Advertising Effects through Violent Virtual Experience - Presence, Arousal, Brand Memory and Attitude in 3D Violent Games

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Abstract

With the increase of computer game users, violent games have attracted attention because of their potential for effects on user behaviors. However, as most violent game studies have focused mainly on aggression, there are relatively few studies about the advertising effects in violent games. Based on the General Aggression Model (GAM), this study investigated whether sensory realism cues (blood and screams of pain) and users' trait aggression affect brand memory and attitude through the users' physiological arousal (measured via skin conductance) and the sense of presence. A popular 3D first-person shooter game, Half-Life 2, was used for the experiment, and path analyses were used to test mediation models. Results show spatial presence strongly predicts brand memory while it reduces positive brand attitude in the violent game, and physiological arousal increases brand attitude although it does not influence brand memory. The effects of sensory realism cues and trait aggression on arousal and presence were tested, and congruity and familiarity effects were examined as well. Findings and implications are discussed.

1. Introduction

With the advances of technology, recent media have become more interactive and realistic. Likewise, recent portrayals of violence have become more realistic with the development of technologies in violent media [1]. In studies about violent TV programs, violence or murder using realistic blood, body and weapons have been focused on because of their putative effects on users' violent behaviors [2, 3, 4]. Similarly, the effects of realistic cues on perceived violence and aggression also have been reported in violent game studies [5, 6, 7].

Most studies about violent games, however, have focused on the effects of violent cues on a user's level of aggression, that is a user' aggressive thoughts or behaviors. There are relatively few studies about the advertising effects of violent games, such as brand memory and attitude change. Specifically, in advertising research, although some recent studies investigated advertising effects of games with respect to product placements, most studies have been conducted by using non-violent environments such as sports or racing games [e.g., 8, 9, 10, 11].

In-game advertising market size reached $77 million in 2006 and is expected to be about $1 billion by 2012 with the rapid increase of global game markets [12]. In 2008, violent (shooting or fighting) games comprised 3 out of 5 block-buster video games in global game markets [13]. Despite the increase of advertising demand in popular violent games, however, the effects of violent cues have not been sufficiently examined.

In addition, there is little research about the advertising effects of violent cues based on a theoretical framework about how violent media effects occur. In violent media, how realistic cues affect user behavior, perception, and memories has been a central concern [see 14, 15, 16]. In explaining the mechanism of violent media effects, the General Aggression Model (GAM, [17, 18]) is a useful framework to explain the process. According to GAM, violent cues affect user aggression through arousal, aggressive thoughts (e.g. primed memory) and affects [17]. Based on the GAM, many studies investigated the effects of violent media by focusing on their effects on aggressive thoughts, behavior, or memory of violence [6, 19, 20, 21, 22]. We could also assume that violent games influence advertising effects through the violent experience.

The objective of this study was to investigate the effects of violence cues (realistic blood and screaming sound) and personal cue (users' trait aggression) on both memory and attitude based on the GAM framework. In particular, since recent video games are actualized in immersive Virtual Reality (VR) space where users experience higher arousal and the sense of presence - the sense of "being there" [1, 23, 24], we will test path models about the mediating effects of physiological arousal and the sense of presence between violent and personal cues and the dependent variables (brand memory and attitude). Finally, congruity and familiarity effects will be tested on users' brand memory and attitude change.

2. Previous Literature and Hypotheses

2.1. Mediated Aggression in Violent Realism: GAM (General Aggression Model)

Violent media have been reported to have a close relationship with user aggression and violent behavior [5, 14, 17, 25]. In violent gaming research, many studies have shown that violent video games can instill aggressive cognitions or

thoughts [19, 26, 27, 28].

Regarding the effects of violent media, the General Aggression Model (GAM) provides a useful framework for explaining why exposure to violent media influences user aggression [see 17]. The GAM postulates both short-term and long-term effects - Short-term effects explain the effects of violent media on user aggression from a single exposure (single-episode) while long-term effects deal with its development into the user's aggressive personality from multiple or repetitive exposures.

According to single-episode GAM, violent media influences aggression through their impact on the person's present internal state represented by arousal, cognitive, or affective variables - Violent media increases aggression by increasing physiological arousal, by priming aggressive cognitions (including previously learned aggressive scripts or schemata), or by creating aggressive affective state [17, 18].

There are two factors that affect aggressive states by influencing present internal state – situational and personal inputs. Situational inputs are features (or cues) of the present situation that increase user aggressive states such as presence of weapon, an insult, or an uncomfortable environment while personal inputs include whatever the person brings to the current situation such as attitudes and beliefs [29]. Situational inputs, thus, include all kinds of stimulating violence cues in media content that can affect user aggression by influencing user arousal, cognition, or affect; personal inputs can include personal traits or tendencies related with aggression. Regarding the effects of violent video game play, for example, personal inputs include users' trait aggression, whereas situational inputs have included violent video game exposure (play) [21].

With respect to situational inputs, we should consider the elements from the effects of recent developments in technology. Owing to advanced technology, video games have transmitted much stronger arousal and engagement in games with realistic cues than in the past [1, 22]. Realistic cues in violent media mean stimuli to make objects or environments such as characters, weapons, blood, sound, and a user's point of view as real as the actual ones. Many of realistic violence cues make sensory components of the representation in the media by simulating the same experience in the natural environment with advanced technology – for example, a highly realistic representation of weapon (visual realism) or realistic sound (auditory realism). Thus, we can call such realistic cues "sensory realism cues." In violent video games, sensory realism cues have been one of the central concerns because of their effects on users' arousal and aggression [e.g., 5, 6, 22].

Graphically realistic visual cues have been reported to affect users' perceived violence in violent-media studies [30]. Among graphical cues, realistic blood has been especially focused on because it is one of the general depictions in violent games and the depiction of realistic blood is one of important criteria that differentiate youth-oriented games from adult-only games in game rating boards (e.g. "Game Ratings and Descriptor Guide" in Electronic Software Rating Board (ESRB) in USA, Computer Entertainment Rating Organization (CERO) in Japan, Game Rating Board (GRB) in Korea). In violent gaming studies, the presence of blood has been shown to increase both users' gore perception and aggressive thoughts [7]. Particularly, recent violent game studies have reported the effect of blood on user arousal and aggression. According to Ballard and Weist's study [5], presence of blood in a first-person shooter game, *Mortal Kombat*, heightened user arousal more than a no-blood condition. Furthermore, the realistic amount of blood in violent games was reported to influence user arousal [6]. In their experiment, users in medium blood conditions showed higher physiological arousal than low or no-blood conditions. According to Jeong et al. [22], more realistic blood color (red) increased both users' physiological and perceived arousal than less realistic blood color (blue) condition.

Likewise, other than visual cues, realistic sound cues also have been reported to affect user arousal. Listening to unpleasant sound (e.g. noise) influence user arousal and performance [31, 32, 33]. Specifically, realistic audio pain cues such as screaming and moaning has been reported to increase user arousal [31, 34]. There is little research about the effects of screams on user cognition (memory) and arousal - in violent game studies. However, since the screams of pain have been reported to increase user arousal we will directly test its effects in this study.

In sum, this study will use the short-episode GAM as a basic framework because we will examine the short-term effects of violence cues (situational inputs) on user internal state in a violent video game. Especially, as previous studies have shown the effect of realistic violence (sensory realism) cues on user arousal, this study will focus on user's physiological arousal as an internal state from GAM. Thus, firstly we will investigate the effects of two sensory realism cues - presence of blood and screams of pain – on users' physiological arousal. Additionally, we will see the effect of users' trait aggression (personal inputs) on their arousal. Following hypotheses will be tested:

H1 (a/b): Sensory realism cues such as (a) the presence of blood and (b) screams of pain will lead to increased arousal compared to no blood and no screaming conditions.
H1 (c): User's trait aggression will increase the user's degree of arousal.

2.2. Presence & Arousal in Mediated Experience

In line with the effect of blood and screams of pain on arousal, presence, the sense of "being there" in a virtual environment, has been reported to be affected by such realistic cues.

The sense of presence addresses the degree to which a user's sense of body location and experiential consciousness is focused on experience and action in the virtual world of the media representation rather than the physical world that the user inhabits [24, 35, 36, 37]. With the development of media technology that increasingly blur the distinction between the

actual and the virtual space, researchers have studied the effects of users' mediated experience through their perceived reality in virtual reality (VR) environments: The sense of presence has been focused on to define or identify this mediated experience [38]. In virtual reality (VR) studies, thus, the sense of presence has been one of the central concepts in explaining mediated experience and its effects, and in theorizing about the human-computer interfaces in VR environments [36].

According to Lombard and Ditton [24], there are two factors that affect the sense of presence: media form and individual differences: Media form includes the number of human senses, color, image quality and size, dimensionality, and perspective; while individual differences encompass prior experience, gender, and personality type. These cues have been reported to cause the sense of presence in VR environments. In addition, technical advancement such as graphical and auditory realism has been reported to increase the sense of presence and users' involvement in recent game studies [1]. Thus, once sensory realism cues such as realistic blood visualization or screaming sound are added in the VR environments to stimulate users' senses, they might increase users' sense of presence

Likewise, we suppose that trait aggression will affect users' sense of presence. Recently, some studies have reported the relationship between presence and aggressive feelings [39] and hostility [40]. Even though, there have been few studies about the effect of users' trait aggression on the sense of presence, previous studies obviously show that individual variables like personality affect the sense of presence [24, 41]. In this study, based on the GAM, we will directly test the effect of trait aggression on the sense of presence.

In VR environments, the sense of presence has been reported to be associated with high levels of arousal [see 37, 42, 43, 44]. In media presentations, once users feel the sense of presence, they also show greater physiological arousal [24, 45]. Likewise in video games, a strong sense of presence has been reported to elicit greater enjoyment [24, 46]. In particular, Ravaja and his colleagues [45] showed that a higher sense of presence affected to increase emotional response (i.e. physiological arousal) during video game play. Although both presence and arousal experience are related in VR environments, there has been little research that considers both variables in examining the effects of mediated experience. Thus we propose the following hypotheses:

H2 (a/b): Sensory realism cues such as (a) the presence of blood and (b) screams of pain will lead to increased the sense of presence compared to no blood and no screaming conditions.
H2 (c): User's trait aggression will influence the user's sense of presence.
H3: There will be a close relationship between physiological arousal and the sense of presence.

2.3. Effects of Arousal & Presence on Brand Memory

Arousal affects both subjective vividness and objective accuracy in focal arousing events [47, 48]. Compared with neutral information, arousing information or events have been reported to be better remembered [47, 49]. Thus, emotional content seems to provide contextual details of arousing events (or information) than neutral one, and eventually increases memory of the events with vividness.

Memory effect regarding arousal, however, depends on the centrality of the information [54]. Central or primary information could be operationalized as proximity or closeness to the primary task, centrality in the screen, centrality to the plot, duration on screen, or the size of brands [8, 54]. Such prominent information (brands) has been reported to be better remembered than less prominent one [55, 56]. Particularly, emotionality of high arousal has been reported to increases memory for central details while it decreases memory for background ones [57, 58].

According to the Limited Capacity Model of information processing (LCM), selection processes of user attention are automatically in operation for intensity and selectivity toward the central information [8, 59]. Likewise, in arousing environments, focusing attention on central information could drive users to ignore the others since high arousal is contingent with high selectivity [23]. Thus, users will selectively focus on primary information with intensive attention in such arousing environments, while they neglect peripheral one.

In recent studies about the effect of the centrality of information, proximity or closeness to the primary task in programs has been reported to lead to greater memory effects [55, 60]. Specifically, in gaming studies, Lee and Faber [8] showed the effect of proximity in a racing game. Likewise, in this study, we place brand logos right behind the opponents, which makes users see the brands whenever they shoot the opponents. In addition, we provide arousing events of blood splattering on the brands whenever opponents are shot. Therefore, we can suppose that central information embedded in arousing environments in the game will be remembered well with the increase of users' arousal.

We also assume that presence will affect brand memory significantly. In VR studies, presence has been regarded to enhance memory effects [24]. According to Kim and Biocca [61], presence is highly correlated with individual's ability to recall material. Specifically, in violent games, presence increases identification with characters [62], which lead users to consider their experience in the mediated environments as actual or direct experience and to remember their experiences vividly [42].

In product placement studies, however, such effects of presence on brand memory are not clear: Grigorovici and Constantin [23] showed that presence (involvement) negatively affected users' brand recall, but Nelson and her colleagues [10] could not find any evidence of such negative effects of presence on brand memory. According to LCM, presence or engagement could be factors that make users

focus on central information with selectivity and intensity [10]. In media environments, thus, brands of product placement are difficult to be memorized by the users since the brands are not prominent (not central) in the programs. However, on the contrary, if the brands are designed to be central information, the effects of presence on brand memory could be positively significant. In this study, therefore, we suppose the sense of presence will increase users' brand memory. We hereby test the following hypotheses:

H4 (a/b): (a) Arousal and (b) presence will increase users' brand memory.

2.4. Brand Attitude in Virtual Experience

According to Russell [63], the pairing of a product with an emotionally rich show (television or movie) conditions a transfer of affect from the show to the product. Positive feelings, thus, extend to the advertising or brands within the program through affect transfer [64]. In VR studies, Grigorovici and Constantin [20] reported that there was a significant effect of the level of emotional arousal on preferences toward the brands embedded in a 3D virtual environment. Higher arousal of excitement, therefore, could induce better attitude towards the brands embedded in the program.

In addition, subjects with higher feelings of presence show better attitude toward the brands. People with higher presence in VR space show higher preference for the brands [10, 61]. Likewise, addition of presence increases positive feelings about brands embedded in the games [65]. In addition, higher perceived realism (presence) induced higher brand preference, such that presence leads to more arousal and affect and more positive brand attitudes with favorable purchase intentions [20]. Thus, we propose the following hypothesis:

H5 (a/b): (a) Arousal and (b) presence will increase users' attitude toward the brands.

2.5. Congruity and Familiarity Effects in Virtual Violence

In product placements studies, congruity has been drawing researchers' attention because of its effects on brand memory. Congruity has been conceptualized in advertising research as the relationships between the visual and verbal elements of the advertisements [66]; as the product category and brand names [67], and as "thematic connection" referring to the conceptual match between the brand's product and game content [11].

In gaming studies, Gwinner and Eaton [68] defined congruity as "image congruity" that occurs when the image of the product category matches the image of the focus of the game. More recently, concerning advertising effects, Lee and Faber [8] defined congruity as the relationship between the product category of the embedded brand and the content of the game. In this study, we will take "image congruity," such that congruent ads mean violent image logos that match with the image of the violent game.

Concerning the effect of congruity on memory, many of previous studies between advertising and product category showed that people remember congruent information better than incongruent information [64, 69]. Moorman and his colleagues [64] showed that thematically congruent ads in magazines were substantially remembered than incongruent ads. Furnham, Gunter, and Richardson [70] also reported that thematic congruity between advertisements and program environment increases memory for embedded advertisements. However, the effects of congruity have been mixed since other researchers have reported the opposite results. Lee and Faber [8], for example, reported that people showed high memory scores on incongruent ads in racing games than on congruent ads. Russell [71] also reported that memory improves when modality and plot connection are incongruent.

In the context of violent environments, Gunter, Furnham, and Pappa [72] reported that violent advertisements were remembered better than when placed in violent film than when placed in nonviolent one. Likewise, regarding congruity effect on user attitude, Wise and his colleagues [11] showed a stronger positive relationship between attitude toward the ad-games and attitude toward the brands when the games are highly connected with the brand's product. However, there have been few studies about the congruity effects in the context of violent video games. In this study, following the Gunter et al.'s study [72], we will suppose that congruent (violent image) logos will be remembered better than incongruent ones, and users' attitude toward the logos will be positively changed.

Brand familiarity is also one of influencing variables in advertising studies [10, 73, 74]. Nelson et al. [10] showed that well-known brands are better recalled than fictitious ones. They interpreted the result that people automatically have better accessible attitude toward well-known brands and thus familiar brands are better remembered than fictitious ones. On the effect of familiarity on user attitude, Mau et al. [74] found that attitude toward unfamiliar brands is much improved over that of familiar brands. Likewise, familiar brands have reported to have low influence on attitude change [75]. Therefore, this study assume that familiarity increase the memory of brand logos, but the attitude change toward familiar logos will not be higher than that of unfamiliar logos. Thus, we will test the following hypotheses:

H6 (a/b): (a) congruent logos and (b) familiar logos will be remembered better than incongruent logos and unfamiliar logos.

H7 (a/b): (a) congruent logos will increase user attitude toward the logos, but (b) the attitude change toward familiar logos will not be higher than unfamiliar logos.

3. Methods

3.1. Design and Participants

The experiment used a mixed design. Between subjects, we manipulated 2 levels of blood (presence or absence) x 2 levels of sound (presence or absence of screams of pain. Within subjects, we compared memory toward familiar-unfamiliar and congruent/incongruent logos in the game.

A total of 60 participants (M = 20.9 years, SD = 2.57) were recruited from a major mid-western university in the United States. Participants were recruited for the study on a voluntary basis from three undergraduate classes. They were randomly assigned to one of the four between subject conditions. Participants received course credits for their participation in the experiment.

3.2. Stimulus Materials

The experiment used the game *Half-Life 2*, which is rated "M" (Mature) by the Entertainment Software Rating Board (ESRB) because of violence, blood and gore. We modified the original version for the experiment using Garry's Mod (www.garrysmod.com), which is a design tool for users to change gaming environments. Participants played for about 5 minutes to finish one session. They walked through several corridors to kill the opponents who blocked their way to the ending point. There were 20 sites where players had to fight against (20 total) opponents. Participants wore headphones during game play to block external noise and to maximize the clarity of auditory cues. Blood was splattered on the background logo of each location in the game, while the blood emitted by wounded enemies was either on or off, depending on experimental condition.

Whenever participants shot and killed an opponent, screams of pain were heard in the experimental condition. Participants could hear all other sound effects (e.g., footsteps, shooting, etc.) regardless of condition. All enemies wore military clothes with gas-masks covering their faces.

3.3. Measures

Trait aggression was measured by the Buss-Perry's Aggression Questionnaire [76]. There are four different traits of aggression in this measure with 29 items (7-scale measure): hostility, anger (or temper), physical aggression, and verbal aggression. Each factor showed good reliability (hostility, α = .71; anger, α = .63; physical aggression, α = .71; verbal aggression, α =.67)

Galvanic Skin Response (GSR) was measured through skin conductance levels (SCLs) using the Biopac MP150 system (Biopac Inc., Goleta, CA). The hardware settings for SCLs were 20μΩ/volt filtering and a 1.0 Hz high-pass filter, and 200 samples per second. SCL baseline was measured for 30 seconds before beginning the game, and during play SCLs were measured continuously.

Presence was measured by the ITC-SOPI (Independent Television Commission – Sense of Presence Inventory) multidimensional presence scale [77]. The questionnaire is composed of four factors such as spatial presence, engagement, ecological validity, and negative effects. We focused on two factors - spatial presence and engagement. The questionnaire, thus, is composed of 33 items (5-scale measure): (a) *spatial presence* (20 items; e.g., "I felt as though I was in the same space as the characters and/or objects," "I had a sense of being in the scenes displayed," α = .92), and (b) *engagement* (13 items; e.g., "I felt involved in the displayed environment," "I paid more attention to the displayed environment than I did to my own thoughts," α = .85).

A recognition memory test followed the game playing session. Each participant viewed a series of 40 logos: Twenty of them were in the game – ten of them were associated with real businesses (e.g. *Samsung, Google, Boeing, Remington, Toyota,* etc.), but the other ten were from fictitious companies; the other twenty were not in the game (half were real companies and the other hale (half of them were real company logos, and the other half were fictitious). The twenty logos that were in the killing sites of the game had been experienced with blood emission and screams of pain. Each user's memory score was summed from the correctly-answered scores of the twenty logos where the user could experience blood-splatter (on vs. off) and screams of pain (on vs. off). Participants were instructed to determine whether they had seen the logo during game play or not.

To gauge attitude toward logos, participants provided ratings on the following dimensions: good, favorable, positive, and like (7-scale measure). The attitude questionnaire for pre-test was taken about one week prior to the experiment. After the experiment, the attitude questionnaire was taken again toward the real logos in the game. (Pre-Q: M = 4.05, SD = .83; Post-Q: M = 4.56, SD = .69)

Finally, we investigated the effects of familiarity and congruity. Participants were asked about the familiarity of logos in the pre-questionnaire one week before the experiment. Total 40 logos were asked: Half of them were in the game and the other half were not. In the same way, the degree of violence toward each logo was also asked with 7-scale measure. Among the 20 in-game logos, 10 were real logos and the other 10 were fake logos. Followed the results, among the 10 real logos, 5 were categorized into violent image logos (e.g. *US Army, ATK, Ithaca guns, Colt, EA games; M =5.38, SD =.52*) and the other 5 were into non-violent logos (e.g *Continental, Google, Samsung, Boeing, Remington, M =2.91 , SD =.40*); likewise, among the 10 real logos, 5 logos were classified into familiar logos (e.g. *Google, US Army, EA games, Samsung, Continental; M =5.87, SD = .45*) and the other 5 were into unfamiliar logos (e.g. *ATK, Remington, Colt, Boeing, Ithaca guns; M =2.79, SD =.57*).

3.4. Procedure

Participants were asked by e-mail to complete an online questionnaire one week prior to the experiment. The questionnaire gathered information from the participants about their game experience, demographics, and attitude toward logos (pre-attitude). Just prior to starting an experimental session, each participant practiced moving their

character and using weapons. For this practice, a printed page of instructions was provided, and a trained experimenter read these instructions aloud and aided in their practice. The practice phase did not exceed 5 minutes, and there was no opponent at this level. Before beginning the game, participants completed a baseline recording session for physiological arousal (SCLs) during which they sat quietly and relaxed.

Participants played one session of the experiment game. While playing the game, physiological arousal (skin conductance) was measured. After the experiment, the questionnaires were administered to assess the participant's sense of presence (during the game). The recognition-memory test followed. Each participant viewed 40 logos: Half of them had been viewed during game play, and half had not. Participants were asked to quickly decide whether they had seen the logos before or not. Finally, a questionnaire assessed participants brand attitude toward the logos encountered in the game.

4. Results

Before we present our mediation models we examined direct effects of sensory realism cues and trait aggression on physiological arousal, spatial presence, engagement, brand memory, and brand attitude. Table 1 shows the mean values of the variables for each condition.

	Blood		Screams of pain	
	On	Off	On	Off
Arousal (SCLs)	.31 (.10)	.03 (.07)	.29 (.12)	.05 (.06)
Spatial presence	2.71 (.76)	2.63 (.83)	2.79 (.67)	2.54 (.88)
Engagement	3.12 (.82)	3.40 (.88)	3.50 (.83)	3.03 (.84)
Brand memory	10.20 (3.30)	10.04 (3.62)	10.96 (3.41)	9.29 (3.33)
Brand attitude	.51 (.37)	.52 (.29)	.57 (.35)	.46 (.30)

Table 1. Means and Standard Deviations of Key Variables

4.1. Direct Effects of Sensory Realism & Aggression Cues

To test the effects of sensory realism cues on physiological arousal (SCLs – subtraction from baselines), we used one-way analysis of covariance (ANCOVA). First, with arousal as the dependent variable, the sensory realism cues (blood and screams of pain) as the independent variables, and each trait aggression factor (hostility, anger, physical aggression, or verbal aggression) as the covariate, we conducted ANCOVA tests.

Subjects in blood condition (M = .31, SD = .10) displayed higher physiological arousal than those in no blood condition (M = .03, SD = .07), and players with screams of pain (M = .29, SD = .12) during violence showed higher arousal than no screams condition (M = .05, SD = .06). There were significant effects for the blood condition: with hostility, F (1, 47) = 5.05, p < .05; with anger, F (1, 47) = 3.72, p < .05; with physical aggression, F (1, 47) = 4.85, p < .05; and with verbal aggression, F (1, 47) = 3.64, p < .05. Likewise, we found significant effects for the screams of pain on the arousal: with hostility, F (1, 47) = 4.23, p < .05; with anger, F (1, 47) = 4.27, p < .05; with physical aggression, F (1, 47) = 3.37, p < .05; and with verbal aggression, F (1, 47) = 3.12, p < .10. However, we could not find any significant effect of the covariate variable (hostility, anger, physical aggression, or verbal aggression) and any interaction effects on physiological arousal.

In the same way, we examined the direct effects of sensory realism cues and trait aggression on the sense of presence. For this test, we used two factors of presence from the modified ITC-SOPI – spatial presence and engagement. For spatial presence, we could not find any significant effect of sensory realism cues (blood and screams of pain). However, there a significant effect of anger on spatial presence, F (1, 47) = 5.29, p < .05; and verbal aggression on spatial presence, F (1, 47) = 3.79, p < .05; which means that players with higher degree of anger or verbal aggression show higher degree of spatial presence.

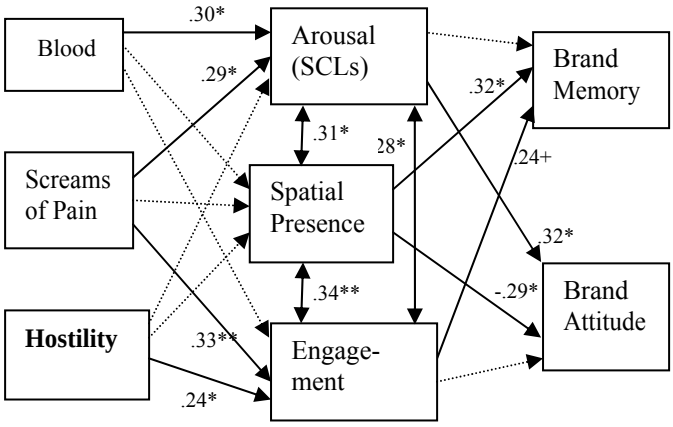
On engagement, the screaming sound condition showed significant effects (screams, M = 3.50, SD = .83; no screams, M = 3.03, SD = .84): with hostility, F (1, 47) = 5.81, p < .05; with anger, F (1, 47) = 4.87, p < .05; with physical aggression, F (1, 47) = 3.14, p < .10; and with verbal aggression, F (1, 47) = 2.73, p < .10. In addition, there was a significant effect of anger on engagement, F (1, 47) = 5.90, p < .01; physical aggression on engagement, F (1, 47) = 4.08, p < .05; and verbal aggression on engagement, F (1, 47) = 3.32, p < .05. However, we could not find any interaction effect betweens.

Brand memory showed that about 50% of the logos were correctly answered (M = 10.13, SD = 3.44). With brand memory scores as the dependent variable, there was a significant effect for the screams of pain (screams, M = 10.96, SD = 3.41; no screams, M = 9.29, SD = 3.33): with anger, F (1, 47) = 5.05, p < .05; with verbal aggression, F (1, 47) = 2.75, p < .10. Likewise, there was a significant effect of anger on memory, F (1, 47) = 20.86, p < .001, which implies that participants who were higher in anger showed higher scores in brand memory.

Finally, on brand attitude, there was no effect of sensory realism cues and trait aggression. However, we could find an interaction effect between blood and screams on brand attitude: with hostility, F (1, 47) = 4.55, p < .05; with anger, F (1, 47) = 4.04, p < .05; with physical aggression, F (1, 47) = 4.76, p < .05; and with verbal aggression, F (1, 47) = 5.08, p < .05. With no blood condition, screaming condition (M = .34) was significantly lower than no screaming condition (M = .71) in brand attitude change; while with blood condition, screaming condition (M = .80) was higher than no screaming one (M = .21).

4.2. Structural Equation Model Tests

To test the mediation model, we performed path analyses The models specify the effects of blood, screams of pain, and trait aggression on both arousal and presence, and test the relationships among arousal, presence, brand memory, and brand attitude. Since the trait aggression has four sub-factors, we adopted four structural equation models: with hostility (model-1), anger (model-2), physical aggression (model-3), and with verbal aggression (model-4). The four mediation models sufficed the good fit criteria.



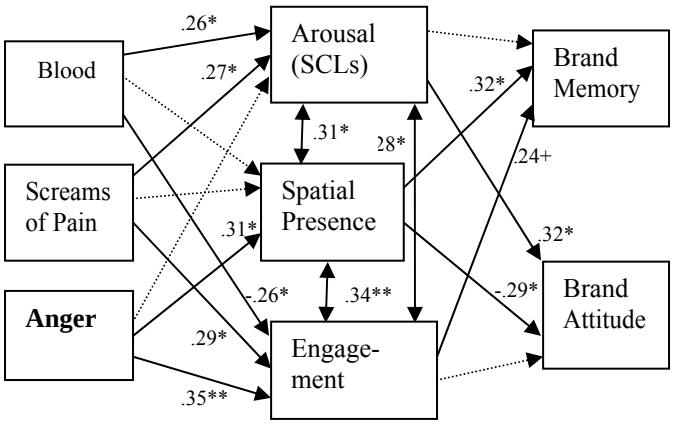
*p < .05, **p < .01, ***p < .001

Note. The coefficients are standardized.
Model fit: χ^2 = 6.22, df = 10, p > .05;
RMSEA = .000; CFI = 1.000; GFI = .968

Figure 2 (Model-1, Hostility) Path Analysis

4.2.1. Effects of Sensory Realism Cues and Trait Aggression on Arousal and Presence. As we have seen in the direct effects, sensory realism cues (i.e., blood and screams of pain) showed significant effects on physiological arousal through all the models (see Figure 2-3). Specifically, participants in the blood condition showed higher arousal than those in the no-blood condition. Likewise, players exposed to the screams of pain during violence showed higher arousal than those in no-scream condition. For trait aggression, we could not find any significant effect on physiological arousal, which implies that there is no short-term effect of personal aggression traits on physiological arousal. Thus, H1a and H1b were supported, but H1c was rejected.

For spatial presence, there was no effect of sensory realism cues. However, aggression factors, specifically anger and verbal aggression, showed significant effects on spatial presence (anger, β = .31, p < .05; verbal aggression, β = .27, p < .05). For engagement, scream sound condition had significant effects in all models, and blood condition had negatively significant effects on engagement in model-2 (β = -.26, p < .05) and in model-4 (β = - .26, p < .05). Thus, H2b was strongly supported while H2a was supported negatively in anger (model-2) and verbal aggression (model-4). Interestingly, all the factors of trait aggression showed significant effects on engagement (anger, β = .35, p < .01; physical aggression, β = .27, p < .05; verbal aggression, β = .28, p < .05; and hostility, β = .24, p < .05). However, no models showed the significant effects of prior game experience on arousal and presence. These results indicated that H2c was strongly accepted, but both H8a and H8b were rejected.



*p < .05, **p < .01, ***p < .001

Note. The coefficients are standardized.
Model fit: χ^2 = 10.80, df = 10, p > .05;
RMSEA = .044; CFI = 921; GFI = .922

Figure 3 (Model-2, Anger) Path Analysis

4.2.2. Effects of Arousal and Presence on Brand Memory. For the effect of spatial presence and engagement on memory, there were significant effects. The result showed that those who feel high spatial presence had strongly high memory scores, β = .32, p < .05. Likewise, the effect of engagement was also marginally significant effect on memory scores (β = .24, p < .10). This result indicates that presence predicts memory scores pretty strongly: participants who feel higher presence in the game remember the logos better than those who feel lower presence. Thus, H4b was supported with spatial presence, and marginally supported with engagement.

The effects of spatial presence on memory were bigger in unfamiliar and fake logos, and the effect was much stronger on violent logo memory scores than the memory score on non-violent logos. When we used a regression analysis with memory (each of unfamiliar and familiar logo memory) scores as a dependent variable and other variables as independent variables (arousal, spatial presence, and engagement), there was significant effect of spatial presence only on memory scores of unfamiliar logos (β = .37, p < .001). Likewise, with each memory (real and fake logo memory) score as a dependent variable, spatial presence affect both real logo memory (β = .32, p < .05) and fake logo memory (β = .35, p < .01). On the violent and non-violent logo memory scores, spatial presence has a very strong effect on only violent memory scores (β = .39, p < .001).

There was a marginally significant correlation between arousal and memory (r = .22, p < .10). However, when other variables (spatial presence and engagement) were controlled

for, those who felt high arousal did not show any significant difference in memory scores. Thus, H4a was rejected. In the correlation between arousal and presence, arousal was significantly associated with engagement (r = .28, p < .05), and also there was a significant correlation between arousal and spatial presence (r = .31, p <.05). Spatial presence showed high relationship with engagement (r = .34, p < .01). Thus, H3 was supported.

4.2.3. Effects of Arousal and Presence on Brand Attitude. With three variables – arousal, spatial presence, and engagement, each effect on attitude was tested. With arousal, there was significant effect on attitude (β = .33, p < .05). This result indicates that participants who have high arousal in the game show better attitude toward logos in the game. With spatial presence, there was strong effect on attitude, but interestingly negative effects of spatial presence on attitude (β = -.29, p < .05). This result shows that players who feel higher spatial presence show negative attitude change toward logos in the game. However, engagement did not show any significant effect on attitude (β = .18, *n.s.*). Thus, H5a was supported, but H5b was not.

4.3. Congruity and Familiarity Effects

Participants remembered familiar logos better than unfamiliar ones (familiar logos, M = 3.54, SD = 1.05; unfamiliar logos, M = 2.99, SD = 1.23; t = 3.22, p < .01). Likewise, real logos were remembered better than fake ones (real logos, M = 6.60, SD = 2.03; fake logos, M = 3.43, SD = 2.16; t = 8.59, p < .001). However, there was no significant difference in memory scores between violent image logos and non-violent image logos (violent logos, M = 3.29, SD = 1.18; non-violent logos, M = 3.33, SD = 1.24; t = -.22, *n.s.*). Thus, H6b was supported, but H6a was not supported.

In order to check the difference in players' attitude changes toward the brand logos in terms of familiarity and congruity, we compared the average values of attitude changes between pre-test and post-test of attitude scores. However, there was no difference in players' attitude changes between familiar and unfamiliar brands (familiar logos, M = .57, SD = .71; unfamiliar logos, M = .46, SD = .11; t = .81, *n.s.*), and between violent and non-violent brands (violent logos, M = .52, SD = .98; non-violent logos, M = .52, SD = .80; t = .03, *n.s.*). Therefore, H7a was rejected and H7b was supported.

5. Discussion

Our general research questions regarding in-game advertising were: Does the realistic game violence affect user experience of the game and how does changes in-game experience affect brand memory and attitude? Specifically, we investigated how sensory realism inputs (blood and screams of pain) and trait aggression (hostility, anger, physical and verbal aggression) influence brand memory and attitude through physiological arousal in violent games. In addition, we examined how game experience, that is arousal and feelings of presence, mediated the realism of the game and individual differences in trait aggression.

The results of mediation model analyses indicate that there are two primary effect paths from independent cues to dependent variables in path models: the first one is the path from sensory realism inputs through (physiological) arousal to brand attitude; and the other is connected from (trait) aggression to brand memory through the sense of presence.

The first path shows that blood and screams affect ultimately brand attitude by increasing user arousal. This result is in line with previous literature. Both graphical effects like realistic blood [5, 6, 22] and sound effects like screams or moaning [31, 34] have been reported to increase user arousal. In addition, users of higher arousal (excitement) showed positive brand attitudes [23]. Specifically, this result is matching with the single-episode GAM process explaining the effects of sensory realism inputs on user arousal.

The second path indicates that memory is affected by presence or engagement rather than arousal. Compared with the first path, memory does not seem to be affected by emotional factors in violent games while attitude change is influenced by arousal. Among the variables in this experiment, spatial presence was the most influencing factor predicting brand memory. This result is also matching with that of previous literature: The effects of presence in virtual environments have been reported to increase memory [24, 61]. The finding in this study strongly implies that enhancing presence in violent games will result in increased memory effects of in-game ads.

Considered the path models, among the sensory realism cues, screams of pain could increase both memory and attitude more effectively than blood cue. The analysis of path models show that screams of pain could increase brand memory through engagement and enhance brand attitude through arousal. Although both blood and screams increased physiological arousal, blood did not (or negatively) affect engagement while screaming sound increased engagement significantly at all models. This result implies that sound effects like screams of pain are a very useful tool to increase both arousal and engagement while graphical effect like blood could be a disturbing factor for users to engage in the game.

Interestingly, contrary to the effect of arousal on attitude, spatial presence decreases the positive attitude toward logos in the game. This fact indicates that, if we increase the feeling of spatial presence in violent games, players' attitude toward the logos in the game decreases even though they remember them. This is contrary to the previous studies that have shown presence increases preference or positive feelings about the brands [e.g., 10, 61].

However, some studies with opposite results have been reported in terms of product liking or persuasion knowledge: Cowley and Barron [54], for example, reported that prominent product placements were negative to brand attitude to the people who more like the program because they realize the persuasive intention of the product placements. According to their study, viewers who are higher in program liking are

more attentive because they look forward to watching the program to satisfy their entertainment goals (e.g., enjoyment). Such viewers who affectively involved in the program are more sensitive to interruption [78]. In game studies, players who feel higher presence are likely to have higher enjoyment and intention to purchase the product (game) [79]. Thus, game players who feel higher degree of presence and have higher likeness to the game could be more sensitive to the prominent logos in the game as to have negative feelings toward the brands. In this experiment, the logos were used to be as prominent as users easily find their existence. This might have brought about user's antipathy against the logos, which blocks the positive attitude toward the logos. We leave the effect of persuasion knowledge on user attitude in immersive (causing higher presence) gaming environments for future studies.

Secondly, regarding the negative effect of spatial presence on attitude, we could suppose that this is because of the user's identification with the character in the game. In violent games, player who feels higher presence has strong identification with the virtual body (avatar) of the player [62]. Recent studies have reported that presence mediates violent game playing to aggressive feelings [39] and to hostility [40]. Because of the strong identification, violent game players would naturally have the aggressive feelings (e.g. hostility or anger) of the avatars that should shoot the opponents to kill. With higher feelings of spatial presence, such aggressive feelings could be transferred into the logos that were right behind the opponents.

Concerning the relationship between arousal and presence, we found that there was a strong relationship between them in virtual game environments. This result is consistent with the results in VR environments studies. [see 24, 37, 42, 43, 44]. However, although presence and arousal are closely related with each other, their effects on memory and attitude are very different. As we saw in the findings, arousal increased only user attitude while presence affected memory positively and attitude negatively. In information process studies, arousal has been reported to influence data accumulation and increase memory [50]. In traditional adverting studies, negative ads have been reported to increase views' memory [51, 52]. Previous studies, however, have not been conducted in interactive environments as computer game users experience. In addition, such experiments have been focused on the direct effect of arousal on memory without considering the sense of presence. This study used both arousal and presence that are highly correlated with each other, and examined interactive games. Considered the differences, arousal does not seem as influential on brand memory in interactive environment.

Regarding familiarity and congruity effects, as we expected, real and familiar logos were remembered better than fake and unfamiliar logos. Unexpectedly, however, no congruity effect on memory was found in this study. The memory scores on violent image and non-violent image logos did not show any significant difference. This result is contrary to the previous research such as Gunter et al. [72] and Rodgers [69]. However, incongruent information also has been reported to have possibilities to be remembered better because the incongruent information can be paid greater attention because it is distinctive, novel, and prominent [53]. Since there have been few studies about the congruity effects in violent games, it seems to need more research to generalize the result in violent context.

What is the possible effect of advertising in violent games? Are there paths that improve brand memory and attitude? From the path models, there appear to be two primary paths that diverge for strategies that are intended to increase brand memory or brand attitude. The results of this study suggest advertisers to see game designs that increase spatial presence to increase brand memory. On the other hand game designs that make users feel higher arousal may affect brand attitude. The first path shows that increasing arousal by using sensory realism cues is the most effective way to improve users' brand attitude, while the second path implies that to enhance presence (both spatial presence and engagement) is the most influencing way to increase brand memory.

For lower-aggressive users who show lower levels of trait aggression, to strengthen sound cues that can be combined with graphical effects seem to be the most effective way . To the lower-aggressive users, the first path controlling for user aggression could be best applied. For them, sensory realism cues (both visual graphic and sound) could increase brand attitude through arousal. Regarding brand memory, screaming sound was more crucial since it could influence brand memory through engagement while blood did not have any positive effect on engagement. Therefore, for lower-aggressive users, sensory realism cues, especially sound cues could be the most fruitful factor in increasing advertising effects without regard to user aggression.

Brand memory could be maximized in higher-aggressive users. In the second path, spatial presence was the most effective variable in increasing brand memory. However, only aggression factors (anger and verbal aggression) enhanced the spatial presence directly while sensory realism cues did not affect spatial presence at all. Such factors of aggression influenced brand memory strongly through both spatial presence and engagement. However, controlling for the sensory realism cues, such aggression factors did not have any substantial path to increase brand attitude; the increment of spatial presence even reduced the degree of brand attitude. Thus, although users have stronger spatial presence (and engagement) in highly immersive (causing higher presence) virtual environments and accordingly remember more brands in violent games, they could have negative attitude toward the brands: This seems like a paradox in violent games for advertisers.

However, considering total effects on brand attitude, the amount of the effects of both arousal and sensory realism cues on attitude (standardized total effect = .45) surpasses that of spatial presence (-.29). Thus, overall effect on attitude is positive. Likewise, overall effect on brand memory is strongly positive owing to spatial presence and engagement (.90).

In sum, violent games could be a useful tool for advertisers to increase both brand memory and attitude toward the brands in the game. The current study showed that advertising in violent games could be effective in higher arousal on brand attitude. In addition, displaying ads in highly immersive (causing higher presence) violent games could maximize brand memory by increasing spatial presence and engagement. Among sensory realism cues, sound cues (e.g. screams of pain) could be more effective tools than graphical ones since they could increase both brand memory and attitude regardless of the degree of user aggression. Graphical cues were also effective in increasing brand attitude through arousal. Finally, advertiser could use not-violent image ads in violent games since there was no significant difference in advertising effects between congruent (violent image) and incongruent brands.

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