Does Violent Video Gaming Induce Hostile Emotional Processing in Habitual Players? Evidence from Eye-Tracking Metrics

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Abstract

The present study examined whether habitual interaction with violent video games would result in hostile emotional processing among players. A total of 42 adult students participated in the experiment. They were categorized as habitual violent video gamers (HVVGs; n = 21, M_{age} = 20.09 years, SD = 0.89) and non-video gamers (NVGs; n = 21, M_{age} = 21.66 years, SD = 2.01). Participants completed an emotional go/no-go task that required them to recognize facial expressions of happiness, anger, disgust, fear, and sadness. Results indicated that HVVGs outperformed NVGs in the emotion recognition task, demonstrating higher response accuracy and faster reaction times. Overall recognition capacity was superior for happiness than for the negative emotions across the groups. Fixation metrics corroborated this pattern. Participants showed shorter times to first fixation in the mouth region when recognizing happiness, along with longer first- and total-fixation durations. This consistent gaze pattern suggests greater perceptual salience of happiness on a specified facial region, contributing to its recognition advantage. In contrast, recognition of negative emotions showed a scattered gaze pattern, indicating weaker diagnostic cues in specific facial regions, rather than reflecting an emotional desensitization. Overall, the study calls into question the General Aggression Model's assertion that habitual violent video gaming induces hostile emotional processing. It also cautions against attributing such processing primarily to violent video gaming alone. Instead, the findings emphasize the importance of accounting for broader dispositional and environmental factors when explaining hostile emotional information processing in violent video gamers.

CCS Concepts

• **Applied computing** → Law, social and behavior sciences; Psychology.

Keywords

Violent video games, Facial emotion recognition, Aggression, General Aggression Model

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1 Introduction

Facial emotion recognition allows individuals to discern others' emotional states, needs, and intentions [32, 45]. This reciprocation facilitates adaptive behavioral adjustments to foster or avoid social interactions [9, 11]. Any impairment in processing facial emotions can reduce social competence, affecting the ability to modulate behaviors across varied social contexts [45]. It is conceivable that not all facial emotions are equally recognized, as each has a distinct recognition efficacy [38]. Studies suggest that happiness is recognized more rapidly and accurately than other basic emotions [13]. This "happy-face advantage" is mainly due to the frequent occurrence of happy expressions in social interactions [10, 32]. It is also characterized by a preferential allocation of attentional resources to specific facial regions, particularly around the mouth [9, 10, 33]. Recognizing negative emotions requires a more distributed attention across facial regions [9, 44]. Discrete negative expressions often involve similar changes in facial feature configurations, which can induce response confusion. This overlap reduces the recognition efficacy for negative emotions [23].

Studies supporting the General Aggression Model (GAM) report that exposure to violent media primes aggression, leading to a "processing bias" that reduces recognition of happiness [2, 6, 25, 28]. However, most of these studies rely on exposing participants to a brief gaming session just before the experimentation. Such an exposure does not accurately reflect the effects of habituation to violent media content. Brief exposure to violent content may induce mood-congruent priming [29], temporarily increasing aggressive tendencies [19], or triggering stress-like physiological responses [36]. These short-term effects can negatively influence everyday social behaviors [37], including the recognition of facial emotions. It is, therefore, essential to distinguish these immediate reactions from enduring changes (e.g., habituation) that develop over years of exposure to video games [31].

Recently, Ubaradka and Khanganba [43] explored whether habitual violent gaming would induce hostile emotional processing among players. In an experimental comparison of interactive (i.e., video games) and non-interactive (e.g., movies) violent media, Ubaradka and Khanganba [43] reported no significant differences in accuracy, reaction time, or bias in recognizing emotional facial expressions across exposure conditions. Their design separated interactivity from violent content, demonstrating that neither repeated engagement with violent video games nor passive consumption of violent media produced measurable distortions in emotional perception. Their subsequent study [44] employed fixation metrics to investigate whether habitual violent gamers differ from non-violent video gamers in their ability to recognize facial emotions. The findings revealed no group differences in emotion recognition performance. This pattern suggests that, even at early stages of perceptual processing, emotional expressions are sampled comparably across groups. Further, violent video gamers demonstrated a robust happy-face advantage, likely driven by the greater perceptual salience of the mouth region. Interestingly, reduced accuracy for negative emotions was explained by scattered gaze patterns [9] rather than by diminished emotional sensitivity. These findings contradict predictions derived from the GAM, which posits that repeated exposure should prime hostile attribution biases and impair sensitivity to positive affective cues.

The present study builds on the work of Ubaradka and Khanganba [43, 44] to investigate whether habitual exposure to violent video games reduces the happy-face advantage and impairs the recognition of negative facial emotions. It examines the ability to recognize facial emotions between habitual violent video gamers (HVVGs) and non-video gamers (NVGs), with the latter group having no prior exposure to violent video games. The study assumes a happy-face advantage among participants [8, 11, 46] and compares the ability to recognize happy and negative facial emotions between HVVGs and NVGs. While some studies have reported impaired emotional processing among violent video gamers [3, 26], the overall evidence remains inconclusive [16, 34, 43, 44]. In light of these mixed findings, we propose that the recognition capacity for happy faces will be higher than that for negative ones (H1), HVVGs will not show a reduced happy-face advantage compared to NVGs (H2), and HVVGs will not show impaired recognition ability for negative emotions compared to NVGs (H3).

The present study employs the emotional go/no-go task paradigm [42] and integrates eye-tracking metrics to examine the role of attentional mechanisms in facial emotion recognition. While performance metrics such as correct responses (CRs) and reaction times (RT) indicate the degree to which specific facial emotions are consciously identified and discriminated, eye-tracking metrics offer a means to dissect the recognition and response execution period into more granular segments. One approach for investigating attentional allocation involves monitoring gaze behavior, such as fixations and saccades [17]. For instance, Calvo and Nummenmaa [12] demonstrated that the smiling mouth attracts the first fixations more frequently than any other facial region, indicating a "perceptual salience" of the mouth for happiness. Increased visual attention to these perceptually salient facial regions is associated with enhanced recognition accuracy [9]. In contrast, negative emotions elicit a more distributed gaze pattern across various facial areas, reducing the impact of perceptually salient regions [5]. Additionally, their less frequent occurrence in daily interactions contributes to response ambiguity, thereby reducing their overall recognition efficacy [11].

Three fixation metrics are employed in this study to measure perceptual salience and attentional orientation during facial emotion recognition: a) Time to the First Fixation (TFF), measuring the interval from the stimulus presentation to the onset of the first fixation; b) First Fixation Duration (FFD), reflecting the length of the initial fixation on a designated fixation region, and; c) Total Fixation Duration (TFD), encompassing the aggregate time spent fixating on a specific area. This integration of fixation metrics offers insights into the perceptual salience of facial emotions within specific fixation regions [9]. Generally, a faster TFF, along with longer FFD and TFD on a particular facial region, denotes enhanced perceptual salience of that region for a specific emotion [9, 40, 41]. These fixation indices, combined with traditional behavioral metrics, enable us to trace when, where, and for how long attention settles on diagnostic facial features during emotion recognition. By comparing these trajectories in HVVGs and NVGs, the present study subjects the broader predictions of the GAM to an empirical test, assessing whether habitual exposure to violent video games impairs facial emotion recognition or whether such claims are overstated.

2 METHODS

2.1 Participants

An a priori power analysis in MorePower (v 6.0.4) [14] indicated that 32 participants would provide 80 % power to detect a medium within-between interaction (η_p^2= 0.06) at $\alpha = 0.05$ (two-tailed) in a two-way mixed-factorial ANOVA. The final sample pool consisted of 42 adult students, which included HVVGs ($n = 21$, $M_{\text{age}} = 20.09$, $SD = 0.89$) and NVGs (n= 21, $M_{\text{age}} = 21.66$, $SD = 2.01$). Participants were recruited from a higher education institution in India through an interest survey disseminated via e-mail advertisements. HVVGs were required to have at least five years of experience in violent video games, playing for a minimum of one hour daily. In contrast, NVGs were defined by their complete abstention from any video game genre for the preceding year and a minimum of three years without violent gaming engagement. To achieve parity between the groups, the study limited its NVG cohort to 21 participants, randomly selected from 35 eligible participants. Procedures were approved by the Institutional Human Ethics Committee of the authors' affiliated institution and conformed to the Declaration of Helsinki.

2.2 Facial stimuli

The study utilized a set of 165 front-view color faces taken from the Karolinska Directed Emotional Faces (KDEF) data set [35]. To familiarize participants with the task, an initial practice block of 15 faces was used. The main experiment used 150 faces as stimuli, presented in five discrete blocks of 30 each. To control for potential sex effects, an equal number of male and female faces was used. Each stimulus was 562 × 762 pixels and displayed one of the five emotions (happiness, anger, disgust, fear, and sadness).

2.3 Eye-tracking system

The eye movements were captured using the Tobii TX300 eye tracker, which was built into the lower portion of a 23-inch TFT display. The screen boasted a resolution of 1280 × 1024 pixels, ensuring high-quality visual presentation and precise gaze-tracking capabilities. The eye tracker was calibrated on nine standard points and used a 300 Hz data sample rate for binocular tracking. A maximum dispersion threshold of 0.5 degrees and a minimum fixation period of 70 ms were maintained. For presenting facial stimuli and collecting data, Tobii Studio (version 3.3.2) was used on a computer (Asus

G750JX-T4191H equipped with an Intel Core i7-4700HQ processor and 8GB of RAM).

2.4 Experimental task

Each participant was tested in a semi-dark and acoustically treated laboratory to optimize conditions for the facial emotion recognition task. The experimental task followed an emotional go/no-go paradigm. The task comprised five blocks, each presenting 30 facial emotions categorized into go and no-go trials. Before each of the five task blocks, presented in random order, participants were informed of the specific facial emotion that would serve as the go trial. They had to press the left mouse button upon recognizing the target facial emotion. The go trials occurred at a 60% frequency to promote prepotent responding. Conversely, no-go trials were shown 40% of the time, with participants instructed to refrain from clicking the left mouse button. For instance, in a block focused on happiness, 18 happy faces were designated as go trials, while 12 other facial emotions (three of each type) were used as no-go trials. The valence of the no-go trials was not disclosed to the participants, yet they were directed to refrain from pressing for any facial emotion other than the instructed one. After calibration, participants were given thorough instructions and completed a brief practice session of 15 trials. The trials were pseudo-randomized to prevent predictability, ensuring no more than two consecutive no-go facial emotions were presented. Each trial appeared on the screen for a fixed duration of 1,000 ms, with participants encouraged to respond as swiftly as possible. A fixation jitter was presented for 800 ms after each trial. Comprehensive instructions were provided to ensure participants fully understood the task requirements and could perform the task accurately. On average, participants completed the experiment within 20-30 minutes.

2.5 Design and data analysis

The variables included the participant group (HVVGs and NVGs), the five basic facial emotions from the KDEF dataset, and the fixation regions, which were categorized into three areas of interest (AOIs): eyes, nose, and mouth. The study employed a mixed-factorial design, 2 (group: HVVGs vs. NVGs) × 5 (facial emotion: happiness vs. anger vs. disgust vs. fear vs. sadness) × 3 (fixation region: eye vs. nose vs. mouth), with the first factor as a between-groups variable.

Facial emotion recognition was evaluated by the percentage of CRs (hits on go trials) and the corresponding RTs (time to the first mouse click) using a 2 (group: HVVGs vs. NVGs) × 5 (facial emotion: happiness vs. anger vs. disgust vs. fear vs. sadness) mixed-factorial ANOVA with the first factor as a between-groups variable. The variation of TFF, FFD, and TFD was then measured separately using a 2 (group: HVVGs vs. NVGs) × 5 (facial emotion: happiness vs. anger vs. disgust vs. fear vs. sadness) × 3 (fixation region: eye vs. nose vs. mouth) mixed-factorial ANOVA with the first factor as a between-groups variable. The two-way interaction between the facial emotion and fixation region highlights the perceptual salience of specific emotions within certain facial regions. Additionally, the three-way interaction among group, facial emotion, and fixation region suggests differences in perceptual salience between HVVGs and NVGs.

3 Results

The Greenhouse-Geisser correction is reported for *F*-statistic scores wherever Mauchly's sphericity test was nonsignificant. A post hoc pairwise comparison was conducted to assess whether the factors differed significantly, with a Bonferroni correction for multiple comparisons.

3.1 Facial emotion recognition accuracy

The main effect of the group, $F(1, 40) = 14.05$, $p < .001$, $\eta_p^2 = 0.26$, showed that HVVGs were significantly more accurate than NVGs in recognizing facial emotions. There was also a main effect of the facial emotion, $F(3.10, 124.14) = 62.77$, $p < .001$, $\eta_p^2 = 0.61$. Pairwise comparisons indicated that the percentage of CRs was significantly higher for happy faces than for disgust, sadness, anger, and fear. No interaction effect was observed between the group and facial emotion, $F(3.10, 124.14) = 1.27$, $p = .28$, $\eta_p^2 = 0.03$. The main effect of the group, $F(1, 40) = 22.14$, $p < .001$, $\eta_p^2 = 0.35$, showed that HVVGs were significantly faster than NVGs in recognizing facial emotions. There was also a main effect of the facial emotion, $F(4, 160) = 27.04$, $p < .001$, $\eta_p^2 = 0.40$. Pairwise comparisons indicated that the happy faces were recognized faster, followed by anger, sadness, disgust, and fear. An interaction effect was also observed between group and facial emotion, $F(4, 160) = 3.52$, $p < .01$, $\eta_p^2 = 0.08$, indicating that HVVGs were significantly faster at recognizing all facial emotions than NVGs, irrespective of valence (See Table 1).

3.2 Gaze behavior analyses

There was a main effect of group with regard to TFF, $F(1, 40) = 4.21$, $p < .05$, $\eta_p^2 = 0.10$, indicating that TFF was significantly faster among NVGs than HVVGs. The main effect of the facial emotion, $F(4, 160) = 6.85$, $p < .05$, $\eta_p^2 = 0.14$, with pairwise comparisons, showed that the TFF was significantly faster for happy faces, followed by fear, disgust, anger, and sadness. There was also a significant interaction effect between the facial emotion and fixation region, $F(6.01, 240.45) = 2.98$, $p < .01$, $\eta_p^2 = 0.07$, indicating that the TFF was faster for a) angry faces in the eye region and b) happy faces in the nose and mouth regions (see Table 2). There was no significant three-way interaction between the group, facial emotion, and fixation region, $F(6.01, 240.45) = 0.53$, $p = .77$, $\eta_p^2 = 0.01$.

There was no main effect of the group with regard to FFD, $F(1, 40) = 2.73$, $p = .10$, $\eta_p^2 = 0.06$, indicating that the FFD was comparable between HVVGs and NVGs. The main effect of the facial emotion, $F(3.19, 127.94) = 8.32$, $p < .05$, $\eta_p^2 = 0.17$, with pairwise comparisons, showed that the FFD was significantly longer for happy faces, followed by sadness, anger, disgust, and fear. There was also a significant interaction effect between the facial emotion and fixation region, $F(5.79, 231.91) = 3.39$, $p < .01$, $\eta_p^2 = 0.08$, indicating that the FFD was longer for a) fearful faces in the eye region and b) happy faces in both the nose and mouth regions (see Table 2). There was no three-way interaction among group, facial emotion, and fixation region, $F(5.79, 231.91) = 1.12$, $p = .34$, $\eta_p^2 = 0.02$.

There was no main effect of the group with regard to TFD, $F(1, 40) = 1.73$, $p = .19$, $\eta_p^2 = 0.04$, indicating that the TFD was comparable between HVVGs and NVGs. The main effect of the facial emotion, $F(3.23, 129.44) = 7.11$, $p < .05$, $\eta_p^2 = 0.15$, with pairwise comparisons,

Table 1: Interaction effects between the group and facial emotion for the CRs and RTs

Group	Facial Emotion	CRs (in percent) M (SE)	RTs (in ms) M (SE)
HVVGs	Happiness	98.41 (2.45)	594.81 (17.85)
	Anger	72.22 (3.43)	706.47 (15.10)
	Disgust	76.71 (3.92)	709.09 (15.81)
	Fear	46.29 (4.55)	769.04 (17.96)
	Sadness	72.48 (3.77)	694.90 (14.52)
NVGs	Happiness	84.74 (2.45)	713.57 (17.85)
	Anger	56.34 (3.43)	768.47 (15.10)
	Disgust	71.95 (3.92)	766.95 (15.81)
	Fear	36.24 (4.55)	803.71 (17.96)
	Sadness	57.14 (3.77)	798.95 (14.52)

Table 2: Interaction effects between the facial emotion and fixation region for the fixation metrics

Group	Facial Emotion	TFF (in ms) M (SE)	FFD (in ms) M (SE)	TFD (in ms) M (SE)
Eye	Happiness	212.24 (27.50)	238.79 (12.63)	437.02 (27.56)
	Anger	196.71 (31.61)	227.64 (12.24)	475.79 (33.61)
	Disgust	235.45 (30.72)	227.24 (10.37)	411.64 (27.46)
	Fear	181.10 (25.38)	239.57 (12.38)	502.76 (31.59)
	Sadness	276.17 (33.50)	229.50 (11.51)	444.48 (29.77)
Nose	Happiness	220.17 (25.08)	287.55 (22.22)	463.48 (31.57)
	Anger	284.29 (31.16)	258.02 (14.57)	416.24 (24.71)
	Disgust	259.83 (26.04)	264.38 (13.54)	455.81 (27.10)
	Fear	275.19 (28.73)	246.31 (14.69)	418.67 (25.43)
	Sadness	251.74 (36.60)	253.43 (15.38)	427.14 (26.33)
Mouth	Happiness	445.64 (17.00)	303.90 (15.19)	364.29 (23.03)
	Anger	567.43 (18.51)	239.17 (8.94)	261.12 (11.19)
	Disgust	522.57 (22.14)	230.67 (11.00)	255.67 (14.77)
	Fear	518.28 (20.52)	220.83 (8.64)	243.12 (10.58)
	Sadness	524.88 (24.59)	253.31 (10.96)	288.69 (15.91)

showed that the TFD was significantly longer for happy faces, followed by fear, sadness, anger, and disgust. There was also a significant interaction effect between the facial emotion and fixation region, $F(5.81, 232.45) = 6.96$, $p < .01$, $\eta_p^2 = 0.15$, indicating that the TFD was longer for a) fearful faces in the eye region and b) happy faces in both the nose and mouth regions (see Table 2). There was no three-way interaction among group, facial emotion, and fixation region, $F(5.81, 232.45) = 1.41$, $p = .21$, $\eta_p^2 = 0.03$.

4 Discussion

The present study examined whether the GAM's assertions of increased hostile emotional processing among violent video gamers are supported or overstated. It compared the ability of HVVGs and NVGs to recognize happiness with that of anger, disgust, fear, and sadness, using performance and eye-tracking metrics. The results supported H1 showing that participants demonstrated a pronounced ability to recognize happy faces over negative emotions. While both groups showed comparable rates of CRs, HVVGs demonstrated significantly faster RTs across all facial emotions. They displayed a 17% higher response accuracy and required approximately 120 milliseconds less time to recognize happy faces than the NVGs. This accelerated recognition pattern also extended to negative emotions, with HVVGs exhibiting superior recognition ability compared to NVGs. Consequently, the results rejected H2 and H3 by underscoring the sustained happy-face advantage and absence of impaired recognition of negative emotions among HVVGs.

The fixation metrics supported these results, showing that happy faces elicited faster TFF, with longer FFD and TFD. The two-way interaction effect between the facial emotion and fixation region showed that participants directed their gaze more quickly and extended it to the mouth region when recognizing happy faces. These findings align with prior research, suggesting enhanced visual attention toward the perceptually salient mouth region while recognizing happiness [5, 9, 10]. The results also showed no significant difference in the perceptual salience between HVVGs and NVGs in recognizing positive and negative facial emotions. Furthermore, compared to HVVGs, NVGs showed faster TFF but shorter FFD and TFD. This pattern indicates a distracted gaze among NVGs after the initial fixation [40, 41]. In contrast, HVVGs displayed a slower TFF followed by a longer FFD and TFD, indicating more sophisticated emotional processing. With an extended gaze after the initial fixation, HVVGs perceived specific fixation regions as more informative for accurate recognition of happiness, thereby attributing higher perceptual value to the mouth region [9]. Although the three-way interaction effect was not statistically significant, these gaze metrics provide crucial insights into the cognitive advantages that gamers may possess.

Superior visual attention processing among HVVGs indicates an attentional advantage as observed in the previous studies. For example, Ciobanu et al. [15] explored whether the attentional benefits that violent (or action) video gamers exhibit with non-emotional stimuli extend to facial expressions. Their results showed that violent video gamers outperformed non-gamers in tasks requiring attention to discriminate facial emotions. This enhanced performance among gamers was primarily due to a heightened response to the attended emotional stimuli rather than a diminished response to distracting information. The findings suggest that violent video gamers excel at concentrating on relevant stimuli and disregarding irrelevant ones. This discrepancy is consistent with the idea that emotional stimuli inherently draw attention to their spatial location, complicating the suppression of irrelevant stimuli [15].

Overall findings from performance and fixation metrics suggest that habitual exposure to violent video games does not necessarily translate into impairments in emotional processing in real-world contexts. These findings align with recent scholarly works [16, 39, 43, 44] indicating that the transient effects on emotion recognition [3, 4, 26, 27] do not reflect the long-term consequences of habitual violent video gaming. However, it is crucial to acknowledge that the GAM rejects the idea of viewing individuals as entirely malleable "blank slates" before being exposed to violent media [1, 7]. Our findings resonate with this perspective, suggesting that while some individuals might be more susceptible to the influence of violent content, others may not exhibit alterations in aggression levels or cognitive biases. Therefore, our work does not totally undermine the GAM itself but rather challenges the interpretations of studies that have overstretched the model's application to exaggerate the impact of violent video games.

There could also be a potential role of "aggression catharsis" in mitigating hostile tendencies through violent video games [20, 30]. In this context, Greitemeyer and Mügge [22] found that HVVGs are more likely to believe in the aggression-reducing effects of such games than non-gamers. This belief may stem from an attempt to alleviate cognitive dissonance associated with consuming violent media, as suggested by Gentile [21]. They argue that individuals justify their engagement with violent content by adhering to the notion of its cathartic effects, which supposedly purge negative emotions and hostile tendencies. The aggression catharsis, thus, acts as a "psychological buffer," allowing habitual gamers to rationalize the consumption of in-game violence under the guise of mood improvement [24]. The aggression catharsis induced by violent video games serves not only to mitigate the accumulation of negative emotions but also to diminish the reinforcement of hostile knowledge structures. This process, in turn, could foster a predisposition towards perceiving positive cues in the environment more readily. Hence, the aggression catharsis mechanism, facilitated by violent video gaming, could have paradoxically contributed to the increased perceptual salience for happy faces and also optimized the recognition efficacy for negative emotions. But this interpretation remains speculative, as aggression catharsis was not directly measured in the current investigation. We recommend that future research should empirically examine whether perceived cathartic benefits contribute to why violent video gamers do not necessarily exhibit hostile emotional processing despite repeated exposure to violent digital content.

Furthermore, it is noteworthy that the mean age of HVVGs was approximately 20 years (M_{age} = 20.09 years, SD = 0.89), with an average of eight years dedicated to playing violent video games. These formative developmental years might have profoundly influenced their emotional processing and cognitive development. The early and sustained exposure to violent video games during these critical years could have led HVVGs to develop adaptive strategies for processing emotional stimuli that might mirror those observed in NVGs [18]. It is likely that these gamers habituated to, or managed, heightened responses to negative content over time, culminating in a perceptual and emotional processing pattern akin to that of non-gamers. This normalization process might attenuate perceptual distinctions in emotional salience, rendering aggressive cues less impactful even after habitual exposure to violent video games.

This study holds significant implications for addressing concerns regarding the purported adverse effects of violent video games on players' emotional processing. Video games have frequently been positioned as potential contributors to societal problems, particularly following highly publicized violent incidents such as the Columbine and Sandy Hook shootings. Such claims have increased moral panic, wherein violent media are often framed as convenient cultural explanations for social evils despite limited empirical support for direct causal associations. Our findings challenge such simplistic narratives and contribute to the growing body of evidence questioning the tendency to treat violent video games as cultural scapegoats for broader societal concerns. Furthermore, the observed performance advantages among habitual violent video gamers suggest that repeated interaction with gaming environments may be associated with enhanced perceptual and cognitive efficiencies rather than solely negative outcomes. Despite these implications, our study has a few limitations. First, we acknowledge that the study's sampling strategy could have introduced self-selection bias. Participants were recruited based on stringent inclusion criteria and volunteered from a self-selected pool, thereby inherently skewing the sample toward individuals who already met the extreme exposure requirements. Given the focus on long-term habituation, probability sampling was impractical, as no existing registry of individuals with the precise exposure profiles was available for random selection. We also acknowledge a noticeable skew toward titles such as *Valorant* and *BGMI (Battlegrounds Mobile India)* that feature relatively cartoonish violence. While a few participants reported playing games with more graphic, intense violence (e.g., *Mortal Kombat*), their representation in the sample was limited. This imbalance restricts the ability to draw conclusions about the differential psychological impact of varying degrees and types of in-game violence. Additionally, while this study collected information on perceived violence, blood, and gore in the video game, it did not account for the variability in gameplay settings participants might have used. Contemporary video games, including popular titles like *BGMI* and *Valorant*, allow players to minimize or modify violent content, such as replacing blood with sparks or cartoonish graphic effects. Consequently, it is unclear whether participants in our study were uniformly exposed to raw, unmodified violence or intentionally selected alternative visual settings to reduce graphic elements.

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