THE EFFECTS OF HABITUAL VIOLENT VIDEO GAMING ON PLAYERS' EMOTIONAL PROCESSING: AN EXPERIMENTAL EVALUATION OF THE GENERAL AGGRESSION MODEL

Ph.D. Thesis

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I hereby certify that the work which is being presented in the thesis entitled **THE EFFECTS OF HABITUAL VIOLENT VIDEO GAMING ON PLAYERS' EMOTIONAL PROCESSING: AN EXPERIMENTAL EVALUATION OF THE GENERAL AGGRESSION MODEL** in the partial fulfillment of the requirements for the award of the degree of **DOCTOR OF PHILOSOPHY** and submitted in the **DISCIPLINE OF PSYCHOLOGY, SCHOOL OF HUMANITIES AND SOCIAL SCIENCES, INDIAN INSTITUTE OF TECHNOLOGY INDORE**, is an authentic record of my own work carried out during the time period from July 2022 to January 2026 under the supervision of Prof. Sanjram Premjit Khanganba, Professor, Human Factors & Applied Cognition Lab, Discipline of Psychology, School of Humanities and Social Sciences, Indian Institute of Technology Indore.

The matter presented in this thesis has not been submitted by me for the award of any other degree of this or any other institute.

22/04/2026

MR. ANANTHA U. G.

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

22/04/2026

PROF. SANJRAM PREMJIT KHANGANBA

ANANTHA U. G. has successfully given his Ph.D. Oral Examination held on 22 April 2026

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Om Sarve Bhavantu Sukhinah
Sarve Santu Niraamayaah |
Sarve Bhadraanni Pashyantu
Maa Kashcid-Duhkha-Bhaag-Bhavet |
Om Shaantih Shaantih Shaantih ||

Om. May all beings experience happiness.
May all be free from suffering and illness.
May all perceive and walk the path of what is auspicious and just.
May no one be touched by sorrow.
May peace prevail everywhere, without limit.

To "Aniketana," my spirit

May it remain unconfined, free from fear, enclosure, and limitation;
liberated from narrow identities and imposed boundaries;
and ever expanding toward a universal, fearless awareness.

SYNOPSIS

THE EFFECTS OF HABITUAL VIOLENT VIDEO GAMING ON PLAYERS' EMOTIONAL PROCESSING: AN EXPERIMENTAL EVALUATION OF THE GENERAL AGGRESSION MODEL

Abstract

This study examined whether habitual engagement with violent video games impairs emotional processing, as proposed by the General Aggression Model (GAM). According to this model, repeated exposure to violent content increases the accessibility of hostile cues and biases a person's cognition, affect, and arousal. However, these claims have been criticized as overstated. The present research focused on whether habitual violent video gaming is associated with deficits in recognizing basic facial emotions, including happiness, sadness, anger, disgust, and fear. Across three experiments, habitual violent video gamers were compared with different control groups using facial emotion recognition tasks.
Experiment 1 investigated whether habitual exposure to violent media biases emotional information processing and whether such effects differ by mode of interactivity. A total of 54 violent media users participated, comprising habitual violent video gamers (n = 27, M_{age} = 20.07 years, SD = 1.26) and non-video gamers (n = 27, M_{age} = 21.29 years, SD = 1.10). Both groups demonstrated a robust happy-face advantage, as well as poorer recognition of negative emotions. When trait aggression was statistically controlled, group differences were further attenuated.
Experiment 2 employed gaze behavior analysis during an emotional go/no-go task. A total of 42 violent media users participated, classified as habitual violent video gamers (n = 21, M_{age} = 20.09 years, SD = 0.89) and non-video gamers (n = 21, M_{age} = 21.66 years, SD = 2.01). Groups did not differ in overall emotion recognition accuracy. Eye-tracking indices

supported a happy-face advantage, with greater perceptual salience for the mouth region. Experiment 3 employed the same emotional go/no-go paradigm to compare habitual violent video gamers (n = 30, M_{age} = 20.03 years, SD = 0.92) who primarily played first-person shooters with habitual nonviolent video gamers (n = 30, M_{age} = 21.23 years, SD = 3.64). Both groups showed higher accuracy, faster responses, and fewer false alarms for happy faces, whereas recognition of negative emotions remained poorer. Overall findings do not support the claim that habitual violent video gaming impairs facial emotion processing. Instead, they underscore the need to consider broader psychosocial factors when evaluating the impact of violent video games.

Keywords: Violent Video Games; General Aggression Model; Facial Emotion Recognition; Happy-Face Advantage.

1. Introduction

1.1. Background of the Study

The influence of violent media has been a subject of debate since the widespread integration of digital technologies into daily life. This issue has become pronounced in the context of video games, given their accessibility and their impact on younger audiences. Video games have surged in popularity since their inception in the late 20th century and have become an integral part of modern interactive media. According to Newzoo reports, the global gaming population has reached approximately 3.3 billion, and the industry’s market value is expected to hit $188.9 billion by 2025. The most popular video games feature violence and aggression as central themes, reflecting their widespread appeal in the entertainment industry. As these games evolve in realism and immersive experiences, they elicit diverse effects on an individual’s cognition, affect, and behavior. This widespread availability and the diversity of content have sparked public and academic debates regarding their potential adverse effects on players.

The primary concern about violent video games is their potential to increase aggression and related violent behaviors. Over the past two decades, the General Aggression Model (GAM) has emerged as a dominant framework to explain how exposure to violent media can escalate subsequent aggression and potentially lead to violent behaviors (Anderson & Bushman, 2002). The GAM conceptualizes aggression from the standpoint of immediate social interactions and also from the angle of enduring personality development (Anderson & Bushman, 2002). According to this model, aggression induced by media content develops through current cognitive, affective, and arousal/behavioral readiness states (Allen et al., 2018). The present research specifically foregrounds the affective dimension, examining whether exposure to violent video games fosters hostile emotional information processing. Nevertheless, because these internal states are bidirectional and mutually reinforcing (Anderson & Bushman, 2002), affective changes are unlikely to remain isolated. For instance, if violent video games are found to increase aggressive tendencies, this may manifest as reduced empathic concern (affect), which subsequently heightens the accessibility of hostile thought process (cognition), ultimately facilitating aggressive behaviors (behavioral readiness). In this sense, while the affective pathway is the immediate focus, GAM suggests that any affective alterations reverberate across cognitive and behavioral domains, cumulatively shaping the trajectory of aggressive outcomes.

1.2. Violent Video Games and Emotional Processing

The GAM posits that even a brief exposure to violent media fosters impulsive appraisals, leading individuals to perceive ambiguous situations as hostile, a phenomenon referred to as "hostile attribution bias" (Anderson & Bushman, 2002). Such biased information processing is theorized to alter emotional responsiveness, making aggressively toned information more salient and more readily processed than neutral or prosocial cues. Early studies investigated this phenomenon by employing the “Emotional Stroop” task (Anderson et al., 1996). In this paradigm, attentional allocation is assessed by measuring reaction time (RT) differences between emotionally laden and non-emotionally laden words, providing an index of how emotional content captures attentional resources.

Building on this line of inquiry, Kirsh (1998) demonstrated that the influence of violent video games extends beyond attentional capture to the interpretation of social information. In this study, children who played a violent game were more likely to attribute hostile intent to peers in ambiguous stories compared to those who played a nonviolent game, reflecting a brief hostile attribution bias. This work complements the Stroop findings by showing that violent media exposure not only biases attention toward negative stimuli but also alters the way individuals appraise and emotionally respond to ambiguous social cues. Likewise, Kirsh et al. (2005) found that violent video gamers experienced significant interference when processing negatively valenced words, indicating a cognitive bias toward emotionally congruent stimuli. This aligns with the principles of GAM, suggesting that violent video gaming amplifies the salience and processing of negative information. Emotional Stroop tasks provided only indirect evidence of bias, since the emotional relevance of words is incidental to the task. To address this limitation, later studies adopted more ecologically valid methods, such as facial emotion recognition tasks. These paradigms directly assess whether individuals exposed to violent video games are more attuned to negative emotional cues in social contexts (see Diaz et al., 2016; Kirsh & Mounts, 2007).

In addition to biased information propositions, GAM studies have also contended for the systematic numbing of emotional reciprocation after violent media exposure. This process is referred to as “emotional desensitization," characterized by a reduced responsiveness to emotional stimuli that would normally evoke strong affective reactions, typically arising after repeated exposure to violence in media or interactive contexts, such as video games (e.g., Carnagey et al., 2007). Unlike short-term priming effects, which emphasize the immediate activation of aggressive thoughts and hostile interpretations, desensitization highlights an enduring process through which individuals become less emotionally reactive to depictions of violence. The implication is that over time, users may not only show a decline in empathic concern but also demonstrate attenuated physiological and behavioral responses to others' pain or distress. Recent studies have extended the concept of emotional desensitization to facial emotion processing, suggesting that violent video gaming impairs the recognition of affective expressions. For instance, reduced accuracy in identifying negative emotions such as disgust has been reported among habitual violent video gamers (Diaz et al., 2016). However, these findings remain inconsistent, with several studies failing to replicate such impairments across different behavioral tasks or neural indices (cf. Liu et al., 2017).

The literature examining desensitization through facial emotion recognition remains limited, leaving several critical issues unresolved. A key challenge lies in clarifying how the GAM accounts for the emotional consequences of violent video gaming. GAM studies often highlight biased processing of positive emotions, particularly reduced recognition of happy faces, whereas desensitization frameworks predict a broader dampening of affective responsiveness across valence. This raises an important conceptual friction: are violent video games primarily associated with selective impairments that disadvantage affiliative emotions, or do they induce a generalized blunting of positive and negative affect? Furthermore, the scope of desensitization remains ambiguous, as existing studies offer inconsistent evidence regarding whether impairments are confined to negative expressions (e.g., anger, disgust) or extend to positive cues as well. Addressing these questions is crucial for refining theoretical explanations of media effects. The present research directly addresses this gap by situating violent video game exposure within the intersecting lenses of biased emotional information processing and desensitization, and by empirically examining its implications for emotional processing, as operationalized through facial emotion recognition paradigms.

1.3. Research Gaps

A growing body of meta-analytical research suggests that links between violent video games and aggression are small, heterogeneous, or contingent on design choices (Hilgard et al., 2017). Longitudinal and preregistered analyses frequently report minimal or nonsignificant effects, raising concerns that the GAM's overarching claims may be overstated. Another major issue is publication and reporting bias in this line of research. Skeptics often argue that studies supporting the GAM are more likely to be published and cited, while those with null or unexpected findings struggle to gain visibility (Ferguson & Dyck, 2012). Several review works have flagged selective reporting and "researcher degrees of freedom" as potential sources of inflated support for desired effects (Hilgard et al., 2017). The upshot is that the published record may overstate the role of violent games in fostering aggression unless it is interpreted alongside bias diagnostics, sensitivity analyses, and evidence from prospective, well-controlled designs.

A significant criticism of the GAM also lies in its tendency to pathologize the consumption of violent media, assuming that individuals who choose such content harbor an inherent affinity for violence or aggression. This assumption negates the motivational diversity underpinning media selection. Studies based on Mood Management Theory (Zillmann, 1988) propose a fundamentally different interpretation. Individuals may engage with violent video games not to cultivate aggression, but rather to regulate their emotional states. According to this theory, media users strategically select content that helps alleviate negative affect or enhance mood. In this light, violent video games may serve as a "mood-enhancing tool," particularly for those experiencing frustration, boredom, or stress. This perspective challenges the deterministic assumptions of the GAM. Rather than assuming a unidirectional influence of violent gameplay on aggression, mood management frameworks recognize bidirectional and purposeful engagement with media. Likewise, the catharsis hypothesis asserts that violent gameplay may actually reduce aggression by providing a symbolic outlet for hostile emotions (Geen & Quanty, 1977). It posits that engaging with aggressive stimuli can reduce aggressive arousal, thereby serving a therapeutic function. In the context of digital media, this framework has been empirically explored in relation to violent video games, which are thought to offer players an emotionally immersive yet safe environment to discharge negative affect.

Although the GAM has been influential in conceptualizing the effects of violent media exposure on aggression through emotional desensitization and biased emotional information processing, several methodological concerns undermine the validity and generalizability of its empirical findings. A significant critique concerns the transient nature of most experimental designs used in GAM research (Kirsh & Mounts, 2007). Many of these studies have exposed participants to brief sessions of violent video gameplay or media clips, often lasting no more than 15–30 minutes, before measuring hostile emotional processing. While such designs may succeed in activating aggressive scripts in the short term, an important question arises whether these transient priming effects can be legitimately generalized to habitual players who have been engaging with violent media for so many years. Moreover, studies reporting hostile information processing or emotional desensitization have frequently overlooked key individual differences in gameplay frequency, accumulated experience, game genre preferences, addiction proneness, and broader contextual variables such as personality traits or social environment. This omission introduces a significant conceptual gap that impaired emotional processing is not a uniform or mechanistic outcome of violent media exposure, but rather a complex, multidetermined process that likely varies across individuals and developmental trajectories. Without accounting for these factors, the validity and generalizability of GAM claims remain tenuous and potentially overstated.

1.4. Rationale

As the preceding critique underscores, a range of methodological and conceptual limitations, particularly the reliance on short-term experimental manipulations and limited ecological validity, raise serious concerns about the robustness and generalizability of GAM findings. While the GAM remains a dominant framework in media psychology, the extent and consistency of scholarly criticism suggest that its conclusions may have been overstated or prematurely generalized, contributing to a form of "moral panic" within academic discourse and public opinion. In an era where digital media consumption is ubiquitous and increasingly necessary, it becomes imperative to evaluate violent video games from a balanced, empirically grounded, and theory-agnostic perspective. Rather than presuming harm, the task of media psychology must be to interrogate the conditions under which media effects manifest, for whom, and through what mechanisms. In response to these concerns, the present research seeks to critically re-evaluate the tenets of the GAM by adopting an alternative perspective that questions the deterministic view that violent video game exposure inevitably escalates aggression or impairs emotional functioning.

The present research diverges from short-term experimental paradigms and instead focuses on individuals who have been habitual players of violent video games, thereby introducing greater ecological and developmental relevance. Recognizing that the GAM postulates three interrelated internal states as mediators of aggressive behavior, this study intentionally narrows its focus to the emotional processing component, which has been most frequently cited in the literature as a marker of desensitization and hostile information processing (Carnagey et al., 2007). Moreover, to examine this dimension with greater ecological validity, the present research employs a facial emotion recognition task, a well-established paradigm for assessing social cognitive and emotional functions that are theoretically sensitive to both desensitization and hostile interpretation biases. Emotional recognition tasks have previously been used to investigate processing deficits in populations characterized by aggression or emotional blunting, making them a methodologically appropriate and theoretically grounded tool to examine whether habitual violent gaming impairs cognitive and emotional functioning in a meaningful way. Given the potential for gamers to become habituated to in-game violence, it is plausible that the initial aggressive priming may not necessarily represent the long-term cognitive and emotional impacts of such gaming practices (Ferguson & Dyck, 2012). Against this backdrop, the present research tests the GAM to examine whether its effects have been overstated, as skeptics contend, or whether violent media exposure genuinely exerts a detrimental influence on users.

1.5. Aim and Objectives

The primary aim of this thesis is to critically examine whether habitual engagement with violent video games is associated with elevated aggression levels and impaired emotional information processing. In doing so, the thesis addresses central limitations of the GAM, particularly its insufficient focus on the long-term effects of violent media exposure, the neglect of individual predispositions to aggression, and the absence of a strong empirical corpus linking emotional desensitization to facial emotion recognition paradigms. Specifically, this thesis investigates whether impairments in recognizing basic facial emotions will occur, indicating an overall emotional desensitization, or whether reduced accuracy in recognizing positive emotions, such as happiness, will be observed, which reflects a bias consistent with the GAM's predictions of hostile emotional processing. In line with this overarching aim, the specific objectives of this thesis are formulated as follows:

1. To assess dispositional levels of aggression (across physical aggression, verbal aggression, anger, and hostility) among habitual violent video gamers, and to evaluate whether these levels are within the normative range or indicative of heightened aggression contingent upon media usage.
2. To examine the relationship between violent media consumption and aggression, with a particular focus on whether dispositional aggression correlates with violent gameplay frequency and whether such consumption exerts a potential causal effect on aggression outcomes.
3. To investigate whether habitual violent video gamers display impairments in recognizing basic facial emotions (i.e., anger, disgust, fear, happiness, and sadness).
4. To explore whether impairments are especially pronounced for positive emotional expressions, such as happy faces, compared to negative emotions, thereby indicating biased information processing in line with the GAM's postulates.
5. To compare the levels of dispositional aggression and facial emotion recognition performance of habitual violent video gamers with different control groups, such as (a) non-interactive violent media users, (b) non-video gamers, and (c) nonviolent video gamers. These control groups will be used across three independent experiments.

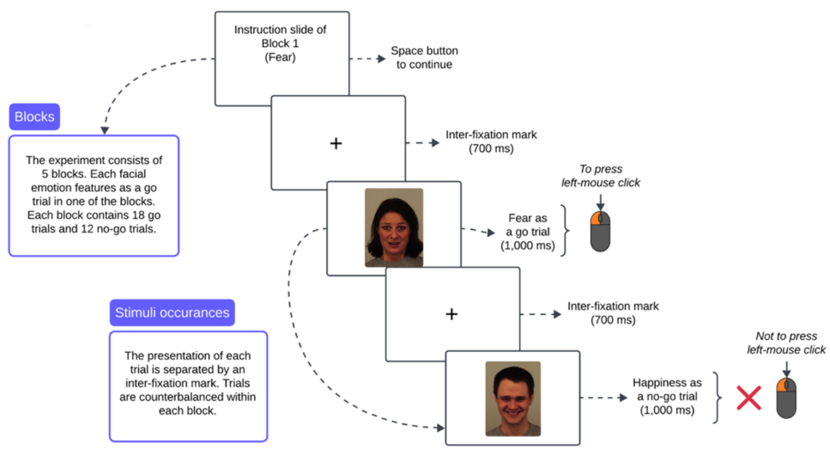
1.6. Study Outcomes and General Discussion

Across three systematically connected experiments, the present research examined whether habitual engagement with violent video games affects trait aggression and facial emotional processing. The studies collectively challenge widely held assumptions posited by the GAM, which attributes long-term violent media use to hostile cognition, impaired emotional information processing, and aggressive behavioral tendencies. Firstly, Experiment 1 compared habitual violent video gamers (classified as interactive violent media users) with non-video gamers who consumed violent content only through passive formats such as films and television. The study employed a 2 (experimental group: violent video gamers and non-video gamers) × 4 (facial emotion: anger, fear, happiness, and sadness) mixed factorial design, with the first factor serving as a between-subjects variable. The results showed that both groups exhibited a robust happy-face advantage and reduced capacity to recognize negative emotions. Importantly, trait aggression did not differ across users, and its inclusion as a covariate consistently reduced media-related effects on emotion recognition. These findings demonstrate that facial emotion recognition outcomes are more strongly associated with inherent dispositions than with media interactivity or content alone.

Experiment 2 extended the inquiry by incorporating advanced gaze behavior metrics to examine the interplay between aggression and emotional processing. In contrast to Experiment 1, this study compared habitual violent video gamers with non-video gamers who had no history of frequent violent media consumption in any format. Facial emotion recognition was assessed through an emotional go/no-go paradigm using five basic emotional expressions from the standardized KDEF dataset, and visual attention was measured across three areas of interest (AOIs)—the eyes, nose, and mouth. The study employed a mixed-factorial design with 2 (experimental group: violent video gamers and non-video gamers) × 5 (facial emotion: anger, disgust, fear, happiness, and sadness) × 3 (fixation region: eye, nose, and mouth), with the first factor serving as a between-groups variable. Both groups demonstrated similar recognition accuracy, replicating the happy-face advantage. Crucially, eye-tracking indices revealed that enhanced recognition of happiness was associated with strong perceptual salience of the mouth region, whereas weaker recognition of negative emotions was associated with distributed gaze patterns across the face. The findings did not support desensitization or hostile biases toward negative emotions, thereby questioning GAM's predictions and emphasizing perceptual rather than affective mechanisms in processing facial cues (see Figure 1).

Figure 1

The Emotional Go/No-Go Task Paradigm



Experiment 3 applied the same experimental paradigm as Experiment 2 but compared habitual violent video gamers with habitual nonviolent video gamers. The study employed a mixed-factorial design, with 2 (experimental group: violent video gamers and nonviolent video gamers) × 5 (facial emotion: anger, disgust, fear, happiness, and sadness) × 3 (fixation region: eye, nose, and mouth), where the first factor served as a between-groups variable. Findings revealed no differences in emotion recognition between groups, further establishing that habitual exposure to in-game violence does not reduce recognition of either positive or negative affective displays. Even at the level of gaze metrics, both groups used similar perceptual strategies, and violent gamers demonstrated lower levels of trait aggression. These results strongly dispute the notion that violent gaming disrupts emotional functioning.

Collectively, these experiments converge on three central conclusions: (a) Habitual violent video game play does not inherently increase aggression, (b) Facial emotion recognition follows natural perceptual salience patterns independent of violent media exposure, and (c) Dispositional aggression is a more decisive predictor of emotional processing outcomes than media content. These studies highlight a growing need to reconsider the GAM's applicability, particularly its overly generalized assumptions regarding habitual effects of violent media. The research demonstrates that emotional recognition biases, once attributed to hostile script acquisition or desensitization, may actually reflect normative perceptual tendencies in facial decoding. The findings substantiate emerging critiques that the GAM insufficiently addresses personality, mood regulation, catharsis, and broader psychosocial determinants of aggression (Ferguson & Dyck, 2012; Hilgard et al., 2017). In contrast, frameworks such as mood management and catharsis offer alternative interpretations in which gaming serves not as aggressive training but as emotional relief or regulation.

1.7. Significance

These findings have broad implications across policy, practice, education, and media discourse. For policymakers, the results challenge regulations driven by moral panic and discourage blanket assumptions that violent games foster antisocial behavior, suggesting instead the value of "age-appropriate" access and educational guidance rather than punitive restrictions. From a clinical and developmental perspective, the evidence reinforces that aggression is shaped by multiple interacting factors, indicating that violent media should not be pathologized in isolation and that interventions must consider familial, social, and dispositional influences. For parents and educators, the consistent happy-face advantage across all participants suggests that gaming does not impede emotional development, instead redirecting attention toward balanced media use, emotional literacy, and healthy peer engagement, rather than content-based fear. Finally, these findings contribute to reshaping public discourse by dismantling stigma surrounding violent gaming and replacing moralized assumptions with an empirically grounded understanding that recognizes neutral or even positive behavioral outcomes among habitual players. While the present experiments critically address the moral panic surrounding violent video games, they do not endorse excessive or addictive gaming. All participants were screened for problematic gaming behaviors, ensuring that findings reflect habitual. but not compulsive usage. It is important to note that outcomes may differ in cases of gaming addiction or among individuals with high dispositional aggression, who may be more susceptible to translating in-game violence into real-world hostility. These cautions were consistently acknowledged across all three experiments, underscoring that potential risks are linked to individual and contextual vulnerability rather than violent gameplay itself.

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LIST OF PUBLICATIONS

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ACRONYMS

ACC	Anterior Cingulate Cortex
ANOVA	Analysis of Variance
ANCOVA	Analysis of Covariance
AOI	Area of Interest
BGMI	Battlegrounds Mobile India
BPAQ	Buss and Perry Aggression Questionnaire
CI	Confidence Interval
C-MEQ	Content-Based Media Exposure Questionnaire
CR	Correct Response
CRTT	Competitive Reaction Time Task
DLPFC	Dorsolateral Prefrontal Cortex
EEG	Electroencephalogram
ERP	Event-Related Potential
ESRB	Entertainment Software Rating Board
FA	False Alarm
FFD	First Fixation Duration
FPS	First-Person Shooter
fMRI	Functional Magnetic Resonance Imaging
FTC	Federal Trade Commission
GAAM	General Affective Aggression Model
GAM	General Aggression Model
GSR	Galvanic Skin Response
GMST	Genov Modified Stroop Task
HFAC	Human Factors & Applied Cognition
HR	Heart Rate
HVVG	Habitual Violent Video Gamer
IAPS	International Affective Picture System
IARC	International Age Rating Coalition
IGDS9	Internet Gaming Disorder Scale-Short-Form

KDEF	Karolinska Directed Emotional Faces
MPFC	Medial Prefrontal Cortex
N2pc	N2-Posterior-Contralateral
NBC	The National Broadcasting Company
NPC	Non-Player Characters
NVG	Non-Video Gamer
NVVG	Nonviolent Video Gamer
PEGI	Pan European Game Information
PSPC	PG Student Progress Committee
RPG	Role-Playing Game
RT	Reaction Time
SAM	Self-Assessment Manikin
TCRT	Taylor Competitive Reaction Time Task
TFF	Time to the First Fixation
TFD	Total Fixation Duration
TFT	Thin Film Transistor
U.S.	United States
VRI	Video Game Rating Index

CHAPTER 1

GENERAL INTRODUCTION

1.1. Background

The influence of violent media has been a subject of sustained debate since the widespread integration of digital technologies into daily life. This issue has become pronounced in the context of video games, given their accessibility and their impact on younger audiences (Scharrer et al., 2018). Video games have surged in popularity since their inception in the late 20th century and have become an integral part of contemporary interactive media. Industry forecasts project that the global video games market will grow modestly beyond 2025, with total revenues expected to reach approximately $205 billion by 2026 (Udonis, 2024). Video games are now accessible on nearly every modern entertainment platform, offering a wide range of themes that span from casual puzzles to violent narratives. This transition toward enhanced realism and immersion has, in turn, sparked a deeper investigation into how gaming affects cognition, emotion, and behavior. The stakes of this inquiry are particularly high regarding violent content, which remains a focal point of academic debate. Given the ubiquity of these games among youth, it is essential to determine whether the resulting public concern is a legitimate response to evidence or a byproduct of moral panic.

The primary concern about violent video games is their potential to increase aggression and related violent behaviors. Historically, this association has been grounded in foundational perspectives such as Social Learning Theory (Bandura & Walters, 1977) and Script Theory (Huesmann, 1986). Over the past two decades, the General Aggression Model (GAM) has emerged as a dominant framework, synthesizing elements from several established theories of aggression to explain how exposure to violent media can escalate subsequent aggression and potential violent behaviors (Anderson & Bushman, 2002; Bushman & Anderson, 2002).

The GAM conceptualizes aggression from the standpoint of immediate social interactions and also from the angle of enduring personality development (Anderson & Bushman, 2002). At its core, the model proposes that aggression can be explained through the activation of "hostile knowledge structures" that guide social information processing. Even a brief exposure to violent media is argued to "prime" these knowledge structures, making aggressive thoughts and responses more readily accessible in memory (Anderson & Dill, 2000; Kirsh, 1998). Repeated exposure to media violence is further theorized to strengthen these hostile knowledge structures, making them more resistant to change and more likely to operate automatically over time (Allen et al., 2018; Anderson & Bushman, 2018). This automaticity implies that aggressive responses associated with violent media can be triggered with less conscious deliberation.

The GAM also accounts for chronic effects of violent media exposure through the "emotional desensitization" mechanism. This process entails a gradual reduction in negative affective reactions to violent stimuli following repeated exposure, which in turn normalizes aggression and reduces empathic responsiveness to others' suffering (Anderson et al., 2010). Experimental studies support this claim, showing that individuals exposed to violent video games exhibit lower physiological arousal to actual violence (Carnagey et al., 2007) and reduced prosocial sensitivity (Krahé et al., 2011). Over time, this reduced affective reactivity may foster more tolerant attitudes toward aggression, thereby reinforcing aggressive dispositions (Denson et al., 2020; Engelhardt et al., 2011). Taken together, these propositions suggest that violent media exposure may influence aggressive behavior immediately through the cognitive priming of hostile knowledge structures, and cumulatively through enduring alterations in emotional and cognitive processing.

The GAM frames these influences through the interconnection of cognition, affect, and arousal/behavioral readiness (Allen et al., 2018; Anderson & Bushman, 2002). The present research specifically foregrounds the affective dimension, examining whether exposure to violent video games fosters hostile emotional information processing. Nevertheless, because these "internal states" are bidirectional and mutually reinforcing (Anderson & Bushman, 2002), affective changes are unlikely to remain isolated. For instance, if violent video games are found to increase aggressive tendencies, this may manifest as reduced empathic concern (affect), which subsequently increases the accessibility of hostile thought process (cognition), ultimately facilitating aggressive behaviors (behavioral readiness). In this sense, while the affective pathway is the immediate focus, GAM suggests that any affective alterations reverberate across cognitive and behavioral domains, cumulatively shaping the trajectory of aggressive outcomes.

1.2. Violent Video Games and Emotional Processing

The GAM posits that even a brief exposure to violent media fosters impulsive appraisals, leading individuals to perceive ambiguous situations as hostile, a phenomenon referred to as "hostile attribution bias" (see Bushman & Anderson, 2002). Such biased information processing is theorized to alter emotional responsiveness, making aggressively toned information more salient and more readily processed than neutral or prosocial cues. Early studies investigated this phenomenon by employing the "Emotional Stroop" task (see Anderson et al., 1995, 1996). In this paradigm, attentional allocation is assessed by measuring response time differences between emotionally laden and non-emotionally laden words, providing an index of how emotional content captures attentional resources.

Building on this line of inquiry, Kirsh (1998) demonstrated that the influence of violent video games extends beyond attentional capture to the interpretation of social information. In this study, children who played a violent game were more likely to attribute hostile intent to peers in ambiguous stories compared to those who played a nonviolent game, reflecting a brief hostile attribution bias. This work complements the Stroop findings by showing that violent media exposure not only biases attention toward negative stimuli but also alters the way individuals appraise and emotionally respond to ambiguous social cues. Likewise, Kirsh et al. (2005) found that violent video gamers experienced significant interference when processing negatively valenced words, indicating a cognitive bias toward emotionally congruent stimuli. This aligns with the principles of GAM, suggesting that violent video gaming amplifies the salience and processing of negative information (Bushman & Anderson, 2002).

It is crucial to note that Emotional Stroop tasks provide only indirect evidence of bias, as the emotional relevance of words is incidental to the task. To address this limitation, subsequent research has pivoted toward more ecologically valid paradigms, such as emotion and facial expression recognition. Unlike Stroop tasks, these paradigms directly assess whether individuals exposed to violent video games are more attuned to negative emotional cues in social contexts. Empirical evidence supports this shift toward direct assessment. For instance, Kirsh et al. (2006) observed that high consumption of violent media predicted a hostile processing pattern where participants were significantly faster at identifying angry faces but slower to recognize happy ones, a result that held regardless of baseline aggression. Extending this finding to the interactive realm, Kirsh and Mounts (2007) found that exposure to violent video games specifically impaired the accuracy of happiness recognition, though it did not affect the detection of anger. Diaz et al. (2016) further demonstrated that participants exposed to violent games showed impairments in recognizing emotional expressions such as disgust, suggesting that repeated violent gaming skews perceptual sensitivity across several negative affective cues. By moving from indirect tasks to direct assessments of social and emotional information processing, this line of inquiry underscores how violent video games may not only prime hostile cognitions but also alter the affective processes that underlie everyday interpersonal interactions.

In addition to biased information propositions, several GAM studies have contended for the systematic numbing of emotional reciprocation after violent media exposure. This process is referred to as "emotional desensitization," which is characterized by a reduced responsiveness to emotional stimuli that would normally evoke strong affective reactions, typically arising after repeated exposure to violence in media or interactive contexts such as video games (Bushman & Anderson, 2009; Carnagey et al., 2007; Funk et al., 2004). Unlike short-term priming effects, which emphasize the immediate activation of aggressive thoughts and hostile interpretations, desensitization highlights an enduring process through which individuals become less emotionally reactive to depictions of violence (Krahé et al., 2011). The implication is that over time, users may not only show a decline in empathic concern but also demonstrate attenuated physiological and behavioral responses to others' pain or distress (Bartholow et al., 2006).

Recent studies have extended the concept of emotional desensitization to facial emotion processing, suggesting that violent video gaming impairs the recognition of affective expressions. This line of research suggests that violent gaming may act as a "perceptual filter," blunting players' ability to decode subtle affective expressions. For instance, Diaz et al. (2016) identified a selective impairment in the recognition of disgust among habitual violent gamers, while Miedzobrodzka et al. (2021) reported broader recognition deficits across a spectrum of negative emotions. However, the literature is currently defined by a notable lack of consensus, with several studies failing to replicate such impairments across different behavioral tasks or neural indices (Y. Liu et al., 2017; Pichon et al., 2021). These discrepancies question whether desensitization is a universal consequence of violent gaming or if it is contingent upon critical moderators, such as the duration of exposure or underlying dispositional traits.

Furthermore, a key challenge in this line of research lies in clarifying how the GAM accounts for the emotional sequelae of violent gameplay. While some studies backing this model often highlight a selective bias against positive cues (e.g., reduced recognition of happy faces), desensitization frameworks posit a more generalized dampening of affective responsiveness, irrespective of valence. This tension introduces a critical conceptual friction of whether violent video games are primarily associated with selective impairments that disadvantage affiliative emotions, or whether they induce a generalized blunting of positive and negative affect. The scope of this desensitization remains academically ambiguous, as empirical evidence fluctuates between findings of isolated impairments in negative expressions (e.g., anger or disgust) and broader deficits that encompass positive cues as well. Resolving this inconsistency is essential for refining the theoretical architecture of media effects. The present research addresses this gap by situating violent video game exposure at the intersection of biased information processing and desensitization, empirically evaluating these competing predictions through the precise lens of facial emotion recognition paradigms.

1.3. Research Gaps

Although the GAM is among the most frequently cited frameworks in violent media research, it is also one of the most debated and controversial, too. Before evaluating how violent video games influence emotional processing, one must first determine if media engagement reliably fosters aggression, and whether that foundational link is empirically settled or remains under active dispute. While a considerable body of research supports the premise that violent media cultivates aggressive behavior (Anderson et al., 2010, 2017; Bushman & Anderson, 2002; Gentile et al., 2011, 2014), the model continues to face rigorous scrutiny from skeptics who question its predictive validity. Meta-analytical studies suggest that the link between violent video games and aggression is small, heterogeneous, or contingent on design choices (Hilgard et al., 2017). Recent longitudinal and preregistered analyses report minimal or nonsignificant effects, raising concerns that the GAM's overarching claims may be overstated (Ferguson & Wang, 2019; Przybylski & Weinstein, 2019). Moreover, when studies incorporate stronger controls and prospective designs, effect estimates often attenuate, implying that previously observed associations may reflect confounding, measurement choices, or analytic flexibility (Elson & Ferguson, 2014; Hilgard et al., 2017).

Parallel to these critiques, scholars have emphasized a shift toward multifactorial models that prioritize "buffering" or "catalyzing" factors, such as personality traits, family dynamics, and sociocultural norms (Ferguson, 2008; Ferguson, Cruz, et al., 2008; Ferguson, Rueda, et al., 2008). These factors can mitigate or magnify the potential effects of violent media. For example, adolescents exposed to high levels of media violence showed greater aggression when they also came from dysfunctional families, illustrating a "double dose" effect (Fikkers et al., 2013). Similarly, longitudinal studies indicate that personality characteristics and contextual risk factors are often stronger predictors of aggression and antisocial behavior than violent media use alone (Ferguson, Rueda, et al., 2008; Von Salisch et al., 2011).

Empirical validity of the GAM is also frequently compromised by methodological constraints that hinder the generalizability of its findings. A primary criticism concerns the temporal limitations inherent in its experimental design. Much of the supporting evidence (e.g., Bartholow et al., 2006; Kirsh et al., 2006; Kirsh & Mounts, 2007; Wang et al., 2009) relies on acute laboratory exposures (e.g., sessions often lasting only 15 to 30 minutes) to measure shifts in hostile information processing. While such designs may succeed in activating aggressive scripts in the short term, an important question arises whether these transient priming effects can be extrapolated to represent the psychological state of habitual gamers with years of cumulative exposure. Building on these methodological critiques, recent neuroscientific inquiries have increasingly questioned the purported affective consequences of violent video game exposure, specifically challenging the desensitization hypothesis. Studies suggest that brief gaming sessions may trigger transient priming but fail to induce meaningful or enduring shifts in emotional processing. For example, Kühn et al. (2019) used functional magnetic resonance imaging (fMRI) to track participants over two months of daily violent gameplay, finding no significant alterations in the neural correlates of emotional processing. This suggests that even sustained exposure does not necessarily rewire affective circuitry. Likewise, Szycik et al. (2017) found that the neural correlates of empathy in habitual violent gamers remained comparable to non-gaming counterparts, further challenging the notion of reduced emotional responsiveness.

Moreover, studies reporting hostile information processing or emotional desensitization have frequently overlooked key individual differences in gameplay frequency, accumulated experience, game genre preferences, addiction proneness, and broader contextual variables such as personality traits or social environment. This omission introduces a significant conceptual gap that impaired emotional processing is not a uniform or mechanistic outcome of violent media exposure, but rather a complex, multidetermined process that likely varies across individuals and developmental trajectories. Without accounting for these factors, the validity and generalizability of GAM claims remain tenuous and potentially overstated.

Beyond methodological inconsistencies, the field faces a systemic challenge in the form of publication and reporting bias. Critics contend that the literature surrounding the GAM suffers from a "file drawer effect," wherein studies confirming the model's predictions are disproportionately published and cited, while null or contradictory results languish in obscurity (Ferguson, 2007; Ferguson & Kilburn, 2010). Several review works have flagged selective reporting and "researcher degrees of freedom" as potential sources of inflated support for desired effects (Elson & Ferguson, 2014; Hilgard et al., 2017). The upshot is that the published record may significantly overstate the relationship between violent gameplay and aggression. Consequently, any robust theoretical interpretation must look beyond simple effect sizes and prioritize bias diagnostics and evidence from prospective, preregistered designs, which offer greater transparency and methodological rigor.

Furthermore, many GAM studies have disproportionately emphasized external, learned influences, particularly violent media exposure, and the subsequent formation of hostile knowledge structures. In doing so, they have often downplayed or insufficiently addressed the role of dispositional factors that directly or indirectly predispose individuals to aggressive behavior. Ferguson and Dyck (2012) argue that the GAM assumes a universal susceptibility to media violence, often treating individuals as "blank slates" upon which aggressive scripts are inscribed through repeated exposure. As a result, dispositional variables such as trait aggression, impulsivity, or emotional dysregulation are either treated as "peripheral moderators" or overlooked altogether. This imbalance risks oversimplifying the dynamic nature of human aggression, which is shaped by a combination of intrinsic and extrinsic factors.

A significant criticism of the GAM also lies in its tendency to pathologize the consumption of violent media, assuming that individuals who choose such content harbor an inherent affinity for violence or aggression. This assumption negates the motivational diversity underpinning media selection. Drawing from Mood Management Theory (Zillmann, 1988), alternative interpretations suggest that engagement with violent video games is often a strategic form of emotional regulation rather than a precursor to violence (Reinecke, 2016). Within this framework, players are viewed as active agents who utilize media as an "enhancing tool" to alleviate boredom, mitigate frustration, or dissipate stress. Recent empirical evidence supports this claim, suggesting that violent gameplay can facilitate mood repair in stressful conditions (Denson et al., 2022). Ultimately, these findings challenge the deterministic linearity of the GAM. Rather than assuming a unidirectional influence of violent gameplay on aggression, mood management frameworks recognize bidirectional and purposeful engagement with the media (N. D. Bowman & Tamborini, 2015; J. Liu, 2020).

In a related vein, proponents of the catharsis hypothesis argue that violent gameplay may actually reduce aggression by providing a symbolic outlet for hostile emotions. Originally rooted in the Freudian psychoanalytic framework, catharsis was later adapted for social and media psychology by Geen and Quanty (1977). It posits that engaging with aggressive stimuli can reduce aggressive arousal, thereby serving a therapeutic function. In the context of digital media, this framework has been empirically explored in relation to violent video games, which are thought to offer players an emotionally immersive yet safe environment to discharge negative affect. For example, Gentile (2013) argued that such gameplay experiences could provide a psychological "release valve," especially for individuals experiencing high levels of frustration or stress. Several studies have quantified momentary declines in aggressive feelings following gameplay, particularly among those high in trait anger or stress (cf. Bowman & Tamborini, 2015; Kühn et al., 2019). Likewise, a longitudinal eight-wave study reported that violent (vs. nonviolent) video gaming was associated with decreased verbal and physical aggression among heavy users, lending support to the catharsis hypothesis

(E.-J. Lee et al., 2021). While the catharsis hypothesis remains debated and not without its critics (cf. Kersten & Greitemeyer, 2022), contemporary studies underscore its theoretical and empirical relevance in reevaluating simplistic and overstated interpretations of violent media consumption.

1.4. Rationale

While GAM remains a dominant framework in media psychology, the extent and consistency of scholarly criticism suggest that its conclusions may have been overstated or prematurely generalized, contributing to a form of "moral panic" within academic discourse and public opinion (Markey & Ferguson, 2017). As the preceding critique underscores, a range of methodological and conceptual gaps, particularly the reliance on short-term experimental manipulations and limited ecological validity, raise serious concerns about the robustness and generalizability of GAM findings. The present research diverges from short-term experimental paradigms and instead focuses on individuals who have been habitual players of violent video games, thereby introducing greater ecological and developmental relevance. Additionally, this investigation centers on emotional processing using a facial emotion recognition paradigm, a component that the literature identifies as an important marker of desensitization and hostile information processing (Diaz et al., 2016; Kirsh & Mounts, 2007; Pichon et al., 2021). Emotional recognition tasks have previously been used to investigate processing deficits in populations characterized by aggression or emotional blunting, making them a methodologically appropriate and theoretically grounded tool for examining whether habitual violent gaming impairs cognitive and emotional functioning in meaningful ways (e.g., Miedzobrodzka et al., 2021, 2022).

In an era where digital media consumption is ubiquitous and increasingly necessary, it becomes imperative to evaluate video games from a balanced, empirically grounded, and theoretically "agnostic" perspective. Rather than operating largely under a presumption of harm, the objective of contemporary media psychology must be to interrogate the specific conditions under which effects manifest, identifying for whom these effects occur and the precise mechanisms that drive them. In response to these concerns, the present research seeks to critically test the tenets of the GAM by adopting an alternative perspective that questions the deterministic view that violent video game exposure inevitably escalates aggression or impairs emotional functioning. Given the potential for gamers to become habituated to in-game violence, it is plausible that the initial aggressive priming may not necessarily represent the long-term cognitive and emotional impacts of such gaming practices (Ferguson & Dyck, 2012).

Against this backdrop, the present research tests the GAM assertions to examine whether its effects have been overstated or whether violent media exposure genuinely exerts a detrimental influence on users. Specifically, it examines whether habitual exposure to violent video games produces measurable changes in aggression, with particular emphasis on emotion recognition paradigms as an index of hostile information processing as well as desensitization. In doing so, the research not only evaluates the robustness of the GAM but also advances the broader goal of refining theoretical models in media psychology to better reflect the variability and contextual nature of digital media engagement.

1.5. Aim and Objectives

The primary aim of the present thesis is to critically examine whether habitual engagement with violent video games is associated with elevated aggression levels and impaired emotional information processing. In doing so, it addresses central limitations of the GAM, particularly its insufficient focus on the habitual effects of violent media exposure, the neglect of individual predispositions to aggression, and the absence of a strong empirical corpus linking emotional desensitization and hostile information processing to facial emotion recognition paradigms. Specifically, this thesis investigates whether there will be impairments in the recognition of basic facial emotions, indicating an overall emotional desensitization, or a reduced accuracy in recognizing positive emotions, such as happiness, reflecting a bias consistent with the GAM's predictions of hostile emotional processing. In line with this overarching aim, the present thesis is an attempt to achieve the following objectives:

1. To assess levels of aggression among habitual violent video gamers, and to evaluate whether these levels are within the normative range or indicative of increased aggression contingent upon media usage.
2. To examine the relationship between violent media consumption and aggression.
3. To investigate whether habitual violent video gamers display impairments in recognizing basic facial emotions (i.e., happiness, anger, disgust, fear, and sadness).
4. To explore whether impairments are especially pronounced for positive emotional expressions, such as happy faces, compared to negative emotions, thereby indicating biased (or hostile) information processing in line with the GAM's postulates.
5. To compare the levels of aggression and facial emotion recognition performance of habitual violent video gamers with different control groups, such as (a) non-interactive violent media users, (b) non-video gamers, and (c) nonviolent video gamers. These control groups will be used across three independent experiments, each designed to address the proposed objectives.

1.6. Individual Chapters

Chapter 1 provides a brief introduction to the background, theoretical framework, and problematization. Chapter 2 is the Literature

Review section, which provides a comprehensive overview of the historical debates and theoretical frameworks surrounding violent video games, followed by an extensive review of studies that support and criticize the GAM. This section begins by clarifying how violent video games are classified and traces their evolution from early arcade titles to contemporary photorealistic blockbusters. The chapter also examines how some of the infamous school shooting cases, such as the Columbine, Virginia Tech, and Sandy Hook shootings, have intensified scrutiny of violent games, often framing them as cultural scapegoats in public and political discourse. Building on this, the discussion highlights the recurrent cycles of moral panic that position games as "folk devils," despite the lack of consistent empirical evidence linking them to extreme violence. The latter sections of the chapter situate violent games within broader psychological theorization, covering classical models of aggression, such as social learning, script theory, arousal and excitation transfer, and desensitization. While Chapter 1 briefly introduces the GAM, Chapter 2 provides a detailed account of the model, explaining its core principles, extensions, and the way it situates violent media, particularly violent video games, under continuous scrutiny. In doing so, Chapter 2 establishes both the historical context and the conceptual foundations upon which the thesis builds its empirical investigations. The chapter concludes with critiques of the GAM, noting concerns about overgeneralization, publication bias, and the uncertainty of translating priming effects into habitual outcomes.

With the research gaps and key limitations of the GAM established, the thesis proceeds to three core experimental studies, presented in the subsequent chapters. Each study is examined independently while remaining aligned with the overarching objectives and central aim of the thesis. Every experiment is introduced with its own background, research problem, and hypotheses, followed by a detailed methodology and presentation of results. To maintain clarity, each experimental study concludes with a dedicated discussion section that evaluates the acceptance or rejection of the stated hypotheses and highlights the broader implications of the findings. While certain elements may overlap across the three studies, given their shared foundation in the overarching objectives, each has been specifically designed to address research questions with different control groups and experimental protocols.

Chapter 3 turns to the first experimental study, which examines facial emotion processing among habitual violent media users. The study compares two groups: individuals who regularly engage with violent video games (interactive media) and those who primarily consume violent content through films and television (non-interactive media). Using a facial emotion recognition paradigm, the chapter investigates whether frequent exposure to violent media influences the “happy-face advantage” and whether this effect differs by mode of media interaction. Trait aggression is included as a control variable to account for individual predispositions. By examining whether interactive and non-interactive violent media present differential effects on emotional recognition, Chapter 3 provides critical evidence against strong causal claims of the GAM and underscores the importance of considering individual traits in conjunction with media exposure.

Chapter 4 presents the second experimental study, which compares facial emotion processing between habitual violent video gamers and non-video gamers. The study investigates whether repeated exposure to violent games alters the happy-face advantage and whether such effects extend to the recognition of negative emotions. In doing so, it examines emotional desensitization and potential biases in the processing of emotional information. While Chapter 3 focused only on behavioral outcomes, Chapter 4 extends the analysis by incorporating eye-tracking methodology. Participants completed an emotional go/no-go task, which not only measured recognition performance but also provided detailed gaze metrics, allowing for a granular assessment of attentional allocation to diagnostic facial regions.

Chapter 5 presents the third experimental study, which examines facial emotion processing among habitual violent media users. While the previous experiment in Chapter 4 investigated violent video gaming more broadly, this study narrows its scope to FPS games, a genre characterized by immersive, highly interactive combat. The rationale for this focus lies in the unique cognitive and perceptual demands of FPS gameplay, which requires sustained attention and continuous engagement with hostile cues presented within a first-person narrative. These features make FPS games an important "test case" for evaluating whether heightened interactivity and realism amplify the effects predicted by the GAM, particularly desensitization and attentional bias in emotion recognition. Structurally, the study follows the same design as the second experiment, combining the emotional go/no-go paradigm with eye-tracking to measure recognition performance and gaze allocation. By isolating a genre that dominates the violent gaming landscape, this study aims to provide sharper insights into whether specific forms of violent gameplay exert stronger influences on socio-cognitive processes compared to violent gaming in general. Furthermore, this experiment introduces a critical comparative dimension by evaluating facial emotion recognition in habitual violent gamers against a control group of habitual nonviolent gamers. This distinction represents a significant departure from previous designs, as it enables the investigation to isolate the effects of "violent content" from the broader habits associated with frequent gaming. By controlling for gaming frequency and engagement, the study can more accurately determine whether observed deficits in social perception are a direct consequence of violent stimuli or a byproduct of a chronic gaming lifestyle.

Chapter 6 presents a general discussion that synthesizes and integrates the key findings from the three experiments, drawing together the individual discussion points into a cohesive interpretative framework. This chapter also highlights the theoretical, empirical, and methodological significance of the present doctoral thesis. Chapter 7 presents the study's overall conclusions, outlining the broader implications of the findings and elaborating on the scope and directions for future research. A comprehensive list of Appendices is provided thereafter, followed by the reference section.

CHAPTER 2

LITERATURE REVIEW

2.1. Classification and Evolution of Video Games

The gaming industry does not categorize “violent video games” as a distinct genre. Instead, genres are defined by functional mechanics and the mode of player agency (e.g., shooters, action/adventure). Violence, therefore, is a thematic layer rather than a structural foundation. Despite this technical distinction, the term has been adopted as a taxonomical heuristic by sociologists, policymakers, and media critics to categorize gameplay based on its representational content. Building upon this framework, the present thesis uses the label “violent video games” as a descriptive variable to identify titles featuring high levels of simulated physical conflict, without suggesting that these games share a unified mechanical or structural origin.

Further, the intensity and frequency of violent content in games are typically assessed using established content rating systems. In this study, the classification of violence in computer and console games is based on the Entertainment Software Rating Board (ESRB) and the Pan European Game Information (PEGI) systems, both of which provide standardized criteria for evaluating violent themes and their severity. For mobile games, violence ratings are derived from the International Age Rating Coalition (IARC) system, which integrates ratings from multiple regional boards and is widely adopted by app distribution platforms such as Google Play and the Apple App Store.

Originally, researchers coined the term “aggressive gaming” to study the violent content within games. For instance, Anderson and Ford (1986) sought to quantify the immediate affective consequences of exposure to varying degrees of simulated aggression. They employed a self-reported 7-point scale to assess violence based on content and graphics. Games like *Zaxxon* (1981) and *Robottack* (1983) were rated high in violence, while *Castle Guard* and *Centipede* received moderate ratings for their violent content. The findings indicated that players who engaged in more aggressive gameplay (e.g., *Zaxxon*) exhibited higher levels of hostility and anxiety than those who played milder games (e.g., *Centipede*). Anderson and Ford (1986) thereby provided early insights into a method for classifying video games based on their violent content.

The roots of what might now be called violent gameplay can be traced back to the late 1970s and early 1980s. This period is marked by the meteoric rise of arcade video games. Bowman and Rotter (1983) observed that the majority of these games engaged players in simulated acts of destruction, killing, or violence, reporting that 85% of the 28 games they analyzed contained such content. The prevalence of violence was also documented by Dominick (1984), who noted that genres like "shoot-'em-up" and "beat-'em-up," with their aggressive mechanics, were particularly influential among youth. Arcade games such as *Space Invaders* (1978) and *Pac-Man* (1980) served as early examples of what could be considered violent video games. Their fast-paced, competitive mechanics captivated global audiences and sparked debates on the psychological and social influence of video games (Ellis, 1990). Other notable titles, such as Atari's *Battlezone* (1980) and Midway's *Wizard of Wor* (1981), served as foundational prototypes for the contemporary "first-person shooters" (FPS) genre. Although these games lacked explicit violence by current standards, they introduced mechanics that required players to eliminate threats (Kent, 2010). Despite their technical simplicity, they incorporated core elements such as targeting precision, evasive maneuvers, and the potential for collateral damage, features that remain central to the design of modern violent video games. This style of interaction, combined with the commercial success of several titles, laid the groundwork for the development of games with more overtly violent themes, reflecting an evolutionary trajectory toward increasingly direct depictions of conflict and aggression.

Beyond shooters and arcades, studies have explored the impact of "fighting games" such as *Karateka* (1984) and *Double Dragon* (1987), which are the precursors to the contemporary "beat-'em-up" genre. For instance, Schutte et al. (1988) investigated the effects of video game exposure on children's behavior. They found that children who engaged with a violent video game (i.e., *Karate*) displayed aggressive behaviors that reflected the hostile traits and actions of the in-game characters. Likewise, Irwin and Gross (1995) reported that children exhibited more object aggression during free play involving violent video games and more interpersonal aggression in frustrating situations compared to their counterparts who played less violent games. Both studies support Social Learning Theory (Bandura & Walters, 1977), emphasizing that aggression can be learned and reflected in children's behavior by observing the actions of video game characters.

An interesting trend in the evolution of violent video games is their progressive enhancement of graphic depictions, particularly with respect to blood and gore. Dill and Dill (1998) noted that one of the most iconic and widely played games of the 1990s, *Mortal Kombat* (1993), exemplified this shift. It achieved "cult" status in the United States, centered on a "to the death" combat system between two humanoid martial arts fighters. Its graphic violence was a major contributor to its popularity, prompting the release of increasingly explicit sequels in 1994 and 1995 (Elmer-Dewitt & Dickerson, 1993). These updated versions introduced elaborate "finishing moves," or "fatalities," allowing characters to perform brutal actions, such as burning opponents down to their skeletons or decapitating them with a dangling spine. Even in its contemporary forms, *Mortal Kombat* retains the core fighting mechanics of the original, yet the exponential growth in graphics has intensified the immersive quality of its violence.

A similar trajectory of realism and thematic intensity can be observed in other influential titles of the early to mid-1990s. For example, id Software's *Wolfenstein 3D* (1992) pioneered the FPS format by placing players directly in the role of a soldier navigating Nazi strongholds (Carnagey & Anderson, 2004). Shortly thereafter, *DOOM* (1993) expanded upon these mechanics by introducing networked multiplayer capabilities and intense graphic violence, including gore and demonic imagery (Pinchbeck, 2013). Both *Wolfenstein 3D* and *DOOM* not only revolutionized technical and aesthetic standards for the FPS genre but also became focal points in public debates over the potential psychological effects of realistic virtual violence (Anderson & Bushman, 2001; Anderson & Dill, 2000; Sherry, 2001). Together, these examples show how early technological and design innovations in the 1990s set the stage for the sustained escalation of violent visual and thematic elements in video game development.

Over the past two decades, violent video games have undergone a marked escalation in realism and interactivity. These advancements are largely driven by processing power, graphics rendering, and online connectivity. Successful titles, such as the *Grand Theft Auto* series, introduced narrative-driven open-world environments that allow players to engage in complex acts of violence within highly detailed virtual settings (Loguidice & Barton, 2012). Such designs not only expanded the scope of gameplay violence but also normalized exposure to explicit content, including nudity, gambling, and coarse language. Enhanced graphical fidelity enabled lifelike depictions of blood spatter, injury detail, and environmental destruction. Similarly, advances in artificial intelligence allowed non-player characters (NPCs) to exhibit more reactive and aggressive behaviors. The introduction of online multiplayer in franchises such as *Halo 2* (2004) and *Counter-Strike: Source* (2004) extended these dynamics into persistent, socially interactive contexts, where competitive and cooperative forms of virtual combat unfolded within global player networks (Jansz & Tanis, 2007). This social dimension has been linked to the reinforcement of aggressive norms through peer interaction and repeated exposure in competitive settings (Adachi & Willoughby, 2011).

The rapid expansion of shooters, open-world action/adventure, and role-playing games (RPGs) has extended their reach to a global audience over the past two decades. Technological advancements in these games have enabled photorealistic portrayals of violence, marking a stark departure from the pixelated combat of early gaming eras. Studies have examined how these high-fidelity depictions intensify emotional engagement and physiological arousal during gameplay (Kessner & Cortes, 2023; Spence, 2024; Wills & Wright, 2023). Narrative design plays a crucial role in this immersive effect. Modern blockbuster titles, such as *Red Dead Redemption 2* (2018), *The Last of Us Part II* (2020), and *Call of Duty: Modern Warfare II* (2022), integrate violence within richly developed story arcs, where players often progress in tandem with the unfolding narratives. The fusion of interactivity and cinematic storytelling is particularly prevalent in genres where violence is integral to gameplay mechanics. The narrative style, with the freedom to "do almost anything under the sky," not only enhances player agency but also fuels anticipation for sequels. Market performance data reinforces this trend. At the same time, a critical paradox remains, as in, despite the upward trend toward intensifying the graphic and psychological realism of violence, does this immersion translate into actual behavioral aggression in players? Also, if such content is theorized to produce negative affect, why does the consumer demand for increasingly visceral and immersive gameplay continue to escalate?

Recent market reports show that shooter games and action-adventure titles dominate the global gaming industry. In 2024, shooters accounted for 14.1% of total PC gaming revenue, making them the top-grossing PC genre, while action/adventure games led on consoles with 17.1% of revenue (RocketBrush Studio Ltd., 2024). The *Call of*

Duty franchise illustrates this dominance, generating over $30[1] billion in lifetime revenue and selling 500 million copies worldwide (Byshonkov, 2024). Individual titles have broken entertainment launch records, with *Modern Warfare* (2019) earning $600 million in its first three days, *Modern Warfare 2* (2009) grossing $310 million in its first 24 hours and surpassing $550 million in five days, and *Modern Warfare 3* (2011) reaching $1 billion in just 16 days. In 2024, *Call of Duty: Black Ops 6* was the best-selling game in the U.S., marking the 16th consecutive year the franchise topped annual sales charts (Panchenko, 2024). Narrative-driven action-adventure titles, such as *Red Dead Redemption 2* (2018), *The Last of Us Part II* (2022), and *Ghost of Tsushima* (2020), have also achieved multimillion sales, often dominating console leaderboards due to their strong storytelling appeal (Sweney, 2018). RPGs maintain a robust market presence as well, with the *Pokémon* franchise surpassing 480 million units sold and *Final Fantasy* exceeding 200 million units globally.

This cycle of hype around violent gameplay is sustained by the intense anticipation for *Grand Theft Auto VI* (Stuart, 2025). As part of one of the most commercially successful and culturally influential franchises, this game has already garnered massive attention despite limited official information. Rockstar Games' reputation for delivering sprawling, detail-rich worlds where players can engage in unrestricted action has set expectations for groundbreaking advancements in graphics, narration, and interactivity. The hype is not merely about gameplay, but it reflects the broader cultural positioning of such games as entertainment spectacles that blend technological innovation with "transgressive" content.

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[1]Note: Financial data and commercial metrics are presented in U.S. Dollars (USD) to align with global industry standards and ensure consistency with the original data sources. While the present study is contextualized within the Indian market, reporting data in local currency (INR) for globally sourced figures could introduce computational discrepancies or misrepresent market trends due to fluctuating exchange rates.

Given this trend and sales data, it is reasonable to conclude that violent video games occupy a dominant position in the global gaming industry. Their commercial success is not restricted to a handful of countries but rather reflects a global phenomenon. As a result, violent gaming has moved beyond being a niche activity for a select demographic and has become normalized and integrated into everyday digital consumption. If one accepts the argument that violent video games inevitably produce aggression, the logical extension would be that more than a billion players worldwide are now at risk of increased aggression simply because of their gaming habits. However, the present research makes it absolutely clear about its stance that none of the aforementioned facts negate legitimate concerns about the psychological impact of repeated exposure to violence in contexts of problematic and addictive usage. Yet framing violent games as a singular driver of aggression oversimplifies a multifaceted social problem that also involves individual vulnerabilities, mental health, and other environmental stressors. In effect, the global popularity of violent games demonstrates not evidence of a mass desensitization toward violence, but rather the cultural normalization of interactive media as a form of entertainment that, for most players, remains detached from real-world aggression.

Sometimes this line of argument becomes highly polarized. A small but vocal group of commentators has consistently positioned violent video games as cultural culprits, linking them to extreme acts of violence. Several high-profile school shootings in the U.S. have amplified this perception, with gaming repeatedly cast under public and political scrutiny. Importantly, such claims rarely remain confined to debates about whether violent games shape aggressive cognitions or momentary arousal. Instead, they escalate into a pattern of “scapegoating,” where violent gameplay is implicated as a default cause in the absence of other clear antecedents for adverse consequences. This tendency reflects broader socio-political dynamics as “moral panics” emerge during moments of societal anxiety, and media narratives strategically single out accessible cultural artifacts (i.e., video games) as symbolic targets for blame (Ferguson, 2008; Sternheimer, 2007). Within this framework, the present research acknowledges several instances of extreme violence that were initially attributed to video game consumption. These anecdotes are integrated into the discussion not to validate claims of causality but to critically analyze how interactive media, such as video games, have been repeatedly used as a “reductive explanatory device” in public and political discourse.

2.2. Historical Anecdotes

The discourse on the possible link between violent video games and aggression escalated after the 1999 Columbine High School shootings. This incident was pivotal in drawing increased scrutiny from the news outlets, policymakers, and the public (Springhall, 1999).

On April 20, 1999, Eric Harris and Dylan Klebold carried out a planned armed attack on their school, killing 13 people and injuring many others before taking their own lives. Beyond the immediate devastation and the prolonged rescue efforts that followed, the attack left behind a trail of cultural debates about causality and blame (Springhall, 1999). A particularly striking revelation was Eric Harris’s engagement with video game modification. He had created custom levels for *DOOM* (1993), allegedly replicating the school’s architecture. These modifications incorporated features like “God Mode,” allowing players to be invincible and, in effect, simulate a massacre rather than the typical strategic survival gameplay. This reconfiguration blurred the boundary between recreational challenge and fantasized omnipotence, intensifying suspicions about the games’ influence. Rabbi Abraham Cooper of the Simon Wiesenthal Center highlighted the troubling nature of these games, suggesting they might have served as a rehearsal for the actual massacre. Reports also initially indicated that Eric Harris created similar custom levels in *Duke*

Nukem (1991), which included virtual pipe bombs resembling those later employed during the attack.

In the aftermath of the Columbine massacre in 1999, significant scrutiny was placed on the gaming industry, primarily due to the attackers' "alleged" interest in violent video games. President Bill Clinton directed the Federal Trade Commission (FTC) to investigate the industry's marketing practices (D. Bond, 2011; Springhall, 1999, 2016). The FTC's findings revealed that many video game companies were directly marketing games rated as "Mature" to minors, specifically targeting children between the ages of 12 and 17 years (Walsh, 2001). This led to a public outcry and calls for stricter regulation of video game sales to minors. The FTC's recommendations focused on improving the enforcement of age restrictions at the point of sale. As a result, the industry made a concerted effort to adhere to these guidelines. This moderation has significantly impacted the gaming market in the U.S. By tracking the effectiveness of these new measures, it was found that in the early 2000s, minors could purchase "Mature" rated games without any barriers 85% of the time. However, by 2010, this number had decreased dramatically to 20%, indicating substantial improvement in compliance with age-restriction policies (Engle, 2001).

Subsequent incidents of extreme violence, such as the Virginia Tech massacre in 2007 and the Sandy Hook Elementary School shooting in 2012, further entrenched video games in global debates. Each tragedy reignited public and political calls to scrutinize whether exposure to violent video games fosters a propensity toward committing violence. Some of these debates have also framed games as symbolic culprits within wider anxieties about cultural decline and moral responsibility.

On the morning of April 16, Virginia Tech senior Seung-Hui Cho committed a tragic mass shooting, starting with the killing of two individuals at West Ambler Johnston residence hall. After changing out of his bloodied clothes, Cho sent materials that expressed his contempt for his peers and one of his professors to NBC and the university's English Department. Armed heavily, he barricaded Norris Hall's main doors and commenced a deadly rampage in the classrooms, ultimately killing 30 more people, including 25 students and five faculty members, before police intervention led him to take his own life (Davies, 2008). A few broadcasting agencies, including NBC News (Benedetti, 2007), speculated on a potential link between Cho's actions and his involvement with the video game *Counter-Strike*. Prominent "anti-gaming" advocates such as Jack Thompson and Phil McGraw further amplified these claims, blaming video games for translating violent behaviors. This reaction reflects a recurring media pattern in which violent games are hastily linked to mass shootings and other acts of violence (Ferguson, 2008). However, the coverage also captured the gaming community's frustration, emphasizing that attributing the heinous actions of a mentally troubled individual to video games oversimplifies underlying issues of mental health and societal violence. Notably, the Virginia Tech Review Panel (2007) itself rejected the gaming hypothesis, reporting that Cho had little to no meaningful exposure to violent video games.

Likewise, the Sandy Hook Elementary School shooting in December 2012 has kept alive debates about the alleged negative impacts of violent video games. The incident stands as one of the deadliest school shootings in U.S. history. On the morning of December 14, 2012, 21-year-old Adam Lanza first shot and killed his mother in their Newtown, Connecticut residence. Armed with multiple firearms legally purchased and owned by his mother, he then drove to Sandy Hook Elementary School, where he forced entry and carried out a mass shooting that left 26 victims dead, before taking his own life as police arrived at the scene. The Guardian (Pilkington, 2013) reported that Lanza had an extensive history of playing violent video games. It particularly emphasized Lanza's possession of several popular titles, including *Call of Duty* and *Grand Theft Auto*, alongside the discovery of a computer game called *School*

Shooting (alleged but not confirmed). Such reporting amplified concerns that gaming might have influenced his actions. However, subsequent official investigations stressed that Lanza's profound mental health difficulties, social impairments, and access to firearms were far more salient explanatory factors. While violent games were present in his environment, they were not established as causal in the attack and, in fact, nonviolent games such as *Dance Dance Revolution* (1998) dominated his gaming history.

It is important to recognize that while some perpetrators had a history of playing video games, there is no conclusive evidence that gaming directly causes extreme violence, nor can such behaviors be generalized from isolated cases to the wider population. In other words, it is not plausible to make the assertion that "shooters were gamers" or that "gamers turned shooters." Large representative survey data also undermine the claim. Nearly 85% of U.S. teens report playing video games, and a majority of boys play daily (Pew Research Center, 2024). In such a context, observing that a shooter played video games is statistically uninformative. In fact, data from *The Violence Project* show that fewer mass shooters report a history of violent video gaming than not, directly contradicting the narrative that violent games are a primary driver of mass shootings (The Violence Project, 2022).

Case studies corroborate this perspective across several other mass shootings. For example, in the Utah Trolley Square attack (Feb 12, 2007), a 745-page FBI review reported no motive and uncovered no wider plot. Even the media reports did not identify gaming as a causal factor, instead focusing on the perpetrator's personal and relational difficulties (The Salt Lake Tribune, 2011). Likewise, in the Northern Illinois University shooting (Feb 14, 2008), the report summaries foregrounded a documented history of mental health issues without linking to video games (Illinois State Police, 2008). This pattern recurs in later tragedies. In the Aurora theater shooting (July 20, 2012), where James Holmes killed 12 people and injured 70 during a midnight screening of *The Dark Knight Rises* (2012), early media commentary speculated about possible video game influences. Yet official investigations focused on Holmes' psychiatric history, including diagnoses of schizotypal tendencies and psychosis, alongside his detailed preparation and weapons stockpiling, not on gaming (Knoll & Annas, 2016). Similarly, after the Charleston church shooting (June 17, 2015), which resulted in the deaths of nine African American parishioners, there was little evidence of any gaming connection. Instead, investigators highlighted the perpetrator's radicalization through white supremacist ideology (el-Nawawy & Elmasry, 2018).

The association between violent video games and extreme violence has not been confined to the U.S. but has surfaced in global debates as well. In Finland, the 2007 Jokela school shooting was framed around the perpetrator's reported engagement with FPS games (Oksanen et al., 2013). Media outlets, under the pressure of public outrage, emphasized gaming as a central influence, and Finnish officials initiated inquiries into violent media use among youth. A similar pattern unfolded in Norway in 2011, when Anders Behring Breivik's coordinated attacks killed 77 people. His own claim that he used *Call of Duty: Modern Warfare 2* as a training tool was eagerly amplified by Scandinavian and international media, overshadowing evidence of his extremist ideology (Enstad, 2017). The narrative of gaming as a "murder simulator" offered a simpler explanation than acknowledging the convolutions of radicalization and systemic security lapses. Likewise, the Munich mall shooting in 2016 reproduced these dynamics in the German context, as early reporting stressed the perpetrator's supposed obsession with *Counter-Strike*. Politicians and anti-gaming advocates reignited debates over banning "Killerspiele" (also known as "killer games"). This occurred despite criminological evidence showing no robust causal link between violent gaming and actual violence, once again positioning video games as symbolic "folk devils" while diverting attention from structural factors such as bullying, mental health, and access to weapons (Carey, 2016).

These cases highlight the cyclical pattern of media reactions and political agitation in the aftermath of mass shootings. Violent video games are repeatedly invoked as convenient explanatory shortcuts, despite the fact that official investigations consistently emphasize a broader constellation of contributing factors, such as mental health difficulties, social isolation, and extremist ideology (Ferguson, 2008; Markey & Ferguson, 2017). A closer examination of these incidents provides little evidence to justify video games as causal agents of mass violence; rather, it offers stronger grounds for questioning why they are so frequently scapegoated. Even when mass shooters referenced or engaged with violent titles, these behaviors are better understood as symbolic outlets or secondary expressions of predisposed pathologies and radical worldviews, rather than causal triggers of violence. In this sense, video games function less as instigators and more as cultural artifacts integrated into already-formed patterns of violence, thereby undermining claims that they operate as direct drivers of mass killings.

Moreover, such overstatements foster "moral panic," a social dynamic in which disproportionate fear is mobilized around a perceived cultural threat (Bowman, 2015; Ferguson, 2008; Markey & Ferguson, 2017). By positioning violent games as "folk devils," media and political actors create simplified narratives that resonate emotionally but distort empirical realities (Sternheimer, 2007). These narratives amplify public anxiety, legitimize calls for restrictive legislation, and stigmatize millions of ordinary players, while diverting policy attention away from structural determinants of violence. In doing so, moral panics not only fail to resolve the problem but also entrench cycles of fear and scapegoating that resurface with each new tragedy.

2.3. Violent Video Games and Moral Panic

In 2013, in the wake of the Sandy Hook Elementary School shooting, President Barack Obama called for more scientific research into the potential effects of violent games, signaling the topic's political salience. However, this was not a new policy concern. Over the preceding three decades, U.S. lawmakers at the federal and state levels convened numerous hearings, introduced bills, and enacted laws to regulate the sale of violent video games (Walsh, 2001). Critics argue that such legislative efforts often emerge in response to gun violence tragedies rather than a balanced assessment of the evidence (Ferguson, 2008). Markey et al. (2015) reported that nearly 5,000 articles discussing the role of violent video games in the context of three school shootings were found in an online newspaper database following these events. Such disproportionate coverage reflects a pattern of moral panic, in which public fear is amplified by selective reporting by news agencies and biased political rhetoric (Ferguson, 2008).

While violent video games may appear "incidentally" in the backgrounds of certain mass shooters, it is essential to question whether the association between gaming and violence is uniquely tied to the American socio-political narrative or reflects a broader global trend. Although a handful of violent incidents have been documented in countries such as Finland, Germany, and other parts of Europe, their frequency remains strikingly low compared to the recurrent pattern of mass shootings in the United States. This disparity highlights the importance of considering structural and cultural differences rather than attributing causality solely to gaming itself.

A particularly revealing comparison emerges when examining countries with some of the largest and most active gaming markets. Nations such as China, Japan, and South Korea report exceptionally high levels of video game engagement, often exceeding those in the United States (Newzoo, 2024). Yet, despite comparable or greater exposure to violent video games, these countries do not experience similar levels of gun violence (Gumas et al., 2024). Importantly, empirical studies from these regions have rarely documented violent crime in connection with video game use, suggesting that gaming alone cannot be a sufficient explanatory factor. In emerging markets such as India, the literature on the relationship between video gaming and aggression is still at a nascent stage, and extreme violence linked to gaming is virtually absent from empirical reports. This makes the uncritical generalization of American findings to other cultural contexts conceptually misleading. It is also important to observe that recent studies within the U.S. consistently link higher rates of gun ownership and weaker firearm regulations to increased shooting incidence. This highlights that firearm access, rather than gaming exposure, is the more critical factor (Reeping et al., 2019; Siegel et al., 2020). Therefore, the present study is particularly timely in addressing an important research gap. While American discourse is "saturated" with debates on this topic, there is a notable absence of empirical data exploring the relationship between gameplay and actual violence within the Indian context, where cultural and social inhibitors may produce different behavioral outcomes.

While some advocates claim video games fuel extreme forms of violence, an equally large (and arguably larger) body of scholars disputes these assertions, emphasizing that such claims often reflect vested interests and secondary gains rather than objective evidence. These skeptics note that politicians, news outlets, and anti-gaming groups dramatize media violence during gun violence, folding video games into broader "culture wars" narratives. One of the most prominent early critiques comes from Christopher J. Ferguson, who argues that much of the moral panic surrounding violent video games can be traced to deeper societal disputes in which moral beliefs are frequently presented under the guise of scientific research (see Ferguson, 2007, 2008, 2018). Similarly, Kutner and Olson (2008) contend that games have functioned as a convenient scapegoat when the actual determinants of violent crime, such as family environment, genetics, poverty, and inequality, are complex and politically costly to address. Surette (2011) adds that the news media tend to emphasize negative rather than positive reports because such coverage often attracts greater public attention.

From a criminological standpoint, scholars argue that the fixation on violent video games reflects "moral entrepreneurship" rather than scientific consensus. Cohen's (2011) framework of moral panic continues to resonate, with video games replacing earlier "folk devils" such as comic books (Wright, 2003) and heavy metal music (Walser, 2015). Sternheimer (2007) directly criticized politicians for creating moral panics around video games, characterizing them as crusaders who produced these folk devils. Accordingly, politicians offer superficial solutions to perceived social problems, rather than pursuing more rational and empirically verifiable responses. In this context, video games have been portrayed as threats to children and adolescents. They were frequently scapegoated for broader social concerns, including youth violence, the spread of new technologies, and the perceived decline of adult authority over youth. In this context, Sternheimer (2007) noted a historical pattern in which new technologies and cultural phenomena, such as cars, radio, movies, rock music, and comic books, were similarly accused by politicians of promoting youth immorality and crime, leading to calls for regulation or censorship.

The extrapolation that violent video games directly incite extreme forms of violence is not only implausible but also inconsistent with empirical crime trends. For instance, while sales of violent video games surged globally between the years 2000 and 2020, rates of violent youth crime in the U.S. and many other industrialized nations either declined, plateaued, or showed no statistically significant increase during this same period (Duwe, 2020; Markey et al., 2015). For instance, Duwe (2020) reported that the 1980s and early 1990s were the decades with the highest incidence of mass shootings in the U.S. when examining collated data from 1976 to 2018. If we were to adopt the logic of anti-gaming advocacy, this would suggest that relatively rudimentary, pixelated games from the 1980s (e.g., *Space Invaders*, *Pac-Man*, or the early action titles) were somehow more "criminogenic" than the realistic depictions of violence found in contemporary franchises such as *Call of Duty* or the *Grand Theft Auto* series. Such reasoning quickly collapses under scrutiny, underscoring that these moral panic claims do not withstand a rigorous test of historical correlation.

Likewise, Ferguson (2015) investigated the relationship between societal engagement with violent video games and youth violence rates in the U.S. from 1996 to 2011. Specifically, data were collected on video game sales by identifying the top five best-selling titles per annum. These titles were then analyzed using a composite weighting system based on their ESRB violence descriptors to quantify the intensity. Simultaneously, longitudinal metrics for youth violence were compiled, focusing on the 12–17 (years) age demographic. These figures were sourced from official government databases and restricted to "serious violent crimes" to ensure the analysis focused on the most severe behavioral outcomes. The analysis revealed that the most popular games during this period were rated T (*Teen*) or M (*Mature*), indicating high levels of exposure to violent content. Yet the analysis revealed a strong negative association between violent video game consumption and youth violence, with time-series tests confirming that the results were not due to spurious autocorrelation. While these findings do not establish causality, they clearly indicate that youth violence fell markedly during years when violent game consumption was most widespread, directly contradicting claims that such media fuel extreme violence. These studies lend further credence to the growing skepticism about any association between media violence and societal violence.

A recent systematic review by Sanchez et al. (2020) highlights several varieties of common causal and contributory factors of gun violence, including, but not limited to, mental illness, suicidal ideation, intimate partner and family violence, socioeconomic status, community distress, domestic life, childhood trauma, current or previous substance abuse, and firearm access. Although realistic violence in gameplay has peaked in the past two decades, this review study did not designate violent video games as a principal causal factor for gun violence. Instead, the evidence points toward structural and psychosocial determinants that shape prolonged trajectories of violent behavior. In the current context, this is especially important, as many of the deadliest mass shootings in the United States involved perpetrators with histories of familial dysfunction, social isolation, and unfettered access to firearms, factors that cannot be meaningfully explained through gaming habits.

In the middle of these debates, the last decade has witnessed remarkable policy changes from renowned bodies. For instance, the American Psychological Association (2020) explicitly cautioned that attributing extreme violence to violent video gaming is "not scientifically sound." At best, studies have shown a small, reliable link with minor aggressive outcomes (e.g., arguing, shoving), not with criminal violence (cf. Anderson et al., 2010). Similarly, the U.S. Supreme Court in *Brown v. Entertainment Merchants Association* (2011) struck down attempts to restrict violent video game sales to minors, noting that existing research did not establish a causal connection between playing such games and committing violent crimes (Ferguson, 2013). The court emphasized that exposure to violent media was no different from reading violent literature or watching violent films, neither of which has been credibly tied to mass violence. Major public health agencies have been reinforcing this position. In an earlier case, the American Academy of Pediatrics (AAP, 2016) differentiated between general concerns about screen time and unfounded claims of video games precipitating extreme acts of violence. The U.S.

Secret Service and Department of Education (Vossekuil, 2002; Vossekuil et al., 2002, p. 22) likewise reported no consistent evidence linking school shooters' media habits to their violent actions.

There is also growing evidence that violent games can fulfill constructive psychological functions such as catharsis or stress relief (Ferguson et al., 2014; Huntemann, 2009; E.-J. Lee et al., 2021). In this sense, gameplay may diffuse violence rather than amplify it, providing an outlet analogous to watching horror films or participating in contact sports, both of which simulate violence without being treated as predictors of mass shootings. However, early inquiries during the 1990s were often limited in scope, focusing on a narrow range of effects while lacking the multidimensional theoretical perspectives necessary to capture the intricacy of interactive media (e.g., Irwin & Gross, 1995; Kirsh, 1998). Even the gaming industry was still in its infancy back then, with the most popular titles offering simple graphics and mechanics, making it difficult to draw firm conclusions about their impact on behavior. However, this early notion shifted dramatically when concrete reports of multiple school shootings challenged the potential role of violent video games. Several meta-analyses and systematic reviews from this period highlighted major inconsistencies in the claimed link between violent video games and actual violence, casting doubt on the straightforward culpability of video games (cf. Griffiths, 1999; Sherry, 2001). This divergence in findings indicates that researchers were equally skeptical of laying the blame squarely on video games and were instead exploring a range of other potential factors contributing to such violence.

Synthesizing these observations, it becomes evident that the scholarly and public discourse surrounding video game violence in India has yet to coalesce into substantive policy frameworks. This stagnation is primarily attributable to a dearth of indigenous media effects research. Currently, the discourse oscillates between a considerable reliance on Western empirical data and the adoption of imported moral panics and societal anxieties often extrapolated from developed nations without regard for local social and cultural trends. The present thesis addresses this critical gap by investigating the potential link between violent gaming exposure and aggression, specifically contextualized to the Indian population. Methodologically, this investigation moves beyond mere behavioral observation. While aggression is quantified through validated self-reporting tools, its underlying mechanisms are assessed through the emotional processing of players within the theoretical architecture of the GAM.

2.4. Theoretical Frameworks of Aggression

Aggression and violence are foundational constructs in psychological research, particularly within the study of social behavior and media effects. Aggression is defined as any behavior that is intentionally carried out with the proximate goal of causing harm to another person who is motivated to avoid that harm (DeWall et al., 2012, pp. 301–344). This definition emphasizes three essential criteria. First, aggression must be an observable behavior, the behavior must involve intentionality, and the target must be motivated to avoid the harm, thereby excluding consensual contexts such as masochistic practices or assisted suicide (Allen et al., 2018). Within this framework, violence[2] is conceptualized as a specific and more severe subset of aggression and defined as aggression that has serious physical harm (DeWall et al., 2012,

[2]Note: The present thesis deliberately confines its conceptual scope and empirical examination to aggression as the primary outcome of interest. It does not directly or explicitly operationalize or measure violence or severe physical harm. Accordingly, violence is treated not as an independent construct but as a narrower manifestation within the broader aggression framework. Any references to "violent video game content," "gameplay violence," or "the translation of violence" in the ensuing theoretical discussion or interpretive narrative are employed descriptively to denote the nature of the media stimuli rather than the outcome variables under investigation. The psychological and behavioral effects discussed in relation to such content are therefore systematically interpreted and attributed to aggression, consistent with established theoretical definitions in the GAM.

pp. 301–344). Conceptually, all violent acts are aggressive, but not all aggressive acts are violent. For instance, a child forcefully pushing another child to protect a valued object represents aggression without meeting the threshold of violence. This hierarchical distinction is essential for theoretical clarity and empirical precision when examining harmful behaviors across contexts.

Media violence research in the 1980s began to move beyond its traditional focus on television and turned toward emerging video games (Bower, 1985; Dominick, 1984; Silvern & Williamson, 1987). This transition was driven by public concern that video games introduced interactive dynamics distinct from the passive consumption of television. Early studies during this period did suggest a potential association between violent video gaming and aggressive behavior (e.g., Anderson & Ford, 1986; Silvern & Williamson, 1987). Much of this work was based on Social Learning Theory, which proposed that repeated exposure to violent games could escalate aggression through observation and imitation (e.g., Ellis, 1990; Silvern & Williamson, 1987).

Social Learning Theory posits that individuals acquire behaviors by observing and imitating models whose actions are rewarded, leading these behaviors to become part of their longstanding repertoire (Bandura, 2009; Bandura & Walters, 1977; Hoffman, 1994; Irwin & Gross, 1995). According to this perspective, when players identify with strong game characters and receive rewards for violent actions, their aggressive thoughts and behaviors often increase soon after play (Anderson & Dill, 2000; Ballard & Wiest, 1995; Dill & Dill, 1998; Irwin & Gross, 1995; Kirsh, 1998). Games are seen as a form of active practice, not just passive viewing, which makes aggressive schema easier to learn and recall during conflicts. Recent studies also highlight the theoretical relevance of Social Learning Theory to explain how identification, rehearsal, and rewards connect violent gaming with aggression (Borrego-Ruiz & Borrego, 2025; Teng et al., 2019; Zhen et al., 2011). This demonstrates that the fundamental principles of Social Learning Theory remain central to understanding the impact of violent video games.

Huesmann's Script Theory is another prominent framework to explain the role of media violence in aggression (Huesmann, 1986, 2007). This framework is deeply rooted in Bandura's Social Cognitive Theory (Bandura, 1986, 2009), which itself is an expansion of Social Learning Theory. According to Script Theory, repeated exposure to violent media makes individuals acquire scripts or mental guides for how to interpret social situations and respond to conflict (Huesmann, 1986, 1998, 2007). Video games, with their interactive and immersive qualities, are argued to strengthen these scripts more directly than passive media. Early studies in the 1990s and 2000s showed that violent gameplay was associated with increased accessibility of hostile scripts, causing "hostile attribution biases," a cognitive tendency wherein individuals are more likely to interpret ambiguous social cues or others' actions as intentionally hostile, which in turn influences how players respond to provocation (Bushman & Anderson, 2002; Kirsh, 1998). Script Theory suggests that active gameplay allows players to practice aggressive responses, making these scripts easier to recall in real life. Recent studies also show that violent video game play predicts the use of aggressive scripts in social interactions, supporting the view that games act as training grounds where hostile responses are learned and reinforced (Gentile et al., 2014; Hasan et al., 2013).

In addition to the view that aggression is largely learned through experience, several theoretical frameworks help explain the mechanisms by which violent video games may produce aggressive outcomes.
The General Arousal Model posits that violent games increase non-specific physiological arousal (Ballard & Wiest, 1995; Calvert & Tan, 1994). This heightened arousal state, though not inherently aggressive, can intensify preexisting responses, thereby amplifying aggressive tendencies. For example, if an individual is already frustrated, violent gameplay may

elevate arousal to the point where frustration escalates into overt aggression. A closely related but distinct explanation is offered by excitation transfer theory (Zillmann, 1983). This framework proposes that physiological arousal dissipates slowly, allowing residual arousal from one activity (e.g., physical exercise or video gameplay) to carry over and influence responses to subsequent events (e.g., an interpersonal conflict). If the latter event triggers anger, the individual may experience exaggerated hostility due to the lingering arousal (Zillmann & Bryant, 1974). Moreover, once individuals cognitively label themselves as angry, they may remain in that state and be primed for aggression even after the original source of arousal has faded.

The Cognitive Neoassociation Theory emphasizes the role of cognitive activation (Anderson & Ford, 1986; Berkowitz & Rogers, 1986), where exposure to violent content activates aggressive mental associations stored in memory. Once triggered, these associations increase the accessibility of aggressive thoughts, which in turn increases the likelihood that aggressive cognitions will translate into behavior. Thus, violent video games may not only stimulate arousal but also prime cognitive scripts that guide aggressive responses. Desensitization perspectives further extend this narrative by focusing on repeated and habitual exposure. Frequent engagement with violent games is thought to blunt emotional sensitivity to violence, thereby weakening natural inhibitory mechanisms that would otherwise constrain aggression (Anderson & Dill, 2000; Funk et al., 2003). Over time, individuals may come to perceive aggressive behavior as less distressing or socially inappropriate, making aggressive actions more likely in both virtual and real-world contexts.

Taken together, the aforementioned theoretical frameworks suggest that violent video games can influence aggression through both direct and indirect processes. Yet, most of these early approaches are applied in isolation, each offering valuable but partial insights into the phenomenon. By focusing narrowly on either arousal, cognition, or emotions, they often overlook the interactions between all these internal states. Also, many early theories lacked the temporal depth required to reconcile short-term effects with the long-term development of an aggressive personality structure. The emergence of the GAM sought to address this gap by integrating key elements from multiple theoretical perspectives into a comprehensive and unified framework (Anderson & Bushman, 2002).

2.5. The General Aggression Model

2.5.1. Overview of the Model

The GAM incorporates components from several theories, including Social Learning Theory (Bandura & Walters, 1977), Excitation Transfer Theory (Zillmann, 1983), Cognitive Neoassociation Theory (Berkowitz, 1993; Berkowitz & Rogers, 1986), Social Interaction Theory (Tedeschi & Felson, 1994), and Script Theory (Huesmann, 1986, 1998). It was initially proposed as the General Affective Aggression Model (GAAM) to explain how situational triggers such as pain, exposure to firearms, and violent media content could precipitate aggressive behaviors (Anderson et al., 1995). Subsequent refinements broadened its scope from short-term affective and cognitive processes to long-term mechanisms, including the formation of aggressive personality and normative beliefs (Allen et al., 2018; Anderson & Bushman, 2018).

While initially grounded in a social cognitive framework, the GAM has evolved into a "bio-social-cognitive model" (Anderson & Bushman, 2018) that incorporates physiological mechanisms into its explanation of aggression. This expansion has elevated this model to the status of a "meta theory," positioning it as a dominant and parsimonious framework in the media violence literature. The GAM has been applied to a wide range of aggressive acts, including suicide, interpersonal violence, and even broader social issues such as responses to global climate change.

Although the GAM integrates multiple theoretical models, it primarily uses a "knowledge structure" framework derived from Huesmann's Script Theory (Huesmann, 1986, 1998). Knowledge structures refer to organized mental frameworks that shape how individuals interpret situations, evaluate others, and decide on appropriate actions (Huesmann, 1998). They are acquired and strengthened through repeated exposure to relevant experiences. The process of frequent rehearsal not only solidifies them but also increases their connectivity to other cognitive concepts, making them more readily activated (Huesmann, 1998). Although the GAM is an "overarching model" for understanding aggression, this thesis primarily explains the model from the perspective of violent video gaming. For instance, if a player is frequently exposed to violent video games where the characters respond to challenges or threats with aggression or violence, they are more likely to form a robust, easily accessible "hostile knowledge structures" that equate such responses with appropriate reactions in real-life situations.

The GAM identifies "scripts" and "schemata" as two broader categories of knowledge structures formed through experience, and that significantly shape perception at various levels (Anderson & Bushman, 2002). This can range from basic object recognition to complex social interactions. The knowledge structures can become automated through frequent use and encompass affective states, behaviors, and beliefs, commonly guiding an individual's interpretation of social and personal events. Affect is considered a major component of the GAM and is incorporated into these knowledge structures in three ways. First, through "affect nodes" or concepts like anger that activate with the structure. Second, it contains knowledge about when and how the affective components influence behavior. Third, some knowledge structures treat affect as an "action rule," specifying that certain behaviors, such as aggression following an insult, should occur only under intense emotional conditions, such as extreme anger (Bushman & Anderson, 2002).

Knowledge structures are further categorized into three interrelated subtypes: (a) perceptual schemata, (b) person schemata, and (c) behavioral scripts.

Perceptual schemata guide the interpretation of sensory cues in the environment, helping players rapidly distinguish between hostile and benign stimuli. Violent games amplify this process by repeatedly requiring players to detect threats through visual or auditory indicators, such as enemy uniforms, weapons, or footsteps. Research shows that violent gameplay can increase attentional bias toward aggressive cues and increase the accessibility of hostile interpretations, reinforcing perceptual schemata that prioritize threat detection (Bartholow & Anderson, 2002; Kirsh, 1998).

Person schemata influence how players form judgments about individuals or groups. Video game storylines often present opponents as morally corrupt or socially threatening, thereby shaping a worldview in which aggression is justified (see Gentile et al., 2011; Hasan et al., 2013). For example, antagonists in tactical shooters like *Project I.G.I.* (2000) or *Call of Duty: Black Ops* (2010) are framed as terrorists, criminals, or enemy combatants, leading players to categorize them as hostile "out-groups." This aligns with findings that repeated engagement with violent game narratives fosters hostile attribution biases, where ambiguous actions are more likely to be interpreted as intentionally aggressive.

Behavioral scripts provide stored sequences of actions that can be enacted in social contexts. Violent games repeatedly reward players for responding to threats with aggression, thereby reinforcing scripts that link hostile cues with violent responses (Anderson & Dill, 2000; Carnagey & Anderson, 2004). For instance, clearing a room of enemies in *Project I.G.I.* (2000) or receiving mission rewards in *Grand Theft Auto: San Andreas (2002)* not only provides reinforcement within the game but also strengthens aggressive behavioral scripts that may be retrieved in future conflict situations.

2.5.2. Development of Aggression

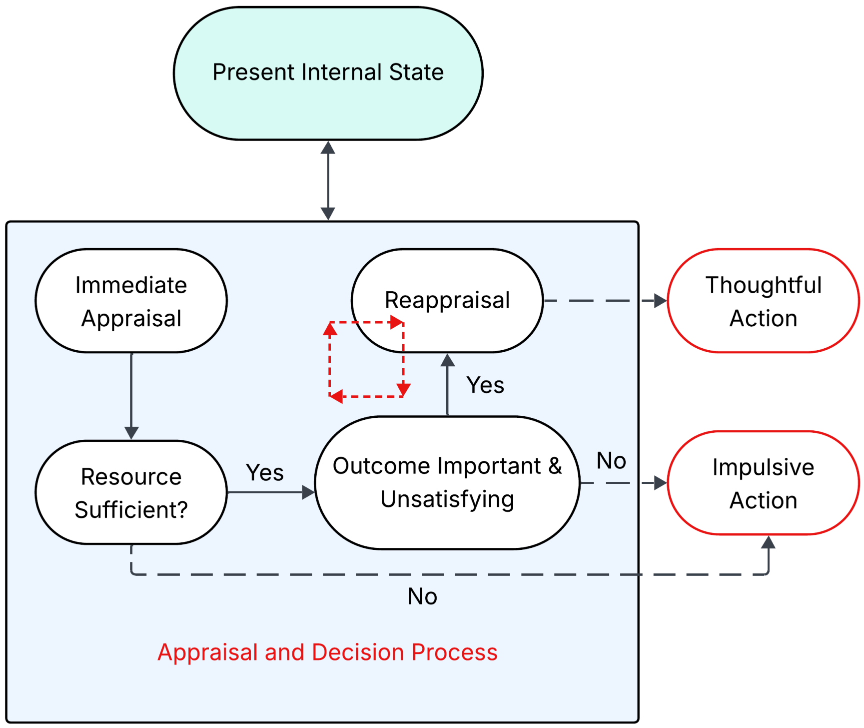
The GAM conceptualizes aggression as the outcome of dynamic interactions between personal and situational variables within a "person-in-the-situation" framework (Anderson & Bushman, 2002). Each aggressive episode unfolds across three distinct yet interconnected phases: (a) inputs, (b) routes, and (c) outcomes (see Fig. 1). These episodes operate in cycles, such that the behavioral outcomes of one episode feed back into the person and situation, shaping subsequent encounters. Moreover, these repeated episodes contribute not only to momentary aggressive outbursts but also to enduring developmental changes through the gradual reinforcement of knowledge structures, beliefs, and personality dispositions.

The first stage of the model, "the input phase," highlights the role of personal and situational variables in setting the stage for aggression. Personal factors encompass relatively stable or transient characteristics, including personality traits, attitudes, genetic predispositions, and prior learning histories. Among the most salient of these are "hostile attributional bias," which predisposes individuals to interpret ambiguous social cues as intentionally harmful (De Castro et al., 2002; Kirsh, 1998). Within the context of violent video games, players high in trait aggression are especially likely to exhibit such biases. Additionally, violent gameplay can exacerbate "hostile perception bias," whereby social interactions are interpreted as aggressive, and "hostile expectation bias," wherein individuals come to anticipate aggressive responses from others in conflict situations (Bushman & Anderson, 2002). These biases are not simply dispositional but are reinforced and retriggered during gameplay, making aggressive interpretations increasingly accessible. Situational factors, by contrast, involve immediate environmental triggers such as provocation, the presence of weapons, social stress, noise, temperature extremes, alcohol consumption, and, critically, exposure to violent media. The GAM places violent video games as particularly potent situational inputs as they are interactive, immersive, and reward players for enacting aggression. Unlike passive media such as television, violent games repeatedly place individuals in scenarios where aggressive behavior is modeled, enacted, and reinforced through mechanisms such as points, level progression, or narrative rewards (Anderson & Carnagey, 2004).

The second stage of the GAM is "the routes," which describes how input variables influence the individual's internal state through three interconnected components: (a) cognition, (b) affect, and (c) arousal (Anderson & Bushman, 2002). Affect refers to the emotional consequences of exposure to violent media. Violent video games often evoke anger, frustration, or hostility, particularly during competitive defeats or challenging gameplay. These negative affective states increase the salience of aggressive responses to subsequent provocations. Cognition encompasses the thoughts, beliefs, and scripts that are primed during and after gameplay. Violent video games repeatedly activate aggressive scripts that emphasize forceful or hostile strategies for conflict resolution. Over time, these scripts become chronically accessible and are more readily applied to ambiguous interactions. For example, FPS games encourage players to interpret targets as "enemies" and to solve problems through violent means, thereby reinforcing the notion that aggression is effective and justified. The final component of the routes phase, arousal, reflects the physiological activation produced by violent gameplay. Action gameplay in immersive environments increases physiological arousal, including heart rate (HR) and adrenaline release, thereby amplifying the intensity of emotional and cognitive reactions. Heightened arousal decreases the threshold for aggressive responding, making even minor provocations more likely to elicit hostility.

Figure 1

Appraisal Process within the General Aggression Model



Note. Immediate appraisal is relatively automatic and often shaped by game-based cues (e.g., hostile avatars, competitive threats). Reappraisal requires cognitive resources and can override initial impulses by considering broader context (e.g., "it's just a game," "aggression may not be rewarded offline"). Habitual exposure to violent games can impair this reappraisal capacity over time, normalizing aggressive scripts and reducing inhibitory processes. The illustrative model is adapted from Anderson and Bushman (2002).

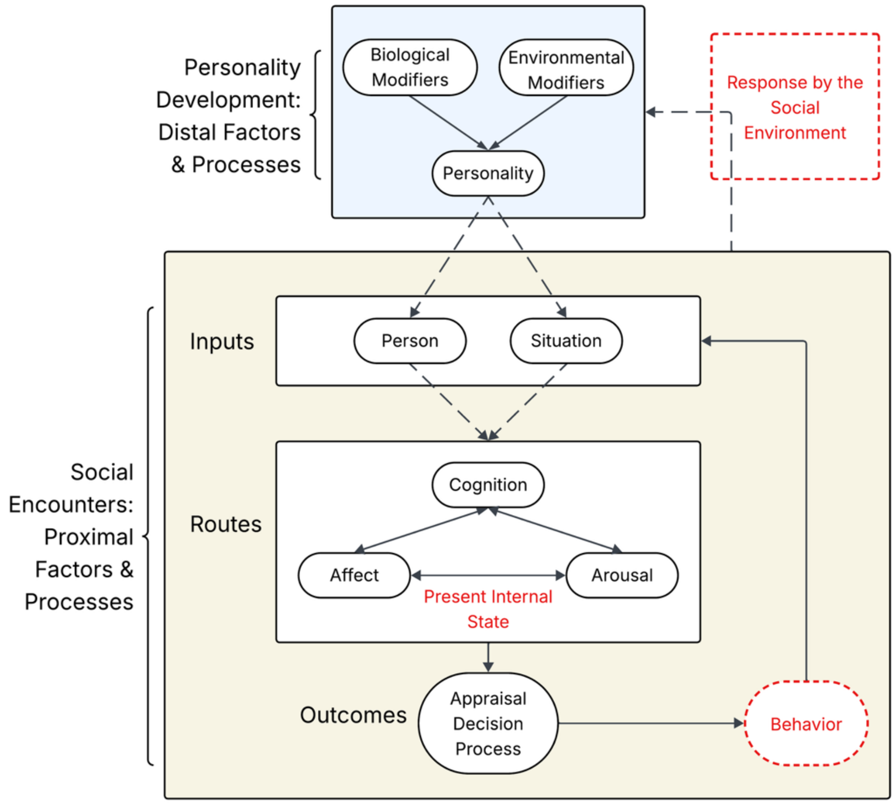
The "outcomes phase" of the GAM explains how internal states are translated into observable behavior through appraisal processes (Allen et al., 2018; Anderson & Bushman, 2002, 2018). These actions, in turn, influence social interactions, which, in turn, trigger personal and situational factors, thereby perpetuating each episode of aggression in a cyclical manner. Initially, an automatic, immediate appraisal assesses the situation based on the individual's current internal state, which is shaped by personal and situational factors. For instance, aggressive thoughts might lead to interpreting a neutral event as hostile (Allen et al., 2018).

Immediate appraisals can trigger affective responses (e.g., anger) and influence goals and intentions (e.g., retaliation). Following this, decisions are made based on available resources (see Fig. 1). If resources allow and the appraisal outcome is significant and unsatisfactory, the individual might engage in a more deliberate reappraisal, seeking alternative perspectives. If not, an impulsive reaction may occur, which can be either aggressive or nonaggressive based on the appraisal's content. This reappraisal process might cycle multiple times, affecting the individual's internal state with each iteration. Ultimately, the chosen action influences ongoing social interaction, which, in turn, affects personal and situational factors, potentially reinforcing or altering behavioral tendencies and perceptions.

The GAM emphasizes the cyclical nature of aggressive episodes. Each outcome not only affects the immediate social interaction but also feeds back into personal and situational factors, thereby influencing subsequent episodes. Repeated exposure to violent video games strengthens aggressive scripts, normalizes hostile interpretations of social interactions, and also "desensitizes" players to the consequences of violence (Allen et al., 2018; Anderson & Bushman, 2018). These changes accumulate over time, gradually shaping an enduring personality characterized by increased trait aggression, hostile biases, and reduced prosocial responding (Allen et al., 2018; Anderson & Bushman, 2018; Bushman & Anderson, 2002). In this sense, the GAM conceptualizes violent video games as "proximal factors" of aggression in the short-term and "distal factors" of aggressive personality in the long-term (Anderson & Carnagey, 2004). Through repeated cycles, violent gameplay is thus theorized to alter developmental trajectories, reinforcing the accessibility of aggressive knowledge structures and increasing the likelihood of aggression across diverse contexts. The overall model is summarized in Figure 2.

Figure 2

Overview of the General Aggression Model



Note. The GAM organizes each episode of aggressive behavior into inputs, routes, and outcomes. Proximate factors and processes explain single episodes of aggression and are shaped by distal factors and processes. Each aggressive episode, in turn, influences subsequent episodes at the proximate level by altering person and situation factors. Over time, repeated episodes also affect distal causes and processes, potentially leading to changes in personality through modifications in knowledge structures. The illustrative model is adapted from Anderson and Bushman (2002).

Distal factors in the GAM represent enduring biological and environmental influences that shape personality and, in turn, feed back into each episode of aggression (see Fig. 2). If proximal factors are the "sparks" that ignite aggression in the moment, distal factors are the "fuel lines" that determine how easily those sparks turn into fire. Firstly, the "Biological Modifiers" act like an individual's baseline wiring. For instance, low serotonin levels and hormone imbalances make it harder to regulate impulses, much like faulty brakes in a car. Testosterone provides a striking example. Research consistently shows that higher testosterone is linked to greater dominance and aggression, and levels spike after competitive victories (Book et al., 2001). This can also be applied to video games, where a player who dominates action gameplay may experience a hormonal surge that mimics real-world dominance contests, thereby reinforcing aggressive tendencies over time.

On the other side, the "Environmental Modifiers" are the social ecosystems that either cultivate or inhibit aggression. Growing up in violent neighborhoods, experiencing harsh parenting, or being embedded in cultural norms that glorify aggression all tilt the scales toward an aggressive personality. The GAM strongly advocates for media violence, particularly violent video games, as critical environmental modifiers that exacerbate this effect. This is because they not only depict aggression but also reward it. Within this framework, Anderson et al. (2010) demonstrated that exposure to violent media not only increases aggressive behavior but also reduces prosocial actions, with effect sizes surpassing public health risks like passive smoking and its link to lung cancer (Bushman & Anderson, 2001). In conjunction, biological vulnerabilities and violent environmental settings function as a "prolonged training ground" for aggression. Each gaming experience is perceived as a rehearsal, seemingly harmless in isolation, but when repeated over the years, it progressively reshapes knowledge structures and personality toward an aggressive disposition.

While aggression is often described as an isolated episode, the GAM also emphasizes the development of aggression as a personality trait. Anderson and Bushman (2002), in their initial model presentation, suggest that habitual exposure to factors such as violent media can cultivate an aggressive personality. This transformation occurs through the development, automation, and reinforcement of hostile knowledge structures, including aggressive beliefs, attitudes, perceptual schemata, expectation schemata, behavior scripts, and desensitization to aggression (Anderson & Bushman, 2002; Bushman & Anderson, 2002). For instance, when we apply the GAM lens, a player who often engages in violent video gaming may exhibit increasing aggression, which in turn affects their social environment. This individual may find it challenging to maintain relationships with less aggressive peers, leading to shifts in their social interactions and the types of situations they encounter. Their relationships in professional settings or with family members may suffer, while their connections with peers who exhibit similar aggressive behaviors may strengthen. Essentially, the same factors that cause short-term increases in aggression are believed to promote long-term aggressive tendencies through repeated exposure (Anderson & Bushman, 2002).

In their updated model, Anderson and Bushman (2018) define social environments as key mediators that can influence the relationship between immediate situational triggers (also referred to as proximal factors or episodes of aggression) and an individual's personality. Social environments that actively discourage aggression, either by withholding rewards or by imposing penalties, can help counteract the impact of these situational triggers. For instance, in the case of a player who is frequently involved in playing violent video games, if the school environment actively discourages aggression by promoting positive behavior reinforcement and implementing strict anti-bullying policies, this could mitigate the aggressive tendencies possibly fostered by gaming. Similarly, if parents at home do not reward aggressive behavior and instead impose consequences, this can also neutralize the aggressive effects of violent games. In these scenarios, both school and home serve as social environments that mediate the impact of the adolescent's gaming behavior (the situational trigger) on their personality development.

Anderson and Bushman (2018) extend the previously discussed five predominant knowledge structures that shape personality development by incorporating aspects of "brain structure and function." It also explains how changes in personality can affect the likelihood of aggressive behavior in specific situations. This influence manifests in two ways: a) by affecting the personal variables that individuals bring into social interactions, and b) by altering the situational variables themselves. For instance, personality changes may systematically alter the types of situations an individual seeks or encounters, the kinds of people they meet in these situations, and even how long-standing friends behave around them. With these updates, the GAM now integrates additional elements beyond script theory, thereby enhancing its explanatory power. While the preceding sections have extensively explained the tenets of the GAM, the following sections adopt a more critical lens. Beyond reviewing empirical evidence supporting the model's positions, alternative perspectives are also discussed, which categorize the GAM as an "overextended" paradigm, especially regarding the effects of video games on aggression.

2.6. Reported Consequences of Violent Video Gaming

The literature supporting the GAM varies in emphasis and methodology, but much of it broadly converges on Script Theory and desensitization models to interpret the adverse outcomes of violent video game exposure. These two frameworks explain aggression through interconnected cognitive, affective, and behavioral processes, which are conceptualized as "bidirectionally connected" internal states. Within this body of research, the effects of violent video games are commonly examined across immediate (short-term) and enduring (long-term) outcomes.

Short-term effects include cognitive priming of aggressive scripts, hostile attribution biases, increased physiological arousal, and hostile affect, which together increase the likelihood of aggressive responses in proximal situations (Allen et al., 2018; Anderson & Bushman, 2018; Bushman & Anderson, 2002). In contrast, long-term or habitual exposure is theorized to result in emotional desensitization to violence, reductions in empathy, diminished prosocial behavior, and the internalization and reinforcement of aggressive norms (Carnagey et al., 2007; Funk et al., 2004). Early cognitive and affective changes may gradually consolidate into stable aggressive personality tendencies over time. These mechanisms have been investigated using experimental, correlational, cross-sectional, and longitudinal designs, offering varied levels of causal inference.

The following sections synthesize key themes in the GAM literature concerning the relationship between violent video games and aggression. Across themes, the evidence does not always show direct behavioral aggression as an outcome. Rather, it frequently reveals predictive markers or pathways that lead to aggression. These include cognitive mechanisms such as hostile expectation biases and aggressive interpretative schemas, affective mechanisms such as reduced empathy or prosocial concern, and emotional desensitization to violence. Additionally, several studies investigate how violent video games shape emotional processing, particularly in relation to hostile cues. The review concludes by critically examining the theoretical and methodological criticisms of the GAM literature.

2.6.1. Transient Vs. Enduring Effects

Despite pioneering applications of the GAM to violent gaming, the early experimental studies by Anderson and Dill (2000), Bushman and Anderson (2002), and Bartholow and Anderson (2002) did not fully elaborate on the model's foundational premise. These studies demonstrated that violent gameplay could increase aggressive cognition, affect, and arousal, but they did not explain why participants were limited to only a brief gaming session. Moreover, they did not report participants' broader gaming histories, a significant omission given the possibility of learning effects and habituation. This limitation carried into later work, leaving a grey area in how short-term findings related to habitual gameplay and long-term development.

A comprehensive meta-analysis by Anderson and Bushman (2001) reviewed experimental, correlational, and longitudinal evidence on violent video games. It reported consistent associations between violent game play and heightened aggression, aggressive cognition, aggressive affect, increased cardiovascular arousal, and reduced prosocial behavior. Experimental evidence indicated causal links, while correlational studies connected violent games with more serious real-world aggression. Importantly, the meta-analysis also outlined best practices for research design, stressing the need for appropriate nonviolent control conditions and for avoiding confounds such as game difficulty, boredom, or frustration. Yet even this synthesis did not consider participants' prior exposure to violent games or assess how habitual play fits within the GAM framework, an omission that would become increasingly relevant in subsequent research.

Extending their previous review study, Anderson et al. (2004) tested whether violent video games exert specific short-term effects on aggressive cognition and behavior beyond general arousal or frustration. Their research comprised three controlled laboratory experiments, one correlational study, and a meta-analysis, making it one of the most comprehensive early demonstrations of the GAM in the context of video games and aggression. In their experiment 1, participants were randomly assigned to play one of five violent games (e.g., *Dark Forces*, *Marathon 2*, *Wolfenstein 3D*, *Speed Demon*, *Street Fighter*) or five nonviolent games (e.g., *Glider Pro*, *Myst*, *Indy Car II*, *Jewel Box*, *3D Ultra Pinball*). After a

brief gameplay period, they completed a word completion task. Those who played violent video games produced significantly more aggressive word completions, indicating increased accessibility of aggressive scripts.
In their experiments 2 and 3, the investigators selected two closely matched games and used the Competitive Reaction Time Task (CRTT) to measure behavioral aggression. Participants who played the violent game selected higher noise blast punishments for a supposed opponent, particularly under ambiguous provocation, showing that violent content increased aggressive behavior independent of arousal, frustration, or enjoyment levels. The accompanying correlational study linked habitual violent gaming to chronic aggressive cognitions and real-world aggression, while the meta-analysis confirmed consistent transient effects across cognition, affect, physiological arousal, and behavior. Collectively, their findings provided strong evidence that violent game exposure serves as a situational aggression trigger, aligning precisely with the cognitive priming route proposed by the GAM.

Moving from acute exposure to habitual patterns, Gentile et al. (2004) provided important evidence that violent gaming does not merely have short-term consequences but may also cultivate enduring aggressive tendencies. Surveying over 600 adolescents, they found that habitual engagement with violent games was associated with higher levels of hostility, more frequent aggressive behaviors, and poorer academic performance. Interpreted through the GAM, these outcomes reflect how repeated rehearsal of violent scenarios strengthens and automates hostile knowledge structures. Specifically, Gentile et al. (2004) emphasized that violent gaming "develops, learns, and reinforces" hostile attribution biases and aggressive scripts, which then become chronically accessible in everyday social interactions. These specific effects are extensively discussed in the following sections.

Carnagey and Anderson (2004) examined the link between violent video gaming and aggression through a literature review and defended studies that support the GAM by discussing their approach to the long-term effects of video games. The review argued that while the GAM primarily focuses on episodic analysis, its cyclical nature effectively addresses enduring impacts. This is because repeated exposure to specific stimuli, such as media violence, can make certain knowledge structures, like aggressive scripts, more accessible over time. Although the authors of the review, including one of the GAM's original theorists, do not explicitly state that studies supporting the GAM have investigated long-term effects, they suggest it is reasonable to infer that these studies implicitly consider the habitual impact of violent video gaming. However, it is factual to acknowledge that early GAM research did not empirically demonstrate whether the short-term effects of violent video gaming could be generalized to habitual gaming practices.

This line of defense was later strengthened by Anderson et al. (2010), whose large-scale meta-analysis synthesized evidence from diverse methodologies across cultures and confirmed consistent effects of violent gaming on aggression. Anderson et al. (2010) analyzed 381 effect sizes from 136 studies with over 130,000 participants across North America, Europe, and Asia. Results showed consistent effects of violent video game play on aggressive behavior, aggressive cognition, and hostile affect, alongside decreases in empathy and prosocial behavior. Importantly, the findings held across different research designs and cultural contexts, with no evidence that sex moderated the effects. The meta-analysis substantiated that violent video games function as a causal risk factor for aggression in both the short-term, through priming of aggressive scripts, and in the long-term, through repeated rehearsal and consolidation of hostile knowledge structures.

Although the meta-analysis by Anderson et al. (2010) faced criticism from some contemporaries and later studies, Huesmann (2010) strongly endorsed its conclusions in his commentary. He described the review as the "strongest evidence" of that period that violent video games stimulate aggression. According to Huesmann, the findings align neatly with Social Learning Theory, which posits that children and adolescents acquire behavioral scripts and moral codes through repeated exposure to modeled behaviors. Importantly, Huesmann highlighted that violent video games should be viewed as a "public health risk." While not every player becomes aggressive, exposure to the game increases the likelihood of aggression at the population level. In doing so, he strengthened the consensus among GAM scholars that violent video games serve as powerful socialization tools, teaching and reinforcing aggressive scripts that influence short- and long-term behavior.

By the late 2000s, researchers began to test the habitual effects of violent video games on aggression through longitudinal and cross-sectional designs. For example, Anderson et al. (2008) conducted a cross-cultural study in the United States and Japan with children and adolescents. Participants reported their video game habits at the beginning of the school year and were assessed for aggressive behavior later in the year. Violent game exposure predicted increases in physical aggression over time, even after controlling for prior aggression levels and sex. The authors argued that repeated gameplay strengthened aggressive knowledge structures that became accessible during provocation. The findings also demonstrated that the processes proposed by the GAM were not limited to Western contexts. Likewise, a study with German adolescents supported this developmental pathway. Möller and Krahé (2009) carried out a two-wave panel study with adolescents. They measured violent video game use and physical aggression at two time points separated by 30 months. Results showed that violent video game use at Time 1 predicted higher physical aggression at Time 2, while aggression at Time 1 did not predict later violent game use. These findings supported the GAM prediction that exposure fosters the rehearsal and learning of aggressive scripts, rather than aggression simply leading individuals to prefer violent games.

2.6.2. Factors Linking Gaming and Aggression

Carnagey and Anderson (2005) examined how game contingencies shape the reinforcement of aggressive scripts. They conducted three experiments using different versions of the racing video game (i.e., *Carmageddon 2*) to isolate the role of reward and punishment. In one version, violent actions such as running over pedestrians were rewarded, in a second, the same violent actions were punished, and in a third, all violent elements were removed. The first experiment assessed aggressive affect, testing whether players would experience more hostile emotions after playing the game. The second experiment examined aggressive cognition by measuring the accessibility of aggressive concepts using a word-completion task. The third experiment examined aggressive behavior, using a competitive noise-blast paradigm in which participants could deliver aversive sounds to an opponent. Across all three studies, a consistent pattern emerged. That means, when violence was rewarded, players showed higher levels of hostile emotion, greater accessibility of aggressive thoughts, and more aggressive behavior, complementing the Script Theory assertions of the GAM (e.g., Anderson & Bushman, 2002; Bushman & Anderson, 2002). These results demonstrate that rewarded violence strengthens aggressive scripts as effective strategies for future situations.

Studies also clarified how personal factors interact with violent game play to increase aggression. In a study by Konijn et al. (2007), participants were randomly assigned to one of four conditions that combined violence (violent vs. nonviolent) and realism (realistic vs. fantasy). Each boy played one of twelve pretested games for 20 minutes. Examples of violent, realistic games included *America's Army*, *Killzone*, and *Max Payne*, while violent fantasy games included *DOOM 3*, *Quake*, and *Metroid Prime*. Nonviolent realistic games included *Pro Evolution Soccer*, *The Sims 2*, and *Tony Hawk's Underground*, and nonviolent fantasy games included *Mario Kart*, *Super Mario Sunshine*, and *Final*

Fantasy. Aggression was measured using a competitive reaction-time task in which participants set noise levels for an ostensible opponent, with high levels framed as potentially causing permanent hearing damage. The results showed that violent gameplay significantly increased unprovoked aggression compared to nonviolent gameplay. Importantly, aggression was strongest among boys who expressed high wishful identification with violent characters, especially when the games were realistic. Realism and immersion increased identification, which in turn heightened aggression. These findings supported the GAM by showing that identification with violent characters can amplify the rehearsal and accessibility of aggressive scripts, thereby increasing aggressive behavior even after a brief play session.

Likewise, Giumetti and Markey (2007) tested whether dispositional anger moderated the effects of violent video game play on aggression, an assumption drawn from the GAM. Participants were randomly assigned to play either one of three violent games (i.e., *Mortal Kombat: Deadly Alliance, DOOM 3, Return to Castle Wolfenstein*) or one of three nonviolent games (i.e., *Tetris Worlds, Top Spin Tennis, Project Gotham Racing*) for 15 minutes. Aggression was then assessed through participants' written responses to three ambiguous story stems, which were coded for aggressive content. Results showed that violent gamers generated significantly more aggressive responses than nonviolent gamers. More importantly, trait anger significantly moderated this effect. Participants high in trait anger displayed a stronger increase in aggressive responses after violent gameplay, whereas those with low trait anger were not significantly affected. These findings supported the GAM by demonstrating that both situational factors (e.g., violent games) and person factors (e.g., anger) jointly influence aggressive outcomes, with anger amplifying the activation and rehearsal of aggressive scripts. It is essential to situate this study within the broader context of GAM research, as even the original authors of the model often overemphasized situational factors over dispositional ones.

Participants' age also emerged as an important personal factor while assessing the relationship between violent gaming exposure and aggression. Initial studies applying the GAM did not restrict participants to a narrow age range, but instead, they examined aggression across childhood, adolescence, and adulthood (Bushman & Huesmann, 2006; Funk et al., 2003; Konijn et al., 2007; Wang et al., 2009). Particular attention, however, was given to children and adolescents, as impairments in thought processes or emotional regulation during these developmental stages could more readily produce enduring personality changes. For instance, Kirsh (2003) examined the role of violent video games during adolescence, emphasizing that this period represents a critical window when youth are especially sensitive to provocation and naturally drawn to competitive or aggressive activities. review situated violent games within the GAM framework, noting that in the short term, exposure functions as a situational variable that alters internal states by increasing aggressive thoughts, emotions, and arousal (Anderson & Bushman, 2001; Bushman & Anderson, 2002). Over time, these repeated exposures were theorized to encourage the formation of aggressive beliefs, attitudes, and scripts. Other studies in this period reinforced the importance of examining youth populations. For example, Anderson and Dill (2000) demonstrated that violent gameplay increased aggressive cognition and behavior among college students, but also highlighted adolescent vulnerability to media effects.

2.6.3. Violent Video Gaming and Hostile Attribution Bias

Exposure to violent video games has been theorized to shape aggression not only through behavior but also by altering underlying cognitive processes that guide social interpretation. According to social cognitive perspectives, repeated engagement with violent game content can activate and reinforce aggressive cognitive schemas, increasing the accessibility of hostile thoughts during social encounters (Bushman & Anderson, 2002; Huesmann, 1998). These hostile cognitions influence how individuals encode, interpret, and respond to social information, particularly in ambiguous situations where intent is unclear. Short-term and repeated exposure to violence may predispose individuals to expect hostility from others, a phenomenon conceptualized as hostile cognitive bias (Crick & Dodge, 1994). A specific form of such social cognitive bias is hostile attribution bias. It refers to the tendency to infer malicious intent behind others' ambiguous actions, and it has been identified as a robust precursor to reactive aggression in children and adults (Dodge & Frame, 1982).

One of the earliest empirical demonstrations linking violent video games with hostile cognitive bias comes from Kirsh (1998). This study proposed that violent video games may prime aggressive schemas, thereby increasing the likelihood of attributing hostile intent in ambiguous social situations. Using an experimental design, children were randomly assigned to play either a violent video game (i.e., *Mortal Kombat II*) or a nonviolent game (i.e., *NBA Jam: Tournament Edition*), after which they responded to ambiguous story-stem vignettes to assess their interpretations of peer intent. Findings revealed that children in the violent game condition were significantly more likely to make hostile attributions compared to those in the nonviolent condition, indicating a short-term cognitive priming effect that facilitates aggressive social information processing. Kirsh (1998) argued that such biased interpretations may not directly manifest as overt aggression in the immediate context but may serve as cognitive precursors to aggressive behavior over time. Irrespective of the merits of the results, this study is significant in providing one of the foundational supports for later formulations of the GAM.

Kirsh (1998) demonstrated that exposure to violent video games elicited a short-term hostile attribution bias among children, but this effect emerged only when participants responded to ambiguous social scenarios in an open-ended format. When predefined response options were provided, the effect disappeared, suggesting that hostile attributional styles may operate primarily within spontaneous, automatic information processing rather than deliberate reasoning.

Building on this premise, Krahé and Möller (2004) extended the investigation to a broader, cross-sectional context by examining how habitual exposure to violent video games shapes aggressive cognitive structures in adolescents. The study proposed that frequent engagement with violent games fosters acceptance of aggression as normative and promotes a tendency to interpret ambiguous social cues as hostile. Attraction to violent games predicted higher acceptance of physical aggression norms, which in turn mediated the relationship between violent game exposure and hostile attributional bias. No direct effect of violent gaming on hostile attributions was found, but an indirect effect through aggressive norms was evident. The relationship did not extend to relational aggression, indicating that violent gaming influences cognition specific to physical aggression (Anderson et al., 2007), which can also be termed as "violence" in general (DeWall et al., 2012).

Krahé and Möller (2004) also examined the psychological mechanisms underlying the link between violent video game exposure and hostile attributions. They proposed that "normative beliefs" play a central role in this process by acting as cognitive filters that influence how individuals evaluate the acceptability of aggression and how frequently they believe such behavior occurs in social settings. When someone decides whether another person's behavior was meant to be hostile, their judgment often depends on their general view of the world and how frequently they expect hostility from others. If a person believes that aggression is both acceptable and widespread, they are more likely to assume that another person's ambiguous actions were driven by harmful intent. This idea aligns with Huesmann's (1998) social cognitive view,

which posits that beliefs about aggression influence how aggressive thoughts and behaviors are learned and expressed. Research supports this reasoning. Huesmann and Guerra (1997) demonstrated that children who perceived aggression as acceptable were more likely to exhibit aggressive behavior. Likewise, Dodge and Coie (1987) found that those who made hostile attributions were more likely to respond aggressively.
Thus, normative beliefs serve as a cognitive bridge linking violent media exposure to hostile interpretations of social information and, ultimately, to aggressive behavior.

Möller and Krahé (2009) extended this study by examining the long-term effects of violent video gaming on adolescent aggression. The study measured exposure to violent games, normative beliefs about aggression, hostile attribution bias, and both physical and indirect/relational aggression. Participants were first assessed at Time 1 (T1) and followed up 30 months later at Time 2 (T2). At T1, participants reported playing violent video games such as *Counter-Strike*, *Grand Theft Auto*, *Max Payne*, *Medal of Honor*, and *Tekken*, which were rated high in violent content by expert coders. Exposure to such games was associated with greater acceptance of physical aggression and a higher hostile attribution bias. Results showed that violent gaming predicted physical aggression indirectly via normative beliefs. For relational aggression, the effect was direct but weaker, with no mediation through hostile attributions. Longitudinal findings revealed that exposure to violent video games at T1 predicted physical aggression at T2, mediated by increased normative beliefs supporting aggression. No such relationship emerged for indirect aggression.

Beyond the conventional narrative that violent video games increase hostile attribution bias, Bonus et al. (2015) investigated how enjoyment influences hostile attributions, particularly in individuals experiencing frustration. The study investigated whether violent video games could facilitate emotional restoration by meeting players' basic psychological need for competence (see Ryan & Deci, 2000). In doing so, it also tested the cathartic potential of violent gameplay in reducing aggression-related outcomes, as proposed by cognitive models of catharsis (see Denzler et al., 2011). Participants were randomly assigned to either a violent (i.e., *First of the North Star: Ken's Rage*) or nonviolent game (*LittleBigPlanet 2*) condition, with half of them undergoing a task that induced frustration beforehand. The researchers found that participants who progressed in the game and experienced less frustration had higher feelings of competence and greater enjoyment. However, among those who played violent video games, greater enjoyment predicted increased hostile attributions, while lower enjoyment reduced them. The results suggest that while gameplay may reduce frustration and enhance enjoyment, such emotional restoration can reinforce hostile interpretations of ambiguous social situations during violent gaming. These findings challenge the simplistic view that violent games uniformly increase aggression (cf. Bushman & Anderson, 2002) and suggest that emotional restoration can either attenuate or amplify hostile interpretations depending on enjoyment levels. The study is significant as it highlights the detailed psychological processes underlying hostile attributions, offering an understanding of when and for whom violent games may pose a risk for aggression (cf. Ferguson & Rueda, 2010).

2.6.4. Violent Video Gaming and Hostile Expectation Bias

While hostile attribution bias focuses on how individuals interpret others' ambiguous actions as intentionally aggressive (Kirsh, 1998), hostile expectation bias extends this by examining the anticipatory component, whether individuals expect others to behave aggressively in the future (Dill et al., 1997). This distinction is important within the GAM (Anderson & Bushman, 2002), which posits that repeated exposure to violent media strengthens cognitive scripts associated with aggression. Over time, these scripts are theorized not only to shape how people interpret ambiguous situations (as in hostile attribution bias) but also how they anticipate social interactions unfolding (as in hostile expectation bias). In the context of violent video games, these biases are reported to be activated through gameplay that rewards aggression and normalizes hostile responses.

Early experimental evidence suggests that exposure to violent games does not merely entertain, but it immediately alters perception and interpretation in social encounters. For example, Bushman and Anderson (2002) examined whether a short session of violent video gameplay would influence hostile expectation bias. After playing either a violent (e.g., *Carmageddon, Duke Nukem, Mortal Kombat, Future Cop*) or nonviolent game (e.g., *Glider Pro, 3D Pinball, Austin Powers, Tetra Madness*), participants were asked to interpret ambiguous social situations and anticipate how a character might think, feel, or act. The results showed that participants who played violent video games were significantly more likely to interpret the characters' thoughts, emotions, and behaviors as hostile compared to those who played nonviolent games. Within the framework of the GAM, hostile expectation bias reflects the activation of aggressive cognitive scripts learned and rehearsed in virtual environments. These scripts may then generalize to offline contexts, leading players to expect hostility even from neutral or ambiguous others and preparing them to respond defensively or retaliate, even in the absence of actual provocation.

Anderson and Murphy (2003) replicated this study, testing hostile expectation bias only in females. Participants were divided into three groups. One group played a violent video game (i.e., *Street Fighter II*) with a female protagonist, another played the same game with a male protagonist, and the third group played a nonviolent game (i.e., *Oh No! More Lemmings*). Aggression was empirically assessed using a modified Taylor Competitive Reaction Time Task (TCRT) and a questionnaire that evaluated their reasons for setting specific noise levels, which simulated punishments in the task. In the TCRT, participants reacted to tones in competition with a fictitious opponent. The “loser” of each round was predetermined and received a loud noise, the intensity of which was set by what they believed was the opponent’s choice. In reality, there was no opponent, and the participants’ settings for the noise level of the “opponent” were used to measure their aggressive behavior. The results showed that a brief exposure to violent video games could increase aggressive behavior among females. This increase was partly driven by revenge motivations, but not significantly by instrumental aggression motivations. Additionally, playing a violent video game with a protagonist matching the player’s gender slightly increased aggression, although this finding was not statistically significant. Later works corroborated these patterns, showing that identification with violent characters (Konijn et al., 2007) and revenge motivation (Zhang, Tian, et al., 2021) can amplify aggressive cognitions and behaviors.

Likewise, Zhen et al. (2011) modeled how violent video game exposure relates to physical aggression through beliefs about aggression, hostile expectations, and empathy. Drawing on a sample of 795 Chinese adolescents across grades 5, 8, and 11, the investigators tested an integrated mediation model. Results revealed that all three mediators partially explained the relationship between violent game exposure and aggressive behavior, accounting for 42% of the variance in physical aggression. Of particular relevance to the present discussion, the study highlighted the role of hostile expectation bias as a pathway linking violent game play to actual aggression. Adolescents who frequently played violent games were more likely to interpret others’ actions as intentionally hostile, which in turn increased their likelihood of responding aggressively (Bushman & Anderson, 2002; Dill et al., 1997). However, while the hostel expectation bias was a significant mediator in the overall sample, its influence was weaker and less consistent than that of aggressive beliefs, emerging most clearly among younger male participants. Zhen et al. 2011 concluded that hostile expectation bias represents a developmentally contingent cognitive mechanism, one that may interact with normative beliefs about aggression and declining empathy to reinforce aggressive behavior, particularly during early adolescence.

Building on these findings, Hasan et al. (2012) shifted focus from motivational explanations of aggression to the cognitive mechanisms through which violent video games influence social behavior. Their study demonstrated that violent gameplay not only increases aggression but also distorts social expectations, making players more likely to anticipate hostility from others in ambiguous situations. In their experiment, participants played either a violent (i.e., *Condemned 2, Call of Duty 4, The Club*) or nonviolent video game (i.e., *S3K Superbike, Dirt 2 Pure*) for 20 minutes before responding to story-stem tasks designed to measure hostile expectation bias. Those exposed to violent games were more likely to predict aggressive thoughts, emotions, and behaviors in others, indicating that violent media can prime aggressive cognitive schemas (Bushman & Anderson, 2002). Importantly, this cognitive bias partially mediated the effect of violent game exposure on subsequent aggressive behavior, as measured by the CRTT. Although aggression levels were generally higher among males, the cognitive mechanism linking violent gameplay to aggression was present in males and females alike. These findings reinforced earlier work by demonstrating that violent video games influence not only behavioral aggression but also cognitive processing, suggesting that aggression may emerge indirectly through biased interpretations of social intent.

Hasan et al. (2013) extended this line of inquiry through an experimental study to examine whether repeated exposure to violent video games cumulatively increases hostile expectation bias and aggressive behavior, thereby offering causal evidence for enduring effects of violent media exposure. Unlike short-term experimental designs (e.g., Bushman & Anderson, 2002; Hasan et al., 2012), this study examined cumulative effects over three consecutive days. Participants were randomly assigned to play either a violent (e.g., *Call of Duty 4*, *Condemned 2*) or a nonviolent (e.g., *Pure*, *Dirt 2*) video game for 20 minutes per day. Each participant played a different game from the assigned category each day. After gameplay, two outcomes were measured: (a) hostile expectations, assessed using ambiguous interpersonal story stems where participants predicted the protagonist's thoughts, feelings, and actions; and (b) aggression, measured through a validated "noise blast task" where participants set the intensity and duration of an aversive sound directed at a fictitious opponent. The results showed a linear increase over three days in hostile expectations and aggressive behavior for those in the violent game condition, with no such increase observed in the nonviolent condition. Latent growth curve analysis confirmed that violent video game exposure significantly influenced the intercept and slope for both hostile expectations and aggression. Moreover, hostile expectations significantly mediated the effect of violent gameplay on aggression, complementing their previous study (Hasan et al., 2012). This suggests a cognitive mechanism whereby violent games increase anticipatory hostility.

While many studies have considered video games as a whole to prime aggression and cause hostile expectation bias, some have also explored the specific game attributes that contribute to such priming. Ivory and Kaestle (2013) examined whether "profanity" within violent video games contributes to increased hostile expectations and other aggression-related cognitive and affective outcomes. Profanity is considered a form of verbal aggression in their study, unlike previous studies that have relied mostly on physical aggression. They used a 2 (protagonist profanity: present vs. absent) × 2 (antagonist profanity: present vs. absent) between-subjects design using a customized FPS game, *Rescue Strike*, with four versions differing only in the presence or absence of profanity in character dialogue. The most significant finding was that profanity significantly increased hostile expectations regardless of whether it was used against the protagonist or the antagonist. This supports the GAM's assertion that situational inputs (e.g., language) can prime aggression and related cognitive mechanisms. Interestingly, profanity did not increase the accessibility of aggressive thoughts or aggressive affect, and in fact, antagonist profanity reduced self-reported aggressive feelings. No effects were found on perceived arousal. These findings suggest that profanity in violent games may primarily operate through higher-order cognitive appraisals (i.e., hostile expectations) rather than automatic affective or arousal. Moreover, effects were not moderated by gender, prior gaming experience, or baseline aggression, indicating the robustness of profanity's influence on hostile expectations across individual differences.

2.6.5. Violent Video Gaming and Prosocial Behavior

Research consistently shows that the effects of violent video games on aggression do not always manifest as overt aggressive behavior. Instead, it is reported to impair broader aspects of social functioning, including reductions in prosocial behavior, such as helping, cooperating, and showing empathy. Anderson and Bushman's (2001) meta-analysis emphasized this concern by analyzing eight independent tests examining the relationship between violent video game exposure and prosocial behavior. Their findings revealed a significant negative effect[3] ($r^+ = -.16$), with experimental studies showing an even stronger average effect size ($r = -.17$, 95% CI [–0.25, –0.08]), suggesting that even brief exposure to violent video games can lead to temporary decreases in helping behavior. Similarly, non-experimental studies have shown a negative correlation ($r = -.14$, 95% CI [–0.25, –0.02]) between exposure to violent video games and real-world prosocial behaviors.

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[3] r^+ is the average effect size across multiple studies, where each individual study's effect size (correlation coefficient, r) is weighted by its sample size.

Likewise, Anderson et al. (2010) reported that violent video game exposure reduces prosocial behavior across research designs and cultural contexts. They argued that increased aggressive thoughts and emotions after gameplay may interfere with empathic feelings that usually support helping behavior. The analysis revealed that exposure to violent video games was significantly associated with lower levels of prosocial behavior, even after controlling for factors such as sex and baseline prosocial tendencies. Longitudinal analyses showed that violent gameplay at one time point predicted lower prosocial behavior at a later time point, suggesting a potential long-term effect. In the full-sample analyses, experimental studies yielded the strongest negative effect ($r = -.16$, 95% CI [–0.23, –0.1]), while longitudinal studies showed smaller effects ($r = -.11$, 95% CI [–0.15, –0.07]). Cross-sectional studies demonstrated modest effects ($r = -.09$, 95% CI [–0.13, –0.09]), possibly due to cultural or methodological differences. Western samples showed stronger negative relationships ($r^+ = -.23$) than Eastern samples ($r^+ = -.08$), suggesting that cultural norms may moderate the influence of violent gaming content on social outcomes. Further, studies using specific gameplay measures of violent exposure found larger negative effects than those using general measures.

Similarly, Bushman and Anderson (2009) conducted two experiments to examine whether exposure to violent video games reduces prosocial behavior by desensitizing individuals to others' pain. In Study 1, participants played either violent (i.e., *Carmageddon, Duke Nukem, Mortal Kombat, Future Cop*) or nonviolent video games (i.e., *Glider Pro, 3D Pinball, Austin Powers, Tetra Madness*) for 20 minutes before overhearing a staged physical altercation outside the lab. Participants who played violent games took significantly longer to help an injured victim, were less likely to notice the emergency, and perceived it as less serious, compared to those who played nonviolent games. Study 2 extended these findings to a naturalistic field setting with adult moviegoers. After viewing either a violent or a nonviolent film, participants encountered a woman who dropped her crutches. Those exiting violent movies delayed helping by over 26% compared to participants in other conditions. Together, the findings support desensitization theory by demonstrating that violent media exposure diminishes empathy and responsiveness to others' distress. This study is significant as one of the first to examine the effects of interactive (e.g., video games) and non-interactive (e.g., movie clips) forms of violent media exposure, demonstrating that both exert comparable adverse effects on prosocial behavior, rather than showing differential influences.

Studies supporting the GAM have also emphasized that the reduced prosocial behavior is not a simple direct effect of violent gaming but occurs through reduced empathy and self-control, which are critical for helping behavior. For example, You et al. (2015) examined whether playing violent video games is associated with reduced prosocial behavior and increased aggression among adolescents, and whether emotional competence mediates these effects. The investigators used a cross-sectional survey, where violent video game exposure was measured based on participants' favorite games and frequency of play, while outcomes included aggression and prosocial behaviors toward family/friends and strangers. Results showed that violent video game exposure had a significant direct positive effect on aggression, supporting the GAM (Anderson & Bushman, 2002). Importantly, violent game exposure indirectly reduced prosocial behavior by lowering empathy and behavioral self-control. Emotional regulation did not mediate any relationships. These findings suggest that violent gameplay may weaken the social and emotional skills necessary for helping behaviors, thereby reducing prosocial tendencies, such as the willingness to help others or engage in supportive behavior.

2.7. Present Research

2.7.1. Violent Video Gaming and Emotional Processing

The person-in-situational approach of the GAM is broad, and as a result, the study of aggression under this framework spans a wide range of outcomes and mechanisms. Given the bidirectional nature of internal states proposed by the model and the extensive research focused on the "affect" domain, the present thesis limits its scope to the effects of violent video game exposure on emotional processing in gamers. The central question examined is whether habitual engagement with violent video games impairs emotional information processing. Specifically, the thesis asks whether such engagement amplifies hostile knowledge structures that favor negative emotional interpretations or whether it leads to emotional desensitization toward negative stimuli.

Research on emotional processing itself is broader, as prior studies have employed diverse paradigms and stimulus sets to assess emotional functioning. To reduce this variability, the present investigation focuses specifically on facial emotion processing. It examines whether violent video game players show impairments in processing emotional expressions, whether any observed deviations differ from conventional patterns of emotion recognition, and whether such impairments, "if present," are better explained by hostile information processing or by desensitization. These questions are addressed in the sections that follow, along with critical evaluations and null findings that challenge key assumptions of the GAM and thereby strengthen the rationale for the present research problem.

Emotional information processing serves as a vital marker for assessing cognitive biases, which aligns with the GAM's core principle regarding the reciprocal connections between internal states. The GAM primarily utilizes Script Theory and desensitization perspectives to elucidate how violent gaming alters emotional processing. One of the foundational studies by Kirsh et al. (2005) examined the impact of violent video games and trait hostility on attention to negative words using an "Emotional Stroop" task. This task assessed how personal (e.g., trait hostility and anger) and situational factors (e.g., exposure to violent games) might bias the processing of emotionally valenced information. A total of 129 college students played either a violent video game (e.g., *House of the Dead 2*) or a nonviolent game (e.g., *Kayak Extreme*) for 15 minutes. After the gameplay, they completed the Genov Modified Stroop Task (GMST), where they identified the color of emotionally laden or neutral words. This task measured how emotional content affected their attention. Participants who played violent video games showed increased Stroop interference, indicating more difficulty in shifting attention from emotionally valenced words, compared to those who played nonviolent games. Furthermore, participants with high trait hostility showed greater Stroop interference, supporting the GAM assertion (Anderson & Bushman, 2002; Bushman & Anderson, 2002). Specifically, players with high trait hostility encountered more interference in violent game scenarios than their less hostile counterparts and even more than low hostility players in nonviolent scenarios.

Despite Kirsh et al. (2005) highlighting how violent media (i.e., video games) can bias cognitive and emotional information processing, it is interesting to note a key limitation in their methodology. The emotional Stroop task they used involved negatively valenced (i.e., threat words) and neutral words, which were irrelevant to the main task of identifying the color of the words. Therefore, it is crucial to locate the hypothesized processing bias in tasks that directly involve the identification of emotionally congruent information.

Weber et al. (2006) transitioned the field from behavioral to physiological investigation by utilizing fMRI to explore the emotional processing of violent video gamers. Their study sampled 13 young adults, veteran players who had engaged with violent video games since age 12, averaging 15.1 hours of weekly play. They were engaged in a video gaming session, playing a “Mature” rated FPS game (*Tactical Ops: Assault on Terror*). The gameplay was closely examined with onscreen activities classified into various levels of interaction and violence. These categories ranged from “active/safe, no imminent danger/no violent interactions” to “active/fighting and killing, many violent interactions,” allowing for a detailed analysis of the nature and intensity of the violence displayed during the game. The analysis showed that virtual gameplay violence suppressed activity in affective brain regions such as the anterior cingulate cortex (ACC) and the amygdala, suggesting alterations in cognitive areas associated with aggression. The observed effects were linked to the violent content of the games, supporting the theory that virtual violence can affect brain functions related to aggressive thoughts, feelings, and behaviors. Researchers also speculated about a potential suppression of positive emotions due to exposure to virtual violence, raising the question of whether playing violent video games differentially impairs various types of emotions.

Wang et al. (2009) used a similar premise to test the short-term effects of playing violent video games. A total of 44 adolescents took part in this experiment. Information on violent media exposure, including video gaming and TV media, was collected from the participants, followed by the gaming session. Participants were randomly assigned and instructed to play *Need for Speed* (2005), a nonviolent car driving game, or *Medal of Honor* (1999), a violent FPS game. They spent about 30 minutes learning and practicing their assigned game to ensure proficiency for independent play during a subsequent visit. After practicing, they completed the Video Game Rating Index (VRI), which assessed various aspects of the game experience. Within four weeks of the initial session, participants returned for a second visit to undergo an fMRI scan. Prior to the scan, they played their assigned game for another 30 minutes. This setup was designed to assess the neural responses to playing violent versus nonviolent video games. Results showed that violent video gamers showed reduced activity in the prefrontal cortex during the Counting Stroop task. Specifically, violent video gamers showed reduced activity in the left dorsolateral prefrontal cortex (DLPFC) and decreased functional connectivity between the left DLPFC and dorsal ACC compared to nonviolent gamers. These brain regions are crucial for executive functions such as selective attention and response inhibition. On the other hand, during an Emotional Stroop task, the violent video game group showed increased activity in the right amygdala and reduced activation in the medial prefrontal cortex (MPFC). Additionally, functional connectivity analysis showed negative coupling between the right amygdala and MPFC in the nonviolent video game group, whereas this connectivity was absent in the violent game group. These results indicate distinct neural responses to short-term exposure to violent versus nonviolent video games.

As mentioned earlier, the GAM initially emphasized the cyclical nature of aggression through cognitive, affective, and arousal routes in single episodes of media exposure (Anderson & Bushman, 2002). However, scholars soon argued that habitual engagement with violent media, particularly video games, could foster enduring personality changes by dulling individuals' emotional reactivity to violence. This conceptual expansion drew heavily from the desensitization model in social psychology, which posits that repeated exposure to violent or distressing stimuli leads to a reduction in physiological and emotional responsiveness over time (Funk et al., 2004). Thus, desensitization was theorized as one mechanism through which violent video games influence the "distal personality" components of the GAM.

Theoretically, the desensitization process has been situated at the intersection of the GAM's affective and arousal routes. Whereas single episodes of violent gameplay were expected to increase aggressive thoughts and hostile affect in the short run, habitual exposure was believed to blunt aversive emotional reactions, such as empathy, guilt, or fear

(Carnagey et al., 2007). The model suggests that this emotional numbing reduces physiological arousal (e.g., HR) and increases tolerance for violence, thereby lowering internal barriers against aggressive behavior. Within the GAM framework, desensitization operates as a cumulative process, where repeated violent gameplay reinforces aggressive knowledge structures while simultaneously weakening emotional safeguards, thereby increasing the likelihood of aggression across various situations.

Early studies in this area have noted reduced empathetic responses and weakened moral judgments among players of violent video games. For example, Funk et al. (2003) explored the association between short-term and long-term exposure to violent games with blunted empathetic responses and impaired moral judgments. Short-term effects were assessed by analyzing children’s responses to vignettes after playing violent or nonviolent games, expecting more aggressive reactions from those who played violent games. Older children played *Marble Drop* (1996) or *Terra Nova* (1996) on a desktop computer, while younger children played *Croc: Legend of the Gobbos* or *Earthworm Jim: New Junk City* (1997) on a portable laptop. Long-term effects were evaluated by examining the relationship between prolonged gaming, pre-existing empathy levels, attitudes toward violence, and responses to similar vignettes. Children aged 5–12 years completed questionnaires on their gaming habits and empathy before and after playing a game for 15 minutes. They then rated their level of frustration and how much they enjoyed the game. Responses to vignettes were recorded and scored for aggression or empathy using a self-reporting scale. Results showed that children with more prolonged exposure to violent games had lower empathy levels and scored lower on empathy vignettes. Older children generally scored higher for both empathy and aggression. Notably, no transient effects on aggression or empathy scores were observed after playing the games.

Importantly, Funk et al. (2003) noted the difficulty of directly measuring desensitization due to its subtle nature, leading researchers to assess related characteristics, such as empathy and attitudes toward violence. They did not, however, determine how low empathy or high pro-violence attitudes need to be to classify an individual as "desensitized," leaving this as a limitation and an area for future research. Another key issue raised concerns the feasibility of studying the habitual effects of violent video game play on aggression in children. The studies lacked detailed information on participants' backgrounds and gaming histories, which is particularly concerning given children's dynamic developmental stages. However, assessing the long-term effects of video games on children presents considerable challenges and is subject to significant scrutiny. Firstly, pinpointing why children prefer specific genres of games is a complex task. Their gaming choices may be influenced by various factors, such as peer preferences, advertising, or a desire to try something new after playing other games. Additionally, parental control plays a crucial role in regulating children's gaming habits, including selecting and supervising the games they play. Given these varied influences, children's gaming habits are shaped by numerous confounding factors. Therefore, attributing increased aggression or potential emotional desensitization directly to video games requires careful justification. Without accounting for these multiple layers of influence, conclusions about the direct impacts of gaming can be misleading.

Typically, desensitization to violence is conceptualized as a form of habituation (Rankin et al., 2009) that develops through prolonged and repeated exposure to violent stimuli. However, a substantial body of empirical work challenges the notion that extended exposure is a necessary condition. Studies have demonstrated that measurable desensitization effects can occur following relatively brief encounters with violent media, including short gameplay sessions paradigms (e.g., Bushman & Huesmann, 2006; Carnagey et al., 2007). Importantly, short-term exposure paradigms are not confined to the early years of the GAM literature, but they continue to be widely employed in contemporary research. Recent studies still routinely expose participants to brief sessions of violent video games or short violent film clips before assessing affective, physiological, or neurocognitive responses within experimental tasks. While several critiques have been raised against this perspective, the following paragraphs elaborate in detail on short-term desensitization paradigms.

In a pioneering study within the GAM framework, Bartholow et al. (2006) explored whether habitual exposure to media violence could lead to desensitization by reducing negative reactions to violence and removing inhibitions against aggression. The study employed event-related potentials (ERPs), specifically the P300 component, to measure desensitization. They posited that decreased P300 amplitudes in response to violent images would correlate with increased aggression. The study involved 39 undergraduate students, categorized into violent and nonviolent video game players. Participants completed a visual oddball task that included neutral, violent, and negative nonviolent images while ERPs were recorded. They also participated in a competitive task where they could "blast" a loud noise at another participant, which served as a measure of aggression. Results showed that violent video gamers had lower P300 amplitudes to violent images compared to nonviolent players, and these reduced responses predicted greater aggression in subsequent tasks. These findings were consistent even after accounting for individual differences in trait aggressiveness.

This study was pivotal in examining the relationship between video game violence, desensitization, and increased aggression through both behavioral and electrophysiological data. However, it lacked clarity on the criteria for classifying participants as chronic players and did not specify the types of video games involved. Additionally, a significant limitation noted by the researchers is that, although P300 amplitude was hypothesized to mediate the link between video game violence and aggression, specific mediation tests did not support this hypothesis. Thus, despite the association among these variables, the brain's response to violent images did not account for the effects of violence exposure on aggression. Despite these limitations, this experimental study spurred subsequent research that considered the duration of violent video game exposure, categorizing it within different conceptual frameworks to evaluate the potential impact of violent video games.

Bartholow et al. (2006) primarily viewed desensitization only as an "affective response," overlooking its interaction with arousal and cognition. To fill this gap, subsequent research by Carnagey et al. (2007) investigated the effects of violent video games on physiological desensitization. They adopted a clinical approach from Wolpe's systematic desensitization for phobias and defined desensitization as reduced arousal to actual violence following exposure to video game violence. They expanded the GAM and operationalized desensitization as a process where initial arousal responses to violent stimuli diminish, altering an individual's internal state and influencing their decision-making and behavior (Carnagey et al., 2007). The refined model outlines that exposure to violent video games can lead to emotional desensitization, impacting aggression and prosocial behaviors. Initially, violent media (such as video games) often elicit fear and anxiety, but repeated exposure within a positive context (such as exciting music and rewarding violent actions in games) reduces these reactions. This perspective is highly relevant, as it aligns with the growing trend of video games, which have become technically advanced, incorporating elements such as graphics, storytelling, and music. Evidence of desensitization includes observed decreases in physiological arousal, such as HR and galvanic skin response (GSR), after exposure to real violence. Once desensitization sets in, it alters cognitive and affective responses to violence, potentially leading individuals to be less aware of aggression, perceive injuries as less severe, feel less empathy toward victims, view the world as more dangerous, and adopt more favorable attitudes toward violence. These changes are pivotal in shaping future behaviors and decisions regarding violent situations.

Carnagey et al. (2007) used rigorous criteria to assess desensitization in relation to media effects. Their methodology included, (a) random assignment to violent or nonviolent media exposure groups, (b) use of equivalent violent and nonviolent media, controlled for nonviolent factors like excitement, (c) measurement of physiological responses, such as HR and GSR, as indicators of emotion, and (d) the use of real violence as the stimulus in assessments, enhancing the generalizability of their findings compared to studies measuring responses to fictional violence. In their study, 257 college students played either a violent (e.g., *Carmageddon, Duke Nukem, Mortal Kombat, Future Cop*) or nonviolent game (e.g., *Glider Pro, 3D Pinball, 3D Munch Man, Tetra Madness*) for 20 minutes. Following the gameplay, they watched a 10-minute video of actual violence, during which their HR and GSR were monitored. Participants then evaluated the video game on various aspects. It was hypothesized that those who played violent games would exhibit less physiological arousal (lower HR and GSR) when exposed to real violence. The results confirmed this, showing that participants who played violent games had reduced HR and GSR, indicating physiological desensitization to violence.

In addition to demonstrating desensitization, Carnagey et al. (2007) suggested that blunted emotions and cognitive and physiological responses as a result of continuous exposure to violent media might reduce helping and prosocial behaviors toward assisting victims in social situations. A subsequent study by Bushman and Anderson (2009) investigated whether exposure to violent media reduces the likelihood of offering help to those in pain. In their first phase of the experiment, participants (college students) played either a violent or nonviolent video game for 20 minutes. Afterward, while filling out a questionnaire, they heard a staged fight involving an injury outside the lab. Results indicated that those who played violent games delayed in helping, perceived the fight as less severe, and were less likely to report hearing the fight compared to those who played nonviolent games. In the following experiment, moviegoers saw a woman with an injured ankle struggling to pick up her crutches outside the theater. Those who had watched a violent movie were slower to help than those who had watched a nonviolent film or had not yet watched the violent one. Results from both studies indicate that violent media desensitizes individuals to the pain and suffering of others.

While there was a continuous effort to contextualize desensitization in response to habitual exposure to violent media, Fanti et al. (2009) explored whether desensitization could also occur over a short period. A total of 96 college students participated in this study, which involved watching violent and comedic clips to assess their reactions to media violence. After each clip, participants completed a questionnaire evaluating their enjoyment and their sympathy toward the victims in the violent scenes. Additionally, they provided demographic information and reported any severe and inappropriate aggressive acts they had committed in the past six months. This setup aimed to measure the short-term desensitization effects of media violence. The findings showed that desensitization to media violence can occur quickly with repeated exposure, following a "curvilinear" pattern. In this experiment, participants initially experienced aversive reactions to media violence, enjoying violent scenes less and expressing more concern for the victims. However, as exposure continued, these reactions reduced, where participants reported decreasing sympathy for the victims and an increased enjoyment of the violence depicted. The findings suggest that while initial responses to media violence are negative, repeated exposure leads to desensitization, resulting in greater tolerance and even enjoyment of violent content.

An experimental study by Staude-Müller et al. (2008) explored whether violent video gamers exhibit physiological desensitization, specifically in HR and respiration rate. Unlike prior studies, this research did not include nonviolent gaming as a control but instead varied the levels of violence (low vs. high) within a single FPS game (i.e., *Unreal Tournament 2003*). A total of 42 university students participated in this experiment. Their physiological and emotional responses to aversive and aggressive stimuli from the International Affective Picture System (IAPS) were assessed through self-ratings and skin conductance. Contrary to initial expectations, participants became more relaxed, not more aroused, during gameplay, suggesting desensitization aligns with using video games for relaxation. Emotional judgments of the pictures did not differ, but physiological responses did. Those in the "high violence" condition showed reduced reactions to aversive stimuli and were more responsive to aggressive cues. This indicates that video game violence may impact emotional processing differently at various stages and that the cognitive interpretation of these stimuli (shaped by attitudes and social ideals) might not directly reflect the true emotional state. These findings suggest that desensitization can impact behavior when cognitive resources are limited, such as in stressful or ambiguous situations. However, the specific conditions under which these effects influence behavior, especially given the role of cognitive control, remain unclear.

Arriaga et al. (2011) found that habitual violent gaming led to emotional desensitization, specifically manifesting as reduced feelings of displeasure when gamers encountered violent emotional stimuli that would ordinarily elicit negative affect. 58 college students were randomly assigned to play either a violent or a nonviolent computer game, and afterward, they watched emotionally valenced IAPS pictures while the researchers recorded physiological responses and collected affect ratings using the Self-Assessment Manikin (SAM). The key idea was that if violent video gaming produces desensitization, then subsequent exposure to emotional (including violent/negative) stimuli should evoke less pronounced affective responses than would otherwise be expected. Their findings supported this logic by showing that violent game play was associated with reduced affective responding, specifically, reduced intensity of displeasure to violent/negative stimuli. Importantly, they also incorporated participants' habitual violent game habits and showed that game condition and prior habits interacted when predicting aggressive behavior, and that shifts in self-reported valence helped explain (mediate) this relationship. Conceptually, this aligns tightly with the GAM assertions that exposure to violent video games serves as a situational input that shapes affective internal state (i.e., reduced negative valence to violent cues), which can subsequently bias appraisal processes and behavioral output.

Stockdale et al. (2017) extended this argument a step further by showing that violent media exposure does not merely dull responses to violence but also erodes sensitivity to positive and self-regulatory cues. They found that habitual violent video gamers showed lower empathy and reduced brain activity compared to less frequent gamers, as indicated by decreased P100 and N200/P300 amplitudes. They also showed reduced N200/P300 amplitudes during response inhibition, suggesting fewer neural resources were engaged to control behavior. A similar pattern of emotional desensitization has also been reported among individuals who frequently consume passive forms of violent media such as television and films (Fanti et al., 2009; Mrug et al., 2015).

At the neural level, Engelhardt et al. (2011) provided electrophysiological evidence that exposure to violent video games is associated with altered processing of emotionally negative information. In their study, participants were categorized based on their self-reported violent video game exposure and were subsequently exposed to emotionally valenced images while electroencephalographic (EEG) activity was recorded. The authors focused on the P300 component, a late positive ERP that is widely interpreted as an index of attentional allocation and motivational significance, particularly for emotionally salient and aversive stimuli. Their findings indicated that individuals with higher levels of habitual violent video game exposure exhibited significantly reduced P300 amplitudes in response to negative images compared to those with lower exposure. This attenuation suggests a diminished allocation of cognitive and motivational resources to aversive emotional cues. Likewise, Stockdale et al. (2015) found that a brief exposure to violent film suppressed early emotional discrimination components (i.e., N170, P200) and altered inhibitory control markers (i.e., N200, P300) during facial emotional processing. Extending this line of research, Miedzobrodzka et al. (2022) found that both habitual and short-term gaming led to notable reductions in the P300 and P625 amplitudes in response to painful stimuli, suggesting rapid desensitization even among those previously unexposed to violent games.

While emotional processing has been discussed in this section from Script Theory and desensitization perspectives, much of the existing evidence relies on abstract or decontextualized emotional stimuli (e.g., pictures, words, or isolated affective cues). The following sections, therefore, shift attention to a more ecologically valid assessment of emotional processing, specifically facial emotion recognition paradigms, which capture how individuals decode socially relevant emotional signals in real-time. By focusing on performance and biases in recognizing facial emotions, these paradigms allow for a more direct evaluation of how violent video game exposure may influence emotional information processing in contexts that closely approximate actual social encounters.

2.7.2. Violent Video Gaming and Facial Emotional Processing

The present research utilizes a facial emotion recognition paradigm, a tool for investigating not only emotional information processing but also broader socio-cognitive functioning. Facial emotions provide critical cues for interpersonal communication, allowing individuals to interpret emotions and adjust their behavior (Calvo & Nummenmaa, 2016; Gil & Le Bigot, 2023). Accurate recognition of facial expressions is crucial for effective social functioning, as it enables individuals to infer others' emotional states and adjust their own responses accordingly. Studies indicate that efficient facial emotion recognition draws on multiple executive functions, including sustained attention, rapid perceptual discrimination, and intact affective appraisal mechanisms (Mathersul et al., 2009).

In general, it has been reported that happy expressions are recognized more accurately and quickly than negative ones (such as anger, fear, and disgust), a phenomenon known as the "happy-face advantage" (Leppänen et al., 2003; Leppänen & Hietanen, 2004). Several explanations have been proposed for this advantage. From a perceptual standpoint, happy expressions are characterized by distinctive and visually salient features (e.g., exposed teeth, upward curvature of the mouth), which facilitate faster configural processing. From a motivational perspective, happy faces signal social approachability and affiliative intent, making them more rewarding and attentionally prioritized during early stages of processing (Beaudry et al., 2014; Ekman & Friesen, 1978). Neuroimaging and electrophysiological studies further suggest that happy expressions require fewer cognitive resources to decode, relying on relatively automatic processing pathways compared to those involved in decoding negative emotions (Calvo & Beltrán, 2013).

In contrast, recognition of negative facial expressions often shows reduced efficiency and greater variability, particularly for emotions such as fear, disgust, and anger (Beaudry et al., 2014). This reduced efficiency has been attributed to several factors. Negative expressions tend to be more ambiguous, requiring additional interpretative processing to disambiguate their meaning. For example, fear expressions may signal either environmental threat or social submission, necessitating greater reliance on contextual cues. Moreover, negative emotions engage controlled attentional and evaluative processes, which can slow recognition and increase error rates (Calvo et al., 2018; Calvo & Nummenmaa, 2016). Importantly, repeated exposure to violent or threatening stimuli has been proposed to further reduce sensitivity to such negative cues through desensitization mechanisms, potentially exacerbating difficulties in recognizing expressions related to threat or distress (Diaz et al., 2016). It is also reported that there may be scattered or distributed gaze when recognizing negative emotions, unlike when recognizing happiness (Calvo et al., 2018). From this perspective, reduced efficiency in recognizing negative emotions may reflect not only weak perceptual salience but also altered motivational and affective engagement with aversive social signals.

Failures or biases in emotion recognition have been linked to a range of maladaptive outcomes, including impaired empathy (Besel & Yuille, 2010), deficient emotion regulation (In-Albon et al., 2013), and increased aggressive or antisocial behavior (Philipp-Wiegmann et al., 2017). Extending these observations to the context of violent video game exposure, research grounded in the GAM suggests that repeated engagement with violent content may bias cognitive appraisal processes toward negative emotional cues, while simultaneously reducing sensitivity to positive emotional expressions. Such patterns align closely with Script Theory (Huesmann, 2007), which posits that habitual exposure to violent media facilitates the acquisition and reinforcement of hostile knowledge structures, including “scripts.” Once internalized, these scripts guide social information processing in an increasingly antagonistic manner, shaping the interpretation of emotional signals and subsequent behavioral responses.

For instance, Kirsh et al. (2006) investigated whether violent media consumption impacts the speed of recognizing facial emotional expressions (i.e., happy vs. angry). A total of 118 college students participated in the study and were tasked to quickly identify negative and positive emotions as neutral facial expressions morphed into either happy or angry ones. Facial stimuli were taken from the NimStim Face Stimuli Set from MacArthur Research Network on Early Experience and Brain Development. The results showed that independent of trait aggressiveness, participants with high violent media consumption recognized angry faces more quickly and happy faces more slowly. This pronounced negative bias in processing emotional expressions supports earlier findings within the GAM framework (Anderson & Dill, 2000; Kirsh, 1998; Kirsh et al., 2005). Overall, Kirsh et al. (2006) provided empirical evidence suggesting that exposure to violent media reduces the happy-face advantage, which refers to the enhanced accuracy and quickness in recognizing positive expressions (Leppänen et al., 2003).

Building on the broader effects of violent media, in a subsequent study, Kirsh and Mounts (2007) investigated the emotion recognition capacity of violent video gamers. Employing a similar face morphing technique as Kirsh et al. (2006), 197 college students were asked to quickly identify emotions (i.e., happiness vs. anger) during the morph sequence. Participants were randomly assigned to play either a violent (e.g., *House of the Dead 2*) or a nonviolent video game (e.g., *Kayak Extreme*) for 15 minutes, followed by a facial emotion recognition task. In both studies by Kirsh et al. (2006) and Kirsh and Mounts (2007), the "Emotion Effect" was the key dependent variable, calculated by subtracting the average reaction times (RTs) for neutral/happy expressions from the RTs for neutral/angry expressions. Positive scores indicated quicker recognition of happiness. Larger Emotion Effect scores indicated a greater happy-face advantage, while smaller scores suggested a reduced advantage, with a score of 0 indicating no preference for recognizing happy faces. The findings indicated a significant reduction in the happy-face advantage among violent video gamers. The results indicate that violent media, whether interactive or non-interactive, skew attention toward negatively valenced information, which can activate pre-existing aggressive scripts (Huesmann, 2007).

This impaired happy-face advantage was further evidenced by reduced ERPs associated with attentional allocation to positive emotions in individuals exposed to violent media, including video games (Bailey & West, 2013). Participants completed approximately 10 hours of violent gameplay (e.g., *Unreal Tournament 3*) and were compared with a nonviolent gaming group (e.g., Tetris). The findings demonstrated that violent and nonviolent games produced distinct patterns of neural modulation. Specifically, violent gameplay was associated with two separable effects: (a) a generalized increase in ERP amplitudes over right frontal and posterior scalp regions across all facial expressions (angry, happy, and neutral), and (b) a concurrent reduction in attentional allocation to happy faces. In contrast, nonviolent gameplay primarily modulated slow-wave activity over central–parietal and frontal regions, with stronger effects observed for emotionally salient target faces (angry and happy) than for neutral non-target faces.

While some studies indicate reduced accuracy in recognizing happy faces following exposure to violent media (Kirsh et al., 2006; Kirsh & Mounts, 2007), others report impaired recognition of negative emotions due to desensitization (Diaz et al., 2016; Miedzobrodzka et al., 2021). Diaz et al. (2016) examined whether repeated exposure to violent video game content is associated with altered processing of negative emotions. Participants with higher levels of violent game exposure were compared to non-gamers on their ability to identify basic facial expressions. The results indicated reduced recognition accuracy and/or delayed responses for negative emotions among individuals with greater violent media exposure. Importantly, this impairment was not uniformly observed across emotions, suggesting a “selective desensitization” (e.g., to disgust) in sensitivity to distress cues. Diaz et al. (2016) interpreted these findings through a desensitization framework, proposing that repeated exposure to violent content may reduce affective responsiveness to others' suffering, thereby weakening perceptual sensitivity to negative emotional signals. However, they could not rationalize why no such effects were observed on anger or other negative emotions.

Miedzobrodzka et al. (2021) provided a more direct test of the desensitization account by explicitly examining whether violent video game exposure is associated with reduced accuracy in recognizing negative emotional expressions. Across two cross-sectional studies involving adolescents and adults, the investigator assessed emotion recognition accuracy using the Facial Expressions Matching Test. Their results demonstrated a consistent negative association between violent gaming exposure and accurate recognition of negative facial expressions, even after controlling for age, gender, and trait empathy. Importantly, this impairment was particularly pronounced at lower emotional intensities, suggesting elevated perceptual thresholds for detecting negative affect among individuals with higher violent game exposure. Although the correlational design precluded causal inference, the findings align closely with the violent media desensitization model, indicating that repeated engagement with violent interactive content may blunt sensitivity to others' negative emotional cues.

2.7.3. Research Gaps in the GAM Literature

Firstly, this section examines critics who do not endorse the GAM and who question the assumed relationship between violent video game exposure and aggression before extending their concerns to emotional processing outcomes. These studies acknowledge that several studies support the GAM's assertions regarding hostile information processing and potential desensitization following the play of violent video games. However, they argue that aggression cannot be attributed solely to exposure to violent video games. Incidental influences, methodological issues, and situational factors may also contribute to such outcomes

(Ferguson, Rueda, et al., 2008). One of the most prominent critiques of the GAM comes from Ferguson and Dyck (2012), who go so far as to question whether the model should be retired altogether. Their critique extends beyond the GAM itself to challenge the broader applicability of social cognitive approaches to aggression, which they argue rely too heavily on "learning" principles as the central explanatory mechanism. They assert that the GAM aspires to a "general" account of aggression but becomes difficult to falsify because almost any combination of person and situational factors can be "post hoc" fitted to outcomes. Moreover, the theory presumes aggression is broadly maladaptive and largely learned, yet cites little direct evidence that everyday aggression is invariably maladaptive or that learning processes dominate over other determinants (e.g., diathesis–stress and biological influences).

Although the GAM is presented as a comprehensive framework, Ferguson and Dyck also note that it largely reduces the explanation of aggression to processes related to "knowledge structures" derived from Script Theory and other social cognitive frameworks (Ferguson & Dyck, 2012). This criticism becomes particularly relevant when the GAM is used to explain aggression as a "byproduct" of violent media exposure, where the empirical evidence for script acquisition and enduring behavioral change remains inconsistent and often weak. Several preregistered studies have found no meaningful link between violent video game use and adolescent aggression (Przybylski & Weinstein, 2019), and re-analyses of prior meta-analyses show that reported effects are often overstated due to publication bias (Hilgard et al., 2017).

Additionally, the GAM relies heavily on laboratory proxies for "aggression" (e.g., noise blast tasks, Emotional Stroop tests) that may lack ecological validity. Participants typically know they are not harming anyone, and thus, these tasks index competitive behavior or compliance with demand characteristics more than aggression intended to harm (Ferguson & Dyck, 2012). The widespread use of priming measures is especially problematic, as it provides evidence for durable aggressive scripts. Exposure to any of these themes can temporarily prime associated stimuli without implying habitual behavioral change (Ferguson & Dyck, 2012). Consequently, when participants are exposed to violent video games or other forms of violent media, the likelihood of observing biased information processing in the laboratory is high. However, such outcomes are better understood as artifacts of temporary priming effects rather than indicators of enduring aggression. Supporting this point, Hilgard et al. (2017) noted that small and transient priming effects in laboratory settings are unlikely to generalize meaningfully to everyday aggression or violence.

Studies supporting the GAM often treat violent media exposure and actual violence exposure as functionally similar "learning inputs." Ferguson and Dyck (2012) argue this is implausible. Individuals develop the ability to distinguish fiction from reality at an early age (Woolley & Wellman, 1990), and the cognitive processing of fictional violence differs substantially from direct experiences of harm. The stress, fear, and trauma associated with family or community violence are categorically different from the symbolic representations in games or films (Ferguson, Rueda, et al., 2008). Research consistently shows that family violence, harsh parenting, and community aggression are stronger and more reliable predictors of aggressive or antisocial behavior than media exposure (Boxer et al., 2009). In contrast, media play can sometimes serve adaptive purposes. Studies have suggested that video games may act as a form of stress relief, mood regulation, and social engagement rather than a source of harm (Ferguson & Rueda, 2010; Olson et al., 2008). These findings undermine the GAM's implied equivalence of fictional media and actual violent environments, highlighting the need for more precise distinctions between what seems to be a "symbolic exposure" and real traumatic experiences.

These criticisms are evident in studies comparing the emotional processing of gamers to various control groups, such as non-gamers or non-violent video gamers. Most importantly, although studies endorse Script Theory to explain how violent media impacts emotional processing, their reliance on short-term exposure sessions undermines the very premise they seek to test. Script Theory argues that aggressive knowledge structures are learned and reinforced through repeated, habitual encounters with violent content (Anderson & Dill, 2000; Huesmann, 1998; Huesmann et al., 2003), yet many experiments exposed participants to only a few minutes of gameplay or film clips before task performance (Kirsh et al., 2005, 2006; Kirsh & Mounts, 2007). While such acute priming can certainly reveal momentary biases, they fall short in addressing (a) how long these biases persist, (b) how they interact with the habitual nature of media use that individuals accumulate over the years, and (c) whether these effects reflect more than just mood-congruent priming (Kühn et al., 2019) or a transient stress response (Mobbs et al., 2009) instead of a broader, more generalized impact of violent media exposure.

The desensitization research posits a gradual dampening of emotions after frequent encounters with violence (Smith & Donnerstein, 1998), yet a few ERP and fMRI studies exposed participants only for a short period of time (Carnagey et al., 2007; Engelhardt et al., 2011; L. A. Stockdale et al., 2015; Wang et al., 2009). These brief sessions can produce “momentary habituation” that is not equivalent to the sustained emotional numbing that the model predicts. Supporting this criticism, several psychophysiological studies have failed to find evidence that exposure to violent media leads to hostile information processing or desensitization (Gao, Pan, et al., 2017; Goodson et al., 2021; Szycik, Mohammadi, Hake, et al., 2017). Additionally, an emerging body of literature documents counterintuitive or null findings (Y. Liu et al., 2017;

Pichon et al., 2021; Szycik, Mohammadi, Hake, et al., 2017), thereby raising concerns about the consistency and replicability of earlier results.

For instance, Gao et al. (2017) examined long-term violent video game exposure in relation to neural empathy for others' pain. While they found robust neural differentiation between pain and non-pain stimuli, they observed no significant differences in empathic responses between violent and nonviolent gamers. These results directly contradict the GAM's assertion that repeated exposure should reliably blunt affective responding. Likewise, Szycik et al. (2017) examined excessive violent video gamers and non-gamers while they viewed images depicting emotional and neutral situations, with and without social interaction, during fMRI acquisition. Excessive gamers met stringent habitual exposure criteria, including a minimum of four years of experience and daily playtime of at least two hours with FPS titles such as *Counter-Strike* and *Call of Duty*. Despite this sustained and intensive exposure, the investigators observed the expected activation patterns in neural networks associated with empathy and social cognitive processing, with no attenuation in emotional responding among violent gamers compared to non-gaming controls. These null group differences were interpreted as evidence against the desensitization assertion, instead suggesting that any effects of violent media exposure on emotional processing are more likely to be acute rather than reflective of the chronic "emotional numbing" mechanisms posited by the GAM and related studies.

A subsequent work by Szycik et al. (2017) reported a null finding in their Brain Imaging and Behavior fMRI study. In two independent experiments, excessive violent video gamers and non-gamers viewed standardized IAPS images of positive, negative, and neutral valence during fMRI acquisition. The paradigm was explicitly designed to probe automatic emotional processing, avoiding explicit evaluative tasks. Across the experiments, robust activations emerged in canonical emotion-sensitive regions (e.g., bilateral amygdala, parahippocampal gyrus, temporal cortices), demonstrating adequate task sensitivity. Similar to their previous work, neither a main effect of group nor a group × stimulus interaction was observed. This absence of neural attenuation in excessive gamers directly challenges the desensitization hypothesis.

Moving beyond fMRI evidence, Goodson et al. (2021) examined whether violent video game play reduces the P300 response to violent images. They compared violent video gamers with non-gamers and recorded ERPs to violent and neutral IAPS images before and after gameplay. The results showed clear differences between violent and neutral stimuli, but no effect of gamer status on P300 amplitude. The authors interpreted these findings as evidence against the neural desensitization hypothesis. Likewise, Liu et al. (2017) reported no difference in the happy-face advantage between participants who engaged in violent video games for about 25 minutes and those who played nonviolent games for the same duration. There was no group difference in the facilitation task for response accuracy, RTs, or N2pc amplitude (N2-posterior-contralateral). Similarly, in the disengagement task, no notable differences in response accuracy and RTs were found between the groups. However, there was an absence of a significant N2pc response to angry faces in both the violent and neutral video game groups, indicating that the difficulty in disengagement was not specifically associated with exposure to violent video games. Thus, the evidence from behavioral and psychophysiological findings remains ambiguous in definitively supporting a reduced capacity to recognize happiness among violent video gamers.

Although several studies report null effects or contradictory findings that question claims of impaired emotional processing in violent video game players, such evidence is often overlooked in the literature. A strong publication bias exists, alongside a tendency to downplay findings that do not support the predictions of the GAM (Ferguson, 2007; Ferguson & Heene, 2012). Results aligned with the GAM are frequently amplified by anti-gaming activists and other stakeholders, contributing to a sense of moral panic surrounding violent video games. As a result, the term "violent video games" itself is often associated with the assumptions of inherent harm. This framing overlooks the diversity of game genres that fall under the label, including action, adventure, role-playing, shooting, and even racing games. Addressing this stigmatization is particularly important in rapidly growing gaming markets such as India. The present research takes an important step in this direction by focusing specifically on the emotional component of the GAM. The thesis comprises three experiments designed to test key assertions derived from the GAM. It addresses several major gaps in prior research by focusing on habitual gamers with more than five years of experience, avoiding short-term exposure paradigms that may produce momentary conditioning effects, and including three distinct control groups, namely non-interactive violent media users, non-gamers, and non-violent video gamers. In addition, the research extends beyond behavioral measures by incorporating robust eye-tracking metrics in two experiments. Overall, the thesis aims to evaluate whether violent video gaming leads to hostile information processing and emotional desensitization, or whether such claims are overstated and contribute to unnecessary moral panic.

CHAPTER 3

FACIAL EMOTIONAL PROCESSING OF INTERACTIVE VS. NON-INTERACTIVE VIOLENT MEDIA USERS

Highlights

- No alarming levels of aggression were found in either group.
- No significant correlation was found between violent media exposure and aggression.
- Interactive violent media users (i.e., gamers) demonstrated comparable accuracy in recognizing facial emotions to that of non-interactive violent media users.
- No evidence of recognition impairment due to violent media exposure.
- Violent video gamers retained the happy-face advantage with high accuracy for happy expressions.
- Recognition of negative emotions followed the global trend, suggesting no desensitization.

3.1. Introduction

3.1.1. Background

Violence in digital media is a common phenomenon, often portrayed through characters engaging in physical harm toward others on screen (Anderson et al., 2017). The presence of virtual hostility is often intended to generate thrill and excitement in the audience. While such depictions are frequently accepted as part of mainstream media content, they have also raised concerns about the potential increase in aggression and subsequent violent behavior. As a result, the prevalence of violent media has become a focal point of debate within academia and the general public, prompting extensive inquiry into its possible effects on users. If violent media does increase aggression, a critical question arises as to whether the impact varies depending on the mode of media interaction. The present study examines the GAM's assertions that violent media increase aggression and impair emotional processing and further investigates whether these effects differ between interactive violent media and non-interactive violent media.

Interactive violent media primarily involves video games, where individuals directly participate in the aggressive content (Dill & Dill, 1998). In such environments, players are not merely witnessing violence, but they are making dynamic decisions that determine how the violent event progresses, what strategies are employed, and how conflict is resolved. For example, shooter games require players to navigate virtual environments, identify targets, and execute actions that directly translate into violent outcomes. Conversely, non-interactive media involves the passive consumption of violent content through movies, television, web series, and documentaries, in which individuals assume a spectator role, observing rather than engaging with the content (Peng, 2008). For instance, a crime thriller or action film may depict graphic fight scenes or morally complex violent encounters, yet the audience merely watches the consequences unfold on the screen.

There are two competing perspectives on the relative impact of interactive and non-interactive violent media exposure on aggression. An early line of argument posits that violent video games would have modest effects on aggression compared to passive media consumption (Potter, 1999; Sherry, 2001). Proponents of this view highlight several factors, such as the unrealistic graphics, the abstract nature of the violence, and the non-human characters typically found in video games (Sherry, 2001; Silvern & Williamson, 1987). However, as video games have become increasingly realistic in terms of visual rendering and storylines, these arguments require re-evaluation (Barlett et al., 2008; Gentile, 2003). Contemporary video games now feature highly immersive and lifelike content, blurring the line between virtual and real-life experiences (Chalmers & Debattista, 2009; Christy & Kuncheva, 2014). This shift has given rise to a perspective that violent video games could exert a stronger influence on aggression than non-interactive media (Peng, 2008).

Nonetheless, before drawing conclusions about the role of media interactivity, it is essential to examine whether there exists a meaningful association between violent media exposure and aggression itself. The present study aims to address two key research problems. First, it examines whether violent media exposure increases aggression or if the concerns outlined by the model are overstated. While the GAM explains aggression through three broad internal states, this study specifically focuses on the effect of violent media on emotional processing. Second, if there happens to be a meaningful association between violent media exposure and aggression, the study investigates whether this relationship differs based on the mode of media interaction.

3.1.2. Problematization and Hypotheses

The present experiment investigates emotional processing using a facial emotion recognition paradigm, a tool widely regarded as reliable for examining socio-cognitive functioning. Facial emotions provide critical cues for interpersonal communication, allowing individuals to interpret emotions and adjust their behavior (Calvo & Nummenmaa, 2016; Gil & Le Bigot, 2023). Efficient recognition of emotional expressions reflects enhanced cognitive and perceptual skills, such as executive functioning, sustained attention, and rapid information processing (Mathersul et al., 2009). In general, it has been reported that happy expressions are often recognized more accurately than negative ones (such as anger, fear, and disgust), a phenomenon known as the "happy-face advantage" (Leppänen et al., 2003; Leppänen & Hietanen, 2004).

The GAM posits that repeated violent media exposure can erode this happy-face advantage by altering social information processing and creating attentional biases toward hostile emotional cues (Allen et al., 2018; Anderson & Dill, 2000; Bushman & Anderson, 2002, 2002; Kirsh, 1998; Kirsh et al., 2005; Kirsh & Olczak, 2000). However, it is important to acknowledge that the GAM literature presents mixed results in determining whether exposure to violent media impairs facial emotion recognition, and if so, whether this impairment is specific to specific emotions. While some studies indicate reduced accuracy in recognizing happy faces following exposure to violent media (Kirsh et al., 2006; Kirsh & Mounts, 2007), others report impaired recognition of negative emotions due to desensitization effects (Diaz et al., 2016; Miedzobrodzka et al., 2021). Additionally, an emerging body of literature documents counterintuitive or null findings (Y. Liu et al., 2017; Pichon et al., 2021; Szycik, Mohammadi, Hake, et al., 2017), thereby raising concerns about the consistency and replicability of earlier results. Although such inconsistencies are evident in the broader literature on emotional processing, direct evidence within the domain of facial emotion recognition remains limited and inconclusive. Consequently, it can be premature to reject the GAM's claim that violent media exposure reduces the happy-face advantage. In light of this gap, we align with the GAM framework in formulating our initial hypothesis, presuming that habitual violent media users will exhibit a reduced happy-face advantage.

> **H1:** The happy-face advantage will be reduced among habitual violent media users, such that recognition of happy facial emotions will be relatively less efficient than recognition of negative emotions (i.e., anger, fear, and sadness).

This hypothesis primarily tests the GAM's assertion that violent media exposure biases emotional information processing against positive emotions such as happiness. While H1 could also be framed from an emotional desensitization perspective, doing so introduces a conceptual inconsistency. Desensitization research emphasizes a generalized blunting of affective responsiveness to emotional cues after repeated exposure to violent content (Bartholow et al., 2006; Carnagey et al., 2007; Funk et al., 2004). Although there is evidence for reduced sensitivity to negative emotions following violent media exposure, it remains unclear whether such blunting extends to positive affective cues. Moreover, GAM studies have seldom suggested that a reduced happy-face advantage can also be interpreted through the lens of emotional desensitization. Therefore, in our study, if happy faces are recognized more efficiently than negative emotions, the findings would reject H1 and directly challenge the GAM's proposition that violent media exposure biases emotional information processing against positive emotions.

Furthermore, this inquiry is coupled with a critical yet underexplored issue of whether facial emotion recognition differs between users of interactive and non-interactive violent media. Prior research on violent media effects has predominantly focused on single-format exposure, with limited attention given to the role of media interactivity in shaping aggression. Most studies have compared users of violent interactive media (i.e., video games) with either non-users or users of nonviolent content (e.g., Diaz et al., 2016; Liu et al., 2017; Pichon et al., 2021). This gap is theoretically significant because interactivity has been proposed as a key factor amplifying media effects (Lin, 2013). Unlike passive media, video games require continuous user engagement and goal-directed activities, often involving hostile gameplay. This active participation is theorized to enhance the encoding and reinforcement of aggressive scripts and cognitive biases (Dill & Dill, 1998; Polman et al., 2008).

Despite theoretical assertions from the GAM (Anderson & Bushman, 2002), research is limited in directly comparing these two modes of media exposure in terms of their effects on social information processing. To address this question, the present study compares frequent users of interactive media with those who use non-interactive media to test whether habitual exposure reduces the happy-face advantage and impairs the recognition of negative emotions. The interactive media group consists of habitual violent video gamers (HVVGs) who frequently engage with violent gaming content. In contrast, the non-interactive media group comprises non-video gamers (NVGs) who regularly consume violent content through passive formats such as films and television, with no prior history of playing video games. Existing research suggests that violent video games elicit stronger aggressive outcomes than passive media formats, suggesting that interactivity uniquely intensifies the cognitive and affective consequences of violent content (Greitemeyer & Mügge, 2014; Lin, 2013). Within the GAM framework, heightened aggression is expected to compromise socio-cognitive skills, particularly the decoding of emotional expressions (Anderson & Bushman, 2002). If interactivity amplifies aggression, it should also magnify these emotion recognition deficits. Therefore, assuming the differential effects of media interactivity, we propose the following hypothesis.

> **H2:** Compared to NVGs, habitual VVGs will demonstrate reduced recognition capacities across positive and negative facial emotions, such as anger, fear, happiness, and sadness.

It is also critical to note that GAM studies have primarily focused on the effects of violent media exposure, overlooking the equal importance of underlying predispositions. For example, individuals with a high baseline level of aggression may already exhibit biased emotional information processing, independent of media exposure (e.g., Bertsch et al., 2009). While violent media may reinforce their actions, it is unlikely to be the sole contributor to escalated aggression. Moreover, aggression is a multifaceted construct influenced by a range of environmental and psychosocial factors, including family violence, early childhood experiences, substance abuse, and socioeconomic adversity (Greitemeyer & Sagioglou, 2016; Labella & Masten, 2018; M. M. Miller, 2016). Therefore, the emotional processing impairments reported among violent media users may be partially attributable to these underlying influences rather than media exposure alone (Ferguson & Dyck, 2012). To account for these individual differences, the present study incorporates trait aggression as a control variable. This approach allows for a more accurate assessment of whether observed deficits in emotion recognition are primarily related to media exposure or are confounded by pre-existing dispositional tendencies.

3.2. Methods

3.2.1. Participants

A power analysis was initially conducted using G*Power (version 3.1.9.7; Faul et al., 2009) to determine the minimum sample size required for the experiment. The analysis indicated that a sample size of 24 participants (12 in each group) would be sufficient to detect a medium effect size ($f = 0.25$) at an alpha error probability of 0.05 (two-tailed) with a power of .80 in a repeated measures analysis of variance (ANOVA) for within-between interaction effects.

Participants were recruited from a higher education institution in India through an online announcement posted on departmental mailing lists. Interested students first completed a pre-screening survey that assessed violent media consumption and gaming history. Two mutually exclusive user groups were defined a priori, consisting of habitual interactive and non-interactive violent media users. For convenience, these groups are referred to as HVVGs and NVGs, respectively. The study adhered to the principles outlined in the Declaration of Helsinki (1964) and its latest amendments (i.e., 2013 Fortaleza revision). Written informed consent was obtained from each participant prior to the experiment, including details regarding participation and consent for publication. All participants, including those who did not participate but expressed their interest in the study, received non-monetary incentives. The study also obtained necessary approval from the Institute Human Ethics Committee at IIT Indore.

The present experiment established rigorous inclusion and exclusion criteria for each group, encompassing the duration and intensity of media engagement, as well as limits on cross-modal exposure. HVVGs were required to have played predominantly violent video games for at least two hours per day over the past 12 months. The reported games were validated against ESRB and PEGI content ratings. Participants with non-aligned gaming preferences were excluded. Additionally, given the likelihood of overlapping media exposure, the study assessed overall exposure to violent media. Those who had spent more than an hour per day on non-interactive violent media (e.g., movies, TV shows) over the past 12 months were also excluded. Of the 52 volunteers who self-identified as gamers, 25 were excluded due to insufficient daily playtime ($n = 4$), frequent mixed-genre play ($n = 7$), and high consumption of non-interactive violent media ($n = 14$). None of the participants met the threshold for gaming addiction (Pontes et al., 2022; Pontes & Griffiths, 2015).

Meanwhile, NVGs comprised individuals who frequently consumed violent media, such as movies, television, web series, and documentaries, for the past 12 months, engaging a minimum of two hours per day with such content. They were also required to have abstained from all video gaming during the previous 12 months. To ensure eligibility, their past gaming history was reviewed, and those who had ever engaged in regular violent video game play were excluded. Of the 46 volunteers, 11 were excluded due to recent gaming involvement. 27 of the remaining 35 eligible NVGs were randomly selected to match the HVVG group. The final sample comprised 54 healthy adults with an equal number of HVVGs (M_{age} = 20.07 years, *SD* = 1.26) and NVGs (M_{age} = 21.29 years, *SD* = 1.10).

3.2.2. Measures

3.2.2.1. Gaming Addiction

The Internet Gaming Disorder Scale-Short-Form (IGDS9; Pontes & Griffiths, 2015) was utilized as a screening test to assess potential addiction trends among gamers (see Appendix E). The questionnaire employed a 5-point Likert scale (1 = *never* to 5 = *very often*) to measure responses. To screen addicted gamers, researchers examined whether participants endorsed at least five criteria out of the nine, with a particular focus on responses marked as "very often." These responses were considered an endorsement of the specific criterion of gaming addiction. However, no participant met these criteria, indicating that none exhibited signs of addiction.

3.2.2.2. Aggression

Trait aggression was assessed using a 29-item Buss and Perry Aggression Questionnaire (BPAQ; Buss & Perry, 1992). All participants indicated their level of agreement using a 5-point Likert scale (1 = *does not describe me at all* to 5 = *describes me very well*). The questionnaire consisted of four factors: physical aggression (9 items), verbal aggression (5 items), anger (7 items), and hostility (8 items). The overall scale exhibited high internal consistency (Cronbach's α = .80). The questionnaire is provided in Appendix F.

3.2.2.3. Violent Media Exposure

Habitual exposure to violent media was assessed using a 12-item Content-Based Media Exposure Questionnaire (C-MEQ) Den Hamer et al., 2017). A sample item for the NVGs was: "How often do you watch, on movies/web series/documentaries, people who shoot at another person?" This scale was modified for gamers to specifically measure violent media exposure related to their gaming activities. The same question was adjusted to: "How often do you engage in video games, shooting at another person?" Responses were collected on a 5-point Likert scale (1 = *never* to 5 = *very often*), allowing participants to indicate the frequency of their exposure to violent media content. The scale demonstrated high internal consistency when used with HVVGs (Cronbach's $\alpha = .89$) and NVGs (Cronbach's $\alpha = .84$). Gamers were also asked to report their average daily playtime (in hours) and overall gaming experience (in years). They also rated three of their preferred violent video games played over the past 12 months using a 7-point Likert scale (1 = *rarely* to 7 = *often*). They rated each game on the frequency, perceived content of violence, and perceived severity (i.e., exposure to blood and gore). This rating scale allowed participants to express their subjective evaluation of their preferred games. The questionnaire is provided in Appendix G.

3.2.3. Experimental Stimuli

A total of 320 (Male = 160, Female = 160) static facial emotions were used from the Karolinska Directed Emotional Faces (KDEF) data set (Lundqvist et al., 1998). Among those, 112 faces carried neutral expressions, and the remaining 208 carried emotional expressions (52 each). The stimulus presentation was controlled using E-Prime 3 software, which was run on an HP Desktop PC with a 12th Gen Intel® Core™ i7-12700 processor running at 2,100 MHz and equipped with 12 cores. The faces in the experiment were presented in grayscale for the forced-choice trials and with a blue tint for the free-choice trials, both at 560 × 720 pixels. These visual manipulations were employed to distinguish between the two response conditions and ensure clarity in the experimental setup. The stimuli and trials used in this experiment are provided in Appendix C.

3.2.4. Research Paradigm

This study employed an emotional go/no-go paradigm adapted from Tottenham et al. (2011). In this task, participants engaged in forced-choice trials in which they were instructed to respond by pressing a designated key when a target facial emotion (go trials) was presented and to withhold their response when a non-target emotion (no-go trials) appeared. Facial emotion recognition capacity was assessed through the number of correct responses (CRs) on go trials and the corresponding reaction times (RTs). Instances where participants responded during no-go trials were counted as false alarms (FAs), which served as an indicator of response inhibition failure (see Cohen-Gilbert & Thomas, 2013). A higher number of CRs, faster RTs, and fewer FAs are presumed to indicate enhanced recognition and inhibitory control for specific emotional expressions.

In addition to the standard forced-choice design, the present study incorporates free-choice trials, offering a distinct contrast to traditional paradigms (cf. Cohen-Gilbert & Thomas, 2013; Tottenham et al., 2011). While the forced-choice trials capture an individual's performance with respect to the rate of CRs and FAs, free-choice trials can supplement the analysis through their "free will" framework (Duncan, 2001; E. K. Miller & Cohen, 2001; Schel & Crone, 2013). In classical go/no-go paradigms, inhibition is externally signaled, requiring participants to withhold responses in response to external cues (Tottenham et al., 2011). However, everyday inhibitory control frequently involves making voluntary and "free will" decisions (Schel & Crone, 2013). With the availability of free-choice trials, participants could now freely decide whether to respond, without explicit external constraints. This design more closely approximates everyday inhibitory control, which often relies on voluntary decisions rather than externally cued responses. Accordingly, free-choice trials enabled the examination of emotion processing under endogenous inhibition, aligning the task with naturalistic models of cognitive control (Brass & Haggard, 2007; Kühn et al., 2009).

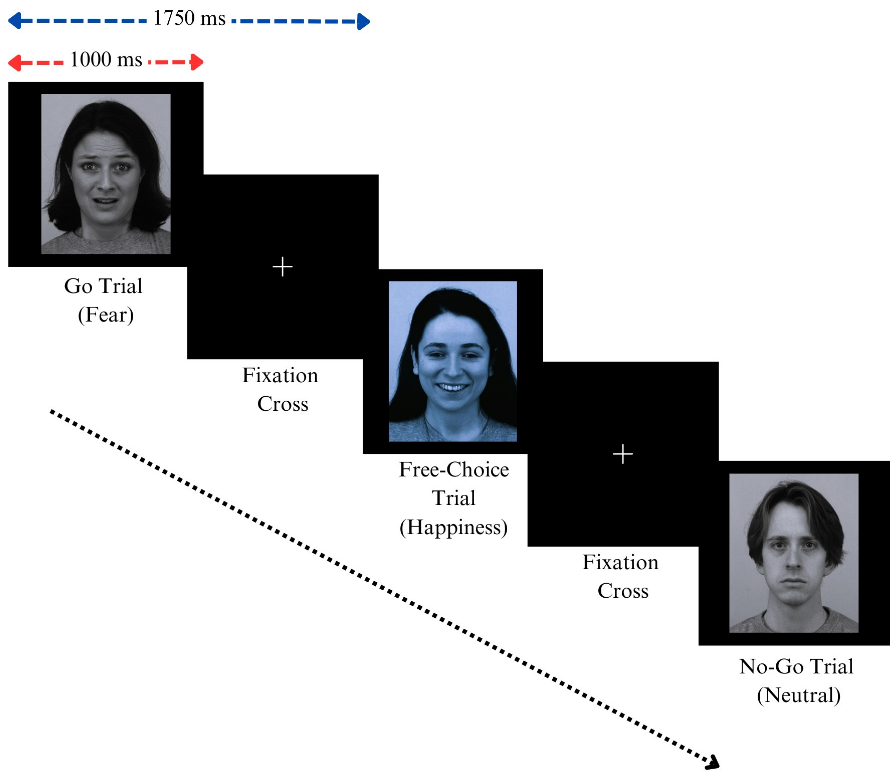
3.2.5. Experimental Procedure

All participants were assessed in a semi-dark, soundproof laboratory setting to ensure controlled environmental conditions. The go/no-go task (Tottenham et al., 2011) combined emotional and neutral faces to create eight blocks of go/no-go trials (anger/neutral, neutral/anger, fear/neutral, neutral/fear, happy/neutral, neutral/happy, sad/neutral, and neutral/sad). In each pair, the first facial emotion served as the "go" trial, and the second as the "no-go" trial. In addition to these forced-choice trials, free-choice trials were integrated into the protocol. These free-choice trials featured a distribution of facial emotions different from those used in the go and no-go trials, allowing participants to make decisions without predefined responses.

Each task block consisted of 40 trials, divided into 20 go trials, 12 free-choice trials, and 8 no-go trials. A prepotency was established, with go-trials comprising 50% of the total trials, highlighting their prominence in the task structure. A significant proportion (30%) of the trials were allocated as free-choice to probe the effect of participants' free will on task performance. The experiment began with a briefing, followed by a short practice block of 15 trials to familiarize participants with the task. During go trials, participants were instructed to press the right arrow key on a keyboard when they saw a designated facial emotion. Conversely, for no-go trials, participants were told to refrain from pressing the key. The specific emotional valence of no-go trials was not disclosed to prevent anticipatory strategies. During free-choice trials, participants encountered blue-tinted facial expressions (see Fig. 3) and were encouraged to rely on instinctive judgments to respond or withhold, thereby simulating a more naturalistic environment.

Figure 3

A Sample Stimulus Presentation Sequence



Note. A fearful face is designated as a “go” trial, while a neutral face serves as a “no-go” trial, and a happy face (depicted with a blue tint) represents the free-choice trial. All the representative stimuli are used with permission from the Psychology Section at Karolinska Institutet for research purposes.

To mitigate the effects of practice and fatigue, the sequence of task blocks was randomized. Furthermore, the trials within each block were arranged in a pseudo-randomized order to avoid more than two consecutive no-go trials. Each trial lasted 1,000 ms, followed by a fixation cross for 750 ms. If participants did not respond within the allotted time window, the task automatically advanced to the next stimulus. During data analysis, missed responses were coded as incorrect for go trials (i.e., omission errors). Before the task, steps were taken to ensure participants fully understood the instructions and could perform the task accurately. On average, participants completed the experiment within approximately 30 minutes.

3.2.6. Research Design

The study employed a 2 (experimental group: HVVGs and NVGs) × 4 (facial emotion: anger, fear, happiness, and sadness) mixed-factorial design, with the first factor a between-groups variable.

3.2.7. Data Analyses

An independent samples *t*-test was conducted to analyze the differences between HVVGs and NVGs on aggression and violent media exposure. In the core analyses, a 2 (experimental group: HVVGs vs. NVGs) × 4 (facial emotion: anger vs. fear vs. happiness vs. sadness) two-way repeated measures analysis of variance (ANOVA) was performed on the percentage of CRs on go trials, RTs on correct go trials, the percentage of FAs on no-go trials, and the percentage of responses on free-choice trials. The percentage of CRs and the corresponding RTs on the go trials were used to measure the accuracy of facial recognition. The percentage of FAs on no-go trials was used to measure the rate of response inhibition failure. The percentage of responses in free-choice trials provides insights into participants' inclination toward specific emotional expressions, complementing measures of response accuracy and inhibition. Further, to examine whether the group or emotion effects observed in the ANOVA persisted after accounting for trait aggression, repeated measures analysis of covariance (ANCOVA) was conducted. The Greenhouse–Geisser correction is reported for *F*-statistic scores wherever Mauchly's sphericity test was significant. Following a significant main effect of facial emotion, post hoc pairwise comparisons were conducted, and the Bonferroni adjustment was applied to control for multiple comparisons.

3.3. Results

3.3.1. Characteristics of the Participants

Results from the independent samples *t*-tests indicate no statistically significant differences in aggression between the groups. Overall aggression levels were comparable, $t(52) = -0.89$, $p = .38$. Specifically, HVVGs ($M = 66.19$, $SD = 14.83$) and NVGs ($M = 69.70$, $SD = 14.21$) did not show alarming aggression levels. This pattern was consistent across all subcomponents of aggression, with small and non-significant effects observed for physical aggression ($t = -0.62$, $p = .54$), verbal aggression ($t = -0.90$, $p = .37$), anger ($t = -0.98$, $p = .33$), and hostility ($t = -1.10$, $p = .28$). Similarly, scores on the violent media exposure measure were not significantly different between groups, $t(52) = -1.19$, $p = .24$. There was no significant correlation found between violent media exposure and aggression ($r = .09$, $p = .87$). Gaming measures were also collected within the HVVG group. The gaming addiction score ($M = 20.44$, $SD = 5.96$) fell below the clinical threshold (Pontes & Griffiths, 2015). HVVGs reported a mean gaming experience of 7.37 years ($SD = 3.85$) and an average daily playtime of 2.29 hours ($SD = 0.46$), aligning with prior research on habitual gaming behavior in non-clinical populations (Diaz et al., 2016). Most gamers played *Valorant* (2020), with approximately 40.71% expressing it as their first preference (frequency = 5.81; perceived violence = 4.27; perceived blood and gore = 2.81). This was followed by *Battlegrounds Mobile India (BGMI;* 2021)*,* which had an 18.5% preference rate (frequency = 5.8; perceived violence = 4.8; perceived blood and gore = 4.4).

Valorant is a 5v5 tactical FPS video game where two teams (Attackers and Defenders) compete across rounds. The primary objective for attackers is to plant a device called the “spike” at designated bomb sites, while defenders aim to prevent the plant or defuse it if it is already deployed. Each match is divided into multiple rounds, and teams switch sides halfway through, ensuring both offensive and defensive play styles are experienced. Each player selects a unique character (agent) with specialized abilities. These abilities include smokes, flashes, reconnaissance tools, healing, and “area denial” skills, which add a strategic layer beyond pure gunplay. However, like any other action game, gun mechanics, such as recoil control, crosshair placement, and precise aiming, remain central to success. Players must balance ability usage with traditional shooting skills. In many ways, *Valorant* is designed as a modern, “hero-shooter” evolution of the *Counter-Strike* formula.

On the other side, *BGMI* is an Indian version of *PlayerUnknown’s Battlegrounds (PUBG)*. It is a battle royale where 100 players drop onto a map (in a typical gameplay), loot weapons, and fight to survive. You start unarmed, gather gear, and engage in combat using strategy, aim, and positioning. A shrinking safe zone forces encounters, while vehicles help movement but reveal position. Modes include solo, duo, and squad, with teammates able to revive each other. Gameplay focuses on rotation and survival, and the successful ending demands precise positioning and utility use.

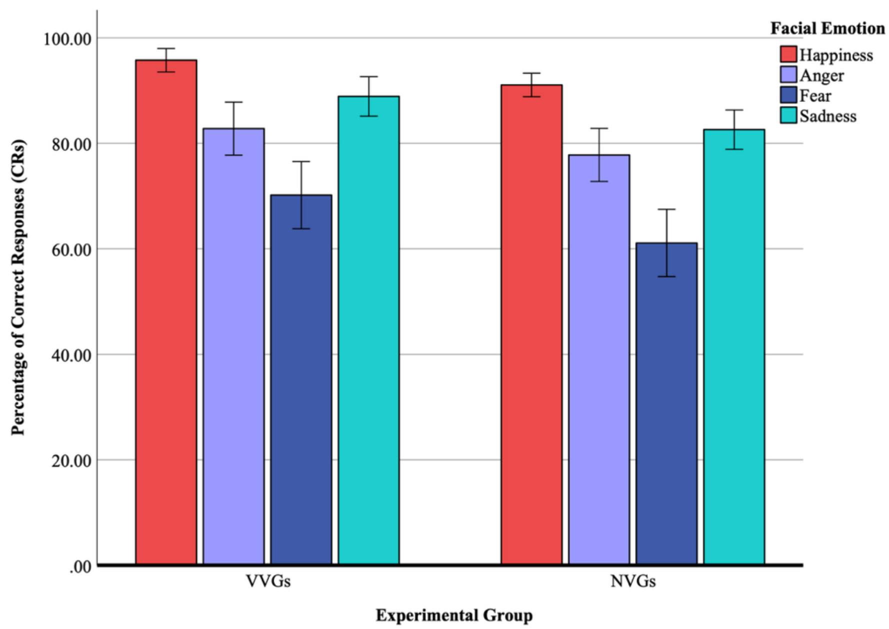
3.3.2. Performance Measures on the Emotion Recognition Task

3.3.2.1. Percentage of Correct Responses (CRs) on Go Trials

The repeated measures ANOVA revealed a main effect of the experimental group, $F(1, 52) = 11.64$, $p < .001$, $\eta_p^2 = 0.18$, indicating that the percentage of CRs was significantly higher ($p < .001$) in the HVVGs ($M = 84.28\%$, $SE = 1.30$) than in the NVGs ($M = 78.26\%$, $SE = 1.30$). A main effect of facial emotion was observed, $F(2.54, 132.52) = 57.02$, $p < .001$, $\eta_p^2 = 0.52$. Post hoc pairwise comparisons showed that the percentage of CRs was significantly higher for happiness (*M* = 93.39%, *SE* = 0.78), when compared with anger ($M_{difference}$ = 13.12%, *SE* = 1.99, $p < .001$), fear ($M_{difference}$ = 27.75%, *SE* = 2.36, $p < .001$), and sadness ($M_{difference}$ = 7.66%, *SE* = 1.62, $p < .001$). There was no interaction effect between the experimental group and facial emotion, $F(2.54, 132.52) = 0.41$, $p = .74$, $\eta_p^2 = 0.01$. Results are further illustrated in Figure 4.

Figure 4

Percentage of Correct Responses (CRs) on Go Trials



Note. This figure displays the mean percentage of correct responses (CRs) for happiness, anger, fear, and sadness across two experimental groups: violent video gamers (VVGs) and non-video gamers (NVGs). Error bars represent ± 2 standard errors of the mean. Both groups showed the highest recognition accuracy for happy faces. VVGs significantly outperformed NVGs across all emotion categories.

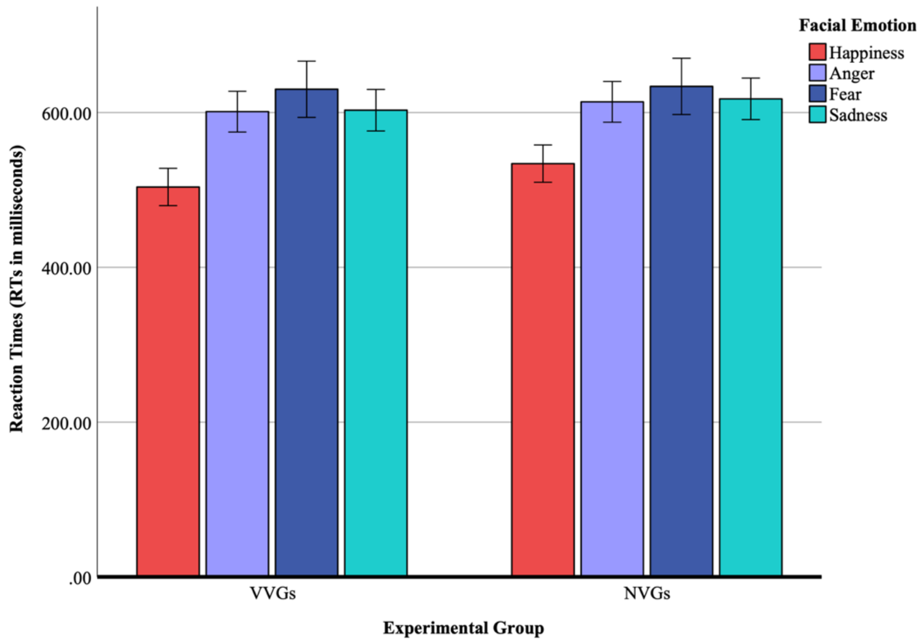
An ANCOVA was conducted to examine the effects of group and emotion on CRs, while statistically controlling for trait aggression. In the ANCOVA, the effect of trait aggression on CR was not significant, $F(1, 51) = 1.18$, $p = .28$, $\eta_p^2 = 0.02$. However, controlling for trait aggression maintained the group effect, $F(1, 51) = 10.63$, $p < .001$, $\eta_p^2 = 0.17$, but the emotion effect was no longer significant, $F(2.56, 130.72) = 0.76$, $p = .50$, $\eta_p^2 = 0.02$. The interaction effects, emotion × aggression, $F(2.56, 130.72) = 0.57$, $p = .63$, $\eta_p^2 = 0.01$, and emotion × group, $F(2.56, 130.72) = 0.46$, $p = .82$, $\eta_p^2 = 0.006$ were also nonsignificant. Although aggression itself was not associated with CR performance, its inclusion altered the partitioning of variance, inflating the error term for the emotion factor and eliminating its significance. The variability in aggression overlapped with emotion-specific variance, but not to a degree that significantly alters overall CR performance. These results suggest that the accuracy advantage of HVVGs is substantial, whereas the differential ease of recognizing specific emotions is sensitive to individual differences in aggression.

3.3.2.2. Reaction Times (RTs) for Correct Go Trials

There was no main effect of the experimental group, $F(1, 52) = 0.97$, $p = .32$, $\eta_p^2 = 0.02$, indicating that the RTs for correct go trials were comparable between HVVGs ($M = 584.53$ ms, $SE = 10.97$) and NVGs ($M = 599.84$ ms, $SE = 10.97$). A main effect of facial emotion was observed, $F(2.53, 131.95) = 43.33$, $p < .001$, $\eta_p^2 = 0.45$. Post hoc pairwise comparisons showed that the RTs were significantly shorter for happiness ($M = 518.92$ ms, $SE = 8.52$), when compared with anger ($M_{difference} = -88.58$ ms, $SE = 9.89$, $p < .001$), fear ($M_{difference} = -113.03$ ms, $SE = 12.49$, $p < 0.001$), and sadness ($M_{difference} = -91.44$ ms, $SE = 8.02$, $p < .001$). There was no significant interaction effect between the experimental group and facial emotion, $F(2.53, 131.95) = 0.52$, $p = .66$, $\eta_p^2 = 0.01$. Results are further illustrated in Figure 5.

Figure 5

Reaction Times (RTs) for Correct Go Trials

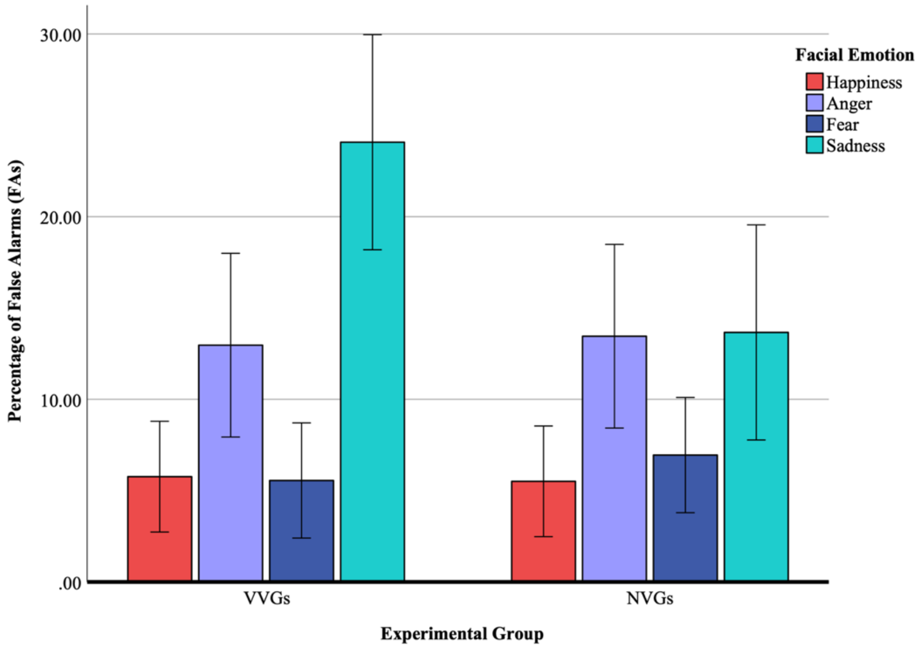


Note. This figure displays the mean reaction times (RTs in milliseconds) for recognizing happiness, anger, fear, and sadness across two experimental groups: violent video gamers (VVGs) and non-video gamers (NVGs). Error bars indicate ± 2 standard errors of the mean. Both groups responded most quickly to happy faces and most slowly to fearful ones. No significant group differences were found.

The ANCOVA yielded no significant covariate effect, $F(1, 51) = 0.01$, $p = 0.91$, $\eta_p^2 = 0.001$. After adjustment, the group main effect remained nonsignificant, $F(1, 51) = 0.97$, $p = .33$, $\eta_p^2 = 0.02$, and the emotion main effect was no longer significant, $F(2.57, 131.07) = 1.86$, $p = .15$, $\eta_p^2 = 0.04$. Additionally, the interaction effects, emotion × aggression, $F(2.57, 131.07) = 1.51$, $p = .22$, $\eta_p^2 = 0.03$, and emotion × group, $F(2.57, 131.07) = 0.68$, $p = .55$, $\eta_p^2 = 0.01$, were also nonsignificant. Thus, individual differences in trait aggression statistically accounted for the previously observed emotional RT differences, whereas gaming status had no measurable influence on the speed of facial emotion recognition.

Figure 6

Percentage of False Alarms (FAs) on No-Go Trials



Note. This figure displays response inhibition rates, indicated by the percentage of false alarms (FAs) for recognizing happiness, anger, fear, and sadness across two experimental groups: violent video gamers (VVGs) and non-video gamers (NVGs). Error bars indicate ± 2 standard errors of the mean. Response inhibition was highest for sad faces and lowest for happy and fearful faces, with no significant differences observed between groups.

3.3.2.3. Percentage of False Alarms (FAs) on No-Go Trials

There was no main effect of the experimental group, $F(1, 52) = 1.43$, $p = .23$, $\eta_p^2 = 0.03$, indicating that the percentage of FAs for no-go trials was comparable between HVVGs ($M = 12.09\%$, $SE = 1.30$) and NVGs ($M = 9.89\%$, $SE = 1.30$). The main effect of facial emotion, $F(2.56, 133.60) = 18.13$, $p < .001$, $\eta_p^2 = 0.25$, with the post hoc pairwise comparisons, showed that the percentage of FAs was significantly higher ($p < .001$) for sadness ($M = 18.87\%$, $SE = 2.08$). Although the percentage of FAs for happiness was the lowest, it did not differ significantly from fear ($M_{difference} = -0.61\%$, $SE = 1.54$, $p = .90$) but was significantly lower than anger ($M_{difference} = -7.57\%$, $SE = 2.05$, $p < .001$) and sadness

($M_{difference}$ = −13.23%, *SE* = 2.42, $p < .001$). Results are further illustrated in Figure 6.

Again, the ANCOVA yielded no significant covariate effect, $F(1, 51) = 0.28$, $p = .60$, $\eta_p^2 = 0.001$. There was no group main effect, $F(1, 51) = 1.24$, $p = .27$, $\eta_p^2 = 0.02$, neither there was emotion main effect, $F(2.58, 131.47) = 2.68$, $p = .06$, $\eta_p^2 = 0.05$. Although, the emotion × aggression effect, $F(2.58, 131.47) = 0.78$, $p = .49$, $\eta_p^2 = 0.02$, was nonsignificant, the emotion × group effect, $F(2.58, 131.47) = 3.05$, $p = .04$, $\eta_p^2 = 0.06$, appeared significant. Thus, group differences regarding inhibiting responses to sad expressions persisted independently of aggression, whereas general emotional differences in response inhibition partially overlapped with individual variability in trait aggression.

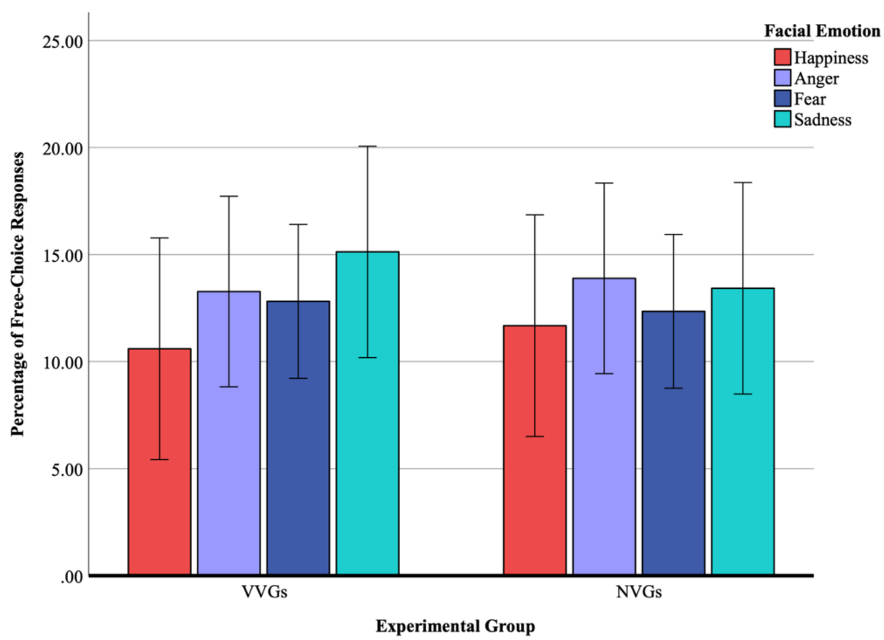
3.3.2.4. Free-Choice Trials

There was no main effect of the experimental group, $F(1, 52) = 0.002$, $p = .96$, $\eta_p^2 = 0.001$, indicating that the response rates for the free-choice trials were comparable between HVVGs (*M* = 12.95%, *SE* = 1.81) and NVGs (*M* = 12.83%, *SE* = 1.81). There was no main effect of the facial emotion, $F\ (2.37,123.52) = 1.41$, $p = .24$, $\eta_p^2 = 0.02$. Additionally, there was no significant interaction effect between the experimental group and facial emotion, $F(2.37, 123.52) = 0.29$, $p = .78$, $\eta_p^2 = 0.06$. Results are further illustrated in Figure 7.

The ANCOVA yielded no significant covariate effect, $F(1, 51) = 2.41$, $p = .13$, $\eta_p^2 = 0.05$. After adjustment, the group effect remained nonsignificant, $F(1, 51) = 0.02$, $p = .89$, $\eta_p^2 = 0.001$, so as the emotion main effect, $F(2.31, 117.69) = 2.13$, $p = .10$, $\eta_p^2 = 0.04$. The interaction effects, emotion × aggression, $F(2.31, 117.69) = 1.83$, $p = .16$, $\eta_p^2 = 0.04$, and emotion × group, $F(2.31, 117.69) = 0.33$, $p = .75$, $\eta_p^2 = 0.007$, were also nonsignificant Interestingly, a quadratic contrast for facial emotion was marginally significant, $F(1, 51) = 4.76$, $p = .03$, suggesting slightly more errors for anger and sadness than for happiness, but this trend did not survive the omnibus test. Overall, free-choice trial accuracy did not differ between HVVGs and NVGs, nor did it differ across facial emotions, and these patterns were unaffected by individual differences in aggression.

Figure 7

Percentage of Free-Choice Responses



Note. This figure displays the percentage of free-choice responses for recognizing happiness, anger, fear, and sadness across two experimental groups: violent video gamers (VVGs) and non-video gamers (NVGs). Error bars indicate ± 2 standard errors of the mean. No significant group differences or emotion-specific preferences were observed.

3.4. Discussion

3.4.1. Hypotheses Testing

This study addressed two key research questions on the effects of habitual violent media exposure. First, it examined whether such exposure increases aggression, thereby biasing emotional information processing, measured through a facial emotion recognition task. Second, it explored whether recognition impairments (if any) vary across modes of interaction with violent media. The study also investigated the influence of trait aggression on facial emotion recognition performance. The results rejected H1, as happy faces were recognized more efficiently than negative emotions. This happy-face advantage was consistent across all the examined performance measures (CRs, RTs, and FAs). The results also rejected H2, as HVVGs performed comparably to NVGs on RTs and FAs but outperformed them on CRs. However, the free-choice trials did not yield any significant results. While trait aggression did not significantly predict performance on any outcome variable, its inclusion as a covariate in the ANCOVA consistently eliminated the statistical significance of the previously observed emotional effects in the ANOVA. This pattern highlights the methodological importance of accounting for dispositional traits when studying media effects. It also reinforces the view that media exposure does not act independently but interacts with individual predispositions to shape emotional and cognitive outcomes.

Experiment 1 assessed facial emotion recognition performance using forced-choice and free-choice trials within an emotional go/no-go paradigm. In forced-choice trials, the well-established happy-face advantage was anticipated, characterized by higher CR rates, faster RTs, and fewer FAs for happy expressions. This pattern has been consistently reported in recent literature (Barros et al., 2023; Calvo et al., 2018; Calvo & Beltrán, 2013). Additionally, incorporating free-choice trials allowed for an exploration of emotion processing under endogenous inhibition, aligning the paradigm more closely with naturalistic emotional control (Brass & Haggard, 2007; Kühn et al., 2009). In classical go/no-go paradigms, inhibition is externally signaled, requiring participants to withhold responses in response to external cues (Tottenham et al., 2011). However, real-life inhibitory control frequently involves voluntary decision-making, or free will. Schel and Crone (2013) introduced the free will paradigm to the emotional go/no-go task, demonstrating that adolescents exhibited significant variability in response inhibition to emotional cues, underscoring the emotional modulation of self-initiated inhibitory control. The inclusion of free-choice trials in this study was inspired by this school of thought, which explored endogenous inhibition and voluntary action, enabling us to examine individuals' emotional orientation driven by free will rather than external cues. Although the free-choice trials did not yield definitive results, they expanded the scope of the emotional go/no-go paradigm by moving beyond traditional measures of response accuracy and inhibition to encompass voluntary emotional decision-making. Therefore, H2 is rejected "only" based on the forced-choice performance metrics such as CRs, RTs, and FAs.

Several complementary mechanisms help explain the robust happy-face advantage observed in this study. Firstly, happy faces are frequently available in interpersonal communications (N. Bond & Siddle, 1996) and tend to have universally recognizable features that transcend cultural boundaries (Ekman & Friesen, 1978). In terms of stimulus properties, the curvilinear features of the smiling mouth rapidly capture overt attention. Eye-tracking studies have shown that gaze lands on and dwells longer in the mouth region of happy faces than on diagnostic regions of negative expressions (Calvo et al., 2018; Calvo & Beltrán, 2013; Calvo & Nummenmaa, 2016). Computational and behavioral work further indicates that happy faces elicit more holistic configural processing, allowing viewers to encode the expression with fewer feature-sampling cycles (Blais et al., 2012). On the other hand, negative emotions distribute their diagnostic cues across multiple upper facial regions, diluting perceptual salience and increasing confusability among anger, fear, and sadness (Calvo et al., 2018). Meta-analytic reviews consistently confirm that recognition accuracy for happiness exceeds that for any negative emotion in both forced-choice and free-choice paradigms (Nummenmaa & Calvo, 2015). The results align with this line of inquiry, as recognition of happy faces was superior to that of negative ones.

Overall results suggest that the happy-face advantage remains evident among habitual users of violent media, and this advantage is consistent across two modes of interaction. Despite repeated exposure to violent content, their emotional recognition appears intact, with no evidence of biased processing against positive emotions as previously reported (cf. Kirsh et al., 2006; Kirsh & Mounts, 2007). Importantly, the absence of such bias does not validate alternative accounts such as desensitization. Desensitization theories predict a generalized dampening of responsiveness to emotional cues, resulting in reduced sensitivity to both positive and negative emotions (e.g., Bailey & West, 2013; Bartholow et al., 2006). In contrast, the present findings revealed reduced recognition for negative emotions "alongside" a robust happy-face advantage, a profile that aligns more closely with broader research demonstrating superior recognizability of happiness compared to negative emotions (Beaudry et al., 2014; Calvo et al., 2018; Leppänen et al., 2003; Leppänen & Hietanen, 2004). Thus, rather than reflecting desensitization, the outcomes suggest that negative emotions are inherently harder to decode, and violent media exposure did not override this baseline asymmetry in emotion processing.

Taken together, these results indicate that violent media use neither supports the GAM's prediction of biased processing against happiness nor straightforwardly maps onto a desensitization framework but instead reflects more fundamental asymmetries in emotion recognition. Therefore, this study contradicts the GAM's key assertions that violent media fosters aggression or facilitates the translation of fictional violence to real-world contexts (Allen et al., 2018; Anderson & Bushman, 2018; Bushman & Anderson, 2002, 2020).

The findings also challenge earlier research indicating impaired facial emotion recognition following violent media exposure, suggesting that these deficits may be less pervasive or more contingent on experimental context than previously assumed (Bailey & West, 2013;

Kirsh et al., 2006; Kirsh & Mounts, 2007). Previous studies frequently interpreted reduced recognition of happy expressions as evidence of aggressive biases in social information processing (Anderson & Dill, 2000; Kirsh, 1998; Kirsh et al., 2005; Kirsh & Olczak, 2000). However, many of these studies employed immediate post-exposure assessments, which could have triggered brief priming or recency effects. Such immediate testing environments are likely to temporarily exaggerate negative emotional biases, rather than reflect stable, generalized cognitive shifts in everyday emotional processing (Breuer et al., 2015; Elson & Ferguson, 2014). The influence of violent media on aggressive cognition and affect appears transient, typically subsiding within minutes after exposure ceases (Barlett et al., 2009; Sestir & Bartholow, 2010).

Some of the recent preregistered longitudinal investigations have failed to identify meaningful causal links between habitual violent media use and subsequent aggression or diminished prosocial behaviors (Coyne et al., 2023; Ferguson & Wang, 2019). Additionally, re-analyses of the classic Anderson et al. (2010) meta-analysis show that once publication bias is corrected, laboratory effect sizes shrink to the point of triviality (Hilgard et al., 2017). Hilgard et al.'s analysis specifically emphasized that methodological factors and selective reporting have artificially inflated the perceived impact of violent media on aggression-related outcomes. The current findings closely align with these recent critiques. In particular, the use of an ANCOVA controlling for trait aggression highlights that individual differences in baseline aggression, rather than exposure to violent media itself, largely account for the minor variations in emotion recognition performance observed. This result reinforces growing evidence that aggressive tendencies and impaired emotional recognition are influenced more robustly by pre-existing dispositional and environmental factors (e.g., developmental adversity, trait hostility, family conflict) than by media exposure per se (Ferguson, 2011; Ferguson, Cruz, et al., 2008; Ferguson, Rueda, et al., 2008; Przybylski & Weinstein, 2019).

Therefore, the link between violent media and impaired emotion recognition, often used as a proxy for aggression, appears neither robust nor enduring, but instead highly contextual and sensitive to methodological artifacts.

Furthermore, participants who predominantly engaged in interactive violent media (i.e., HVVGs) consistently outperformed those exposed primarily to non-interactive violent media (i.e., NVGs) across all assessed metrics, with statistically significant advantages emerging for CRs. Given that both groups were matched for trait aggression, overall frequency, and intensity of violent media exposure, the superior performance of HVVGs likely reflects cognitive and perceptual benefits specifically associated with video gaming. These findings complement previous studies suggesting a cognitive advantage among gamers in emotion recognition tasks. For instance, Ciobanu et al. (2023) found that those who play action video games exhibited superior performance in identifying facial expressions, primarily due to enhanced selective attention toward relevant emotional cues rather than merely reduced distractibility. This reflects greater top-down attentional control, allowing gamers to prioritize emotionally salient stimuli while effectively filtering out irrelevant information. Such attentional advantages are likely rooted in the cognitively demanding nature of violent video games, which often belong to the action genre. These games typically involve fast-paced gameplay, rapid decision-making, precise hand-eye coordination, and combat scenarios that demand quick reflexes (Lee & Heeter, 2017). They require players to monitor multiple dynamic elements simultaneously, thereby engaging attentional control, working memory, and executive functions (Boot et al., 2008, 2011; Green & Bavelier, 2015).

Taken together, the current experimental findings suggest that the superior facial emotion recognition observed in HVVGs may reflect not only efficient emotional processing but also enhanced cognitive functioning. Thus, the benefits of violent video games appear to stem more from their gameplay mechanics than their thematic content (Lin, 2013). Consequently, it may be misguided to critique violent video games solely on the basis of their violent themes, as they may confer meaningful cognitive and emotional advantages. Combined with evidence that violent video games train selective attention and executive control, our results suggest that any transient priming of aggressive schemas is quickly outweighed by the cognitive benefits of sustained gameplay. Although NVGs performed slightly lower than HVVGs in emotion recognition, this should not be framed as an "impairment" but rather as a relative difference in efficiency.

3.4.2. Limitations and Scope for Future Studies

Despite its intent to examine whether habitual exposure to violent media influences facial emotion recognition, this study is not without limitations. Firstly, although our findings are counterintuitive to key predictions of the GAM (Anderson & Bushman, 2002), a few observations temper and caution for overstated conclusions. First, the distribution of trait aggression in the current sample was relatively restricted and comparable across HVVGs and NVGs. Prior work indicates that emotional processing impairments and hostile attribution biases are more pronounced among individuals with high or clinically relevant aggression levels (Engelhardt et al., 2011). Consistent with the existing literature, the ANCOVA results showed that even modest variability in self-reported aggression altered the statistical significance of emotion effects, suggesting that a wider range of aggression might reveal deficits that are currently masked. Accordingly, the present results should not be generalized to populations with elevated aggression or other negative dispositions.

A key concern also lies in the selection of experimental groups. Participants were recruited based on an interest survey, which introduces the possibility of self-selection bias. This may limit the external validity of the findings, as individuals who volunteer for such studies may systematically differ from the broader population. While the use of a targeted sample aligns with the study's aims (i.e., HVVGs and NVGs), a more randomized sampling strategy would have enhanced generalizability and reduced the risk of sampling bias. Additionally, we acknowledge the difficulty of completely disentangling interactive from non-interactive violent media exposure. While the study attempted to isolate habitual gamers from those with frequent passive violent media exposure, such a separation is inherently challenging. Many participants may have encountered violent content on television or in online videos "incidentally" over time. This exposure could have contributed as a confounding variable. Although individuals reporting frequent passive exposure (i.e., more than one hour per day) were excluded, residual overlap cannot be ruled out. While it was relatively straightforward to identify non-gaming participants with minimal (or no) exposure to video games, it proved substantially harder to recruit gamers who had no meaningful exposure to non-interactive violent media. Given this difficulty, the present work recommends that future studies employ rigorous media history assessments and clearer operational definitions when it comes to media interactivity.

Another important limitation concerns the reliance on a self-report measure to assess trait aggression. Although the instrument demonstrated strong internal consistency and is widely used in aggression research, self-reports are vulnerable to social-desirability bias and have limited introspective accuracy. Such biases could have attenuated the true association between aggression and outcome variables, potentially obscuring meaningful effects (e.g., the disappearance of the emotion main effect for CRs and RTs). Additionally, although trait aggression was considered a covariate in the repeated measures analysis, the assumption of linearity between aggression and performance metrics was not supported. As such, ANCOVA results should be interpreted with caution.

Alternatively, the null finding may also reflect the insensitivity of self-report instruments to contextual expressions of aggression, rather than a genuine absence of behavioral or neurocognitive associations. Therefore, the disappearance of emotion effects after covarying for aggression should not lead to the premature conclusion that emotional differences are irrelevant. Even if the adjusted *p*-value exceeds .05, a subtle but real advantage in recognizing happiness over fear may still influence everyday social interactions. We strongly suggest that statistical adjustment should not be conflated with theoretical insignificance.

More critically, the cross-sectional nature of the study precludes any causal inference regarding the relationship between violent media exposure and aggression. Importantly, statistically controlling for aggression (i.e., ANCOVA) is not equivalent to experimental manipulation or temporal separation. Therefore, the present findings can only suggest that frequent and habitual exposure to violent media does not appear to create an aggression-related emotional information processing. In this sense, the influence of violent media may not extend to real-life perceptual or cognitive distortions in emotion recognition. Nonetheless, to address these limitations, future research should incorporate diverse assessments of aggression (e.g., behavioral tasks, peer reports, physiological indicators) and adopt designs or experimental manipulations capable of clarifying the directionality and causal mechanisms underlying the relationship between aggression and violent media exposure. We also recommend that future studies employ larger sample sizes to better test the potential moderating effects of dispositional traits, such as aggression. While our G*Power analysis indicates that the current sample was adequate for the primary effects examined, it may not provide sufficient power for complex analyses.

Furthermore, this study had a restricted demographic profile as most participants were male and fell within a narrow age range. Future research should incorporate more diverse samples across age and gender to explore how these factors may moderate the psychological impact of violent media. Prior work has shown that age may influence the relationship between violent video game exposure and aggressive behavior, with younger individuals potentially being more susceptible to such effects (Burkhardt & Lenhard, 2022). Although our results contrasted with these findings, incorporating age-wise comparisons in future research could yield more tailored inferences. Additionally, while game content was validated using ESRB and PEGI ratings, many participants reported playing titles featuring stylized or "cartoonish" violence, which can reduce the perceived realism and psychological impact. We also did not account for gameplay behaviors or customizable settings that modulate the display of violent content. For instance, games like *Valorant* emphasize strategy and coordination over violence, and players can disable blood effects. These factors can attenuate the internalization of violent themes and should be considered in future studies examining media violence and emotional processing.

3.5. Summary

This study offers a counterintuitive narrative on the ongoing debate about whether violent media exposure would result in aggressive information processing. Contrary to the core assumptions of the GAM, habitual exposure to violent media did not impair emotional information processing. All participants, regardless of the level of media interactivity, demonstrated a sustained happy-face advantage and conventional recognition capacity for negative emotions. Interestingly, gamers showed superior emotion recognition performance, suggesting potential cognitive and attentional advantages conferred by sustained gameplay. This advantage persisted despite comparable aggression levels and media exposure across groups, suggesting that gameplay mechanics, rather than violent content per se, were the likely source of performance differences. Importantly, while trait aggression did not independently predict emotion recognition outcomes, its inclusion as a covariate revealed subtle shifts in statistical significance, particularly for emotional effects. This underscores the critical role of individual dispositions in “media effects” research and highlights the importance of accounting for such variables in future studies. Rather than reinforcing a simplistic causal link between violent media and emotional dysfunction, the findings support a more context-dependent and interactionist view. Although the results challenge the universality of virtual content causing actual aggression, they do not dismiss the possibility that violent media may affect subsets of individuals, particularly those with elevated levels of predisposed aggression.

CHAPTER 4

FACIAL EMOTIONAL PROCESSING AND GAZE BEHAVIOR ANALYSIS OF VIOLENT VIDEO GAMERS VS. NON-VIDEO GAMERS

Highlights

- No alarming levels of aggression were observed in either group.
- No significant correlation was found between violent media exposure and aggression.
- No evidence of recognition impairment due to violent video game exposure.
- Violent video gamers retained the happy-face advantage with high accuracy for happy expressions.
- Perceptual salience for happy expressions was enhanced at the mouth region.
- Recognition of negative emotions was intact, indicating no desensitization effects.
- Gaze distribution was scattered across the face during recognition of negative emotions.

4.1. Introduction

4.1.1. Background

This study advances previous experimental work by incorporating eye-tracking measures to quantify the emotional recognition capacities of violent video gamers. Additionally, as the free-choice trials did not yield significant effects, this experiment employed only the forced-choice emotional go/no-go paradigm. Furthermore, the comparison between gamers (HVVGs) and non-video gamers (NVGs) is conducted without presupposing differences attributable to media interactivity. Unlike Experiment 1, the control group (i.e., NVGs) consists of individuals with minimal exposure to video games, whose consumption of passive violent media is also infrequent.

While performance measures (CRs, RTs, and FAs) 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 (Eisenbarth & Alpers, 2011). For instance, Calvo and Nummenmaa (2008) demonstrated that the smiling mouth attracts the first fixations more frequently than any other facial region, indicating a "perceptual salience" of the mouth in relation to happiness. These characteristics are also referred to as "perceptual confounds," as the smiling mouth makes it easier for the attention to focus on the happy face without processing the affect (Halamová et al., 2023; Nummenmaa & Calvo, 2015). Increased visual attention to these perceptually salient facial regions is associated with enhanced recognition accuracy (Calvo et al., 2018). In contrast, negative emotions elicit a more distributed gaze pattern across various facial areas, reducing the impact of perceptually salient regions (Beaudry et al., 2014). Additionally, their less frequent occurrence in daily interactions contributes to response ambiguity, thereby reducing their overall recognition efficacy (Calvo & Lundqvist, 2008).

Three fixation metrics are employed in this experiment 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. The integration of these metrics offers insights into the perceptual salience of facial emotions within specific fixation regions (Calvo et al., 2018). 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 (Calvo et al., 2018; Theeuwes, 2010; Theeuwes et al., 2000). These fixation indices enable us to track when, where, and for how long attention is directed toward diagnostic facial features during emotion recognition.

4.1.1. Problematization and Hypotheses

Experiment 2 investigates 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 HVVGs and NVGs, with the latter group having no prior exposure to violent video games. Prior to assessing emotional processing, self-reported aggression levels and violent media exposure are measured. Drawing on the findings of Experiment 1 and considering the mixed evidence regarding a definitive association between violent media exposure and aggression (Drummond et al., 2020; Ferguson & Wang, 2019; Hilgard et al., 2017), two foundational null hypotheses are proposed:

H1: HVVGs and NVGs will show comparable scores on self-reported aggression, indicating no significant variance attributable to gaming habits.

H2: Self-reported aggression levels among participants will not be significantly related to their violent media exposure, suggesting an absence of a direct correlation.

Experiment 2 also assumes a happy-face advantage among participants, regardless of their gaming status. This premise is grounded in existing literature indicating that the ability to recognize happiness is typically superior to that of recognizing negative basic emotions (Calvo & Beltrán, 2013; Calvo & Lundqvist, 2008; Yuan et al., 2023). This study newly incorporated the facial emotion of "disgust" into the task, an emotion that was not included in Experiment 1. It further 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 (Bailey & West, 2013; Kirsh & Mounts, 2007), the overall evidence remains inconclusive. Several investigations have found no significant deficits, suggesting that habitual exposure to violent games does not necessarily reduce the recognition of happy expressions (Diaz et al., 2016; Y. Liu et al., 2017) or the optimal recognition of negative emotions (Pichon et al., 2021). In light of these mixed findings, the following hypotheses are proposed:

H3: The recognition capacity for happy faces will be higher than that for negative ones, such as anger, disgust, fear, and sadness.

H4: HVVGs will not show a reduced happy-face advantage compared to NVGs.

H5: HVVGs will not show impaired recognition ability for negative emotions compared to NVGs.

The present experiment employed a modified emotional go/no-go paradigm that deviates meaningfully from the original framework of Tottenham et al. (2011). Instead of relying on neutral faces as no-go stimuli, this design employs non-target emotional stimuli as inhibitory (no-go) trials. This modification shifts the task from passive emotional observation or assessments focused on non-emotional attributes toward an active evaluation of participants' capacity to selectively engage with or disengage from competing emotional cues. Recognition efficiency is operationalized through performance metrics on go trials, specifically the proportion of CRs and the corresponding RTs.

4.2. Methods

4.2.1. Participants

As G*Power does not support sample size estimation for three-factor ANOVA designs, the present experiment conducted an a priori power analysis using MorePower (version 6.0.4; Campbell & Thompson, 2012). The analysis indicated that 32 participants would provide 80 % power to detect a medium within-between interaction ($\eta^2 = 0.06$) at $\alpha = 0.05$ (two-tailed) in a two-way repeated measures ANOVA.

Participants were recruited from a higher education institution in India through an interest survey disseminated via e-mail advertisements. The study defined specific inclusion criteria for gamer and non-gamer participants to ensure a valid comparison. HVVGs were required to have at least five years of experience in violent video games, playing for a minimum of one hour daily. They were also asked to list and rate up to three games they were actively playing for violent content on a 7-point scale. Of the 30 gamers who initially responded to the interest survey, only 21 met the inclusion criteria and were enrolled as HVVGs. 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 the 35 who met the criteria. The final sample pool consisted of 42 adult students, which included HVVGs ($n = 21$, $M_{\text{age}} = 20.09$ years, $SD = 0.89$) and NVGs ($n = 21$, $M_{\text{age}} = 21.66$ years, $SD = 2.01$). All participants had normal or corrected-to-normal vision and provided written informed consent. Procedures were approved by the Institute Human Ethics Committee at IIT Indore and conformed to the Declaration of Helsinki and its further refinements. Participants received equal non-monetary compensation in the form of gift vouchers.

4.2.2. Measures

4.2.2.1. Aggression

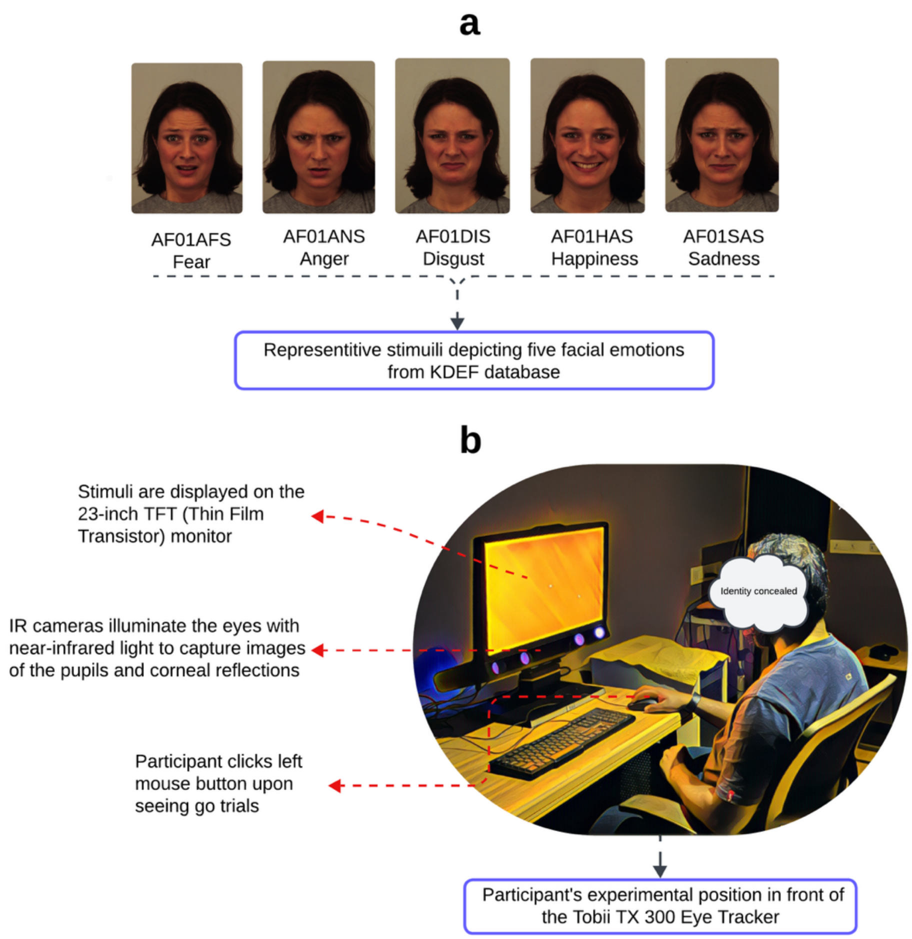
The Buss and Perry Aggression Questionnaire (Buss & Perry, 1992) was used to measure the trait aggression levels among the participants. Using a 5-point Likert scale (1 = *does not describe me at all* to 5 = *describes me very well*), participants indicated their level of agreement with 29 statements. The questionnaire consisted of four factors: physical aggression (9 items), verbal aggression (5 items), anger (7 items), and hostility (8 items). The scale demonstrated high internal consistency (Cronbach's $\alpha = .84$). The questionnaire is provided in Appendix F.

4.2.2.2. Violent Media Exposure

Violent media exposure among NVGs was assessed using a 12-item Content-Based Media Exposure Questionnaire (Den Hamer et al., 2017). Participants rated their frequency of consuming various types of violent media content on a 5-point Likert scale (1 = *never* to 5 = *very often*). The scale showed a strong internal reliability score (Cronbach's $\alpha = .90$). For HVVGs, the questionnaire was adapted to specifically capture exposure to in-game violent content, and this adapted version also demonstrated a high reliability score (Cronbach's $\alpha = .86$). The questionnaire is provided in Appendix G.

Figure 8

Facial Emotional Stimuli and Experimental Setup



Note. (a) Five representative facial emotional stimuli from the Karolinska Directed Emotional Faces (KDEF) database; (b) Participant positioning in front of the Tobii TX300 Eye Tracker. All stimuli are used with permission from the Psychology Section at Karolinska Institutet for research purposes.

4.2.3. Experimental Stimuli

The study utilized a set of 165 front-view color faces taken from the KDEF data set (Lundqvist et al., 1998). 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. All stimuli were 562 × 762 pixels each, displaying one of the five emotions (anger, disgust, fear, happiness, and sadness). The facial stimuli have been validated by Goeleven et al. (2008). See illustrative images of the KDEF data set in Figure 8a. The stimuli and trials are detailed in Appendix D.

4.2.4. Classification of Violent Video Games

This study relied on four major rating systems to evaluate the violent content of the games participants played. For computer and console-based games, ratings from the ESRB and PEGI were utilized. The selection included games depicting violence, ranging from moderate to profound. Specifically, games rated ESRB Teen (moderate violence), Mature 17+ (intense violence, blood, and gore), or Adults Only 18+ (prolonged intense violence with sexual content) were included. Similarly, PEGI ratings of 12 (violence in a fantasy environment), 16 (real-life violence), and 18 (gross violence) were selected. For mobile games, age-based content ratings (ranging from moderate to extreme violence) from the Google Play Store and the Apple App Store were used.

4.2.5. Eye-Tracking System

The participants' eye movements were captured using the Tobii TX300 eye tracker (see Fig. 8b), 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). The facial stimuli were displayed on the TFT monitor. Participants were positioned at a viewing distance of 60-64 cm from the screen, ensuring a consistent viewing angle for accurate gaze tracking.

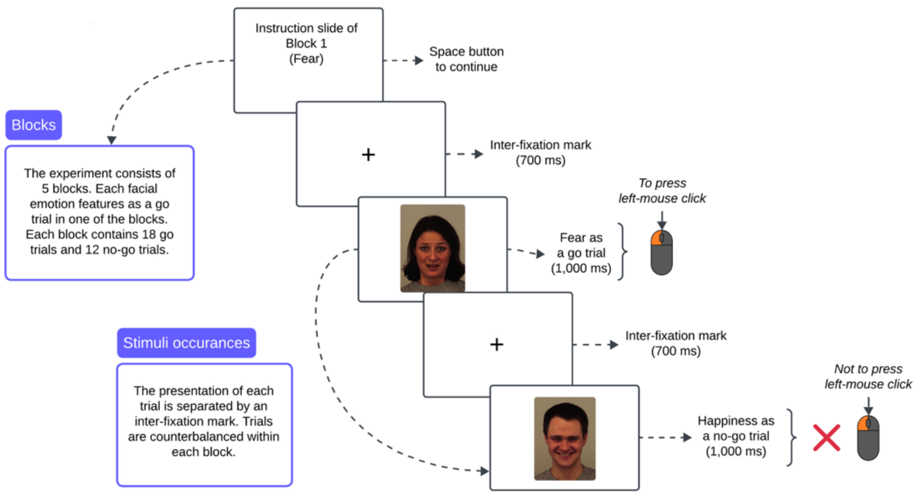
4.2.6. Experimental Procedure

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. Participants had to press the left mouse button upon recognizing the target facial emotion. The go trials appeared 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 received thorough instructions and completed a brief practice session consisting of 15 trials. The trials were pseudo-randomized to prevent predictability, ensuring no more than two consecutive no-go facial emotions were presented (see Fig. 9).

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 700 ms after each trial. If participants did not respond within the allotted time window, the task automatically advanced to the next stimulus. 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 to 30 minutes.

Figure 9

The Emotional Go/No-Go Task Paradigm



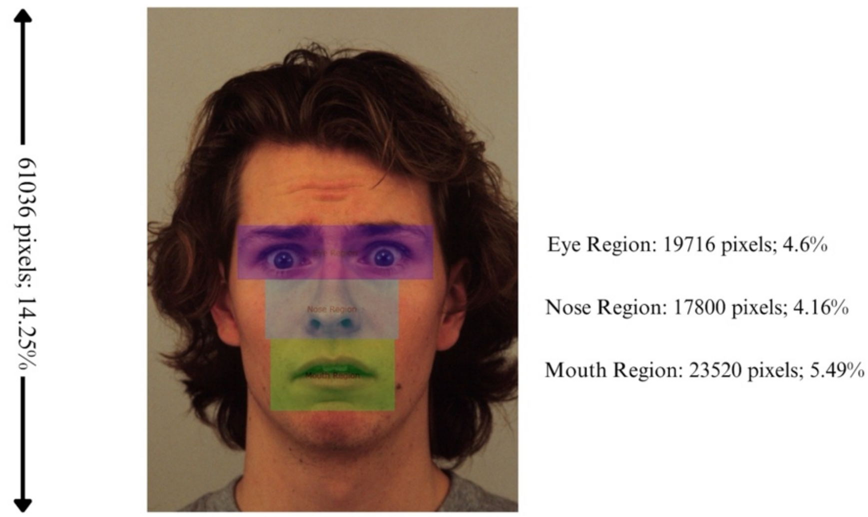
Note. This figure is covered by the Creative Commons Attribution 4.0 International License. Representative stimuli are used with permission from the Psychology Section at Karolinska Institutet for research purposes.

4.2.7. Research Design

The variables encompassed the participant group, which consisted of HVVGs and NVGs, the five basic facial emotions taken from the KDEF dataset, and the fixation regions, which were categorized across three areas of interest (AOIs) such as eyes, nose, and mouth (see Fig. 10). The study employed a 2 (experimental group: HVVGs and NVGs) × 5 (facial emotion: anger, disgust, fear, happiness, and sadness) × 3 (fixation region: eye, nose, and mouth) mixed-factorial design, with the first factor as a between-groups variable.

Figure 10

Heat Map Displaying Examined Fixation Regions



Note. The representative stimulus is used with permission from the Psychology Section at Karolinska Institutet for research purposes.

4.2.8. Data Analyses

The data analyses comprised three main components. Firstly, aggression levels and violent media exposure were compared between HVVGs and NVGs using an independent samples *t*-test. Pearson's product–moment correlation was used to assess the relationship between self-reported violent media exposure and aggression in both groups. Next, the ability to recognize facial emotions was evaluated by the percentage of CRs and the corresponding RTs. This analysis was conducted using a 2 (experimental group: HVVGs vs. NVGs) × 5 (facial emotion: anger vs. disgust vs. fear vs. happiness vs. sadness) two-way repeated measures ANOVA. The variation of TFF, FFD, and TFD was then measured separately using a 2 (experimental group: HVVGs vs. NVGs) × 5 (facial emotion: anger vs. disgust vs. fear vs. happiness vs. sadness) × 3 (fixation region: eye vs. nose vs. mouth) three-way repeated measures ANOVA. The two-way interaction between facial emotions and fixation regions highlights the perceptual salience of specific emotions within specific facial regions. Additionally, the three-way interaction among group, facial emotion, and fixation region suggests potential differences in perceptual salience between HVVGs and NVGs.

4.3. 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 there were significant differences among the factors, with a Bonferroni adjustment for multiple comparisons.

4.3.1. Characteristics of the Participants

HVVGs' habitual engagement with violent video games was evidenced in their overall experience (*M* = 7.62 years, *SD* = 3.62) and the average daily playtime (*M* = 2.48 hours, *SD* = 0.98). *Valorant* was the most preferred game, with approximately 47.66% of HVVGs reporting it as their first priority at the time of the study. This was followed by *BGMI*, which had a 19.04% preference rate.

Table 1

Aggression and Violent Media Exposure

Variables	HVVGs	NVGs	*t*
	M (*SD*)	*M* (*SD*)	
Total Aggression	65.42 (15.51)	73.61 (18.17)	1.57
Physical Aggression	18.76 (5.38)	20.14 (6.61)	0.74
Verbal Aggression	12.14 (3.61)	13.86 (3.75)	1.51
Anger	15.81 (5.22)	18.05 (5.55)	1.34
Hostility	18.71 (7.12)	21.57 (6.61)	1.35
Violent Media Exposure	30.28 (10.39)	25.57 (10.04)	1.49

Table 1 presents the scores on the independent samples *t*-test. The results showed no significant differences between HVVGs and NVGs on total aggression and its four factors. There was no significant difference in violent media exposure between the two groups. Additionally, Pearson's product–moment correlation analysis showed that exposure to violent media among NVGs did not significantly correlate with overall aggression scores (r = .16, p = .47) or with specific factors. A similar pattern was observed among HVVGs, where exposure to in-game violence showed no significant correlation with overall aggression scores (r = .09, p = .69) or with any specific aggression factors.

4.3.2. Performance Measures on the Emotion Recognition Task

4.3.2.1. Percentage of Correct Responses (CRs) on Go Trials

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 (see Table 2). Similarly, there was 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, followed by disgust, sadness, anger, and fear (see Table 2). No interaction effect was observed between the group and facial emotion, $F(3.10, 124.14) = 1.27$, $p = .28$, $\eta_p^2 = 0.03$.

4.3.2.2. Reaction Times (RTs) for the Correct Go Trials

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 (see Table 2). 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 (see Table 3). 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.

Table 2

Main Effects of the CRs and RTs

Variables	CRs (in percent)	RTs (in ms)
	M (*SE*)	*M* (*SE*)
Experimental Group		
HVVGs	73.22 (2.36)	694.86 (11.34)
NVGs	60.68 (2.36)	770.33 (11.34)
Facial Emotion		
Happiness	90.07 (1.73)	654.19 (12.62)
Anger	64.28 (2.42)	737.47 (10.67)
Disgust	74.33 (2.77)	738.02 (11.18)
Fear	41.27 (3.21)	786.38 (12.70)
Sadness	64.81 (2.66)	746.92 (10.27)

Table 3

Interaction Effects of the CRs and RTs

Experimental Group	Facial Emotion	CRs (in percent)	RTs (in ms)
		M (*SE*)	*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)

4.3.3. Gaze Behavior Analyses

4.3.3.1. Time to the First Fixation (TFF)

There was a main effect of the group, $F(1, 40) = 4.21$, $p < .05$, $\eta_p^2 = 0.10$, 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 (see Table 4). There was also a significant interaction effect between the facial emotion and fixation region, $F(6.01, 240.45) = 2.98$, $p < .01$, $\eta_p^2 = 0.069$, 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 5). There was no significant three-way interaction between the group, facial emotion, and fixation region, $F(6.01, 240.45) = 0.53$, $p = .77$, $\eta_p^2 = 0.01$.

Table 4

Main Effects of the Fixation Metrics

Variables	TFF (in ms)	FFD (in ms)	TFD (in ms)
	M (*SE*)	*M* (*SE*)	*M* (*SE*)
Experimental Group			
HVVGs	347.88 (11.32)	259.24 (9.60)	400.67 (10.33)
NVGs	315.00 (11.32)	236.79 (9.60)	381.44 (10.33)
Facial Emotion			
Happiness	292.68 (11.11)	276.74 (11.57)	421.59 (11.68)
Anger	349.47 (12.43)	241.61 (8.02)	384.38 (8.90)
Disgust	339.28 (10.52)	240.76 (7.74)	374.37 (9.21)
Fear	324.85 (9.33)	235.57 (7.67)	388.18 (9.12)
Sadness	350.92 (13.48)	245.41 (6.55)	386.77 (7.93)

4.3.3.2. First Fixation Duration (FFD)

There was no main effect of the group, $F(1, 40) = 2.73$, $p = .10$, $\eta_p^2 = 0.06$, 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 (see Table 4). 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 5). There was no three-way interaction among group, facial emotion, and fixation region, $F(5.79, 231.91) = 1.12$, $p = .34$, $\eta_p^2 = 0.02$.

4.3.3.3. Total Fixation Duration (TFD)

There was no main effect of the group, $F(1, 40) = 1.73$, $p = .19$, $\eta_p^2 = 0.04$, 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, showed that the TFD was significantly longer for happy faces, followed by fear, sadness, anger, and disgust (see Table 4). 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 5). There was no three-way interaction among group, facial emotion, and fixation region, $F(5.81, 232.45) = 1.41$, $p = .21$, $\eta_p^2 = 0.03$.

Table 5

Interaction Effects of the Fixation Metrics

Fixation Region	Facial Emotion	TFF (in ms)	FFD (in ms)	TFD (in ms)
		M (*SE*)	*M* (*SE*)	*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)

4.4. Discussion

4.4.1. Hypotheses Testing

Firstly, the core premise of the GAM was tested by measuring participants' aggression levels. The results supported H1 of Experiment 2, showing that HVVGs and NVGs displayed comparable levels of aggression, thereby indicating no significant variance attributable to gaming habits. Further, the relationship between violent media exposure and aggression levels was examined separately for HVVGs and NVGs.

Results showed no significant association between violent media exposure and aggression in either group, thus supporting H2 of Experiment 2.

These findings challenge previous works in the GAM literature, particularly meta-analyses that have sought to connect violent game exposure to increased aggression. The re-examination of these meta-analyses attributed the phenomenon to either publication bias or small effect sizes (Barrington & Ferguson, 2022). For example, Anderson et al. (2010) found a link between playing violent video games and increased aggression in players. Hilgard et al. (2017) reanalyzed this data and suggested that the observed effects, especially in experimental studies, were predominantly due to publication bias. Similarly, Prescott et al. (2018) noted only minimal long-term relationships between violent gameplay and subsequent aggression. Drummond et al. (2020) re-evaluated this finding and found that the very small effect sizes (r = .06) were statistically nonsignificant, possibly reflecting methodological issues rather than actual effects.

Interestingly, the present study did not find alarming aggression levels among participants, observing comparable levels between the groups. Specifically, the overall aggression scores for HVVGs, including factors like physical, verbal, anger, and hostility, were not as concerning as some advocates of the GAM suggest (Burkhardt & Lenhard, 2022; Zhang, Cao, et al., 2021). This supports the argument that exposure to violent video games does not necessarily increase aggression among players. It is crucial to recognize that a player's reaction to violence is shaped by more than the mere act of virtual combat. In addition to inherent protective factors such as empathy, the game's storyline, moral framing, and character motives can steer players toward experiencing violence (Gao et al., 2017; Zhen et al., 2011) in ways that do not necessarily translate into real-world aggression. Additionally, violence and aggression within a game may be justified by pro-social causes, such as protecting innocents or defending a righteous cause, rather than senseless hostility

(Hartmann et al., 2010; Weaver & Lewis, 2012). This distinction is critical because morality and related motives can change both the player's emotional engagement and the likelihood of transferring in-game aggression to real-world scenarios. Consequently, aggression in these instances may simply remain a "contextual response" rather than evolve into genuine hostility or violence.

With these findings, the present study contends that attributing aggressive behavior exclusively to violent video games is overly simplistic. Rather, a myriad of environmental factors and individual dispositions should be taken into consideration. For instance, Addo et al. (2021) suggest that gamers situated in adverse environments characterized by poor lighting, limited safety, high temperatures, noise, overcrowding, easy access to drugs, and few entertainment or social support options tend to exhibit higher aggression levels. Therefore, it is essential to control such factors when evaluating the causal influence of violent video games on aggression. However, since these findings were based on self-report measures, we further examined the link between violent media exposure and aggression by assessing facial emotional processing.

This study compared the overall ability to recognize happiness with that of anger, disgust, fear, and sadness, using performance and eye-tracking metrics. The results supported H3 of Experiment 2, showing a pronounced ability of the participants (regardless of the gaming group) to recognize happy faces over negative emotions. While both groups showed comparable rates of CRs, HVVGs demonstrated significantly faster RTs across all facial emotions. Specifically, 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, these results rejected H4 and H5 of Experiment 2 by underscoring the sustained happy-face advantage and absence of impaired recognition of negative emotions among HVVGs.

The fixation metrics supported these results, where 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 that enhanced visual attention is directed toward the perceptually salient mouth region when recognizing happiness (Beaudry et al., 2014; Calvo et al., 2014, 2018). 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 suggests a distracted gaze among NVGs after the initial fixation (Theeuwes, 2010; Theeuwes et al., 2000). 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 accurately recognizing happiness, thereby attributing a higher perceptual value to the mouth region (Calvo et al., 2018). Although the three-way interaction effect was not statistically significant, these gaze metrics provide crucial insights into the cognitive advantages that gamers may possess. The fixation patterns show comparatively higher visual attention processing among the HVVGs than the NVGs. It can be inferred that differences in the ability to recognize facial emotions can also arise from the attentional advantage, in addition to differences in emotional processing (Ciobanu et al., 2023)

The findings from both performance and fixation metrics suggest that habitual exposure to violent video games does not necessarily translate into impairments in emotional processing in everyday social contexts. These findings align with recent scholarly works (Diaz et al., 2016; Pichon et al., 2021), indicating that the transient effects on emotion recognition (Bailey et al., 2011; Bailey & West, 2013; Kirsh et al., 2006; Kirsh & Mounts, 2007) do not reflect the long-term consequences of habitual violent video gaming. For instance, Pichon et al. (2021) utilized drift-diffusion modeling and reverse inference techniques to assess the facial emotion recognition of habitual violent (action) video gamers. The results showed that gamers and non-gamers performed comparably in recognizing facial emotions, despite behavioral differences in aggression. This implies that the perceptual skills developed through violent video gaming do not enhance the recognition of familiar stimuli such as emotional faces, suggesting that gamers' emotional processing capabilities align with those of non-gamers. Likewise, Diaz et al. (2016) observed no impairment in the recognition of happy faces among HVVGs compared to NVGs.

While the present study concurs with Diaz et al. (2016) on the happy-face advantage, it departs in its analysis of negative emotions. Contrary to Diaz et al. (2016), who observed increased accuracy and faster identification of fear, our results showed reduced efficacy in recognizing fear, which is consistent with the established literature (Beaudry et al., 2014). Given that fear recognition is generally weaker across facial emotions, the present findings align with this pattern observed in the broader population (Calvo et al., 2018). It is also important to note that the present study found no differences in recognition of negative emotions, as observed by Diaz et al. (2016), thereby contesting their idea of selective desensitization. Moreover, our analysis showed no significant difference in recognizing negative emotions between HVVGs and NVGs, thus refuting the overall concept of emotional desensitization suggested by earlier research (Bailey et al., 2011; Bartholow et al., 2006; Engelhardt et al., 2011; Miedzobrodzka et al., 2021; Miedzobrodzka, Konijn, et al., 2022).

Several factors can explain why violent gamers can maintain a happy-face advantage and optimal recognition capacity for negative emotions despite being habitually exposed to in-game violence. Firstly, our results showed no significant correlation between violent media exposure and aggression, thereby challenging previous assertions of a direct link between these constructs (Kirsh et al., 2006; Kirsh & Mounts, 2007). This outcome highlights the importance of considering personal dispositions and experiences when evaluating the psychological impact of violent video gaming. It is also crucial to acknowledge that the GAM challenges the view of individuals as entirely "malleable blank slates" before exposure to violent media (Allen et al., 2018; Bushman & Anderson, 2020). The current 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, this study 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.

Secondly, HVVGs showed higher levels of violent media exposure yet reported lower aggression levels compared to NVGs, although this difference was not statistically significant. This observation suggests a potential role of "aggression catharsis" in mitigating hostile tendencies through violent video games (Ferguson et al., 2014; Lee et al., 2021). In this context, Greitemeyer and Mügge (2014) 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 (2013). 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 (Kersten & Greitemeyer, 2022). 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 toward 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.

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. This significant span, encompassing formative developmental years, might have profoundly influenced their emotional processing, cognitive development, and potentially their socialization patterns. 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 (see Ferguson, 2013). 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.

4.4.2. Limitations and Scope for Future Studies

Firstly, although the findings have not revealed a direct effect of in-game violence on facial emotion recognition, caution is warranted in generalizing these results to individuals with higher baseline levels of aggression than those included in the current sample. It remains plausible that exposure to violent gameplay or any other violence may exacerbate hostile tendencies in individuals predisposed to aggression. Additionally, the aggression levels are assessed using self-report inventories, which, despite being administered in a controlled environment with efforts to elicit honest responses, are susceptible to self-serving biases and social desirability effects. Future research could benefit from employing more ecologically valid assessments of aggression, such as behavioral tasks or physiological measures, or by experimentally manipulating aggression as a variable in the study.

Another important limitation concerns the broad classification of violent video games used in this study. We acknowledge a noticeable skew toward titles such as *Valorant* and *BGMI* 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 during gameplay, 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. This uncertainty can confound findings on game-induced aggression, as perceived violence can vary significantly depending on how users adjust the gameplay settings. Future research should address this by implementing protocols to meticulously record all relevant in-game settings, including audio and visual modifications.

Furthermore, it is worth acknowledging 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 habituation, probability sampling was impractical, as no existing registry of individuals with the precise exposure profiles was available for random selection. Future studies could address this limitation by screening larger, more diverse populations and constructing exposure groups retrospectively (post hoc) along a continuous gradient of violent gameplay (e.g., low, moderate, and high exposure), rather than relying solely on extreme predefined categories. Above all, the participant pool was exclusively male, which limits the applicability of our findings to a broader audience. Given the wide demographic that engages in violent video games, future research should adopt a more inclusive approach, considering different sexes and gender identities, to enhance the generalizability of the results. Likewise, group classification relied on self-reported gaming history, particularly for the NVG group, which may be subject to recall inaccuracies and social desirability effects. As a result, some degree of misclassification cannot be ruled out, as individuals categorized as NVGs may have had minimal or unreported exposure to video games within the stipulated timeframe. Moreover, the study could not control for vicarious or indirect exposure (e.g., observing others play or exposure through media), making it difficult to ensure the absolute absence of prior experience.

4.5. Summary

The present experiment investigated whether habitual engagement with violent video games affects facial emotion recognition, extending Experiment 1 by incorporating eye-tracking metrics. The results revealed a pronounced ability of participants to recognize happy faces. Notably, habitual violent video gamers showed even faster RTs across all emotions than their non-gamer counterparts. This contradicts the general expectation that exposure to violent content reduces happy-face advantage and leads to suboptimal recognition of negative emotions. The fixation metrics complemented these findings by demonstrating enhanced attentional processing among HVVGs, particularly toward the mouth region, when recognizing happiness. Additionally, in line with the conventional literature, a more scattered gaze pattern was observed during the recognition of negative emotions. Further, HVVGs showed no reduction in perceptual salience compared to NVGs. These findings suggest gamers may develop refined visual strategies to bolster their emotional recognition capabilities. Additionally, the study highlights that habitual exposure to violent games does not uniformly translate to reduced emotional sensitivity or increased aggression. Instead, the findings align with a body of research suggesting that the context, individual traits, and the nature of gaming experiences significantly influence the outcomes of such exposures.

CHAPTER 5

FACIAL EMOTIONAL PROCESSING AND GAZE BEHAVIOR ANALYSIS OF VIOLENT VIDEO GAMERS VS. NONVIOLENT VIDEO GAMERS

Highlights

- No alarming levels of aggression were observed in either group.
- No significant correlation was found between violent media exposure and aggression.
- No evidence of recognition impairment due to violent video game exposure.
- Violent video gamers retained the happy-face advantage with high accuracy for happy expressions.
- Perceptual salience for happy expressions was enhanced at the mouth region.
- Recognition of negative emotions was intact, indicating no desensitization effects.
- Gaze distribution was scattered across the face while recognizing negative emotions.

5.1. Introduction

5.1.1. Background

The present experiment extends the eye-tracking paradigm used to evaluate key assertions of the GAM by directly comparing habitual violent video gamers with nonviolent video gamers. Whereas Experiment 2 employed non-gamers as a control group, Experiment 3 isolates the specific influence of exposure to violent video games. Building on evidence from Experiments 1 and 2, the sample was restricted to players of FPS to ensure a targeted and theoretically meaningful operationalization of violent gaming.

Despite there is extensive research discussing the effects of violent video games, a critical issue emerges from the prevalent oversimplification of this category. Many studies categorize violent video games as a homogeneous group, neglecting the distinct cognitive and emotional impacts produced by their specific genres. In response to this concern and considering the magnitude of violence that manifests in first-person narratives (Schneider et al., 2004; Montag et al., 2012; Pötzsch, 2017), the present study narrows its focus on FPS gamers. Originating with seminal titles such as *Wolfenstein 3D* (1992) and *DOOM* (1993), the FPS genre has evolved considerably in terms of graphics, gameplay mechanics, and narrative depth. Combat themes dominate FPS gameplay, which involves players navigating diverse environments, confronting enemies, and completing objectives to progress through missions, often using animated or realistic firearms. Given the "inherently" violent nature of FPS games, a focused analysis of this genre becomes significant to understand its influence on the emotional processing of gamers. Apart from the control group and genre selection, the emotional go/no-go paradigm and the broader experimental protocol were retained from Experiment 2 to maintain methodological continuity and facilitate clearer comparisons across studies.

5.1.2. Problematization and Hypotheses

While addressing the identified research gaps, the present experiment aims to investigate whether habitual exposure to violent video games impairs emotional processing among violent video gamers. Specifically, it examines whether such exposure reduces the ability to recognize both positive and negative facial emotions compared to habitual nonviolent video gamers (NVVGs). Prior to examining emotional processing, this experiment measures aggression levels among participants to explore any potential correlations between violent media exposure and aggressive behaviors. Considering mixed results on the definitive connection between violent media exposure and aggression (Drummond et al., 2020; Ferguson, 2015a; Ferguson & Wang, 2019; Hilgard et al., 2017), the present experiment posits a foundational null hypothesis:

H1: There will be no statistically significant relationship between violent media exposure and aggression levels among participants.

At the core of this investigation, this experiment explores emotional processing by positing a happy-face advantage, in which happy faces are recognized more quickly and accurately. This assumption is supported by research indicating superior recognition capabilities for happiness compared to other basic emotions (Kirita & Endo, 1995; Calvo & Lundqvist, 2008; Calvo & Beltrán, 2013). Concurrently, this experiment examines the recognition efficacy of negative emotions, which generally show lower recognition rates, particularly fear, which is identified with the least efficiency (Beaudry et al., 2014; Calvo et al., 2018). Further, it compares the recognition abilities for happy and negative emotions between HVVGs and NVVGs. Previous studies indicate that regular exposure to violent video games does not necessarily deteriorate the recognition of happiness (Diaz et al., 2016; Liu et al., 2017), nor does it affect the accuracy of recognizing negative emotions (Pichon et al., 2021). Drawing on these observations, the experiment proposes the following hypotheses:

H2: The recognition capacity for happiness will be greater than for negative emotions (i.e., anger, disgust, fear, and sadness).

H3: HVVGs will not show a reduced happy-face advantage compared to NVVGs.

H4: HVVGs will not show impaired recognition capacity for negative emotions compared to NVVGs.

Similar to Experiment 2, the present study employs an emotional go/no-go task paradigm, drawing on the work of Tottenham et al. (2011). Unlike methods that involve passive observation of emotions or focus on non-emotional aspects of stimuli, this task directly evaluates the capacity to engage with or disengage from pertinent emotional information. Numerous studies, including neuroimaging research, have validated this task to differentiate between top-down prefrontal cognitive systems and subcortical limbic regions involved in processing negative and positive emotions (Hare et al., 2008; Somerville et al., 2011). In the current task, the recognition capacity for facial emotions is primarily measured by the percentage of CRs on go trials, the corresponding RTs, and the percentage of FAs on no-go trials. Experiment 2 relied solely on CRs and RTs, without assessing the no-go trial metrics. However, relying solely on CRs during go trials could misleadingly suggest high accuracy due to a liberal response bias, where participants might press the response button for nearly any stimulus, regardless of its relevance. To reduce this bias, the percentage of FAs on no-go trials is also measured as an indicator of recognition capacity. By including FA rates, we can distinguish between genuinely high accuracy and a propensity for indiscriminate responding (Kestenbaum & Nelson, 1992; Tottenham et al., 2011; Tracy & Robins, 2008). In addition to response accuracy, FA rates quantify how often participants incorrectly identify an emotion that is absent (no-go trials). A combination of low FA rates and high CR rates indicates an enhanced ability to recognize emotional expressions. In contrast, high FA rates, along with high CRs, could suggest a liberal response bias, indicating that participants may be overly eager to respond.

This experiment also incorporates eye-tracking metrics to provide supplementary evidence on visual attention patterns associated with facial emotion recognition. It utilizes three fixation metrics to assess attentional orientation and perceptual salience during facial emotion recognition. First, the TFF indicates the initial attractor points on the face, revealing which facial regions capture attention first and fastest. This rapid attraction to specific diagnostic areas can suggest innate or conditioned responses to particular facial emotions, providing a foundational measure of perceptual salience. After the initial fixation is established, the endurance of this fixation is measured by the FFD. This metric captures how long the first point of focus is held, which can reflect the intensity of the facial emotion in the targeted facial region. A longer FFD indicates deeper cognitive engagement with the facial regions initially deemed most relevant or expressive, suggesting that these areas may contain crucial information for facial emotion recognition. Complementing the TFF and FFD, the TFD accounts for the cumulative duration of all fixations on a specific area. This measure provides cumulative evidence of the amount of visual attention devoted to a particular facial region, highlighting the areas that consistently draw and hold the viewer's attention. Prolonged TFD on specific regions can signal their ongoing relevance in the processing and interpretation of facial emotion.

Integrating these fixation metrics offers insights into the perceptual salience of specific emotions within particular facial regions. For instance, a faster TFF coupled with a shorter FFD suggests rapid identification of facial emotion, primarily driven by its bottom-up characteristics (see Theeuwes et al., 2000; Theeuwes, 2010). In contrast, a slower TFF followed by a shorter FFD may indicate that participants engage in more complex processing, perceiving the facial region as less informative for emotion recognition and thus assigning it lower perceptual significance.

Consequently, a faster TFF, accompanied by longer FFD and TFD on a particular facial region, denotes enhanced perceptual salience of that region for a specific emotion. The current study investigates whether the hypothesized happy-face advantage is reflected in an enhanced perceptual salience, indicated by shorter TFF, along with longer FFD and TFD, when accurately recognizing happy faces in the mouth region. Additionally, it examines whether a reduced recognition capacity for negative emotions manifests as a scattered gaze distribution across the face, rather than focusing on a specific region during recognition. Thus, the study proposes that the previously observed lower efficiency in recognizing negative emotions may primarily stem from reduced perceptual salience, rather than desensitization effects, as proposed by the GAM (Carnagey et al., 2007; Denson et al., 2020; Diaz et al., 2016; Funk et al., 2004). Guided by this alternative interpretation and informed by the findings from Experiment 2, the following hypotheses are formulated:

> **H5:** The recognition capacity for happy faces will be higher, attributed to a faster TFF and prolonged FFD and TFD on the perceptually salient mouth region.
>
> **H6:** The recognition capacity for negative emotions will be lower compared to happiness, attributed to a scattered gaze distribution across different facial regions.
>
> **H7:** HVVGs will show a comparable level of perceptual salience with the NVVGs while recognizing happy facial emotions.
>
> **H8:** HVVGs will show a comparable level of perceptual salience to NVGs while recognizing negative emotions.

5.2. Methods

5.2.1. Participants

The sample size for this study was determined using MorePower (version 6.0.4; Campbell & Thompson, 2012). The analysis showed that a minimum of 32 participants would be necessary to detect a medium effect size ($\eta^2 = 0.06$) at an alpha level of 0.05 (two-tailed), with 80% power, in a three-way repeated measures ANOVA. The final sample pool consisted of 60 adult students, which included an equal number of HVVGs ($n = 30$, $M_{age} = 20.03$ years, $SD = 0.92$) and NVVGs ($n = 30$, $M_{age} = 21.23$ years, $SD = 3.64$). The study received approval from the Institute Human Ethics Committee at IIT Indore, in accordance with the principles of the Declaration of Helsinki and its subsequent refinements.

Participants were recruited from a higher education institution in India through an interest survey disseminated via email advertisements. HVVGs were required to have at least five years of experience playing violent video games. To maintain a "genre pure" policy, they were required to have engaged exclusively with FPS games, with an average daily playtime of two hours. Similarly, NVVGs were required to have at least five years of overall gaming experience and to have strictly avoided FPS or any violent games during this period. NVVGs were also required to engage frequently in nonviolent games for an average of two hours daily. All participants were also required to have normal or corrected-to-normal vision, as the experiment involved eye-tracking methodology. Initially, 42 individuals responded as HVVGs. Five were excluded from the experiment for playing genres other than FPS in the recent past. Seven were excluded due to insufficient gaze sampling (< 50%) during eye-tracking, resulting in a final dataset of 30 HVVGs for analysis. On the other hand, among the 35 individuals who initially responded as NVVGs, three were excluded for insufficient gaze sampling, and two more (with the lower gaze sampling rates of 63% and 57%) were excluded to ensure comparable sample sizes, resulting in 30 NVVGs.

5.2.2. Measures

5.2.2.1. Aggression

The 29-item Buss and Perry Aggression Questionnaire (BPAQ; Buss & Perry, 1992) was used to evaluate individual aggression levels. Participants indicated their level of agreement with each statement using a five-point Likert scale (1 = *does not describe me at all* to 5 = *describes me very well*). The overall scale demonstrated excellent internal consistency (Cronbach's α = .86). The questionnaire is provided in Appendix F.

5.2.2.2. Violent Gaming Exposure

Violent gaming exposure was assessed using a 12-item modified Content-Based Media Exposure Questionnaire (CBMEQ; Den Hamer et al., 2017). The items were specifically designed to assess consumption of violent content in gaming environments. Participants rated their frequency of exposure to different types of violent gaming content on a five-point Likert scale (1 = *never* to 5 = *very often*). The adapted scale showed excellent internal consistency (Cronbach's α = .85). In addition to the CBMEQ, three single-item measures assessed participants' gaming habits on a 7-point Likert scale (1 = *never* to 7 = *always*). These items evaluated perceived gaming frequency, in-game violence, and exposure to blood and gore during gaming, providing further insights into their gaming habits. The questionnaire is provided in Appendix G.

5.2.3. Experimental Stimuli

The same set of stimuli used in Experiment 2 was employed in the present study. A total of 165 front-view color photographs were utilized, sourced from the KDEF data set (Lundqvist et al., 1998). Fifteen emotional faces were used in a practice block to familiarize participants with the task. The main experiment consisted of 150 emotional faces presented in five blocks of 30 faces each. To control for sex-related differences, an equal number of male and female faces was included. Each picture was 562 × 762 pixels and depicted five distinct facial emotions: anger, disgust, fear, happiness, and sadness. The stimulus and trials are detailed in Appendix D.

5.2.4. Eye-Tracking System

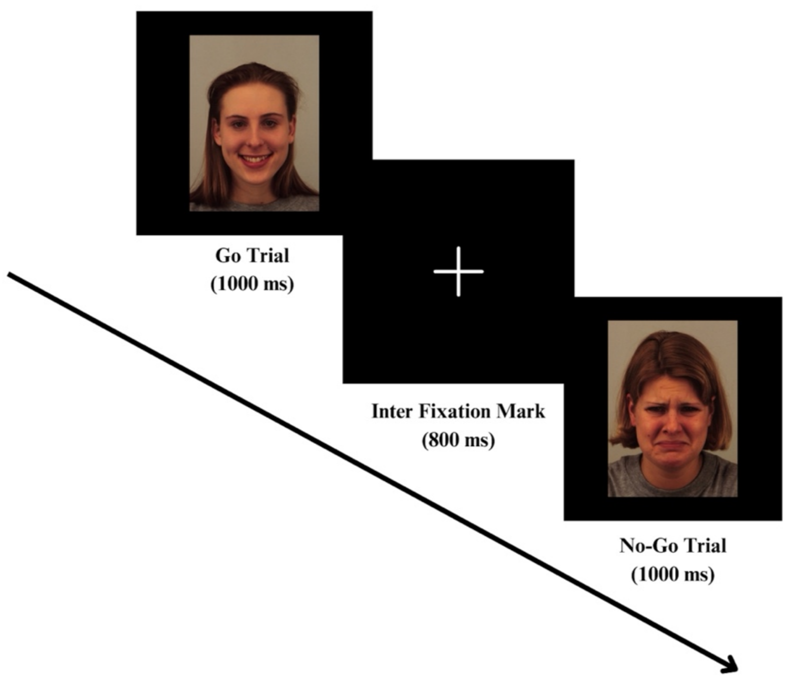
Eye movements were recorded using a Tobii TX300 eye tracker integrated into the lower portion of a 23-inch TFT display. The eye tracker setup was controlled by an Asus G750JX-T4191H computer, equipped with an Intel Core i7-4700HQ processor and 8GB of RAM. All stimuli were presented on the eye tracker display via Tobii Studio (version 3.3.2) at viewing distances ranging from 60 to 64 cm. The eye tracker was calibrated using nine standard points to ensure accurate tracking. Binocular tracking was conducted at a data sample rate of 300 Hz. A maximum dispersion threshold of 0.5 degrees and a minimum fixation period of 70 ms were set to register the valid fixations.

5.2.5. Experimental Procedure

The experiment was conducted in a semi-dark and soundproof laboratory setting. The performance in facial emotion recognition was assessed using an emotional go/no-go task. In the “go” trials, participants were required to press the left mouse button when a specific target (facial emotion) was presented. These go trials were intentionally frequent (60% occurrence) to enhance the participant’s tendency to respond quickly. On the other hand, during the “no-go” trials (40% occurrence), participants were instructed to refrain from clicking the left mouse button when a facial emotion other than the target was displayed. The valence of the no-go stimuli was not disclosed to the participants. However, they were directed to abstain from responding to facial emotions other than the instructed target. After successfully calibrating the eye tracker, participants received detailed instructions and were given a brief practice block of 15 trials to familiarise themselves with the experimental task. Five task blocks, each with 30 faces, were used to present the go and no-go trials. To avoid consecutive repetitions of no-go trials, the presentation order was pseudo-randomized. Each facial emotion was displayed for a fixed duration of 1,000 ms. Subsequently, a fixation cross appeared, lasting 800 ms, following each face stimulus to provide a brief interval before the subsequent trial (see Fig. 11). On average, the participants completed the experiment in 20 to 25 minutes.

Figure 11

Stimuli Presentation in the Go/No-Go Task Paradigm



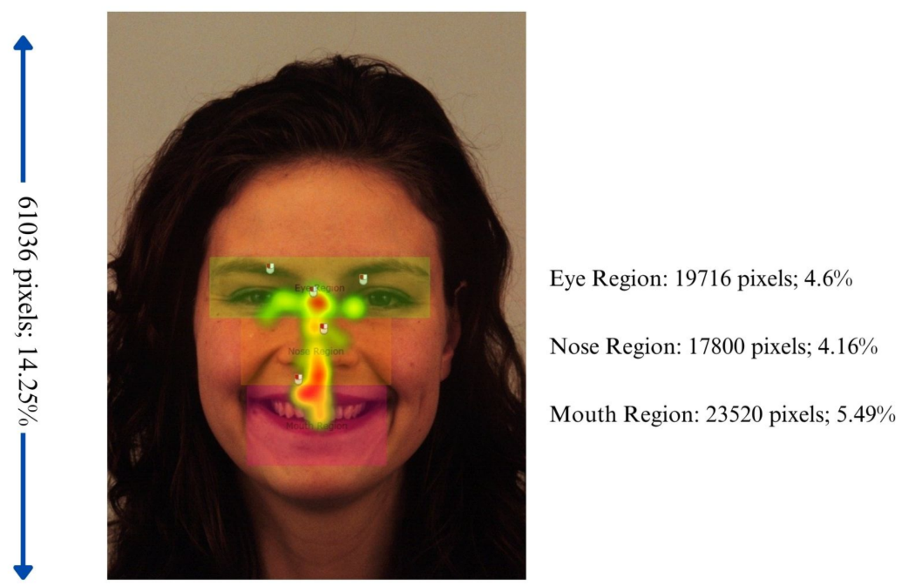
Note. The happy face depicts the go trial, and the sad face represents the no-go trial, illustrating the go/no-go task. Representative stimuli are used with permission from the Psychology Section at Karolinska Institutet for research purposes.

5.2.6. Research Design

The study employed a 2 (experimental group: HVVGs and NVVGs) × 5 (facial emotion: anger, disgust, fear, happiness, and sadness) × 3 (fixation region: eye, nose, and mouth) mixed-factorial design, with the first factor as a between-groups variable. This design allowed for a direct comparison of performance efficacy (i.e., CRs and RTs on go trials and FAs on no-go trials) and gaze behavior across different facial emotions in two distinct gamer groups. Emotional stimuli were sourced from the KDEF dataset. Three broad areas of interest (AOIs)—eyes, nose, and mouth—were identified as fixation regions for evaluating participants' gaze behavior (see Fig. 12).

Figure 12

Heat Map Displaying Examined Fixation Regions



Note. The representative stimulus is used with permission from the Psychology Section at Karolinska Institutet for research purposes.

5.2.7. Data Analyses

Descriptive statistics (mean and standard deviation) were used to explain the characteristics of the participants and gaming information. An independent samples *t*-test was conducted to assess the differences in aggression levels and violent gaming exposure between HVVGs and NVVGs. The core analyses involved evaluating performance efficacy and gaze behavior. Firstly, the performance efficacy of facial emotion recognition was measured through the percentage of CRs in go trials and corresponding RTs (time taken for the first mouse click), using 2 (experimental group: HVVGs vs. NVVGs) × 5 (facial emotion: anger vs. disgust vs. fear vs. happiness vs. sadness) two-way repeated measures ANOVA with the first factor as a between-groups variable and the second as a within-groups variable. A higher percentage of CRs with shorter RTs indicates better performance efficacy. Additionally, the rate of FAs was assessed on no-go trials to evaluate response confusion in recognizing facial emotions.

Further, the gaze behavior was examined in terms of three fixation metrics (TFF, FFD, and TFD), measured separately using a 2 (experimental group: HVVGs vs. NVVGs) × 5 (facial emotion: anger vs. disgust vs. fear vs. happiness vs. sadness) × 3 (fixation region: eye vs. nose vs. mouth) three-way repeated measures ANOVA with the first factor as a between-groups variable and the other two as within-groups variables. The main effects assess gaze efficiency in relation to facial emotions and fixation regions. Additionally, interaction effects between facial emotion and fixation region highlight the perceptual salience of specific facial emotions on specific facial regions. When a facial emotion is recognized, a faster TFF combined with prolonged FFD and TFD in targeted fixation regions indicates enhanced perceptual salience of that emotion in those areas.

5.3. Results

The present experiment reports and discusses only the significant main and interaction effects on ANOVA, complemented by post hoc pairwise comparisons. Given the risk of Type I errors arising from multiple comparisons, a Bonferroni adjustment was applied, ensuring a rigorous threshold for statistical significance. The Greenhouse–Geisser correction was also employed to adjust the *F*-statistic values where the assumption of sphericity was compromised, as evidenced by Mauchly's test.

5.3.1. Characteristics of the Participants

Overall gaming experience and average daily playtime of the HVVGs ($M_{\text{experience}}$ = 8.53 years, *SD* = 3.49; $M_{\text{daily playtime}}$ = 2.60 hours, *SD* = 0.77) and NVVGs ($M_{\text{experience}}$ = 6.33 years, *SD* = 3.31; $M_{\text{daily playtime}}$ = 2.33 hours, *SD* = 0.80) reflected their habitual exposure to their respective video gaming genres. Among HVVGs, *Valorant* was identified as the most preferred game, with approximately 36.66% expressing their engagement at the time of the study. This was followed by *BGMI*, which held a 20% preference rate. Conversely, NVVGs preferred less aggressive, more strategy- or skill-based games. *EA Sports FIFA* was the leading choice among NVVGs, with about 20% engaging with it. This was closely followed by *Asphalt*, which had a preference rate of 16.66%. These games, which emphasize sports and racing skills, indicate a different pattern of engagement that avoids violent content.

The scores on the independent samples *t*-test, $t(58) = 4.22$, $p < .001$, showed that HVVGs had significantly higher levels of violent gaming exposure ($M = 31.70$, $SD = 9.78$) compared to NVVGs ($M = 22.83$, $SD = 6.05$). In contrast, NVVGs demonstrated significantly higher overall aggression scores ($M = 76.06$, $SD = 14.78$) compared to HVVGs ($M = 64.80$, $SD = 13.06$), $t(58) = -3.13$, $p < .05$. This difference was also evident across specific subscales, including verbal aggression, $t(58)$ =

−4.09, $p < .01$, and hostility, $t(58) = -3.54$, $p < .01$. Additionally, Pearson's product–moment correlation analysis revealed no significant correlation between exposure to violent video games and participant aggression levels ($r = .01$, $p = .92$).

5.3.2. Performance Measures on the Emotion Recognition Task

5.3.2.1. Percentage of Correct Responses (CRs) on Go Trials

The two-way repeated measures ANOVA yielded a marginally significant main effect of the experimental group on the percentage of CRs on go trials, with $F(1, 58) = 3.71$, $p = .06$, $\eta_p^2 = 0.06$, indicating that HVVGs were slightly more accurate than NVVGs, considering the overall emotion recognition accuracy (see Table 6). Similarly, there was a significant main effect of facial emotion on the percentage of CRs, $F(3.35, 194.43) = 82.13$, $p < .001$, $\eta_p^2 = 0.59$. The post hoc pairwise comparisons showed that the percentage of CRs was significantly higher for happiness ($p < .001$) compared to all other facial emotions, followed by disgust, sadness, anger, and fear (see Table 6). No interaction effect was observed between the experimental group and facial emotion on the percentage of CRs on go trials, $F(3.35, 194.43) = 0.45$, $p = .77$, $\eta_p^2 = 0.01$.

5.3.2.2. Reaction Times (RTs) on Correct Go Trials

There was no significant main effect of the experimental group on the RTs for the corresponding CRs, $F(1, 58) = 1.20$, $p = .32$, $\eta_p^2 = 0.02$. This outcome indicates that HVVGs and NVVGs performed comparably in terms of the time taken to accurately recognize facial emotions (see Table 6). There was a significant main effect of facial emotion on the RTs, $F(3.47, 201.14) = 52.61$, $p < .001$, $\eta_p^2 = 0.48$. The post hoc pairwise comparisons showed that the RTs were significantly faster while recognizing happiness ($p < .001$) compared to all other facial emotions, followed by sadness, disgust, anger, and fear (see Table 6). No interaction effect was observed between the experimental group and facial emotion on the RTs, $F(3.47, 201.14) = 1.39$, $p = .24$, $\eta_p^2 = 0.02$.

Table 6

Main Effects of the Performance Measures

Variables	CR (in percent)	RT (in ms)	FA (in percent)
	M (*SE*)	*M* (*SE*)	*M* (*SE*)
Experimental Group			
HVVGs	73.33 (2.27)	716.54 (12.91)	5.72 (0.77)
NVVGs	67.15 (2.27)	734.97 (12.91)	5.61 (0.77)
Facial Emotion			
Happiness	92.50 (1.60)	645.15 (12.89)	0.97 (0.40)
Anger	65.28 (2.46)	739.77 (9.56)	5.42 (1.03)
Disgust	75.46 (2.47)	729.29 (10.68)	12.36 (1.26)
Fear	45.83 (2.60)	786.60 (10.95)	4.72 (0.78)
Sadness	72.13 (2.31)	727.98 (11.09)	4.86 (0.78)

5.3.2.3. Percentage of False Alarms (FAs) on No-Go Trials

There was no significant main effect of the experimental group on the percentage of FAs on no-go trials, $F(1, 58) = 0.01$, $p = .92$, $\eta_p^2 = 0.001$. The findings indicate that HVVGs and NVVGs performed comparably in recognizing certain emotions (by mouse clicks) during no-go trials when they were not supposed to (see Table 6). There was a significant main effect of facial emotion on the percentage of FAs, $F(3.19, 200.08) = 26.75$, $p < .001$, $\eta_p^2 = 0.32$. The post hoc pairwise comparisons showed that the percentage of FAs was significantly lower for happiness ($p < 0.001$) compared to all other facial emotions, followed by fear, sadness, anger, and disgust (see Table 6). No interaction effect was observed between the experimental group and facial emotion on the percentage of FAs on no-go trials, $F(3.19, 200.08) = 1.02$, $p = .39$, $\eta_p^2 = 0.02$.

5.3.3. Gaze Behavior Analyses

5.3.3.1. Time to First Fixation (TFF)

There was no significant main effect of the experimental group on TFF, $F(1, 58) = 1.96$, $p = .17$, $\eta_p^2 = 0.03$, indicating that the visual attention mechanisms guiding the initial gaze response were comparable between HVVGs and NVVGs. There was a significant main effect of facial emotion on TFF, $F(3.41, 198.03) = 5.86$, $p < .001$, $\eta_p^2 = 0.09$. The post hoc pairwise comparisons showed that TFF was faster for happy faces than all other facial emotions (see Table 7). However, while this fixation speed was significantly quicker than angry and sad faces, it was statistically similar to those expressing disgust and fear. This finding indicates that although happiness prompted a rapid response, the initial gaze toward happy faces was not uniquely fast compared to all the examined negative emotions. Additionally, there was a main effect of fixation region on TFF, $F(1.62, 93.83) = 44.79$, $p < .001$, $\eta_p^2 = 0.44$, with post hoc pairwise comparisons showing that participants took less time to first fixate on the nose region than on the eye or mouth regions.

Furthermore, there was a significant interaction effect between facial emotion and fixation region on TFF, $F(8, 464) = 3.86$, $p < .001$, $\eta_p^2 = 0.06$. The post hoc pairwise comparisons indicated that TFF was uniquely faster in the eye region for disgust faces than for faces expressing other emotions (see Table 8). In contrast, TFF for fearful faces was faster in the nose region, although this fixation speed was similar to that for disgust and happiness. Notably, happiness showed a markedly faster TFF in the mouth region than all other emotions, highlighting the smiling mouth as a critical region for recognizing positive emotional expressions. There was no significant three-way interaction among the experimental group, facial emotion, and fixation region on TFF, $F(8, 464) = 0.65$, $p = .74$, $\eta_p^2 = 0.01$, indicating that the perceptual salience of TFF was comparable between HVVGs and NVVGs.

Table 7

Main Effects of the Fixation Metrics

Variables	TFF (in ms)	FFD (in ms)	TFD (in ms)
	M (*SE*)	*M* (*SE*)	*M* (*SE*)
Experimental Group			
HVVGs	346.20 (11.87)	266.87 (10.95)	407.40 (10.91)
NVVGs	322.664 (11.87)	248.94 (10.95)	397.18 (10.91)
Facial Emotion			
Happiness	309.12 (11.68)	281.52 (12.97)	422.25 (13.42)
Anger	349.53 (11.31)	248.97 (8.30)	388.48 (8.77)
Disgust	316.61 (9.46)	263.84 (8.77)	401.86 (8.69)
Fear	334.50 (12.29)	242.82 (8.22)	401.98 (10.22)
Sadness	362.39 (13.54)	252.36 (8.25)	396.88 (8.29)
Fixation Region			
Eye	280.74 (21.05)	240.02 (10.87)	409.45 (24.32)
Nose	215.91 (21.50)	276.90 (12.78)	493.84 (25.04)
Mouth	506.64 (18.61)	256.78 (9.73)	303.62 (11.70)

5.3.3.2. First Fixation Duration (FFD)

There was no significant main effect of the experimental group on FFD, $F(1, 58) = 1.34$, $p = .25$, $\eta_p^2 = 0.02$, indicating that HVVGs and NVVGs performed comparably in maintaining their gaze stability after their initial fixation. There was a significant main effect of facial emotion on FFD, $F(2.20, 127.35) = 6.20$, $p < .001$, $\eta_p^2 = 0.10$. The post hoc pairwise comparisons showed that FFD was significantly longer for happy faces than those expressing anger, fear, and sadness (see Table 7). However, this fixation duration was similar to that of those expressing disgust. Additionally, there was a main effect of fixation region on FFD, $F(2, 116) = 3.47$, $p < .05$, $\eta_p^2 = 0.06$, with the pairwise comparison showing that participants spent longer on their first fixation in the nose region than in the eye or mouth regions.

There was no significant interaction effect between facial emotion and fixation region on FFD, $F(5.65, 327.83) = 1.05$, $p = .40$, $\eta_p^2 = 0.02$. However, the results showed that FFD was somewhat longer for fearful faces when participants fixated on the eye region. Similarly, FFD was longer for happy faces when fixated on the nose and mouth regions (see Table 8). There was no significant three-way interaction among the experimental group, facial emotion, and fixation region on FFD, $F(5.65, 327.83) = 0.51$, $p = .79$, $\eta_p^2 = 0.09$, indicating that the perceptual salience of FFD was comparable between VVGs and NVVGs.

Table 8

Interaction Effects of the Fixation Metrics

Fixation Region	Facial Emotion	TFF (in ms)	FFD (in ms)	TFD (in ms)
		M (*SE*)	*M* (*SE*)	*M* (*SE*)
Eye	Happiness	295.50 (30.17)	252.29 (18.43)	409.79 (27.53)
	Anger	263.21 (25.00)	243.96 (13.30)	414.61 (28.15)
	Disgust	243.95 (22.21)	251.29 (11.08)	393.10 (22.97)
	Fear	278.11 (25.91)	225.56 (11.40)	422.56 (29.27)
	Sadness	322.94 (28.89)	227.01 (12.29)	406.95 (27.71)
Nose	Happiness	207.31 (25.01)	301.35 (21.31)	508.59 (30.38)
	Anger	222.94 (26.21)	259.28 (11.89)	470.48 (25.99)
	Disgust	206.83 (21.55)	280.44 (15.28)	505.12 (27.95)
	Fear	203.73 (26.67)	262.20 (12.53)	498.96 (26.05)
	Sadness	238.77 (29.85)	281.22 (16.41)	486.07 (27.52)
Mouth	Happiness	424.55 (20.78)	290.91 (15.61)	348.37 (18.84)
	Anger	562.45 (21.83)	243.66 (11.56)	280.35 (13.20)
	Disgust	499.05 (21.10)	259. 78 (11.79)	307.34 (13.41)
	Fear	521.65 (25.82)	240.71 (13.45)	284.43 (15.19)
	Sadness	525.47 (26.37)	248.84 (11.31)	297.61 (15.59)

5.3.3.3. Total Fixation Duration (TFD)

There was no main effect of the experimental group on TFD, $F(1, 58) = 0.44$, $p = .51$, $\eta_p^2 = 0.01$, indicating that HVVGs and NVVGs displayed comparable levels of engagement in terms of the total time spent fixating on facial emotions. There was a significant main effect of facial emotion on TFD, $F(2.77, 160.70) = 2.98$, $p < .05$, $\eta_p^2 = 0.05$. The post hoc pairwise comparisons showed that while TFD was generally longer for happy faces, this difference was statistically significant only when compared with angry faces (see Table 7). There was a significant main effect of fixation region on TFD, $F(1.58, 91.59) = 15.43$, $p < .001$, $\eta_p^2 = 0.21$, with the post hoc pairwise comparisons showing that TFD was significantly longer in the nose region, compared to the eye and mouth regions.

There was also a significant interaction effect between facial emotion and fixation region, $F(6.60, 382.70) = 1.97$, $p < .05$, $\eta_p^2 = 0.03$. The post hoc pairwise comparisons showed that although TFD was longer for fearful faces when participants fixated on the eye region, this pattern was similar to that observed for all other facial emotions (see Table 8). TFD was notably longer for happy faces in the nose region, comparable only with those expressing disgust and fear. Similarly, TFD for happy faces was significantly longer in the mouth region than for any other facial emotion. This outcome highlights a unique perceptual salience for happiness in this region, reflecting the prominent visual cues associated with smiling expressions, which are primarily centered on the mouth, making it a focal point for recognizing happiness. Furthermore, there was no three-way interaction between the experimental group, facial emotion, and fixation region on TFD, $F(6.60, 382.70) = 1.12$, $p = .35$, $\eta_p^2 = 0.02$, indicating that the perceptual salience of TFD was comparable between HVVGs and NVVGs.

5.4. Discussion

5.4.1. Hypotheses Testing

Experiment 3 investigated whether habitual exposure to violent video games (specifically FPS) affects the ability to recognize facial emotions. The study initially evaluated aggression levels and the extent of exposure to violent video games among participants. As anticipated, the degree of exposure to in-game violence was substantially higher among HVVGs compared to NVVGs. In contrast, aggression levels were greater among NVVGs than HVVGs. The analysis also revealed no significant correlation between violent gaming exposure and aggression among participants, thereby supporting H1 of Experiment 3. These findings strongly suggest that it is overly simplistic to attribute aggressive behavior solely to violent gaming, as claimed by the GAM and related studies. Instead, it is important to consider a broad range of environmental and individual factors, such as family environment, domestic violence, mental health, and even personality traits, as potential risk factors for increased aggression (Addo et al., 2021; Ferguson, 2018; Jerabeck & Ferguson, 2013). The findings are noteworthy as they contradict previous research that has indicated a direct relationship between violent video gaming and increased aggression (Anderson et al., 2010; Prescott et al., 2018).

The study further explored this association by investigating whether there is any impairment in facial emotional processing among gamers. The happy-face advantage was evaluated using performance and eye-tracking metrics. Participants exhibited greater efficiency in recognizing happy faces than other facial emotions. This was evidenced by higher CRs and faster RTs on go trials. Additional analysis revealed a higher rate of FAs for negative emotions on no-go trials. This pattern suggests that negative emotions are generally more difficult for participants to distinguish accurately, and the risk of response confusion is high. In contrast, the rate of FAs was significantly lower for happiness.

The overall results supported H2 of Experiment 3, demonstrating that the happy-face advantage was evident not only in response accuracy during go trials but also in a reduced rate of FAs during no-go trials. The results also indicated comparable performance between HVVGs and NVVGs in overall facial emotion recognition. Both groups showed similar RT efficiency. This finding supports H3 of Experiment 3, suggesting that the happy-face advantage is mutually exclusive of the gaming experience. Additionally, HVVGs and NVVGs performed comparably in recognizing negative emotions, supporting H4.

Concerning the happy-face advantage, the findings are consistent with the recent research by Diaz et al. (2016) and Pichon et al. (2021), which suggests that the short-term effects on emotion recognition observed in earlier studies (Bailey et al., 2011; Bailey & West, 2013; Kirsh et al., 2006; Kirsh & Mounts, 2007) do not necessarily translate into long-term impacts of habitual violent video gaming. Additionally, our analysis found no significant differences in recognizing negative emotions between HVVGs and NVVGs, thus challenging the notion of emotional desensitization supported by prior studies (Bailey et al., 2011; Bartholow et al., 2006; Denson et al., 2020; Engelhardt et al., 2011; Miedzobrodzka et al., 2021, 2022).

In addition to performance metrics, the fixation patterns reflected an enhanced happy-face advantage among gamers. Prior research on gaze behavior has shown that happiness is more readily identified because it is perceptually more salient in the mouth region (Calvo & Nummenmaa, 2008; Calvo et al., 2018). The results supported H5, as participants exhibited a relatively quicker TFF, with prolonged FFD and TFD in the mouth region, when recognizing happy faces. These findings align with prior research, suggesting that enhanced visual attention is directed toward the perceptually salient mouth region during happiness recognition (Beaudry et al., 2014; Calvo et al., 2018). The recognition utility for negative emotions conformed to the conventional pattern observed in the general population, with notably lower performance efficacy for fear (Beaudry et al., 2014). Complementing this result, the fixation metrics revealed that, regardless of type, negative faces required longer to capture initial visual attention. This was evidenced in the prolonged TFF. Furthermore, the FFD on these negative emotions was less stable, indicating that participants frequently shifted their focus away from the initially fixated regions. This gaze behavior suggests that the participants did not obtain sufficient diagnostic information from the initial focus area and therefore felt compelled to search other regions of the face to accurately identify the emotion. This pattern was further supported by a relatively shorter TFD, reflecting a more distributed attentional strategy in which participants scanned multiple facial features to gather emotional cues.

The gaze patterns for negative emotions contrast markedly with those observed for happy faces. While happy faces quickly captured attention and maintained it in specific regions, such as the mouth (known for its expressive visibility in positive emotions), attention to negative emotions was less focused. Instead, it was more scattered across various facial features, thereby supporting H6. This distributed gaze pattern suggests that cues for recognizing negative emotions may be distributed across the face, necessitating a more comprehensive visual assessment to accurately interpret them. It is crucial to observe that the gaze patterns in this study align with existing research (Calvo & Nummenmaa, 2008; Beaudry et al., 2014; Calvo et al., 2018), suggesting that reduced performance efficacy for negative emotions is primarily attributed to scattered perceptual salience rather than to desensitization, as explained by the GAM. Furthermore, the three-way interaction effect supported H7 and H8 of Experiment 3, showing no significant difference in the perceptual salience between HVVGs and NVVGs in recognizing positive and negative facial emotions, respectively. Collectively, these findings indicate that habitual exposure to violent games (such as FPS) does not lead to an attention bias against recognizing positive stimuli, nor does it induce desensitization toward negative emotions.

Experiment 3 explores several reasons why habitual exposure to violent FPS games did not impair emotion recognition among gamers. One key observation is that aggression levels among VVGs were lower than those of the control group, which may have helped regulate the development of hostile cognitive scripts. Previous research aligned with the GAM has postulated that exposure to aggressive content within violent video games can escalate aggression (Bushman & Anderson, 2002; Bartholow et al., 2006; Anderson et al., 2008). However, the current findings contradict these results by indicating that habitual violent gaming did not lead to increased aggression among the participants. Consequently, this lack of increased aggression may have precluded any adverse impact on attention orientation concerning positive emotions. This observation also raises the possibility of "aggression catharsis" as a factor that mitigates the translation of virtual in-game violence into real-world hostility. Greitemeyer and Mügge (2014) provide empirical support for this concept, demonstrating that habitual gamers often believe in the aggression-reducing effects of violent games more than non-gamers or nonviolent gamers do. Such cathartic processes could serve as a psychological buffer, enabling habitual gamers to rationalize their consumption of in-game violence as a mood regulation strategy. Interestingly, this catharsis might not only prevent the accumulation of negative emotions but also reduce the reinforcement of aggressive scripts, altering the gamers' responses to emotional stimuli. Therefore, the overall cathartic effect of violent video games might paradoxically enhance the recognition of positive emotions and optimize the detection of negative emotional cues, as evidenced in this study.

5.4.2. Limitations and Scope for Future Studies

One important limitation is the use of nonviolent gamers as a comparison group. While this comparison helps distinguish the effects of violent content from those of general gaming, it also introduces potential confounds. For example, gamers across genres, whether they play violent games or not, often share certain skills, such as enhanced RTs, decision-making abilities, competitiveness, and engagement levels in gaming (Barlett et al., 2009; Kearney, 2005). This overlap could reduce the effectiveness of the comparison, potentially leading to a null effect when testing specific variables. Also, this overlap makes it difficult to pinpoint whether differences in hostile emotional processing are due specifically to exposure to violent content or to gaming more broadly.

Another potential limitation lies in the relatively narrow selection of FPS games played by our participants. Many of them, such as *Valorant* or *BGMI*, feature stylized rather than graphically realistic depictions of violence. As the gaming industry continues to develop more lifelike representations of violence, it would be worthwhile to explore whether our findings extend to gamers exposed to hyper-realistic content. To that end, future investigations can incorporate a broader spectrum of FPS games, ranging from heavily stylized to highly realistic portrayals, thereby introducing greater variability into the research. We also recommend extending the current paradigm to encompass genres beyond violent FPS games. For instance, titles such as the *Dishonored* or *Deus Ex* series offer different mechanics and goal structures, while narrative-based games like *The Remains of Edith Finch* largely eschew violence. A wider range of gaming experiences would enable researchers to draw more comprehensive conclusions about the potential impact of video game content on emotional processing and help mitigate concerns that the negative effects of violent video games may be overstated in the literature.

Further, although the current results did not show a translation of in-game violence to impaired facial emotion processing, these findings cannot be generalized across individuals with higher levels of trait aggression. It is plausible that individuals with inherent aggressive tendencies might experience an amplification of hostility due to in-game violence. There is also a call for future studies to examine various other personal dispositions, such as personality traits, gender, and age, along with broader developmental and environmental factors, such as family upbringing and exposure to actual violence. These elements provide deeper insights into how different personal and situational factors might influence or modify the relationship between exposure to violent gaming and emotional processing.

5.5. Summary

The findings of this study closely align with those of Experiment 2, demonstrating that habitual exposure to violent video games does not impair the ability to recognize facial emotions. Performance metrics indicated a pronounced efficiency in recognizing happy faces, further supported by fixation patterns. This suggests that the distinctive visual characteristics of happy faces, especially around the mouth region, remain readily perceptible even after exposure to violent content. Therefore, these findings reveal no negative bias in processing information about positive emotions, challenging assumptions made by script theory. Conversely, the recognition of negative emotions was associated with reduced performance efficacy, consistent with patterns observed in the general population. Eye-tracking metrics provided additional insights, showing that the negative emotions required longer initial fixations and shorter durations of visual attention on perceptually salient regions, indicating a more dispersed focus. Thus, the reduced recognition utility for these emotions is attributed to scattered gaze patterns and may not be influenced by desensitization from violent video games. By analyzing the processing of positive and negative emotions, this study offers a comprehensive evaluation of the GAM. Importantly, participants in this study did not exhibit elevated levels of trait aggression despite their exposure to violent video games. This observation highlights the importance of considering individual traits and contextual factors when evaluating the impact of violent video games. This study does not entirely refute the foundational principles of the GAM. Instead, it provides a critique of how script theory and desensitization models may have overstated the negative impacts of violent video games.

CHAPTER 6

GENERAL DISCUSSION

6.1. Major Findings

The present research integrated behavioral and eye-tracking evidence across three experiments to examine whether habitual exposure to violent media, particularly violent video games, is associated with increased aggression and impaired facial emotion recognition. Across all experiments, a consistent pattern emerged, indicating that habitual engagement with violent video games did not impair emotional processing, as reflected in the sustained happy-face advantage and the absence of biased attentional allocation toward hostile or negative facial cues. Instead, the findings suggest that facial emotion recognition is shaped more strongly by fundamental perceptual asymmetries and attentional mechanisms than by exposure to violent video games alone. In this sense, the results collectively challenge the central assumptions of the GAM, which posits that repeated engagement with violent video games produces broadly negative effects on facial emotional processing and aggression.

Performance measures across all three experiments consistently demonstrated a robust happy-face advantage, characterized by higher CR rates, faster RTs, and lower FA rates for happy expressions compared to negative emotions. This advantage persisted regardless of the level of media interactivity (Experiment 1: interactive vs. non-interactive), gaming status (Experiment 2: gamers vs. non-gamers), or exposure to violent content (Experiment 3: violent gamers vs. nonviolent gamers). Gaze behavior analyses in Experiments 2 and 3 extended these performance measures with more granular fixation metrics, clarifying the underlying attentional mechanisms. The overall results align with extensive prior literature indicating that happiness enjoys privileged perceptual and cognitive processing (Calvo et al., 2018; Calvo & Beltrán, 2013; Nummenmaa & Calvo, 2015). This advantage is attributed to distinctive visual features, particularly within the mouth region, which in the present research was conceptualized as enhanced "perceptual salience" during the recognition of happy facial expressions. These findings challenge a core assumption of the GAM, which predicts that repeated exposure to violent media should attenuate sensitivity to positive emotional cues by biasing social information processing toward hostility (Anderson & Bushman, 2002). Across all experiments, recognition efficacy for happiness remained intact and, in some cases, was superior among violent video gamers. This convergence across paradigms, metrics, and samples provides strong evidence that the happy-face advantage represents a stable feature of human emotion perception that is resistant to habitual exposure to violent media.

Furthermore, while negative emotions (particularly fear) were recognized less efficiently than happiness, this pattern mirrored existing global trends (Beaudry et al., 2014; Calvo et al., 2018). Gaze behavior metrics further clarified the underlying mechanism as negative emotions elicited longer times to first fixation, shorter fixation durations, and more "scattered gaze patterns" across facial regions. In contrast, happy expressions consistently showed greater perceptual salience, particularly in the mouth region. Participants oriented their gaze more rapidly toward the mouth (i.e., TFF), maintained longer initial fixations (i.e., FFD), and exhibited greater fixation durations (i.e., TFD) on this region when recognizing happiness. This sustained attentional focus was not observed for negative emotions, in which participants appeared to rely on a broader, less stable scanning strategy, likely due to the absence of a single highly diagnostic facial region. Collectively, these attentional patterns suggest that the reduced recognition efficiency observed for negative emotions is better explained by diminished perceptual salience in specific facial regions, rather than by emotional desensitization.

Previous studies have often overlooked this distinction and have directly attributed reduced recognition capacity to emotional desensitization. Within the GAM literature, repeated exposure to violent content is proposed to dampen emotional responsiveness, especially toward distress cues (Bartholow et al., 2006; Carnagey et al., 2007). However, the present results do not support this account. Reduced recognition efficiency for negative emotions was observed consistently across violent gamers and control participants, indicating that this pattern was not specific to violent gaming exposure. Instead, the findings are "more parsimoniously" explained by the diffuse and less diagnostically concentrated features of negative facial expressions. Moreover, these results converge with recent evidence suggesting that desensitization effects, when present, are transient and unlikely to produce enduring alterations in emotional processing (Breuer et al., 2015; Elson & Ferguson, 2014; Pichon et al., 2021).

One of the primary reasons for the sustained happy-face advantage and the typical recognition pattern for negative emotions appears to be the level of aggression among the participants. Incidentally, self-reported aggression levels were comparable between groups and demonstrated "no reliable association" with violent media exposure. This trend is consistent across all three experiments. Moreover, in Experiment 1, statistically controlling for trait aggression reduced several emotional main effects to non-significance, underscoring the central role of individual predispositions in emotional processing. This pattern is consistent with contemporary critiques of the GAM, which emphasize that aggression is multiply determined by personality traits, developmental history, and environmental context, rather than by media exposure alone (Ferguson, 2015b; Przybylski & Weinstein, 2019). However, as acknowledged in the limitations of each study, the observed patterns of facial emotion recognition may not generalize to individuals who are "dispositionally aggressive" and simultaneously engage in violent video gaming. The present research, therefore, highlights the need for future studies to incorporate a broader range of dispositional factors as control variables to more accurately assess how violent video game exposure interacts with individual predispositions to shape emotional processing.

Beyond directly testing the assertions of the GAM, all three experiments revealed a distinctive pattern that emerged as a post hoc exploratory finding. Habitual violent video game players consistently demonstrated relatively higher levels of cognitive and emotional processing efficiency compared to their respective control groups. In particular, gaze behavior analyses indicated that violent gamers allocated attention more strategically, sustaining fixations on diagnostically informative facial regions rather than engaging in diffuse visual scanning. Accordingly, the observed group differences are more appropriately interpreted as perceptual efficiencies associated with gameplay mechanics, rather than as consequences of violent thematic content. This distinction reinforces the argument that critiques of violent video games often conflate violent content with interactive mechanics, thereby overlooking the substantial cognitive demands inherent in action gameplay. Nevertheless, because the present research did not explicitly hypothesize enhanced cognitive or emotional efficiency among habitual violent video gamers, future studies should systematically examine whether action gameplay contributes to improved attentional control or more efficient processing of emotional cues when compared with non-gamers or nonviolent gamers.

6.2. Significance of Present Research

Although the GAM was originally proposed to explain aggression as the product of personal and situational factors, most works in this line foreground media content as a salient situational input (Bushman &

Anderson, 2002). This move effectively positioned the GAM as a framework in which exposure to violent entertainment could be treated as a pathway through which aggressive thoughts, affect, and behavior might be shaped. While many early studies aligned with the model's logic, subsequent applications sometimes pushed the interpretation further than the framework warranted, presenting video games and related media as direct "sources of aggression" and, by implication, as inherently harmful. Such overextensions helped fuel a moral panic in which media effects were attributed disproportionately to a single cultural product. In some cases, this encouraged research and public commentary that implicitly treated media exposure as sufficient to explain aggression, while paying less attention to other obvious contributors, such as dispositional factors, family and peer environments, stress, social adversity, and broader contextual risks. Although a substantial body of critical scholarship has questioned strong causal claims and highlighted inconsistent effects, concerns about publication bias and selective visibility persist, particularly when simple, alarming messages disseminate more rapidly than nuanced evidence. Given the rapid growth and normalization of gaming over the past decade, the present findings are significant as they challenge moral panic surrounding violent video games. The balanced evidence can identify harms when they exist, but also correct narratives that overstate what the data can support.

The GAM proposes that repeated exposure to violent media can shape social information processing in ways that increase hostile cognition and reduce sensitivity to prosocial or positive cues (Anderson & Bushman, 2002). In the context of emotion recognition, a straightforward implication is that violent video game exposure should push attention toward threat cues (e.g., anger) and undermine efficient processing of positive emotions. However, the present research directly challenges that implication. Recognition efficacy for happiness remained intact and, in some comparisons, was better among violent gamers. This theoretical correction has practical importance because the violent video game debate has repeatedly shown features of increased social anxiety, simplified causal narratives, and the tendency to treat some of the youth outcomes (e.g., new media) as being driven by a single cultural object. Work explicitly analyzing “video game moral panic” argues that public fears have sometimes outpaced evidence, particularly when research findings are filtered through politicized or sensational framings. The present research provides a grounded counterpoint to alarmist claims. In doing so, it does not argue that media can never matter, but it demonstrates that broad GAM assertions about “enduring affective impairment” from violent games should be stated more cautiously and separated from moralized public narratives.

Another arguably defining contribution of this research is its methodological approach. Much of the violent media literature relies heavily on endpoint performance measures (e.g., response accuracy, response time, response inhibition) or on broad physiological indices that can be difficult to interpret mechanistically. These measures can tell us whether differences exist, but they often struggle to clarify why they exist. The integration of eye-tracking shifts the evidentiary standard from “outcome” only inference to the very “process” underlying emotional processing. By analyzing gaze distribution via fixation metrics across facial regions, the research tests the idea of biased information processing directly, asking whether violent gamers “preferentially attend” to hostile or negative cues during emotion recognition.

The integration of gaze behavior analyses has direct implications for the adjudication of several theoretical assertions. Desensitization accounts have been influential in the GAM tradition, with studies reporting reduced physiological responses to violence following violent gameplay (Carnagey et al., 2007) and neural/ERP correlates interpreted as desensitization in chronic exposure work (Bartholow et al., 2006). Yet, the present findings indicate that reduced efficiency for negative emotions occurred similarly across violent gamers and controls and can be parsimoniously explained by perceptual salience rather than a violence-specific dampening of emotional responsiveness. In other words, the study does not merely report "null effects," but it offers an alternative mechanism that explains the observed pattern without assuming chronic harm from violent content.

Beyond these observations, there is also a contextual significance of this research. These experiments are among the early controlled investigations examining violent gaming and emotional processing in an Indian sample, using behavioral outcomes and gaze metrics. This matters because most foundational evidence cited in the violent game debate is drawn from Western samples and contexts, even though gaming is now a global practice with culturally specific norms of play, socialization, and exposure. The Indian context is particularly timely. India has been actively positioning gaming within a broader "creative economy" agenda, often framed under the AVGC (Animation, Visual Effects, Gaming, Comics, and Extended Reality) umbrella. In such an environment, evidence about gaming's psychological correlates is not merely academic. It can shape how the public interprets gaming, how educators respond to "game-based learning," how institutions frame student gamers, and how policymakers balance industry promotion with public concerns. The present findings add an important perspective to this discussion: among typical, non-addictive patterns of play, habitual engagement with violent video games does not appear to produce measurable cognitive or affective impairment. These results can help counter everyday, culturally reinforced assumptions that treat video games as inherently harmful. Rather than being framed as a risky or deviant activity by default, gaming can be understood more accurately as a mainstream form of entertainment that is generally safe for most users when practiced in moderation. These findings are especially relevant because they address a common fear that the growth of gaming culture will inevitably carry widespread "socio-emotional" or sociocultural" costs. Accordingly, as India is heavily investing in a creative economy in the form of video games, public discourse and policy can benefit from locally generated research that separates cultural anxiety from observable psychological outcomes.

CHAPTER 7

CONCLUSION

The present thesis set out to address a persistently contested question within media effects research, namely, whether habitual engagement with violent video games leads to increased aggression, often argued to be reflected as disruptions in emotional information processing. This question occupies a pivotal position in debates surrounding the GAM and broader public discourses that often portray violent video games as "inherently" harmful. Through a systematic investigation spanning three experiments, the thesis critically examined this assumption by integrating some widely used performance measures (response accuracy, response time, and response inhibition) along with fixation metrics. Across all objectives and methodological stages, the cumulative evidence does not support the proposition that habitual violent video gaming is associated with aggression or impaired facial emotion recognition.

One of the most theoretically significant findings of this research was the consistent sustenance of the "happy-face advantage" among violent video gamers. Across experiments, participants showed greater accuracy and faster response times when recognizing happy facial expressions than when recognizing negative emotions. This pattern aligns with the recognition hierarchy in emotion research, wherein positive expressions enjoy a perceptual and cognitive advantage. Crucially, the data revealed no evidence of a reduced happy-face advantage among violent gamers or in any control groups across the experiments. This observation directly contradicts the GAM claims that violent video game exposure dampens sensitivity to positive emotional cues or selectively creates a bias in emotional information processing.

Where reduced efficiency in recognizing negative emotions was observed, particularly for fear, these effects were better explained by attentional mechanisms rather than by emotional desensitization. Eye-tracking data from Experiments 2 and 3 indicated that scattered gaze patterns, rather than reduced emotional sensitivity, accounted for variations in recognition performance. This distinction is important, as it reframes apparent deficits in emotional processing as differences in attentional allocation rather than as affective impairments. Across all three experiments, violent video gamers consistently demonstrated preserved emotional processing capacities, further undermining strong interpretations of the GAM that posit habitual violent game play as a causal driver of emotional dysfunction

From a methodological standpoint, Experiment 1 established a critical baseline by adopting an emotional go/no-go paradigm (Tottenham et al., 2011), with neutral faces serving as no-go stimuli. While the inclusion of free-choice trials represented a methodological exploration, their limited utility informed subsequent refinements. Experiments 2 and 3 employed a modified paradigm in which neutral faces were replaced with non-target emotional expressions, thereby increasing task sensitivity. The progressive inclusion of response inhibition measures in Experiment 3 further strengthened the design. The iterative modifications across experiments, alongside the use of multiple control groups, reflect a proactive research strategy aimed at addressing emerging gaps within the study itself. This progressive refinement of experimental paradigms reflects a methodological strength of this thesis. Rather than relying on a single operationalization of emotional processing, the research adopted a convergent approach that minimized construct ambiguity. This strategy increased the internal validity of the findings and ensured that conclusions were not contingent on idiosyncratic task features. Such rigor is particularly important in a research area marked by inconsistent findings and strong theoretical polarization.

A major methodological contribution of this thesis lies in its integration of eye-tracking as a core analytical tool. Fixation metrics provided valuable insights into perceptual salience and attentional prioritization during the recognition of emotions. By demonstrating that gaze dispersion, rather than emotional insensitivity, accounted for certain performance differences, the thesis highlights the importance of incorporating attentional metrics into media effects research. At the same time, the findings suggest several promising avenues for future research. Expanding beyond fixation duration to include saccades, microsaccades, scan paths, and pupillometry would enable a more comprehensive characterization of the underlying cognitive and affective processes. Integrating such gaze indices with physiological measures holds considerable potential for advancing understanding of emotional engagement in digital media contexts.

The thesis also underscores the utility of facial emotion recognition paradigms as markers of hostile information processing and desensitization. However, it simultaneously draws attention to a critical limitation that warrants careful consideration. Most standardized facial emotion databases are derived predominantly from Western, Caucasian samples. This reliance raises concerns regarding ecological validity, particularly in non-Western contexts. Given that the present research was conducted in India, the absence of validated facial expression databases representing South Asian faces constitutes a significant constraint. Developing culturally representative stimulus sets is therefore not merely a methodological refinement but an essential prerequisite for advancing media effects research in the region.

In terms of gaming exposure, participants reported extensive engagement with contemporary multiplayer titles such as *Valorant* and *BGMI*, reflecting prevailing gaming trends within India. While this enhances the contextual relevance of the findings, it also highlights the need for greater specificity in future research. The continued use of the umbrella term “violent video games” risks obscuring meaningful differences across genres. Action shooters, tactical multiplayer games, and other violent titles place distinct cognitive, emotional, and strategic demands on players. Treating violence as a single construct may therefore oversimplify the ways in which interactive media shape user experience. Future research should adopt frameworks specific to genres that move beyond simplistic content classifications.

Importantly, while the findings of this thesis challenge select overstatements associated with the GAM, this challenge is intentionally circumscribed. The thesis does not deny the existence of problematic gaming behaviors or dismiss concerns related to aggression, addiction, or maladaptive use. Participants were screened for gaming addiction, and the conclusions drawn here do not extend to individuals exhibiting pathological gaming patterns. Moreover, the absence of elevated dispositional aggression among participants likely contributed to the observed outcomes. These factors necessitate caution when generalizing the findings to populations characterized by extreme personality traits or clinical vulnerabilities.

Lastly, this thesis makes a substantive contribution to media effects research within the Indian context, an area that remains underrepresented despite the country’s rapidly expanding gaming population. Rather than advancing an uncritical endorsement of violent video games, the research seeks to temper moral panic and deterministic narratives with empirically grounded evidence. By demonstrating that habitual violent video game engagement does not necessarily impair emotional processing or elevate aggression, the thesis encourages a more balanced understanding of digital media effects. In doing so, it calls for sustained interdisciplinary collaboration among researchers, clinicians, educators, and policymakers to foster scholarly discourse and promote healthier, more informed digital environments.

APPENDIX – A

INFORMED CONSENT

STUDY PROCEDURE: EXPERIMENT 1

"During this task, you will view a series of human faces presented one at a time on a computer screen. Each image will display a face showing an emotional expression. Before the task begins, you will be informed which specific emotion you are required to look for (for example, happiness, anger, fear, or sadness). If the face on the screen shows the instructed emotion, you should respond by pressing the right mouse button as quickly and accurately as possible. If the face does not show the instructed emotion, you should not press any button and simply wait for the next image to appear. Some of the faces will appear with a blue tint. For these faces, there is no strictly correct or incorrect response. You are asked to rely on your intuition or gut feeling to decide whether or not you want to press the right mouse button. You may choose to respond or not respond to these blue-tinted faces based solely on your judgment. Each facial image will be displayed for a very brief time, and you are encouraged to respond quickly while remaining as accurate as possible. You will be given a practice or trial set before proceeding further. You may take breaks if needed, and you are free to stop participating at any point without any penalty."

STUDY PROCEDURE: EXPERIMENTS 2 & 3

1. Calibration Stage: "You will see a red ball moving across the screen from one position to another. The ball will pass through nine different points on the screen. At the center of the ball, you will notice a small dot. Please keep your eyes focused on the center of the dot and follow the ball smoothly as it moves from one position to the next. Try to maintain the same sitting posture throughout the calibration and the experiment. Please avoid unnecessary head or body movements, as remaining still will help ensure accurate measurement. If you feel uncomfortable at any point, you may inform the experimenter or take a short break before continuing During the experiment, you will see a series of human faces presented one at a time on the screen of the eye tracker. Each image will display a face showing an emotional expression. Before the task begins, you will be informed which specific emotion you are required to look for (for example, anger, disgust, fear, happiness, or sadness). If the face on the screen shows the instructed emotion, you should respond by pressing the right mouse button as quickly and accurately as possible. If the face does not show the instructed emotion, you should not press any button and simply wait for the next image to appear. Each facial image will be displayed for a very brief time, and you are encouraged to respond quickly while remaining as accurate as possible. You will be given a practice or trial set before proceeding further. You may take breaks only after completing one full block. You are free to stop participating at any point without any penalty."

CONFIDENTIALITY

"Your responses to the questionnaires and the results of the current experimental task will be anonymous. Please do not write any identifying information on your response sheets. Every effort will be made by the researchers to preserve your confidentiality, including the following:

- Assigning code numbers for participants that will be used on all research notes and documents
- Keeping notes, transcriptions, and any other identifying participant information in a locked file cabinet in the personal possession of the researchers.

Participant data will be kept confidential, except when the researcher is legally obligated to report specific incidents. These incidents include, but are not limited to, incidents of abuse and suicide risk."

CONTACT INFORMATION

"If you have questions at any time about this study, or you experience adverse effects as a result of participating in this study, you may contact the researcher whose contact information is provided at the end. If you have questions regarding your rights as a research participant, or if problems arise that you do not feel you can discuss with the Investigator, please contact the Human Factors & Applied Cognition Lab, Vanadium Pod, IIT Indore."

VOLUNTARY PARTICIPATION

"Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you may withdraw at any time without providing a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researchers. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed."

CONSENT

I have read and understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without providing a reason and without incurring any costs. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature ________________________Date __________

Investigator's signature _______________________Date __________

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APPENDIX – B

PRE-SCREENING SURVEY

SCREENING OVERVIEW:

Participants completed a pre-screening survey across three experiments on (a) Gaming Exposure Classification, (b) Violent Content Exposure.

1. Have you played any video game (mobile, console, PC) in the past 12 months?

   a. Yes

   b. No

2. If yes, when was the last time you played a video game?

   a. Within the past week

   b. Past month

   c. 1–6 months ago

   d. 6–12 months ago

   e. More than 12 months ago

Specify ____________________________

3. On average, how many hours per week do you spend playing video games?

   a. 0 hours

   b. <1 hour

   c. 1–3 hours

   d. 4–7 hours

   e. 8–14 hours

   f. 15+ hours

4. List up to five video games you have played most frequently in the past 6 months.

5. How often do your games involve intentional harm to other characters (e.g., shooting, fighting, killing)?

a. Never
b. Rarely
c. Sometimes
d. Often
e. Very often

6. In the games you play, how often are you required to actively initiate violent actions to progress?

a. Never
b. Rarely
c. Sometimes
d. Often
e. Very often

8. How often do you watch or consume violent content (e.g., news, films, TV)?*

a. Never
b. Rarely
c. Sometimes
d. Often
e. Very often

**Note*: This question was used in Experiment 1 to assess NVGS who consume passive violent content.

APPENDIX – C

KDEF DATA SET FOR EXPERIMENT 1

The KDEF data set employs a standardized filename coding system to classify images by session, actor gender, identity, emotional expression, and viewing angle. Filenames indicate the recording session (A or B), gender (F = female, M = male), a two-digit identity number, a two-letter emotion code (e.g., AN = angry, DI = disgust, AF = fear, HA = happy, NE = neutral, and, SA = sadness), and a suffix denoting head orientation (e.g., S = straight/frontal view).

Anger	Fear	Happy	Sadness	Neutral
AF02ANS	AF01AFS	AF01HAS	AF02SAS	AF01NES
AF04ANS	AF03AFS	AF03HAS	AF04SAS	AF02NES
AF06ANS	AF05AFS	AF05HAS	AF06SAS	AF03NES
AF08ANS	AF07AFS	AF07HAS	AF08SAS	AF04NES
AF10ANS	AF09AFS	AF09HAS	AF10SAS	AF05NES
AF12ANS	AF11AFS	AF11HAS	AF12SAS	AF06NES
AF14ANS	AF13AFS	AF13HAS	AF14SAS	AF07NES
AF16ANS	AF15AFS	AF15HAS	AF16SAS	AF08NES
AF18ANS	AF17AFS	AF17HAS	AF18SAS	AF09NES
AF20ANS	AF19AFS	AF19HAS	AF20SAS	AF10NES
AF22ANS	AF21AFS	AF21HAS	AF22SAS	AF11NES
AF24ANS	AF23AFS	AF23HAS	AF24SAS	AF12NES
AF26ANS	AF25AFS	AF25HAS	AF26SAS	AF13NES
AF28ANS	AF27AFS	AF27HAS	AF28SAS	AF14NES
AF30ANS	AF29AFS	AF29HAS	AF30SAS	AF15NES
AF32ANS	AF31AFS	AF31HAS	AF32SAS	AF16NES

AF34ANS	AF33AFS	AF33HAS	AF34SAS	AF17NES
AF36ANS	AF35AFS	AF35HAS	AF36SAS	AF18NES
AF38ANS	AF37AFS	AF37HAS	AF38SAS	AF19NES
AF40ANS	AF39AFS	AF39HAS	AF40SAS	AF20NES
AM01ANS	AM02AFS	AM02HAS	AM01SAS	AF21NES
AM03ANS	AM04AFS	AM04HAS	AM03SAS	AF22NES
AM05ANS	AM06AFS	AM06HAS	AM05SAS	AF23NES
AM07ANS	AM08AFS	AM08HAS	AM07SAS	AF24NES
AM09ANS	AM10AFS	AM10HAS	AM09SAS	AF25NES
AM11ANS	AM12AFS	AM12HAS	AM11SAS	AF26NES
AM13ANS	AM14AFS	AM14HAS	AM13SAS	AF27NES
AM15ANS	AM16AFS	AM16HAS	AM15SAS	AF28NES
AM17ANS	AM18AFS	AM18HAS	AM17SAS	AF29NES
AM19ANS	AM20AFS	AM20HAS	AM19SAS	AF30NES
AM21ANS	AM22AFS	AM22HAS	AM21SAS	AM01NES
AM23ANS	AM24AFS	AM24HAS	AM23SAS	AM02NES
AM25ANS	AM26AFS	AM26HAS	AM25SAS	AM03NES
AM27ANS	AM28AFS	AM28HAS	AM27SAS	AM04NES
AM29ANS	AM30AFS	AM30HAS	AM29SAS	AM05NES
AM31ANS	AM32AFS	AM32HAS	AM31SAS	AM06NES
AM33ANS	AM34AFS	AM34HAS	AM33SAS	AM07NES
AM35ANS	AM36AFS	AM36HAS	AM35SAS	AM08NES
AM37ANS	AM38AFS	AM38HAS	AM37SAS	AM09NES
AM39ANS	AM40AFS	AM40HAS	AM39SAS	AM10NES
AF02ANS	AF01AFS	AM02HAS	AF02SAS	AM11NES
AF04ANS	AF03AFS	AM04HAS	AF04SAS	AM12NES
AF06ANS	AF05AFS	AM06HAS	AF06SAS	AM13NES
AF08ANS	AF07AFS	AM08HAS	AF08SAS	AM14NES

APPENDIX – D

KDEF DATA SET FOR EXPERIMENTS 2 & 3

The KDEF data set employs a standardized filename coding system to classify images by session, actor gender, identity, emotional expression, and viewing angle. Filenames indicate the recording session (A or B), gender (F = female, M = male), a two-digit identity number, a two-letter emotion code (e.g., AN = angry, DI = disgust, AF = fear, HA = happy, NE = neutral, and, SA = sadness), and a suffix denoting head orientation (e.g., S = straight/frontal view).

Anger	Disgust	Fear	Happiness	Sadness
AF01ANS	AF01DIS	AF01AFS	AF05HAS	AF02SAS
AF04ANS	AF03DIS	AF03AFS	AF07HAS	AF04SAS
AF07ANS	AF05DIS	AF05AFS	AF09HAS	AF06SAS
AF10ANS	AF07DIS	AF06AFS	AF11HAS	AF10SAS
AF14ANS	AF09DIS	AF08AFS	AF13HAS	AF12SAS
AF16ANS	AF11DIS	AF09AFS	AF15HAS	AF14SAS
AF17ANS	AF13DIS	AF11AFS	AF17HAS	AF16SAS
AF20ANS	AF15DIS	AF12AFS	AF19HAS	AF20SAS
AF21ANS	AF21DIS	AF15AFS	AF21HAS	AF22SAS
AF24ANS	AF23DIS	AF17AFS	AF23HAS	AF24SAS
AF26ANS	AF25DIS	AF20AFS	AF25HAS	AF26SAS
AF28ANS	AF28DIS	AF21AFS	AF27HAS	AF28SAS
AF30ANS	AF31DIS	AF24AFS	AF29HAS	AF30SAS
AF32ANS	AF35DIS	AF30AFS	AF31HAS	AM01SAS
AF33ANS	AM01DIS	AF34AFS	AF34HAS	AM04SAS
AM01ANS	AM03DIS	AM01AFS	AM04HAS	AM06SAS

AM04ANS	AM05DIS	AM03AFS	AM06HAS	AM08SAS
AM06ANS	AM07DIS	AM04AFS	AM08HAS	AM10SAS
AM08ANS	AM09DIS	AM06AFS	AM10HAS	AM14SAS
AM10ANS	AM11DIS	AM09AFS	AM13HAS	AM16SAS
AM13ANS	AM13DIS	AM11AFS	AM15HAS	AM18SAS
AM17ANS	AM15DIS	AM12AFS	AM17HAS	AM22SAS
AM19ANS	AM17DIS	AM13AFS	AM20HAS	AM24SAS
AM20ANS	AM20DIS	AM14AFS	AM23HAS	AM26SAS
AM22ANS	AM22DIS	AM15AFS	AM26HAS	AM28SAS
AM27ANS	AM25DIS	AM16AFS	AM29HAS	AM31SAS
AM30ANS	AM27DIS	AM20AFS	AM32HAS	AM34SAS
AM32ANS	AM30DIS	AM21AFS	AM33HAS	BF06SAS
BM12ANS	AM33DIS	AM24AFS	AM34HAS	BF07SAS
BM15ANS	BF17DIS	AM33AFS	AM35HAS	BM12SAS
AF01ANS	AF01DIS	AF01AFS	AF05HAS	AF02SAS
AF04ANS	AF03DIS	AF03AFS	AF07HAS	AF04SAS
AF07ANS	AF05DIS	AF05AFS	AF09HAS	AF06SAS
AF10ANS	AF07DIS	AF06AFS	AF11HAS	AF10SAS
AF14ANS	AF09DIS	AF08AFS	AF13HAS	AF12SAS
AF16ANS	AF11DIS	AF09AFS	AF15HAS	AF14SAS
AF17ANS	AF13DIS	AF11AFS	AF17HAS	AF16SAS
AF20ANS	AF15DIS	AF12AFS	AF19HAS	AF20SAS

APPENDIX – E

GAMING ADDICTION SCALE

The Internet Gaming Disorder Scale-Short-Form (IGDS9; Pontes & Griffiths, 2015) has been utilized as a screening test to assess potential addiction trends among gamers.

INSTRUCTIONS: “These questions will ask you about your gaming activity during the past year (i.e., last 12 months). It means any activities pertaining to video games that have been played either from a computer/laptop or from a gaming console or any other kind of device (e.g., mobile phone, tablet, etc.), both online and/or offline.”

SCORING INFORMATION: Total scores can be obtained by summing up all responses given to all nine items of the IGDS9-SF and can range from a minimum of 9 to a maximum of 45 points (1 = *never* to 5 = *very often*), with higher scores being indicative of a higher degree of addiction. In order to differentiate disordered gamers from non-disordered gamers, researchers should check if participants have endorsed at least five criteria out of the nine by taking into account answers as “very often,” which translates as endorsement of the criterion.

No.	ITEM
1.	Do you feel preoccupied with your gaming behavior? (Some examples: Do you think about previous gaming activity or anticipate the next gaming session? Do you think gaming has become the dominant activity in your daily life?)
2.	Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity?

3.	Do you feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure?
4.	Do you systematically fail when trying to control or cease your gaming activity?
5.	Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game?
6.	Have you continued your gaming activity despite knowing it was causing problems between you and other people?
7.	Have you deceived any of your family members, therapists or others because the amount of your gaming activity?
8.	Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)?
9.	Have you jeopardized or lost an important relationship, job or an educational or career opportunity because of your gaming activity?

APPENDIX – F

TRAIT AGGRESSION SCALE

INSTRUCTIONS: “The following statements ask about your thoughts, feelings, and behaviors. Please indicate how characteristic each statement is of you by selecting the appropriate response on a 5-point scale (1 = *does not describe me at all* to 5 = *describes me very well)*. There are no right or wrong answers. Please respond honestly based on how you typically think and behave.”

SCORING INFORMATION: The 29-item Buss and Perry Aggression Questionnaire (BPAQ; Buss & Perry, 1992) assesses four dimensions: Physical Aggression (9 items), Verbal Aggression (5 items), Anger (7 items), and Hostility (8 items). Scoring involves summing item responses within each subscale. Two items (i.e., 9 and 16) are reverse scored before calculation. Subscale scores reflect specific aggression components, while the total aggression score is the sum of all 29 items after reverse coding.

No.	ITEM
	PHYSICAL AGGRESSION
1.	Once in a while, I can’t control the urge to strike another person.
2.	Given enough provocation, I may hit another person.
3.	If someone hits me, I hot back.
4.	I get into fights a little more than the average person.
5.	If I have to resort to violence to protect my rights, I will.
6.	There are people who pushed me so far that we came to blows.
7.	I can think of no good reason for ever hitting a person.
8.	I have threatened people I know.

9.	I have become so mad that I have broken things.
	VERBAL AGGRESSION
10.	I tell my friends openly when I disagree with them.
11.	I tell my friends openly when I disagree with them.
12.	When people annoy me, I may tell them what I think of them.
13.	I can't help getting into arguments when people disagree me.
14.	My friends say that I'm somewhat argumentative.
	ANGER
15.	I flare up quickly but get over it quickly.
16.	When frustrated, I let my irritation show.
17.	I sometimes feel like a powder keg ready to explode.
18.	I am an even-tempered person.
19.	Some of my friends think I'm a hothead.
20.	Sometimes I fly off the handle for no good reason.
21.	I have trouble controlling my temper.
	HOSTILITY
22.	I am sometimes eaten up with jealousy.
23.	At times I feel I have gotten a raw deal out of life.
24.	Other people always seem to get the breaks.
25.	I wonder why sometimes I feel so bitter about things.
26.	I know that "friends" talk about me behind my back.
27.	I am suspicious of overly friendly strangers.
28.	I sometimes feel that people are laughing at me behind my back.
29.	When people are especially nice, I wonder what they want.

APPENDIX – G

VIOLENT MEDIA EXPOSURE SCALE

Violent gaming exposure was assessed using a 12-item modified Content-Based Media Exposure Questionnaire (CBMEQ; Den Hamer et al., 2017).

INSTRUCTIONS: "The following items ask about how often you are exposed to different types of content in the media you use (e.g., television, movies, internet, social media, and video games). Please indicate how frequently you encounter each type of content across all media platforms combined. Use the 5-point scale provided (1 = *never* to 5 = *very often*). There are no right or wrong answers. Please respond based on your typical media use."

No.	HOW OFTEN DO YOU WATCH PEOPLE SHOOT AT ANOTHER PERSON ON VIDEO GAMES/TV/MOVIES/FILM CLIPS
1.	openly talk about sex?
2.	drink (a lot of) alcohol?
3.	fight?
4.	use drugs?
5.	make a fool of someone else?
6.	are having sex
7.	laugh at another person's expense?
8.	destroy someone else's belongings?
9.	say negative things about another person behind their back?
10.	steal?
10.	make someone else trip and fall for fun?
11.	shoot at another person

APPENDIX – H

CONSOLIDATED LIST OF VIDEO GAMES PLAYED BY THE PARTICIPANTS

Video Game	Genre	Platform(s)	Rating(s)
Call of Duty (series)	FPS (Shooter)	PC, PlayStation, Xbox, Mobile	M / PEGI 18
Call of Duty Mobile (CODM)	FPS (Shooter)	Mobile	17+ (App Store) / PEGI 16
Battlefield (series)	FPS (Shooter)	PC, PlayStation, Xbox	M / PEGI 18
Valorant	Tactical FPS	PC	T / PEGI 16
Counter-Strike (CS:GO)	FPS (Shooter)	PC	M / PEGI 18
BGMI (Battlegrounds Mobile India)	Battle Royale	Mobile	16+ (India rating)
Free Fire	Battle Royale	Mobile	12+ (Google Play)
Fortnite	Battle Royale / Sandbox	PC, Console, Mobile	T / PEGI 12
GTA V / GTA series	Action-Adventure	PC, PlayStation, Xbox	M / PEGI 18
GTA Vice City	Action-Adventure	PC, Mobile, Console	M / PEGI 18

Need for Speed	Racing	PC, PlayStation, Xbox	T / PEGI 12
Rocket League	Sports / Racing	PC, PlayStation, Xbox, Switch	E / PEGI 3
Assassin's Creed	Action-Adventure	PC, PlayStation, Xbox	M / PEGI 18
Age of Empires	RTS (Strategy)	PC	T / PEGI 12
Clash of Clans	Strategy	Mobile	10+ (App Store)
Clash Royale	Strategy / Card	Mobile	10+
Candy Crush	Puzzle	Mobile	3+
Subway Surfers	Endless Runner	Mobile	7+
Temple Run	Endless Runner	Mobile	9+
God of War	Action-Adventure	PlayStation, PC	M / PEGI 18
Prince of Persia	Action-Adventure	PC, Console	T / PEGI 16
Max Payne	TPS	PC, Console	M / PEGI 18
The Witcher 3	RPG	PC, PlayStation, Xbox	M / PEGI 18
Sekiro	Action-Adventure	PC, PlayStation, Xbox	M / PEGI 18
Red Dead Redemption 2 (RDR2)	Action-Adventure	PC, PlayStation, Xbox	M / PEGI 18
Minecraft	Sandbox	PC, Console, Mobile	E10+ / PEGI 7
Subnautica	Survival / Adventure	PC, Console	E10+ / PEGI 7
Block & Load	FPS (Shooter)	PC	T / PEGI 12
Mech Arena	Shooter	Mobile	12+

Standoff 2	FPS	Mobile	16+
FIFA (series)	Sports	PC, Console	E / PEGI 3
FIFA 15 / FIFA 18	Sports	PC, Console	E / PEGI 3
Tekken 3	Fighting	PlayStation	T / PEGI 12
Hitman	Stealth	PC, Console	M / PEGI 18
Contra	Run & Gun	Console	T / PEGI 12
Spider-Man / Miles Morales	Action-Adventure	PlayStation, PC	T / PEGI 16
Metal Gear Solid V (MGS V)	Stealth	PC, Console	M / PEGI 18
Hill Climb Racing	Racing	Mobile	3+
Road Zombie	Action	Mobile	12+
Fan Guns (likely casual shooter)	Casual / Shooter	Mobile	12+
F1 Racing	Racing	PC, Console	E / PEGI 3

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