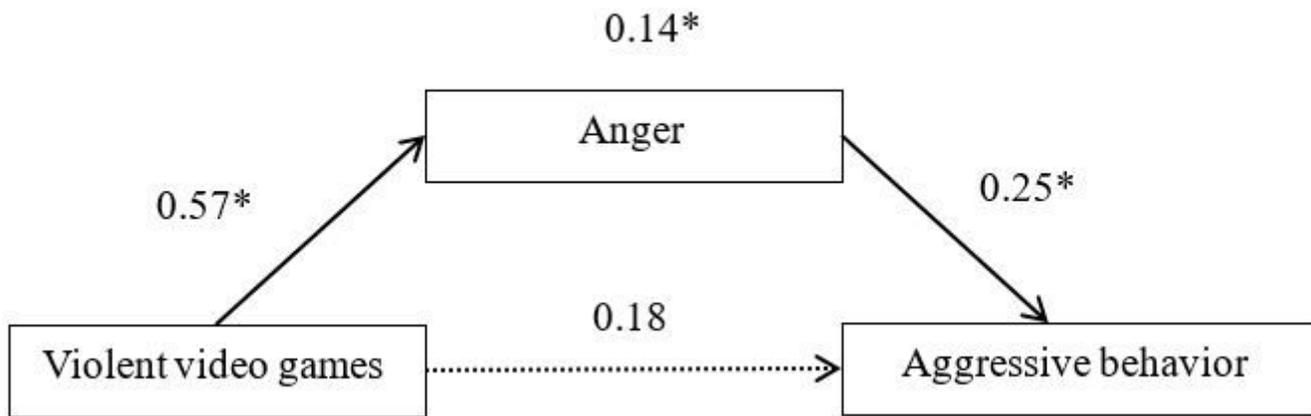
Figure 1

Game x gender interaction on aggressive behaviors. Error bars represent standard deviations. \*\*p < 0.01.



**Figure 2**

Mediation model of violent video games on aggressive behavior through anger. Note. 1 = Violent, 0 = Neutral; Standardized coefficients; Solid lines represent significant paths, dashed line represents a non-significant path; \* $p < 0.05$ .



**Figure 3**

Mediation model of violent video games on aggressive behavior through anger for males. Note. 1 = Violent, 0 = Neutral; Standardized coefficients; Solid lines represent significant paths, dashed line represents a non-significant path; \* $p < 0.05$ .

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [RAWdata.xls](#)