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Violent Video Game Play Impacts Facial Emotion Recognition

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This study assessed the speed of recognition of facial emotional expressions (happy and angry) as a function of violent video game play. Color photos of calm facial expressions morphed to either an angry or a happy facial expression. Participants were asked to make a speeded identification of the emotion (happiness or anger) during the morph. Typically, happy faces are identified faster than angry faces (the happy-face advantage). Results indicated that playing a violent video game led to a reduction in the happy face advantage. Implications of these findings are discussed with respect to the current models of aggressive behavior. Aggr. Behav. 33:353–358, 2007. © 2007 Wiley-Liss, Inc.

Keywords: video games; emotion; violence; media; recognition; reaction time

INTRODUCTION

For nearly two decades, the effects of media violence, and violent video games, in particular, have been empirically scrutinized. Consistently, correlational and experimental research has linked exposure to media violence with increases in aggressive behavior, thoughts, and feelings in children, adolescents, and young adults [Anderson and Bushman, 2001; Anderson and Dill, 2000; Ballard and Lineberger, 1999; Fling et al., 1992; Griffiths and Hunt, 1995]. Moreover, the effect sizes for media violence and aggression tend to be stronger than the effect sizes for condom use and sexually transmitted HIV, passive smoking and lung cancer at work, exposure to lead and IQ scores in children, nicotine patch and smoking cessation, and calcium intake and bone mass [Anderson and Bushman, 2001].

Recently, Kirsh et al. [2006] examined the influence of violent media consumption on the perceptual processing of facial expressions. Typically, positive emotions are more quickly identified than negative emotions, a phenomenon known as the happy-face advantage [e.g., Billings et al., 1993; Leppänen et al., 2003]. The focus of the Kirsh et al. [2006] study was to determine if weekly violent media consumption led to a reduction in the happy-face advantage, thus signifying a violent media-induced negative processing bias. Participants in this study watched a series of calm facial expressions morph (i.e., change) to either an expression of happiness or anger. Participants made a speeded identification of the emotion (happiness or anger) during the morph sequence. Results indicated that, independent of trait hostility, participants high in media violence consumption were faster at identifying anger, and slower at identifying happiness, relative to the subjects low in violent media consumption. The findings suggest that long-term exposure to violent media can alter the processing of novel information, and in particular bias the interpretation of emotional expression. However, it has yet to be established whether short-term effects of this type directly follow violent media consumption.

The interpretation of basic emotional expressions (i.e., happiness, sadness, anger, fear, disgust, and surprise) has been found to be influenced by factors external to the individual, such as situational information and verbal labels [Carroll and Russell, 1996]. Such perceptual biases may also arise as a result of exposure to violent media. Previous research has connected violent media consumption

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and the expression of affect [Anderson and Bushman, 2001]. However, no research has assessed the immediate influence of violent video game play on affect recognition. Yet, there are good reasons to expect an immediate effect. For example, Kirsh et al. [2005], found that individuals exposed to violent video games showed greater Stroop interference for negatively valenced words (in comparison to neutral words) than participants playing nonviolent video games. Violent video game play primes aggressive cognitions and affect and thus can induce a processing bias, subsequently rendering emotionally congruent stimuli more attentionally salient, leading them to receive greater cognitive processing. The purpose of this study is to assess the impact of violent video game play on the identification of positive and negative emotions.

To address this issue, participants played either a violent or nonviolent video game and then watched a series of calm facial expressions morph (i.e., change) to either an expression of happiness or anger. Participants were asked to make a speeded identification of the emotion (happiness or anger) as soon as possible during the morph sequence. On the basis of the contention that exposure to media violence increases the salience of negatively valenced information [Kirsh et al., 2006], it is hypothesized that participants playing the violent video game will evidence a negative processing bias, relative to participants playing the nonviolent video game.

METHOD

Participants were 197 students (69% female; 86% Caucasian) from lower-division psychology courses at a public liberal arts college in western New York State. Participants received extra credit for participation in this study. Participants' ages ranged from 17 to 23 years of age.

Materials

Video games. All video games were played on a Dell PC with specifications (e.g., RAM) exceeding those of the game requirements. The violent video game used in this study was *House of the Dead 2* (*HOTD2*) and the nonviolent video game was *Kayak Extreme (KE)*. *HOTD2*, is a first person shooter game, in which the object is for the player to shoot and kill zombies and assorted demonic creatures. Participants fired a handheld PC USB light-gun [Act-Labs, 2002], which has the look and feel of a silver snub nosed weapon, during this game. The video game was fixed using a "trainer" (i.e., an independently run computer program), such that participants had an unlimited number of lives. This was done in an effort to reduce game related frustration from "dying." Furthermore, it allowed participants to play for 15 min without having to restart the game. Additionally, the color of the blood depicted in the game was changed from green (the default color) to red using a "blood patch" (a computer program). *HOTD2* contains frequent violent acts and excessive gore (e.g., heads exploding; arms shot off; spurting blood). Over the course of the 15 min game play period, participants typically kill hundreds of zombies and demonic creatures.

Kayak Extreme involves players kayaking down rapids in three different world locations. This game was also rigged using a trainer to prevent disqualifications from missing "time gates" while proceeding down a rapid. This allowed participants to kayak down different rapids, instead of repeating the same rapid over and over again. Additionally, fixing the game helped reduce game-related frustration resulting from failing to complete the course due to disqualification as a result of missing too many gates.

Video game rating form. Participants rated their assigned video game on its level of difficulty (Difficulty), excitement (Excitement), humor (Humor), enjoyability (Enjoyability), frustration (Frustration), and violence (Violence). Each question involved a 7-point unipolar scale.

Face stimuli. Depictions of closed-mouth calm facial expressions and corresponding (i.e., same model depicting the emotion) expressions of closed-mouth anger and closed-mouth happiness were taken from the NimStim Face Stimulus Set [MacArthur Research Network on Early Experience and Brain Development, 2002].[1] The NimStim Face Stimulus Set contains color photographs of adult males and females, of varying races, depicting frontal views of emotional expressions. For this study, we used 12 facial expressions (six angry, six happy) for a block of practice trials, followed by an experimental block of 60 expressions (30 angry, 30 happy). Within the experimental block, 30 different models were used, each expressing happiness and anger. Of the 30 models used in the experimental block, 19 were males and 11 were females. Twenty of the models were Caucasian (five females), seven of

[1]Development of the MacBrain Face Stimulus Set was overseen by Nim Tottenham and supported by the John D. and Catherine T. MacArthur Foundation Research Network on Early Experience and Brain Development. Contact Nim Tottenham at tott0006@tc.umn.edu for more information concerning the stimulus set.

the models were African American (three females), two were Asian (both female), and one was classified as other (female). See Figure 1 for a sample of four dynamic sequences at 0, 25, 50, 75 and 100% changed.

Creation of the dynamic stimuli. For each corresponding pair of facial expressions (i.e., calm/happy or calm/angry) a dynamic facial expression was created by morphing (i.e., changing) the calm expression to either happiness or anger using the computer program Magic Morph [iTinysoft, 2002]. To create each morph, the start emotion (i.e., calm) and the target emotion (e.g., happy) were matched using approximately 75 feature points. For instance, the corner of the left upper lip for the start emotion (i.e., calm) was matched to the corner of the left upper lip for the target emotion (e.g., happy). Magic Morph interpolates the intervening points between the start and target images to create new images. A total of 20 Bitmap images were created for each dynamic facial expression. When viewed in sequence, the 20 bitmap images give the appearance of a calm person becoming either angry or happy. For each photographed individual, a dynamic facial expression was created to depict emotional expressions changing from calm to angry and from calm to happy.

Dynamic emotion identification task (DEIT). Stimulus presentation and response collection was accomplished using custom scripts created in E-Prime (Psychology Software Tools, 2002). Each trial began with a warning signal (fixation cross), followed 500 ms later by the presentation of the dynamic facial expression. Each dynamic facial expression was created by displaying 20 individual bitmaps, each for 120 ms. Half of the participants were instructed to press the "z" key if they identified a dynamic facial expression changing from calm to

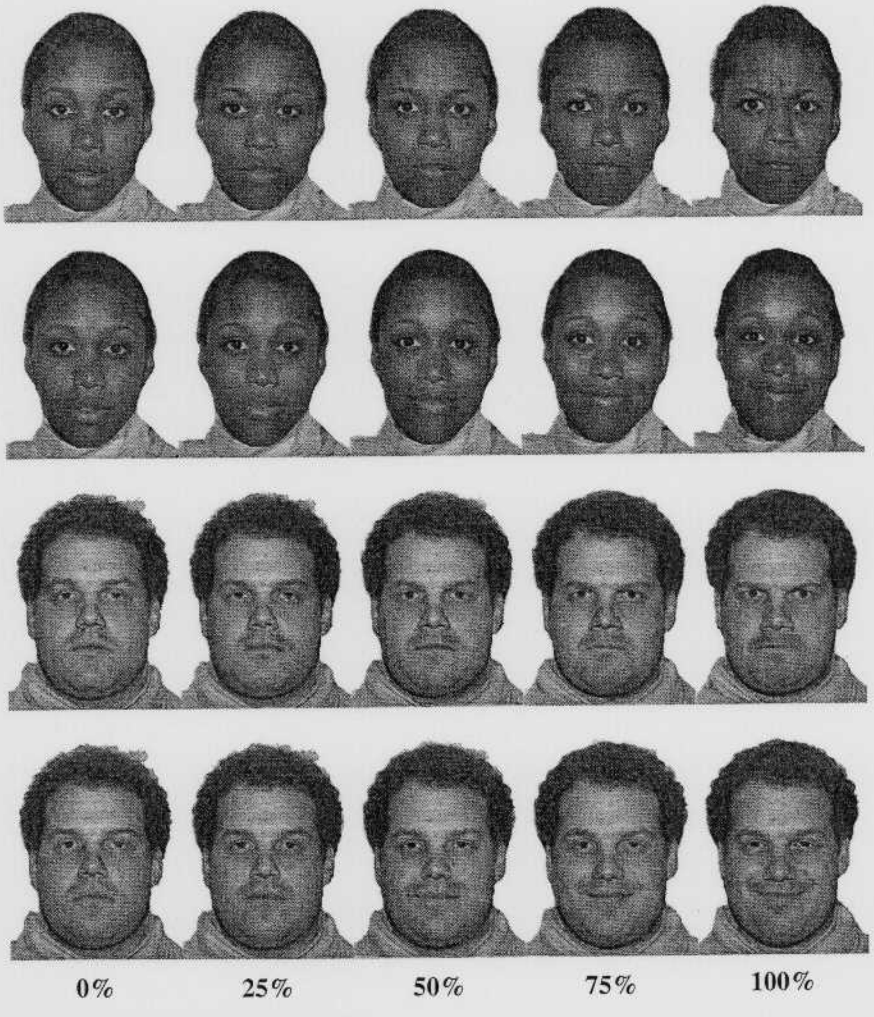

Fig. 1. Dynamic sequences at 0, 25, 50, 75 and 100% changed.

angry and the "/" key if they identify the dynamic facial expression changing from calm to happy; the other half of the subjects were randomly assigned within gender to the opposite response mapping condition. Stimulus displays were response terminated, and participants were notified of incorrect responses by a red "X" appearing in the middle of the screen. Trials were force paced, with an intertrial interval of 2.5 sec. The ordering of the 30 calm-to-angry and 30 calm-to-happy dynamic facial expressions was randomly set for each participant.

Emotion effect. The variable Emotion Effect was created for each individual by subtracting the average RT for calm/happy dynamic facial expression from the average RT for calm/angry dynamic facial expression. Positive scores thus represent faster recognition of happy expressions, a finding that is typically observed [i.e., the happy-face advantage; e.g., Billings et al., 1993; Kirsh et al., 2006; Leppänen et al., 2003]. Thus, larger Emotion Effect scores represent a larger happy-face advantage, whereas smaller Emotion Effect scores represent a smaller happy-face advantage (a score of 0 would indicate no advantage for recognizing happy faces).

Procedure

Within gender, participants were randomly assigned to play either the violent or nonviolent video game. After the game play was completed, participants were randomly assigned to one of the two response mappings. To familiarize participants with the task, and thus reduce error, a series of 12 practice expressions (six calm/angry, six calm/happy) were presented. Following the brief (less than 2 min) training period, the DEIT was conducted. The dynamic facial expressions used during the training period were not used during the experimental task.

RESULTS

Preliminary Analyses

DEIT. Participants were excluded from the study if their performance on the DEIT resulted in an error rate greater than 15%. Based on criterion, less than 2% of participants were excluded from subsequent analyses.

Video game ratings. To verify that the violent and nonviolent video games were categorized correctly, a 2 (Gender) × 2 (Video Game) analysis of variance (ANOVA) was conducted to test for differences in the perceived violence of the video games. Results indicated a significant main effect for Video Game, $F(1, 193) = 1{,}188.2$, $P < 0.0001$, $\eta^2 = 0.86$, observed power = 1.0, with *HOTD2* being rated as significantly more violent than *Kayak Extreme*. No other significant effects were observed.

To test for perceived differences in the experience of playing the violent and nonviolent video games, a series of 2 (Gender) × 2 (Video Game) ANOVAs was conducted. For Frustration, results indicated a significant main effect for Gender, $F(1, 193) = 8.04$, $P < 0.01$, $\eta^2 = 0.04$, observed power = 0.82, with females finding the video games more frustrating than males. The main effect for Video Game approached significance, $F(1, 193) = 3.43$, $P < 0.07$, $\eta^2 = 0.02$, observed power = 0.54, with participants reporting more frustration associated with nonviolent video game play than with violent video game play. For Excitement, the main effects for Gender, $F(1, 193) = 3.96$, $P < 0.05$, $\eta^2 = 0.02$, observed power = 0.51, Video Games, $F(1, 193) = 15.8$. $P < 0.001$, $\eta^2 = 0.08$, observed power = 0.97 and the Gender by Video Game interaction effect were all significant, $F(1, 193) = 22.6$, $P < 0.001$, $\eta^2 = 0.10$, observed power = 0.99. Inspection of the means revealed that, overall, males found video game play more exciting than females, *HOTD* was rated more exciting than *KE*, and that males playing *HOTD* reported the greatest level of excitement. For Humor, the main effect for Video game was significant, $F(1, 193) = 11.6$. $P < 0.001$, $\eta^2 = 0.06$, observed power = 0.92, with participants rating the violent video game as significantly more humorous than the nonviolent video game. For Enjoyability, the main effect for Gender and the Gender by Video Game interaction effect were significant, $F(1, 193) = 11.6$. $P < 0.001$, $\eta^2 = 0.06$, observed power = 0.92 and $F(1, 193) = 20.7$. $P < 0.001$, $\eta^2 = 0.10$, observed power = 0.99, respectively. Results indicated that males enjoyed video game play more than females and that, in particular, males enjoyed violent video game play the most. For Difficulty, there was a significant Gender by Video Game interaction effect, $F(1, 193) = 5.6$. $P < 0.02$, $\eta^2 = 0.03$, observed power = 0.66, with females finding the nonviolent video game the most difficult to play. See Table I for mean ratings of the video games as a function of gender. Given that the violent and nonviolent video games were perceived differently, and that these differences could influence performance on the DEIT and perceived levels of game-related violence, frustration, difficulty, excitement, humor, and enjoyability were entered as covariates in subsequent analyses.

TABLE I. Mean Rating Scores for Video Games as a Function of Gender

	Violent			Nonviolent		
Rating	Male	Female	Total	Male	Female	Total
Violence	6.0	5.8	5.9	1.1	1.4	1.3
Frustration	3.2	3.7	3.5	3.5	4.3	3.9
Excitement	5.2	3.9	4.6	3.5	4.0	3.8
Humor	3.6	3.3	3.4	2.4	2.7	2.6
Enjoyability	5.2	3.5	4.4	3.9	4.1	4.0
Difficulty	3.8	3.6	3.7	3.6	4.5	4.0

Main Analyses

To test the effects of violent media consumption on the Emotion Effect, a 2 (Video Game) $\times$ 2(Gender) analysis of covariance (ANCOVA) was conducted. As noted above, the Emotion Effect was calculated for each participant by subtracting their average RT for identifying dynamic happy facial expressions from their average RT for identifying dynamic angry facial expression (based on correct responses only). The main effect for Video Game on the Emotion Effect was significant, $F(1, 187) = 4.3$, $P < 0.05$, $\eta^2 = .02$, observed power $= 0.54$. Results (in ms) indicated that participants playing the violent video game showed a significantly reduced happy-face advantage ($M = 2.5$ ms; $SE = 23$) in comparison to those playing the nonviolent video game ($M = 95$ ms; $SE = 24$). The ANCOVA also revealed significant covariate effects for enjoyment, $F(1, 187) = 5.8$, $P < 0.05$, $\eta^2 = 0.03$, observed power $= 0.66$, and violence, $F(1, 187) = 4.6$, $P < 0.05$, $\eta^2 = 0.02$, observed power $= 0.56$. All other main effects and interaction effects were nonsignificant. The error rate was less than 2% for each type of dynamic facial expression. Comparable analyses were run on the error rates. None of the main effects or interactions reached significance, and the pattern was not consistent with the presence of a speed-accuracy tradeoff.

DISCUSSION

Previous research has shown that participants are generally faster to identify happy compared to angry expressions, a phenomenon referred to as the happy-face advantage [e.g., Billings et al., 1993; Kirsh et al., 2006; Leppänen et al., 2003]. Although the happy-face advantage occurs in part due to the distinctiveness of the visual features of happy faces and the ambiguity of negative facial expressions, Leppänen et al. [2003] contend that the identification of anger and joy can be moderated by mood inducing stimuli. For instance, Leppänen and Hietanen [2003] found that the presence of pleasant or unpleasant odors modulated the happy-face advantage. Moreover, the present findings suggest that just as odor-based environmental stimuli can bias the speeded identification of positive and negative emotional expressions, so too can media violence. Importantly, the reduction of the happy-face advantage that follows violent video game play occurs even after emotional factors associated with video game play that have the potential to modulate the happy-face advantage (e.g., frustration, enjoyment) are taken into consideration.

The results of this study are consistent with earlier research finding relationships between exposure to violent media and aggressive biases in social information processing [Anderson and Bushman, 2002; Anderson and Dill, 2000; Bushman and Geen, 1990; Huesmann et al., 2003; Kirsh, 1998; Kirsh and Olczak, 2002; Kirsh et al., 2005; Lynch et al., 2001]. In addition, our results are consistent with Bushman's [1998] contention that exposure to violent media primes an individual's aggressive network and that, in turn, such networks influence the processing and interpretation of social information. In this study, this priming (and the resulting processing bias) acted to reduce the identification advantage typically enjoyed by positive facial expressions. Moreover, the current findings are consistent with previous assessments of attentional bias which have demonstrated links between psychopathology (e.g., panic disorder, generalized anxiety disorder, depression), personality characteristics (e.g., anxiety, trait anger) and mood congruent stimuli [e.g., threat words; see Eckhardt and Cohen [1997] or Egloff and Hock [2001]). Thus, in addition to the person variables postulated by General Aggression Model [GAM] (Anderson and Bushman, 2002), this research provides evidence of situational variables inducing an attentional bias.

Moreover, the finding of this study are consistent with our earlier work which found that reported levels of weekly violent media consumption, but not nonviolent media consumption, appear to induce a negative processing bias in the recognition of emotional expressions [Kirsh et al., 2006]. Violent video game play may predispose an individual to perceive anger more rapidly, when anger is present, indicating an attentional bias toward threatening affect. This attentional bias may then increase the likelihood of acting aggressively by priming aggressive scripts or by limiting the processing of information which could reduce the likelihood of aggression.

There are several caveats to this study that need to be mentioned. First, the present results were found using a small sample of video games, thus, potentially limiting the generalizability of the findings [Wells and Windschitl, 1999]. Moreover, the current violent video game involved fantasy violence. Given that realistic violence tends to produce greater effects on aggression than fantasy violence [Kirsh, 2006], future research is needed to see if attentional biases are affected to a greater extent by violent video game play involving more realistic violence (e.g., as seen in *Grand Theft Auto III*). Finally, it is possible that a component of game play, unrelated to violence, impacted the speeded identification of emotion. However, this influence is mitigated by the fact that video game-related frustration, excitement, enjoyment and difficulty (proxies of arousal) were statistically controlled.

In summary, the processing of dynamic facial expressions appears to be affected by violent video game play. However, additional research is necessary to determine the role that multiple risk factors, such as violent media consumption, trait hostility, and realism of violence play in the identification of dynamically changing positive and negative emotions.

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