The effects of violent video games and shyness on individuals’ aggressive behaviors

Yu Tian PhD1 | Mingjian Gao MBA2 | Peng Wang1 | Fengqiang Gao1

1Department of Psychology, Shandong Normal University, Jinan, China
2College of Business and Technology, East Tennessee State University, Johnson City, Tennessee

Abstract
The general aggression model (GAM) has suggested that the interaction between person factors (e.g., personality variables) and situation factors (e.g., playing violent video games [VVGs]) can increase individuals’ aggressive behaviors through their cognition (e.g., hostile attributions), affect (e.g., negative affect), and/or arousal. The present study employed a modified competitive reaction time task to test the effects of shyness, violent (vs. nonviolent) gameplay, and shyness on individuals’ positive–negative affect, hostile attributions, and aggressive behaviors. In addition, the present study also employed structural equation modeling (SEM) to test the mediation (by cognition and affect) and moderation (by shyness). Results showed that playing a VVG increased aggressive behaviors, negative affect, and hostile attributions primarily among shy participants. In addition, the results of SEM also revealed that this moderating role was mediated by negative affect and hostile attributions. The present study supported GAM and showed that individuals’ aggressive behaviors are differentially susceptible to VVGs, depending on their level of shyness in a “for bad and for worse” manner.

KEYWORDS
aggressive behaviors, hostile attributions, positive–negative affect, shyness, VVGs

1 | INTRODUCTION

In June 2011 the US Supreme Court ruled that “video games enjoy full free speech protections and that the regulation of violent game sales to minors is unconstitutional.” The Supreme Court also referred to psychological research on violent video games (VVGs) as “unpersuasive” and noted that such research contains numerous methodological flaws. Since then, a number of studies have explored the potentially negative effects of VVGs (Allen, Anderson, & Bushman, 2018; Anderson & Bushman, 2018) on individuals’ behaviors. Many have explored the effects VVGs have on aggressive behaviors (e.g., Diaz, Wong, Hodgins, Chiu, & Goghari, 2016; Shao, Teng, & Liu, 2019). Most related studies have found that VVGs can increase such behaviors (Gabbiadini & Riva, 2017; Greitemeyer, 2017) by increasing hostile attributions, negative affect, and physiological arousal (Calvert et al., 2017; Greitemeyer, 2017). The search for possible personality moderators of the VVG effect on aggression has been largely unsuccessful, but the general aggression model (GAM) and other social-cognitive models of aggression suggest that short-term effects of playing a VVG might differ in magnitude for people who differ in aggression-related personality traits.

1.1 | GAM and research issues
The GAM (Allen et al., 2018; Anderson & Bushman, 2002; Anderson & Bushman, 2018; Anderson & Carnagey, 2009) offers theoretical explanations of the origins and pathogenesis of aggressive behavior. This model suggests that VVGs players acquire aggressive behavior tendencies through direct and indirect experiences such as observing others, rewarded models, and subsequent imitation, reward, and
punishment. In addition, the GAM provides a mechanism to explain how brief play VVGs can increase aggressive behavior in the immediate situation. The key factors in this mechanism are the individual cognitions (e.g., hostile attributions), affect (e.g., negative affect), and arousal (e.g., physiological arousal) induced by brief play, all of which can increase aggressive behaviors. However, these factors also are all influenced by person factors (e.g., personality variables). Therefore, the GAM suggests VVGs can increase aggressive behaviors in individuals, especially in those with an aggressive personality.

During recent years, a series of studies have found that individuals with interpersonal problems were more likely to be influenced by real-world violence exposure (e.g., Zhang, Liu, Xu, Wu, & Yang, 2017). These studies have suggested that individuals with interpersonal problems were more willing to accept the violent information to develop their negative cognition and aggressive behaviors, which could protect them against the harmful incidents from others (Barnicot, Wampold, & Priebe, 2014; Elison, Garofalo, & Velotti, 2014; Malti, Averdijk, Ribeaud, Rotenberg, & Eisner, 2013).

The core trait of shyness is social anxiety, which is positively related to interpersonal problems (Tian, Bian, Han, Gao, & Wang, 2017; Tian et al., 2018; Zimbardo, 1977). Although previous studies have found shy individuals had more aggressive behaviors than nonshy individuals, no study has tested the joint influence of briefly playing a violent game and shyness on individuals’ aggressive behaviors. According to the results of previous studies, we hypothesized that the short-term effects of VVGs on individuals’ positive-negative affect, hostile attributions, and aggressive behaviors would be stronger in shy than in the nonshy group.

1.2 | Mediating process and moderating process within the GAM

The GAM suggests a mediating process whereby person factors and environmental factors influence individuals’ aggressive behaviors through internal cognition (e.g., hostile attributions), affect (e.g., positive and negative affect), and arousal factors, respectively. Moreover, personal factors and environmental factors may also interact with each other to influence aggressive behaviors through cognitive and affective variables.

1.3 | Modified competitive reaction time task (CRTT)

A large number of studies have used the CRTT to test the influences of VVGs on individuals’ aggressive behaviors (Anderson et al., 2010; Sasamori, Ohmura, Kubo, Yoshida, & Yoshioka, 2018). In recent years, an increasing number of studies have used the modified CRTT (MCRTT) which uses noise blasts for punishment rather than electric shocks (Sasamori et al., 2018). Various versions of this task have shown good internal validity (Hyatt, Chester, Zeichner, & Miller, 2019; Warburton, & Bushman, 2019). An MCRTT with noise punishment was used in the present study to measure individuals’ aggressive behaviors.

1.4 | Present study

To test the validity of the GAM, two steps were conducted. Step 1 tested the effects of brief video gameplay (violent vs. nonviolent) on shy and nonshy individuals’ affect, hostile attributions, and aggressive behaviors. Based on the GAM, we assumed that shyness and playing VVGs would be positively related to negative affect, hostile attributions, and aggressive behaviors, and negatively related to positive affect. We also predicted that these effects would be stronger among shy than nonshy individuals. Step 2 tested the mediating and moderating process within the GAM, and we assumed that shyness and games would influence individuals’ aggressive behaviors through positive-negative affect and hostile attributions and that the level of shyness could moderate the pathway of games → positive-negative affect and games → hostile attributions. This model is called the mediated moderation model (Hayes, 2013).

2 | METHOD

2.1 | Participants

A total of 1,412 undergraduate students (male = 845) from one Chinese university completed the shyness scale. From these participants, 100 (male = 48) of those with a high score on the shyness scale were selected as the shy group, and 100 (male = 52) with a low score on the shyness scale were selected as the nonshy group (the 100 participants with high scores [M = 68.38; standard deviation (SD) = 4.51; range from 63 to 85] and 100 participants with low scores [M = 35.62; SD = 4.66; range from 20 to 40] were selected according to their ranking in shyness scores). A total of 50 participants (male = 24) with a high shyness score and 50 participants (male = 26) with a low shyness score were then selected randomly to play a violent game. The remaining participants played a nonVVG. The final sample comprised 200 participants (mean age = 19.16 years; SD = 0.89), and each experimental condition consisted of 50 participants. Written informed consent was obtained from all adult participants and all legal guardians of nonadult participants. All participants were informed they had the right to withdraw from the study at any time (including if they feel tired). After they completed the experiment, participants were given three small gifts. With the current sample size, the power was sufficient to detect any medium effect (power of 0.98 for at least a medium effect size, including the main effects as well as the interaction between studied variables).

The present study was conducted in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards and was approved by the Human Research Ethics Committee of Shandong Normal University.

2.2 | Design

In this study, a 2 (shyness: shy vs. nonshy)× 2 (game: VVG vs. nonVVG) × 2 (sex of participant: male vs. female) factorial design was employed.
2.3 | Stimuli

Samples with noise levels of 80, 90, 100, and 110 db were selected and all were standardized using the software of Format Factory 4.4.0. In addition, E-prime 1.0 was used to edit the experimental procedure for the present study.

2.4 | Instruments

2.4.1 | Shyness

The Chinese version of the Creek and Buss shyness scale (Cheek & Buss, 1981; Wang, Wang, Han, Gong, & Gao, 2009) was used to measure shyness. The scale consists of 17 items (instead of 14) and is ranked on a 5-point Likert scale, with 1 indicating “strongly disagree” and 5 indicating “strongly agree”. Confirmatory factor analysis showed that the standard measurement model fits the data well: $\chi^2(324) = 621; \text{comparative fit index (CFI)} = 0.97; \text{normed fit index (NFI)} = 0.96; \text{non-normed fit index (NNFI)} = 0.98; \text{root-mean-square error of approximation (RMSEA)} = 0.06$. The Cronbach’s $\alpha$ value for the total scale was 0.87. A sample item for shyness is “It is difficult for me to talk with people.”

2.4.2 | Player Unknown’s Battle Grounds

Player Unknown’s Battle Grounds is one of the most popular computer games in China, with nearly 20 million people registered (China Internet Network Information Center [CNNIC], 2018). To attract players, violent elements such as killing, shooting, bloodshed, and death were added to the game. Therefore, playing Player Unknown’s Battle Grounds was used as a violent game.

2.4.3 | The Sims 3 (sims)

The Sims is a life simulation game and also classified as a sandbox game because it lacks clearly defined goals. The player creates virtual individuals called “Sims”, and customizes their appearance, their personalities and places them in a home, directs their moods, satisfies their desires, and accompanies them in their daily activities and by becoming part of a social network. It offers opportunities, which the player may choose to pursue or to refuse, similar as Player Unknown’s Battle Grounds but is generally considered as a nonVVG.

2.4.4 | Positive and negative affect

The Positive And Negative Affect Schedule (Watson, Clark, & Tellegen, 1988) was used to measure individuals’ positive and negative affect. The scale consists of 20 items (10 items for positive affect and 10 items for negative affect) ranked on a 5-point Likert scale, with 1 indicating “very slightly or not at all” and 5 indicating “extremely”. The Cronbach’s $\alpha$ values were 0.79 for the positive affect scale and 0.84 for the negative affect scale.

2.4.5 | Hostile attributions

The revised reappraisal factor of the Emotion Regulation Questionnaire (Gross & John, 2003) was used to measure individuals’ hostile attributions. The scale consists of six items ranked on a 5-point Likert scale, with 1 indicating “a little” and 5 indicating “a lot”. The Cronbach’s $\alpha$ value for the total scale was 0.76. Sample items for hostile attributions are “My opponent used the loudest noise to punish me intentionally” and “My opponent was vicious because they punished me with the loudest noise.”

2.5 | Procedures

Once seated in front of the computer, individuals assigned to the VVG group were asked to play Player Unknown’s Battle Grounds for half an hour before the experimental tasks, and the nonVVG group played Sims. All the participants were then instructed that they would take part in a reaction time game against their opponents (the participants were not aware of the gender of their partner). They were told that they needed to respond to the experimental task quickly and accurately to win the game. When they won a game, they were told that they can punish their opponent with a noise sample of 80, 90, 100, or 110 db by selecting key “1,” “2,” “3,” or “4”. Conversely, when they lost a game they were told their opponents could also punish them in the same way. During the tasks, all participants were required to wear headphones.

Practice periods then took place. First, participants saw a “+” at the center of the computer screen, which disappeared after 500 ms. A number and letter were then presented for 500 ms in random order: participants were required to distinguish the number with the “F” key and the letter with the “J” key. The PC then responded with “you won” or “you lost”. During this period, participants were told that there was no opponent and the ratio of win and lose (presented in a random order) was set at 1:1, which was not related to their performance. When the participants won the game, they were required to select a noise level (white noise) to punish their virtual opponents; when they lost the game, they were punished with an 80, 90, 100, and 110 db noise that was selected randomly (the ratio of noise samples at 80, 90, 100, and 110 db was set at 1:1:1:1; the noise continued for 2.5 s). Throughout this period, participants took part in 40 trials with numbers or letters in random order, and they heard all noise levels during this period.

During the experimental periods, where the procedure was the same as for the practice periods, each participant took part in 80 trials with numbers or letters in random order (the win/loss pattern and the pattern of punishments set by the supposed opponent were also similar to those in practice periods). During this period, participants were told that they would take part in a reaction time game against their opponents who played the game in another room, and when they won a game they could punish their opponents if not, they would be punished by their opponents. The reaction time and the accuracy of participants’ reactions to each trial were recorded (see Figure 1 in Figure S1, which was presented in Supporting Information Materials).
After the experiment, all the participants were required to complete a positive and negative affect scale and a negative attribution scale based on their experience with the experimental tasks. In addition, participants were probed for suspicion using two-item open-ended suspicion probes (Chen, Lee-Chai, & Bargh, 2001): “Did you find anything strange or unusual about the experimental procedures?” and “What do you think is the purpose of this experiment?” Participants were then debriefed, thanked, and paid. Across the study, no participants guessed our hypotheses or recognized how the two tasks were related.

3 | RESULTS

3.1 | Effects of shyness, games, and shyness × games on individuals’ aggressive behavior, positive and negative affect, and hostile attributions

3.1.1 | Statistical procedures

All data were stored on a disk after each trial and then analyzed offline using SPSS 22.0. Univariate analysis of variances were used to test the effects of sex, shyness, games, and shyness × games on individuals’ aggressive behaviors, positive and negative affect, and hostile attributions. Data from all participants were retained. After playing the assigned game, all participants were required to describe their experiences during the game using a 7-point Likert scale (1 = not at all, 7 = very much) consisting of 15 items (i.e., absorbing, action-packed, arousing, boring, challenging, difficult, enjoyable, entertaining, exciting, frustrating, fun, involving, stimulating, stressful, and addictive). A series of tests have revealed that Player Unknown’s Battle Grounds yielded higher scores in arousal and stimulation, than The Sims 3. Therefore, the scores in arousal and stimulation were statistically controlled in further analysis.

3.1.2 | Effects of shyness, games, and shyness × games on individuals’ aggressive behavior

The results showed that shyness exerted a significant main effect on individuals’ aggressive behavior [F(1, 192) = 5.18; p = .002; η^2_p = 0.09], and those shy individuals (M = 1.98; standard error (SE) = 0.77) exhibited more aggressive behaviors than nonshy individuals (M = 1.65; SE = 0.75). Games exerted a significant main effect on individuals’ aggressive behavior, [F(1, 192) = 7.79; p < .01; η^2_p = 0.12]; playing a VVG yielded greater aggression (M = 2.18; SE = 0.72) than did playing a nonVVG (M = 1.63; SE = 0.66). The shy × games interaction also was significant [F(1, 192) = 4.65; p = .02; η^2_p = 0.08]. A simple effect analysis demonstrated that within the shy group, the effect of playing a VVG on individuals’ aggressive behaviors was stronger [F(1, 96) = 7.81; p < .01; η^2_p = 0.12; M = 2.56; SE = 0.81 vs. M = 1.64; SE = 0.73] than in the nonshy group, [F(1, 96) = 1.32; p = .22; η^2_p = 0.01; M = 1.96; SE = 0.72 vs. M = 1.77; SE = 0.64; see Figure 2a].

3.1.3 | Effects of shyness, games, and shyness × games on individuals’ positive and negative affect

The results showed the main effect of shyness on individuals’ positive affect was not significant, [F(1, 192) = 1.56; p = .11; η^2_p = 0.04]; the main effect of games on individuals’ positive affect was not significant, [F(1, 192) = 0.35; p = .21; η^2_p = 0.00]; the effect of shyness × games on individuals’ positive affect was not significant, [F(1, 192) = 0.66; p = .38; η^2_p = 0.00].

The results showed shyness exerted a significant main effect on individuals’ negative affect [F(1, 192) = 12.33; p < .01; η^2_p = 0.15]; shy individuals (M = 23.29; SE = 0.88) had a more negative affect than nonshy individuals (M = 19.65; SE = 0.67). Games exerted a significant main effect on individuals’ negative affect [F(1, 192) = 6.73; p < .01; η^2_p = 0.11]; the playing a VVG yielded greater negative affect (M = 22.93; SE = 0.85) than did playing a nonVVG (M = 19.98; SE = 0.71). The shyness × games interaction also was significant [F(1, 192) = 4.48; p = 0.04; η^2_p = 0.08]. A simple effect analysis demonstrated that within the shy group, the effect of playing a VVG on individuals’ negative affect was stronger [F(1, 96) = 13.81; p < .01; η^2_p = 0.17; M = 25.34; SE = 0.87 vs. M = 15.93; SE = 0.68] than in the nonshy group, [F(1, 96) = 1.85; p = .18; η^2_p = 0.01; M = 22.91; SE = 0.86 vs. M = 19.84; SE = 0.69; see Figure 2b].

3.1.4 | Effects of shyness, games, and shyness × games on individuals’ hostile attributions

The results showed shyness exerted a significant main effect on individuals’ hostile attributions, [F(1, 192) = 5.14; p = 0.02; η^2_p = 0.08]; shy individuals (M = 8.16; SE = 0.26) had more hostile attributions than nonshy individuals (M = 6.45; SE = 0.25). Games exerted a significant main effect on individuals’ hostile attributions, [F(1, 192) = 4.49; p = 0.04; η^2_p = 0.07]; playing a VVG yielded greater hostile attributions (M = 7.71; SE = 0.29) than did playing a nonVVG (M = 6.88; SE = 0.21). The shy × games interaction also was significant [F(1, 192) = 3.49; p = 0.07; η^2_p = 0.06]. A simple effect analysis demonstrated that within the shy group, the effect of playing a VVG on individuals’ hostile attributions was stronger [F(1, 96) = 4.65; p = 0.02; η^2_p = 0.08].

FIGURE 1 Experimental procedure
96) = 7.81; \( p < .01; \eta^2_p = 0.09; M = 8.69; SE = 0.26 \) vs. \( M = 6.02; SE = 0.24 \) than in the nonshy group. \( F(1, 96) = 2.94; p = 0.06; \eta^2_p = 0.04; M = 7.73; SE = 0.22 \) vs. \( M = 6.82, SE = 0.23 \); see Figure 2c).

3.2 | The effects of the mediating process and moderating process

3.2.1 | Statistical procedures

Structural equation modeling (SEM) with MPLUS 7.0. was used to test the mediating roles of negative affect and hostile attributions on the associations between shyness, games, and aggressive behaviors, and we also test the moderating role of shyness on the pathway of games → negative affect and games → hostile attributions. Previous studies have suggested that this method has satisfactory validity and has determined the mediating process between variables in multiple experiments (Abeyta, Routledge, & Juhl, 2015). In addition, the significance of these mediating paths was previously tested using bootstrapping. Therefore, 1,000 bootstrap samples were created from the original dataset using random sampling with replacement. According to Shrout and Bolger (2002), a mediating effect is significant at the 0.05 level if the 95% confidence interval (CI) does not include zero.

3.2.2 | Descriptive statistics

Table 1 shows that shyness, games, negative affect, hostile attributions, and aggressive behaviors were positively associated with each other, and sex was positively associated with games, hostile attributions, and aggressive behaviors. This achieved the precondition for mediating role tests (Shrout & Bolger, 2002).

3.2.3 | Mediating process and moderating process

The results of SEM suggest that shyness can positively predict individuals’ negative affect (\( \beta = .14; p < .01 \)) and hostile attributions

<table>
<thead>
<tr>
<th>Variables (( N = 200 ))</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sex</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Shyness</td>
<td>0.08</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Games</td>
<td>0.14**</td>
<td>0.21**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Negative affect</td>
<td>0.06</td>
<td>0.24**</td>
<td>0.18**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Hostile attributions</td>
<td>0.13**</td>
<td>0.37**</td>
<td>0.21**</td>
<td>0.27**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6. Aggressive behaviors</td>
<td>0.15**</td>
<td>0.23**</td>
<td>0.14**</td>
<td>0.31**</td>
<td>0.23**</td>
<td>1</td>
</tr>
</tbody>
</table>

| M                           | – | – | 22.51 | 7.57 | 1.83 |
| SD                          | – | – | 5.64 | 2.54 | 0.82 |

Note: Female, nonshy individuals, and nonVVG were coded as 0; male, shy individuals, and VVG were coded as 1; Pearson correlation is equivalent to the t test effect (Zhang, Cao, Wang, Ji, & Cao, 2016). Abbreviations: SD, standard deviation; VVG, violent video game. **\( p < .01 \).
games can positively predict individuals’ negative affect (β = .12; p < .01) and hostile attributions (β = .13; p < .01); shyness × games can positively predict individuals’ negative affect (β = .11; p < .01) and hostile attributions (β = .12; p < .01); and both negative affect (β = .18; p < .01) and hostile attributions (β = .12; p < .01) can predict individuals’ aggressive behaviors (see Figure 3).

The results of the bootstrapping showed that the indirect effect of shyness → negative affect → aggressive behaviors (95% CI: 0.12–0.17), and shyness → hostile attributions → aggressive behaviors (95% CI: 0.09–0.16) were all statistically significant; that games → negative affect → aggressive behaviors (95% CI: 0.08–0.19), and games → hostile attributions → aggressive behaviors (95% CI: 0.14–0.21) were all statistically significant. In addition, the results of a simple slope analysis indicated that within the shy group, the effects of games on individuals’ negative affect (β = .22; p < .01) and hostile attributions (β = .19; p < .01) were stronger than the effects of games on individuals’ negative affect (β = .10; p > .05) and hostile attributions (β = .11; p < .05) within nonshy group. Therefore, the level of shyness moderated the association between games and aggressive behaviors, and this moderating role was mediated by negative effect and hostile attributions.

4 | DISCUSSION

The present study replicated the basic finding the briefly playing a VVG can increase aggressive behavior, aggressive cognition, and negative affect (Anderson et al., 2010; Calvert et al., 2017). Furthermore, the GAM can be used to explain the aforementioned potential mechanisms at play whereby shyness, games, and shyness × games increase individuals’ aggressive behaviors through hostile attributions and negative affect.

4.1 | Effects of VVGs

The present study found that VVGs increased individuals’ hostile attributions and aggressive behaviors, which is consistent with the findings of previous studies (Burrows & Blanton, 2018; Calvert et al., 2017; Greitemeyer, 2017). The GAM suggests that aggressive priming occurs when individuals are exposed to VVGs and also causes a short-term increase in the accessibility of aggressive knowledge structures (such as aggressive beliefs and attitudes and aggressive schemata). These aggressive knowledge structures can increase individuals’ hostile attributions (Anderson & Bushman, 2018; Calvert et al., 2017). Thus, interpreting a situation in a hostile manner can increase anger, which in turn can increase aggressive behaviors. In addition, the GAM does not propose that the internal state variables (hostile attributions, negative affect, and physiological arousal) must occur simultaneously. Any of the three variables can occur first and then influence the other two. Aggression can also be influenced primarily through one or two of the factors. The present study suggests that VVGs can increase individuals’ aggressive behaviors through hostile attributions and affect (Sarkhell, Klasen, Schneider, Goebel, & Mathiak, 2019).

Several previous studies have failed to find that VVGs increase individuals’ aggressive behavior (Ivory & Kalyanaraman, 2007; Kovácsová, Lajunen, & Rošková, 2016). For example, one important study, published in the Journal of Molecular Psychiatry, found no significant changes in a with-VVGs group and without-VVGs group after 2 months of gameplay (Simone et al., 2018). In contrast to these inconsistent results, we suggest that the short-term effects of VVGs are mainly the result of priming effects, and these are short-lived (they may only last for <15 min and can potentially reverse after that time; Sestir & Bartholow, 2010). Therefore, priming effects should only play a role in very close temporal proximity to gameplay, and it is, therefore, difficult to observe the effects of VVGs on individuals’ aggressive behaviors over a longer period of time (e.g., >15 min). The repeated short-term effects of VVGs could, therefore, elicit long-term effects by developing aggressive knowledge structures (Allen et al., 2018; Anderson & Bushman, 2018; Calvert et al., 2017; Riva et al., 2016). These long-term effects should occur over a long period of time due to the small effect size of VVGs. Therefore, the 3 weeks of Teng’s, Chong, Siew, and Skoric (2011) study, the 4 weeks of Williams’s and Skoric (2005) study, and the 2 months of Simone’s (2018) study were not long enough to determine the effects of VVGs on individuals’ aggressive behaviors, whereas the 1 year of Shibuya, Sakamoto, Ihori, and Yukawa, (2011) study and the 3 years of Willoughby’s, Adachi and Good (2012) study were sufficiently long to show such effects.
4.2 | Effects of shyness

Similar to physical fitness, the social fitness model (SFM; Henderson, 1994) implies a set of cognition, affect, and physiological arousal can result in aggressive behaviors, just as GAM suggests. This model was later used to interpret the aggressive behaviors of people with social anxiety, especially shy individuals (who have been found to exhibit a higher level of aggressive behaviors; Gao, Xue, Han, Ren, & Xu, 2016; Gao, Yang, Geng, & Han, 2017; Werthamerlarsson, Kellam, & Wheeler, 1991). Shyness is defined as the anxiety experienced when meeting new people and is derived from the fear of being evaluated and rejected (Zimbardo, 1977). The SFM of shyness suggests that shy individuals’ aggressive behaviors are governed by three cycles. The first is termed the "escape stage." Shy individuals tend to make negative predictions about a social situation, which consequently aggravates an already heightened level of fear due to a lack of confidence. In this stage, shy individuals are more likely to experience feelings of shame (negative affect). The second cycle is called the "self-blame stage," in which shy individuals tend to ascribe hostile attributions to themselves (such as "I am so stupid"), which leads them to self-blame. The third cycle is called the "blame-other stage", in which shy individuals tend to make hostile attributions about others (such as perceiving others as contemptuous and potentially threatening). They then experience negative affect such as anger, which later leads to aggressive behaviors. According to the SFM of shyness, hostile attributions and negative affect are the most important factors explaining the aggressive behaviors displayed by shy individuals.

The SFM of shyness suggested that hostile attributions and negative affect are important factors in explaining shy individuals' aggressive behaviors (Henderson, 1994). The present study found that shy individuals expressed more hostile attributions and negative affect than nonshy individuals, which to some extent supports the SFM of shyness. According to this model, when shy individuals are faced with provocation or aggression (punishment in the present study) from others, they are more likely to experience negative affect due to their negative self-evaluation in the first cycle. Shy individuals then internalize these negative affect through self-blame ("I am so stupid for losing the game") in the second cycle. This self-blame could then result in hostile attributions being made to others. For example, they may believe their opponent used the loudest noise to punish them intentionally, or they may think that their opponent was being vicious when they punished them with the loudest noise. Such hostile attributions could lead to anger and hostility and cause aggressive behaviors in the third cycle (leading them to give a more severe punishment than nonshy individuals; Gao et al., 2016; Gao et al., 2017).

4.3 | Effects of shyness × games

The present study also found that VVGs increased shy individuals’ negative affect, hostile attributions, and aggressive behaviors. The GAM has suggested that individuals with a "risk" personality (e.g., aggressive personality; Gonzalez & Greitemeyer, 2018) are more likely to be influenced by adverse environments (e.g., playing VVGs). The results of the present study suggested that individuals’ aggressive behaviors could be differentially susceptible to VVGs depending on their level of shyness in a "for bad and for worse" manner. This result also expanded the GAM to some extent as it shows that shy individuals were more likely to be influenced by VVGs, specifically, personality factors are any individual differences that may influence how a person responds to a VVGs. In addition, the present study suggested that both negative affect and hostile attributions were important factors mediating the influence of shyness × games on individuals’ aggressive behaviors. According to the SFM of shyness, shy individuals tend to perceive others as contemptuous and potentially threatening. The competition rules of VVGs mean that game players have to use a variety of cruel means to kill or defeat their opponents to survive or obtain rewards. All types of clues from their opponents (such as throwing, aiming, and shooting) tend to be negative, thus increasing game players’ hostile attributions (their opponents are seen as hostile). Such hostile attributions may then migrate to offline activities and thoughts, such as “My opponent used the loudest noise to punish me intentionally” during the CRTT, leading to an increase in negative affect (e.g., anger) and, subsequently, aggressive behaviors.

4.4 | Mediating process and moderating process within the GAM

The present study has suggested the level of shyness could moderate the association between games and aggressive behavior, and this moderating role was mediated by negative affect and hostile attributions. These results supported the GAM. Importantly, although the GAM suggests cognition and affect are the key factors that drive individuals’ aggressive behavior, the model does not clarify the specific cognitive and affect-based factors. For example, shyness × games influenced individuals’ aggressive behaviors through a negative affect rather than a positive affect. Therefore, the results of the present study have helped further develop the GAM, as applied to violent media effects. In addition, the SFM of shyness suggests a mediating process whereby shy individuals tend to make more hostile attributions about others (e.g., perceiving others as contemptuous and potentially threatening). Such hostile attributions mean that they are more likely to experience a negative affect, such as anger, which would then lead to aggressive behaviors. Therefore, the results also supported the SFM of shyness.

4.5 | Limitations and future directions

The present study has several limitations that need to be considered. First, the GAM suggests that individuals’ cognition, affect, and arousal are the key factors leading to aggressive behaviors. However, the present study only collected individuals’ hostile attributions (cognition) and negative affect (affect). Therefore, physiological arousal should also be measured in future studies to explore the physiological mechanism underlying the effects of VVGs on shy individuals’ aggressive behaviors. Second, the hypothesized mediating roles of
hostile attributions and positive–negative effect were assessed after the aggressive behavior measurement. Previous studies found that measuring hypothesized mediators before measuring aggressive behavior in such experimental studies can actually decrease the effect on behavior, suggesting that one should measure the most important variable first, which in the present case was behavior (e.g., Lindsay & Anderson, 2000). Although all participants were asked to recount their positive and negative affect and hostile attributions during the CRTT rather than in their current status (after CRTT) in the questionnaires, it was difficult to distinguish the sequence of positive and negative affect, hostile attributions, and aggressive behaviors. Therefore, more studies are warranted in the future to test the mediation effect of hostile attributions and positive–negative effect. Third, the present study used only one violent and one nonviolent game, which limits the generalizability of the results (Wells & Windschitl, 1999). Therefore, more VVGs and nonVVGs should be studied to generalize the results of the present study. Fourth, positive and negative effect, as well as hostile attributions, were collected after aggressive behaviors were measured.

ENDNOTE

1 Sex was included as a covariate in all the analyses, and the effects of sex (including the main effect of sex and the interactions between sex and the studied variables) are presented in the Supporting Information Materials (see S2).

Orcid

Fengjiang Gao http://orcid.org/0000-0001-5061-0825

REFERENCES


**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section.