

ADVERTISING EFFECTS AND AGGRESSION IN VIDEO GAMES
: EFFECTS OF SENSORY REALISM CUES ON BRAND MEMORY, ATTITUDE, AND
AGGRESSION VIA PHYSIOLOGICAL AROUSAL, AFFECT, AND PRESENCE

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ABSTRACT

ADVERTISING EFFECTS AND AGGRESSION IN VIDEO GAMES : EFFECTS OF SENSORY REALISM CUES ON BRAND MEMORY, ATTITUDE, AND AGGRESSION VIA PHYSIOLOGICAL AROUSAL, AFFECT, AND PRESENCE

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Violent video games have attracted much attention due to concerns over their potential to increase player aggression and potentially affect a player's real-world behavior. However, these game environments are increasingly used to persuade in serious games and in advertising. While most research in this area focuses on their effect on the user's aggression, relatively few studies focus on the impact of violent games on memory and attitude toward advertising that is sometimes present inside these games. As many of the games are highly arousing and often violent, these features may influence how persuasive information and brands are perceived and remembered. The emotions associated with the violent content might interact with the advertising either negatively or positively.

Guided by theories of mediated aggression in virtual environments such as the general aggression model, the excitation transfer theory, and the theory of presence, two experimental studies were conducted by using a modified version of the popular shooter game, *Half-Life 2*. We investigated the effects of sensory realism of violence (i.e., realistic description of blood and screams of pain) on brand logo memory, attitude change towards brands experienced inside the game, and state aggression by controlling users' trait aggression and prior experience of violent games. We also explored the degree to which these effects are mediated by users' experience in the game, specifically the user's emotional states (i.e., negative affect), their level of physiological arousal (i.e., skin conductance levels), and their sense of presence (i.e., spatial

presence and engagement). To model these effects, a path analysis (SEM) was conducted to test the overall effects of the sensory realism cues on user memory, attitude change, and state aggression as mediated by the players' level of arousal, negative affect, and presence in the game.

The results showed that sensory realism cues of violence increased users' physiological arousal and their negative affect. The increased negative affect subsequently enhanced the degree of state aggression. The degree of spatial presence most significantly predicted brand memory. However, it was notable that spatial presence led to a negative change in brand attitude. With increased spatial presence, players remembered brand logos in the game better but resulted in negative changes in brand attitude. Similarly, increased negative affect from the sensory realism cues caused a negative change in brand attitude. The negative affect mediated the effect of screams of pain on attitude change, and the effect of blood on state aggression. Even though the number of violent games is increasing, and will likely include a considerable number of blockbuster titles, advertisers should carefully consider the potentially negative outcome of advertising and user aggression in violent video games.

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INTRODUCTION

Media displays and interaction techniques are often designed to maximize perceptual realism and users' immersion with media content (Biocca, 1997). A prominent example is the portrayal of media violence. About 60% of TV programs contain violence portrayals (Seawell, 1998), and violent games account for about 80% of video game market revenues (C.A. Anderson & Bushman, 2001). Violence or murder using realistic blood, body and weapons, thus, have been focused on in studies about violent TV programs because of their putative effects on users' violent behaviors (Chiricos, Padgett, & Gertz, 2000; Potter et al., 1995). Similarly, the effects of realistic cues on perceived violence and aggression also have been reported in violent game studies (Ballard & Weist, 1996; C. P. Barlett, Harris, & Bruey, 2008; Farrar, Krcmar, & Nowak, 2006). Recently, the arrival of interactive 3D games increasingly supports active behavioral immersion of the user in more perceptually realistic portrayals of violence (Bensley & van Eenwyk, 2001).

With the continuous advances in realistic and interactive technology, video games are increasingly viewed as an attractive advertising medium. In 2007, the global game industry's revenue was about USD 42 billion, and it is expected to reach USD 68 billion in 2012, making it the biggest among the entertainment industries, which include music, movie, book, and the DVD industry (Wikia, 2010). Expenditures in the in-game advertising market reached USD 77 million in 2006, and are expected to exceed USD 1 billion by 2012, following the rapid growth of the global game markets (Yankee-Group, 2007).

Violent games have gained a considerable share in the global game industry. This game category (including shooting or fighting games) comprised three of five bestselling video games worldwide (NPD, 2009). In the top 10 most promising best-selling video games of 2011, 6 of 10 games are violent games (WOX, 2010). These immersive environments of violent gaming are

known to be very arousing (P. Arriaga, F. Esteves, P. Carneiro, & B. M. Monteiro, 2006a; C. P. Barlett & Rodeheffer, 2009), and are thought to foster memory formation for in-game events and locales (Jeong, Biocca, & Bohil, 2008). Thus, some violent games have embedded in-game advertisements (e.g., *Battlefield: Bad Company* by EA, see Figure 1). However, the relatively few studies on the effects of ad placement in violent games seemingly contradict the rapid growth of advertising using this medium.



Figure 1. Advertisements in a violent game (*Battlefield: Bad Company*)

This rapid increase of advertiser demand for visibility in popular violent games stands in contrast to the small number of studies into advertising outcomes against the backdrop of violent content. Most studies of violent games focus on violent cue (e.g., realistic blood, weapons) effects on the observer's aggression level (aggressive feelings or behaviors). There are relatively few studies of the effects of advertising in violent games, such as brand memory formation and attitude change. Most recent studies focusing on advertising effects in games have been tended to

opt for non-violent content such as sports or racing games (M. Lee & Faber, 2007; Nelson, Keum, & Yaros, 2004; Wise, Bolls, Kim, Venkataraman, & Meyer, 2008; Yang, Roskos-Ewoldsen, Dinu, & Arpan, 2006).

The objective of the current study is to investigate how graphical and auditory realism of violence cues (realistic blood and pain sounds), as well as users' trait aggression¹, affect advertising effects (i.e., brand memory and attitude change toward the brands) in the game, and user aggression through physiological arousal², negative affect, and the sense of 'presence' (i.e., the sense of "being there" in a virtual space (Biocca, 1997; Lombard & Ditton, 1997). For the purposes, 1) this study examines the effects of violence cues and trait aggression on physiological arousal, negative affect, and presence. In addition, 2) the effects of arousal, negative affect, and presence on dependent variables (i.e., brand memory, attitude change, and users' state aggression³) are examined. Finally, 3) this study tests the mediation effects of physiological arousal, negative affect, and presence by using a path model (SEM) based on our previous work examining effects of violence cues on brand memory, change in brand attitude, and state aggression through physiological arousal, negative affect, and presence.

Two experiments are conducted. The first experiment focuses on the advertising effects (i.e., brand memory and attitude change) of violence cues in violent games. This experiment investigates roles of arousal and presence between violence cues and the advertising effect variables. The additional experiment examines both advertising effects and the users' aggression state. In addition, the negative affect variable is added to see the roles of arousal and presence on advertising effects by controlling the users' negative emotions in the game.

This work is guided by three frameworks: One is a theoretical framework that explains

the processes underlying violent media effects, known as the general aggression model (C.A. Anderson & Bushman, 2001; C. A. Anderson & Bushman, 2002); another is excitation transfer theory that explains the effect of arousal evoked by media on user aggression via transferred arousal (Zillmann, Katcher, & Milavsky, 1972); the other is the sense of presence which is influenced by realistic cues and affects brand memory, attitude change, and user aggression.

According to the general aggression model, violent media influence user aggression by affecting user internal states such as physiological arousal and aggressive affect (C.A. Anderson & Bushman, 2001), and the effects of increased arousal on memory have been found to co-occur with vividness of portrayal (Kensinger & Schacter, 2006; Ochsner, 2000). In advertising studies, the relation between increased arousal and attitude change has also been investigated (Grigorovici & Constantin, 2004). In addition, affect was reported to influence both memory for commercials (Newhagen, 1998) and attitude change toward the commercials (Russell, 1998; Singh & Churchill, 1987).

Likewise, previous studies of presence report that realistic visual and auditory cues increase the sense of presence (Lombard & Ditton, 1997). Presence has also been reported to influence brand memory and changes in brand attitude (Kim & Biocca, 1997; Nelson, Yaros, & Keum, 2006). In addition, presence was reported to increase user aggression in violent games (Persky & Blascovich, 2008; Nowak, Krcmar, & Farrar, 2008). Thus, it is natural to assume that playing violent games may bring about both advertising effects (i.e., brand memory and attitude change) and user aggression via presence.

CHAPTER 1

Literature Review (1): Mediated Experience in Virtual Violence

General Aggression Model and Excitation Transfer Theory

Violent media have been reported to have a close relationship with user aggression and violent behavior (C.A. Anderson & Bushman, 2001; C. A. Anderson & Dill, 2000; Ballard & Weist, 1996; Gentile, Lynch, Linder, & Walsh, 2004). In violent gaming studies, many studies have shown that violent video games can affect aggressive cognitions or thoughts (C. A. Anderson et al., 2004; Bensley & van Eenwyk, 2001; Sherry, 2001; Tamborini et al., 2004).

Regarding the effects of violent media, general aggression model provides a useful framework for explaining why exposure to violent media influences user aggression (see Anderson & Bushman 2001). The model postulates both short-term and long-term effects: Short-term effect explains the effects of violent media on user aggression from a single exposure (single-episode) while long-term effect deals with its development into the user's aggressive personality from multiple or repetitive exposures.

According to single-episode general aggression model, violent media influences aggression through their impact on the person's present internal state represented by arousal, cognitive, and affective variables: Violent media increases aggression by increasing physiological arousal, by creating aggressive affective state, or priming aggressive cognitions including previously learned aggressive scripts or schemata (Anderson and Bushman 2001, 2002), or some combination of these. The model has been the basis for several studies investigating media violence effects on aggression (C. A. Anderson & Carnagey, 2004; C. A. Anderson et al., 2004; C. P. Barlett et al., 2008; Eastin, 2006; Jeong et al., 2008).

There are two factors that affect aggression by influencing present internal state –

situational and personal inputs. Situational inputs are features (or cues) of the present situation that increase user aggression 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 (C. A. Anderson & Carnagey, 2004). Situational inputs, thus, include all kinds of stimulating 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 game play, for example, personal inputs include users' trait aggression, whereas situational inputs have included violent game exposure (Eastin, 2006).

Trait aggression has been the focus of many media violence studies, including studies on video game violence (C. P. Barlett, Rodeheffer, Baldassaro, Hinkin, & Harris, 2008; Williams & Clippinger, 2002). Trait aggression is an important personal input since it represents stable personality features, including hostility and anger, which may have been influenced by prior exposure to media violence.

With respect to situational inputs, we should consider the elements from the effects of recent development in technology. Owing to advanced technology, video games have transmitted much stronger arousal and engagement in the games with realistic cues than the past (Ivory & Kalyanaraman, 2007; Jeong et al., 2008). Realistic cues in violent media mean stimuli to make objects or environments such as characters, weapons, blood, and sound in media content as real as the actual ones by using graphical or technological tools. Such realistic cues have been one of important concerns especially in violent video games because of their effects on users' arousal and aggression (Ballard & Weist, 1996; C. P. Barlett et al., 2008).

The general aggression model explains about the relationship between arousal and

aggression based on excitation transfer theory. Focusing on the effects of arousal on aggression, excitation transfer theory explains the effects of exposure to excitement-evoking media on viewer aggression through arousal transfer (Zillmann et al., 1972). The excitations (or arousal) refer to the excitation of sympathetic nervous system, such that arousal includes physiological components such as heart rate, skin conductance, blood pressure, and perspiration (Baron & Richardson, 1994).

According to the theory, physiological arousal evoked by early events transfers to later events and it may add to the arousal from the later events: Since arousal may not dissipate for a long time, the early excitations intensify subsequent arousal from the later events because of the residual arousal retained from the earlier arousing experience (Zillmann, 1990, 2006). The degree of intensification depends on the size of the residual arousal caused by the earlier events, and the later events do not have to be related to the early events (Zillmann, 2006).

In violent media, arousal influences user aggression due to the residual arousal from early violent events. In addition, if later events caused aggression, the residual arousal from violent events could much strengthen user aggression due to the intensified arousal from later aggressive events. Considering that violent media are generally arousing as to evoke aggressive feelings or negative affect (e.g. anger, hostility), such arousal could persist over a longer time than the game experience, which potentially induces user aggression because heightened arousal from the experience of violent media could strengthen the degree of arousal with aggressive feelings such as anger or hostility at later events. If arousal evoked by early events is labeled as anger, the residual of the arousal influences later arousal by labeling the later one as anger (C. A. Anderson & Bushman, 2002).

Effects of Realistic Cues and Trait Aggression on Arousal and Affect

The construct of realism has a long history in the area of violence research (C. P. Barlett et al., 2008; Diener & Woody, 1981; Potter et al., 1995). Graphically realistic visual cues of violence have been shown to affect perceived violence (Potter, Pashupati, Pekurny, Hoffman, & Davis, 2002). We focus especially on realistic blood since it is commonly depicted in violent games.

A motivation to control the depictions of blood is the putative relationship between realistic blood description and user aggression. In many countries, game rating boards (e.g., “Game Ratings and Descriptor Guide” in the Electronic Software Rating Board in the USA, Computer Entertainment Rating Organization in Japan, Game Rating Board in Korea) differentiate adult games from youth games based on the description of graphically violent cues, including realistic blood description. Specifically, in Korea, realistic description of blood (i.e., portrayal of red blood) is one of the most crucial rationales to rate the games as adult games because of its potential effects on user aggression through arousal and presence (see the example of *Starcraft 2* (Cifaldi, 2010)). Such is the rationale behind making violence “less realistic” by changing the realistic depiction of blood into something less so (e.g., eliminating blood or changing blood’s color into black) of the creatures in the games. However, there was little research about the effect of realistic portrayals of blood on user aggression.

In game violence studies, the depiction of blood has been found to increase users’ perception of gore and aggressive intention (Farrar et al., 2006). Blood has been shown to increase arousal and aggression in violent games. According to Ballard and Weist (1996), inclusion of blood in a first-person shooter game (*Mortal Kombat*), led to higher arousal than a no-blood condition. In addition, realistic amount of blood has been reported to influence arousal

(C. P. Barlett et al., 2008), with lower levels of blood leading to lower physiological arousal. Jeong et al. (2008) found that realistic blood color increased both physiological and subjective arousal compared to unrealistic blood color.

In the studies of violent media effects, violent programs were reported to cause negative affect, especially anger or hostility. Violent movies increase user's negative affect like hostility (C. A. Anderson, 1997). Violence cues put hostile feelings to television viewers (Bushman, 1995). Recently, violent games were reported to increase users' negative affect such as hostility and anger (C.A. Anderson & Bushman, 2001; P. Arriaga, F. Esteves, P. Carneiro, & M. B. Monteiro, 2006b). Violence in television programs decreased positive affect and enhanced anger (Bushman, 1998). However, there are mixed results in the effects of blood description on user affect in violent games. Barlett and his colleagues (2008) showed that blood condition (more than medium) had a significant increase in negative affect (i.e., hostile feelings); whereas Farrar and her colleagues (2006) reported that the presence of blood had no effect on hostility. There is not much research about the effect of blood portrayal on user affect in game studies. The current study will test this directly.

Other than visual factors, auditory realism (i.e., screams of pain) could affect user aggression in the violent media as a primary factor of sensory realism. Sensory realism refers to formal features of a representation that progressively simulates the same experience in the natural environment, for example a highly realistic representation of violent images (visual realism) or an addition of realistic sound (auditory realism). In interactive media, increased sensory realism results from a wide range of innovations in technological interfaces and interface techniques (Biocca, 1997).

Realistic sound cues have been reported to influence user arousal and affect. Listening to

unpleasant sounds (e.g. noise) influences user emotional arousal and performance (Cassidy & MacDonald, 2007; Loeb, Holding, & Baker, 1982). For example, realistic pain cues such as screaming and moaning have been reported to increase observer arousal with negative affect (Bradley & Lang, 2000; Cassidy & MacDonald, 2007). However, there is little research into the effects of audio realism on arousal and affect in violent video games.

The study reported here uses the short-episode general aggression model as a guiding framework. We examine the short-term effects of violence cues (situational inputs) on user state during video game play. Focusing specifically on violence cue effects on arousal and affect, we observe physiological arousal and negative affect as internal states as in the model. We examine the influence of two sensory realism cues of violence – occurrence of blood and screams of pain – on users’ physiological arousal and negative affect. We also examine the role of trait aggression characteristics on arousal and affect level. We test the following hypotheses:

H1 (a/b): (a) Portrayal of blood and (b) screams of pain will lead to increased arousal compared to the no-blood portrayal and no-screaming conditions.

H2 (a/b): (a) Portrayal of blood and (b) screams of pain will lead the degree of users’ state aggression compared to the no-blood portrayal and no-screaming conditions.

H3 (a/b): (a) Portrayal of blood and (b) screams of pain will lead the degree of negative affect compared to the no-blood portrayal and no-screaming conditions.

H4 (a/b): Higher levels of trait aggression will be related to higher levels of (a) physiological arousal and (b) state aggression.

According to the general aggression model, internal states are affected by either situational or personal inputs (C. A. Anderson & Carnagey, 2004). Situational and personal inputs, thus, have direct effects on internal states, and additionally these could interact to

influence arousal and negative affect. In the current research, we expect that violence cues (depiction of blood or screams of pain) and users' trait aggression are likely to interact to influence physiological arousal and negative affect.

In game violence studies, such interaction effects have not received much attention. Most studies of trait aggression focus on main effects of stimuli on internal states: they test trait aggression as a covariate without much attention to its interactions with stimuli (C. P. Barlett & Rodeheffer, 2009). Recently, Anderson and Carnagey (2009) reported an interaction effect between trait aggression and experimental game conditions (violent vs. non-violent game) on aggressive thoughts (C. A. Anderson & Carnagey, 2009). In their experiment, participants with high trait aggression had more aggressive thoughts in a violent game condition than in a non-violent game condition. Likewise, there are few studies of the interaction between sound and color on arousal in game play. Wolfson and Case (2000) reported the interaction of background color and sound (music) on users' physiological arousal (heart rate) (Wolfson & Case, 2000). They showed that the combination of red color and loud sound increased user arousal in a brick-breaking video game.

Inspired by these observations, we will examine whether violence cues interact with trait aggression. In addition, we expect that specific violence cues (i.e., blood and screams of pain) will interact to influence player arousal and negative affect. This study will test the following research question.

RQ1(a/b): Will there be any interaction between depiction of blood, screams of pain, and individual trait aggression on (a) physiological arousal, (b) negative affect, and (c) state aggression?

Presence in Mediated Experience

Realistic violence cues affect not only arousal or affect level, but also have been shown to influence the sense of “presence” one feels in a virtual environment (e.g., game). Presence is the sensation of being “physically there” in a virtual environment, or the perceptual illusion of non-mediation in a mediated environment (Biocca, 1997; Lombard & Ditton, 1997).

Presence scholars think of presence as a multi-dimensional concept, composed of such factors as spatial presence and engagement (or involvement): Some add more factors such as realness and naturalness. Early approaches to the sense of presence were driven by technological perspective and spatial presence (i.e., a sense of spatial placement in a virtual environment) was a sole factor in the measurement of presence (Wirth et al., 2007). However, with the findings of conceptual intersections with existing psychological constructs like involvement, recent conceptualizations have included sub-dimensions of presence.

Witmer and Singer (1998), for example, considered involvement and naturalness as necessary parts of the presence experience. They defined “involvement” as a psychological state experienced as a consequence of focusing on stimuli or events; and “naturalness” refers to the degree of perceived naturalness toward objects or events in a virtual environment (Witmer & Singer, 1998). Likewise, Regenbrecht and Schubert (2002) included involvement and realness (i.e., reality judgment of the virtual environment) as sub-factors of presence.

Developing such concepts, Lessiter, Freeman, Keogh, and Davidoff (2001) adopted spatial presence and engagement as primary sub-dimensions of presence (Lessiter, Freeman, Keogh, & Davidoff, 2001). They used previous concepts (e.g. spatial presence, involvement, naturalness, realism, etc.) to find crucial factors in measuring the sense of presence. With factor analysis and validity tests, they reported central concepts such as “engagement,” which refers to a tendency to

feel psychologically involved in or focused on the content; and “spatial presence” which refers to a sense of physical or spatial placement in a virtual environment. In the current study, we adopted the multi-dimensional concept of presence and focused on the two primary concepts (i.e., spatial presence and engagement) from Lessiter et al.’s study (2001).

According to Lombard and Ditton (1997), there are two factors that affect presence: media form and individual differences. Media form includes the number of senses affected by the media, image quality and size, dimensionality, and perspective. Individual differences include prior experience, gender, and personality traits. Sensory realism cues such as color and sound, as variables of media form, affect the sense of presence in virtual environments (Lombard & Ditton 1997). Recently, technical advancement in graphical and auditory realism has been reported to increase presence and involvement in high-tech game studies (Ivory & Kalyanaraman, 2007). Thus, we can assume that presence of blood and screams of pain within a game might increase the sense of presence in the virtual environment.

We also suspect that trait aggression will influence the sense of presence in the violent game environment. As the general aggression model indicates, trait aggression could be one of crucial factors in violent game studies (C. A. Anderson & Carnagey, 2009). Recent studies about virtual violence have reported a relationship between presence and aggression (Persky & Blascovich, 2008) and hostility (Nowak, Krcmar, & Farrar, 2008). In the current study, thus, we directly test the effect of trait aggression on presence. We propose the following hypotheses:

H5 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased feeling of spatial presence compared to the no-blood portrayal and no-screaming conditions.

H6 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased engagement compared to the no-blood portrayal and no-screaming conditions.

H5/6 (c): Higher levels of trait aggression will be related to higher levels of the user's (H5c) spatial presence, and (H6c) engagement.

Additionally, we examine whether violence cues and users' trait aggression have interaction effects on the sense of presence. There could be an interaction effect between presence of blood and screams of pain on the sense of presence. In the condition of presence of blood, adding screams of pain could be an addition of further sensory information to the virtual environment as opposed to environments that lack this cue (see Lombard & Ditton, 1997). Thus, the addition of sensory cue might cause supplementary increase in the sense of presence.

Likewise, we also test interaction effects of violence cues with trait aggression on presence. As the long-term effect of general aggression model indicates, users with lower trait aggression could be related to lower exposure to violent games (see Anderson & Bushman 2001). In addition, like the gaming pattern differences between male and female users (see Eastin, 2006; Farrar et al., 2006), perception of violent games (e.g., perceived violence) and degree of involvement could be different between higher and lower users in trait aggression. Controlling for exposure to games, Farrar et al. (2006) reported the interaction effect between sex (women) and stimulus (third-person perspective) on presence. Similarly, our study tests the interaction effects of trait aggression with violence cues on presence.

RQ2 (a/b): Will there be any interaction effects among portrayal of blood, screams of pain, and trait aggression on (a) spatial presence and (b) engagement?

Memory and Attitude Change through Virtual Violence

Does violent experience in virtual environments increase the degree of user memory toward brands in the media? According to Bushman (1998), violent experience in television

programs decrease viewer memory for commercial messages. In the experiment, participants watched either violent or nonviolent film clips, and some commercials were inserted between the film clips. Results showed that participants who saw a violent video had poorer scores in both recognition and recall tests for brand names and commercial messages than those who saw a nonviolent video. In line with the results, Bushman's follow-up tests supported that virtual violence impairs brand memory for television ads (Bushman, 2005; Bushman & Bonacci, 2002). The results were identical for both male and female subjects of all ages regardless of their preference for programs containing violence.

One explanation for the results is that violent condition (i.e., content or cues) might capture more attention than non-violent or neutral conditions (Bushman & Bonacci, 2002). It seems that viewers in violent condition pay more attention to content in the programs than those in the other condition. Based on the limited capacity model of information processing (see Lang, 2000), this implies that capturing user attention in a violent condition would limit the amount of attention that one can pay to the commercials (Bushman & Bonacci, 2002).

However, in the Bushman' studies, they used commercial ads exposed only between film clips and were not embedded in the program. If the ads were given in the programs as part of the focal information, viewers or players could register higher memory scores in relation to the ads. Actually, violence (i.e., content or cues) can increase viewer recognition toward (focal) information presented during the violent video, and facilitate the ability to retrieve the story in the violent program (Lang, Newhagen, & Reeves, 1996). Thus, users exposed to a more violent condition would exhibit higher scores in recognizing the brands placed in the programs.

In addition, recent studies (i.e., Bushman, 2005; Bushman & Bonacci, 2002) did not significantly consider the arousal and emotion effects on memory. It is reported that arousing

content strongly enhances user recognition of specific information (Kensinger, Garoff-Eaton, & Schacter, 2006), and the negative affect impairs memory toward commercials (Wood, Saltzberg, & Goldsamt, 1990). Thus, it seems better to control arousal and affect variables in examining the effect of violence cues on user memory, which will be examined via a path model test in the current study. We will discuss more about the relationship between arousal and memory, and between affect and memory in later sections (see the section, “Effects of Arousal and Presence on Brand Memory” and “Affect Effects in Virtual Violence“)

In violent game research, there are a few recent studies about the effects of violence on brand memory. However, without consideration of information centrality (i.e., focal vs. peripheral information), the results of such studies were mixed. A study showed that participants’ brand recognition were significantly lower in the violent game condition than in the nonviolence condition (S. Yoo & Peña, 2011). But, another study reported that participants in the violent condition showed no significant difference in memory toward in-game brand logos than those in the non-violent condition (Melzer, Bushman, & Hofmann, 2009)

Violence seems to attract user attention and increase user arousal as explained in the general aggression model. Such increased attention or arousal might lead users to focus more on the program or focal information, subsequently resulting in increased memory scores in relation to focal information. But, it seems to need more studies in violent game studies. The current study directly tests this point.

Regarding attitude change, violence could lead to negative change in attitude toward the brands embedded in the programs. Lang et al. (1996) showed that negative (i.e., violent) video increases the negative emotional impact of a story. Such negative emotion will be related to the negative attitude toward the program story and brands embedded in the program. However, there

is not much research done on the effects of virtual violence on memory and attitude change toward the brands embedded in violent games. Therefore, this study directly tests the effects of violence cues on memory in relation to the brands (brand logo memory) and attitude change toward the brands embedded in the game.

H7 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased degree of memory toward the brands embedded in the game.

H8 (a/b): (a) Depiction of blood and (b) screams of pain will lead to a decreased degree of attitude change toward the brands embedded in the game.

RQ3 (a/b): Will there be any interaction effects among portrayal of blood, screams of pain, and trait aggression on (a) recognition memory and (b) attitude change toward the brands in the game?

CHAPTER 2

Literature Review (2): Modeling the Experience of Violence -

Presence, Arousal, Affect, State Aggression, Brand Memory, and Attitude Change

Relationships among Arousal, Presence, and Aggression

If the sense of presence indicates the user's sense of being inside the experience, then presence is likely to be related with some of the effects of experiencing virtual violence, including user arousal in the virtual environments. Advanced and highly interactive virtual environments are associated with a higher sense of presence and are often accompanied by higher levels of arousal (Grigorovici, 2003; Ravaja, 2004; Weiderhold, Davis, & Weiderhold, 1998). Media presentations that bring forth a strong sense of presence were reported to elicit greater self-reported and physiological arousal (Lombard & Ditton, 1997; Ravaja et al., 2006).

In video games, a strong sense of presence has been shown to elicit greater arousal and enjoyment (Heeter, 1995; Lombard, Reich, Grabe, Bracken, & Ditton, 2000). Ravaja and his colleagues (2006), monitoring facial movements and expressions, found that a higher sense of presence was related to physiological arousal during video game play. In other words, arousal is strongly associated with presence in virtual environments (Ravaja et al., 2006). Thus we propose the following hypothesis:

H9 (a/b/c): There will be significant relationships (a) between physiological arousal and spatial presence, (b) between spatial presence and engagement, (c) and between arousal and engagement.

According to the excitation transfer theory, arousal evoked by earlier events in violent media lingers and strengthens aggressive feelings such as anger or hostility from later events (see

(Zillmann, 1996). Thus, increased arousal in violent games could heighten user aggression through the mechanism of excitation transfer. Following the excitation transfer theory, the general aggression model explains that violent media affect user aggression by increasing arousal (C.A. Anderson & Bushman, 2001; C. A. Anderson & Bushman, 2002).

In gaming studies, however, there are just a few studies focusing on the relation between arousal and aggression. Ballard and Weist (1996) found a positive correlation between arousal and hostility in their violent-game experiment. Likewise, Arriaga and his colleagues (2006b) reported the correlation between arousal and hostility. Thus, this study will test whether increased arousal in violent games is related to an increase in user aggression. Based on the excitation transfer theory, we hypothesize that arousal heightened by sensory realism cues will increase users' state aggression (i.e., hostility, anger, physical aggression, and verbal aggression, see Farrar & Krcmar, 2006).

Furthermore, we will examine whether there is a significant relationship of presence with the feelings of aggression such as hostility and anger. There are some recent studies about the relation between presence and aggression. Persky and Blascovich (2008) showed that presence enhanced users' aggression in violent games. Nowak and her colleagues (2008) also reported that violent-game players who felt more presence showed more hostility than those who felt lower levels of presence.

Thus, we explore the following hypotheses.

H10: Individuals with higher levels of physiological arousal will show higher levels of state aggression than those with lower levels after the game.

H11 (a/b): Individuals with higher levels of (a) spatial presence and (b) engagement will show higher levels of state aggression than those with lower levels after the game.

Effects of Arousal and Presence on Brand Memory

Arousing information has been found to be better remembered than neutral information (Bradley, 1994; Bradley, Greenwald, & Lang, 1992; Cahill, Prins, Weber, & McGaugh, 1994; Heuer & Reisberg, 1990). Arousal affects both subjective vividness and objective accuracy in arousing events (Kensinger & Corkin, 2003; Kensinger et al., 2006; Ochsner, 2000). However, the effect of arousal on memory depends on the centrality of the information observed (Cowley & Barron, 2008).

Central or primary information seems to increase memory without regard to the degree of arousal. Primary information can be operationalized as proximity or closeness to the primary task, centrality on the screen, centrality to the plot, duration on screen, size of brand logos, etc. (Cowley & Barron, 2008; M. Lee & Faber, 2007). Recent studies show that closeness to a primary task leads to greater memory effects (d'Astous & Chartier, 2000; Gupta & Lord, 1998; Law & Braun, 2000). Specifically, in gaming studies, Lee and Faber (2007) showed the effect of proximity on brand memory in a racing game.

High arousal has been found to increase memory for central information (Brave & Nass, 2002; Parrot & Spackman, 2000). According to the limited capacity model of information processing, selection processes of user attention are automatically in operation for intensity and selectivity toward the central information (Lang, 2000; M. Lee & Faber, 2007). In arousing environments, focusing attention on central information could drive users to ignore other information since high arousal is contingent with high selectivity (Grigorovici & Constantin, 2004). Users will selectively focus on primary information with intensive attention in arousing environments, while they neglect peripheral information. Thus, the effect of increased arousal on memory can be found in primary information carriers.

Focusing on arousal effects on brand logo memory, in the current study we place brand logos directly behind opponents, ensuring that logos are in the field of view whenever they shoot an opponent. In addition, we depict arousing details near the brand logos (blood splattering over the logos) whenever opponents are shot. We suspect that this arousing and centrally located information will be better remembered as a result of increased user arousal.

We also predict that presence will influence logo memory. According to Kim and Biocca (1997) presence is strongly correlated with an individual's ability to recall material. In violent games, a strong sense of presence increases identification with characters (Tamborini, 2000), leading to better memory for events in the game (Grigorovici, 2003).

In product placement studies, however, the effects of presence on brand memory are unclear. Grigorovici and Constantin (2004) showed that presence negatively affected brand recall. Nelson and colleagues (2006), however, could not find evidence of such a negative relationship between presence and memory. They indicated that presence could be a factor in making users focus selectively on central information. Thus, in mediated environments, brands positioned in areas peripheral to the central task are likely more difficult to remember. In prominent locations, the effects of presence on brand memory could be positive. In the current study, we predict that a strong sense of presence will increase brand logo memory. We test the following hypotheses:

H12 (a/b/c): (a) Arousal, (b) spatial presence, and (c) engagement will increase brand logo memory.

Change in Brand Attitude through Virtual Experience

The effects of both attitude change and user aggression are related via excitation transfer theory (Zillmann et al., 1972). According to the theory, physiological arousal evoked by earlier

events can transfer to later events, and can even add to the arousal resulting from later events. Since arousal dissipates slowly, early excitement events intensify subsequent arousal. This effect could manifest itself in user aggression or positive (or negative) change in attitude toward brands.

In television advertising studies, excitation transfer theory has been applied to explain “affect transfer” from television program to commercials in the program. Singh and Churchill Jr. (1987) observed that advertisements that produce positive emotions could be perceived positively due to residual excitation from prior programming (Singh & Churchill, 1987). Russell (1998) reported that the pairing of a product and an emotionally rich television show or movie conditions a transfer of affect from the show to the product (Russell, 1998). Also, positive feelings influence change in brand attitude positively (C. Yoo & MacInnis, 2005).

In hedonic content like video games, arousal strongly affects user evaluation (i.e., preference) for the content. Consumers show stronger preference for video games if they feel more arousal in the games (Kempf, 1999; Mehrabian & Wixen, 1986). It was also reported that gamers’ physiological arousal is positively related to their pleasure in using games (Ravaja & Kivikangas, 2008). Such emotional arousal might be transferred to the content in the game through excitation transfer or affect transfer. Thus, the increased arousal could induce positive attitude toward brands embedded in the game. Actually, Grigorovici and Constantin (2004) reported that level of arousal had a significant effect on preference for brands embedded in a 3D virtual environment (i.e., video games). We can assume that high arousal could induce positive change in brand attitude in video games. This study will test the arousal effect on attitude change.

However, as the general aggression model posits, violent games seem to be more related to negative emotions like hostile feelings. Thus, the effect of arousal on users’ attitude changes through affect transfer in violent games could be different from such effect in non-violent

hedonic content. In violent game settings, this study tests whether the effect of arousal on the attitude change toward brands in the violent game would be positive or negative.

Similarly, observers with strong feelings of presence in a virtual environment tend to display greater attitude change toward brands (Kim & Biocca, 1997; Nelson et al., 2004; Nelson et al., 2006). Furthermore, if a high degree of presence leads to brand preference, it can also lead to heightened arousal and affect, and more positive change in brand attitude leading to favorable purchasing intentions (Grigorovici & Constantin, 2004). However, there is little research about the effect of presence on attitude change toward brands embedded in violent games. We test the following hypothesis:

RQ4 (a/b/c): Will the increase in (a) arousal, (b) spatial presence, and (c) engagement lead to negative attitude change toward the brands embedded in violent games?

Affect Effects in Virtual Violence

Mood was reported to affect the degree of memory retention. Many previous studies showed that mood (or affect) influences memory (e.g., Bushman, 1998; Christiansen, 1992; Mayer, McCormick, & Strong, 1995). According to the mood management theory, people naturally pursue a positive mood (e.g., pleasure) and avoid negative mood (e.g., pain). When a program induces negative mood, such as anger and distress, viewers would be willing to finish or change the negative mood. In contrast, viewers in a positive mood would more likely want to maintain the positive mood.

Thus, viewers in a negative mood should be in the process of improving their mood by eliminating the negativity, which automatically needs more effort than that entailed with having a positive mood. Because of the effort (or attention), viewers in a negative mood need to focus

more on themselves than on the program, they cannot allot much attention to the program. Therefore, we can assume that users with negative affect (e.g., hostility, anger, or irritation) in violent games could not pay more attention to the embedded in-game brands than those with a non-negative affect. This results in poorer memory scores compared to those with a non-negative affect (Bushman, 1998; Wood et al., 1990).

Affect also influences attitude change. According to the affect transfer hypothesis, user affect toward the program does influence not only the program but also products in the program. If someone has a positive affect toward a program, the positive emotion may be transferred from the program into the in-program products. This transferred affect could result in a positive change in attitude toward the products or commercials in the program (see Russell, 1998; Singh & Churchill, 1987). In advertising studies, positive affect was reported to increase user preference for brands of various types (e.g., Brendl, Chattopadhyay, Pelham, & Carvallo, 2005).

In studies on violence effects, violent programs (e.g., games) were reported to cause negative affect, especially anger or hostility (C. A. Anderson, 1997; Bushman & Geen, 1990), which is in line with the aggression mechanism in the general aggression model. Thus, negative affect could be transferred into the brands in the game, and induce a negative attitude change toward the brands. However, we need to consider that user arousal was also reported to affect the user's preference in correlation with user affect in games. As violent games might cause a negative affect, we need to control the affect variable in investigating the effects of arousal and presence on dependent variables (i.e., memory, attitude change, and state aggression). By controlling the negative affect variable, for example, measuring arousal might provide a better sense of its effect on attitude change, enabling us to assess whether the arousal is linked to a negative or non-negative affect. Therefore, it might also be helpful to explore the relationship

between presence and attitude change when the level of users' negative affect is controlled.

In addition, affect influences aggression. As explained in the general aggression model, violence cues affect user aggression by influencing negative affect, such as anger or hostility. In relation to arousal level, if arousal evoked by early events is labeled as negative affect (e.g., anger), the residue of the arousal affects later arousal by labeling the latter affect as a negative affect (C. A. Anderson & Bushman, 2002). Thus, negative affect could influence user aggression through transferred arousal combined with negative affect.

Furthermore, we will examine the relationships among negative affect, arousal, and presence. Considering that arousal and presence might be correlated with each other in virtual environments, and arousal might be closely related to user affect in violent media, there could be significant relationships among negative affect, arousal, and presence. The current study will test whether negative affect is associated with arousal and presence. Following hypotheses are suggested:

H13 (a/b/c): The increase in negative affect will lead to (a) lower levels of brand logo memory, (b) negative attitude change toward the brands, and (c) higher levels of state aggression.

RQ5 (a/b/c): Will negative affect correlate with (a) physiological arousal, (b) spatial presence, and (c) engagement?

Mediation Roles of Presence, Arousal, and Affect

We will examine the potential mediating effect of presence and arousal between violence cues and advertising effects (brand memory and attitude change) in a path model. Presence is influenced both by technological and individual cues, but it also influences user responses to

media cues. Presence has been reported to play a critical role in mediating between environmental cues and observers' cognitive, affective, and social states. There is evidence for this mediating effect of presence in the human-computer and virtual environment literatures (K. M. Lee, Jeong, Park, & Ryu, 2011; K. M. Lee & Nass, 2004).

Mediating effects of presence in games have been shown for user satisfaction, preference, and enjoyment (K. M. Lee et al., 2011; Park, Lee, Jin, & Kang, 2010). Presence has also been shown to mediate between violent game playing and aggression (Nowak et al., 2008; Persky & Blascovich, 2008). However, there are few studies showing a mediator effect for presence on brand logo memory and attitude change in virtual environments. Likewise, little is known about the mediator effect of presence on aggression in violent games.

In addition, even though the general aggression model and excitation transfer theory imply the mediation roles of arousal between violence cues and user aggression, there are few studies about the mediation effect of arousal. Likewise, following the general aggression model, we can assume that affect mediate between violence cues and aggression. Based on previous studies of violence cues, arousal, affect, aggression, brand logo memory, and change in brand attitude, we examine the mediating roles of arousal and affect in our path model (see Figure 8).

RQ6 (a/b/c): Will physiological arousal, spatial presence, engagement, and negative affect mediate the effects of violence cues on (a) brand logo memory, (b) attitude change, and (c) state aggression?

CHAPTER 3

Experiment 1: Advertising Effects of Violence Cues through Arousal and Presence

Experiment 1 tested how graphical and auditory realism of violence cues (realistic blood and pain sounds), as well as users' trait aggression, influence brand memory and attitude change toward brands embedded in the game through physiological arousal and sense of presence. The following were examined: 1) the effects of sensory realism cues of violence and trait aggression on physiological arousal and presence; 2) the effects of arousal and presence on brand memory and attitude change; 3) the relationships between arousal and presence; and 4) the roles of physiological arousal and presence using a path model (SEM). Figure 2 shows the path model for the test.

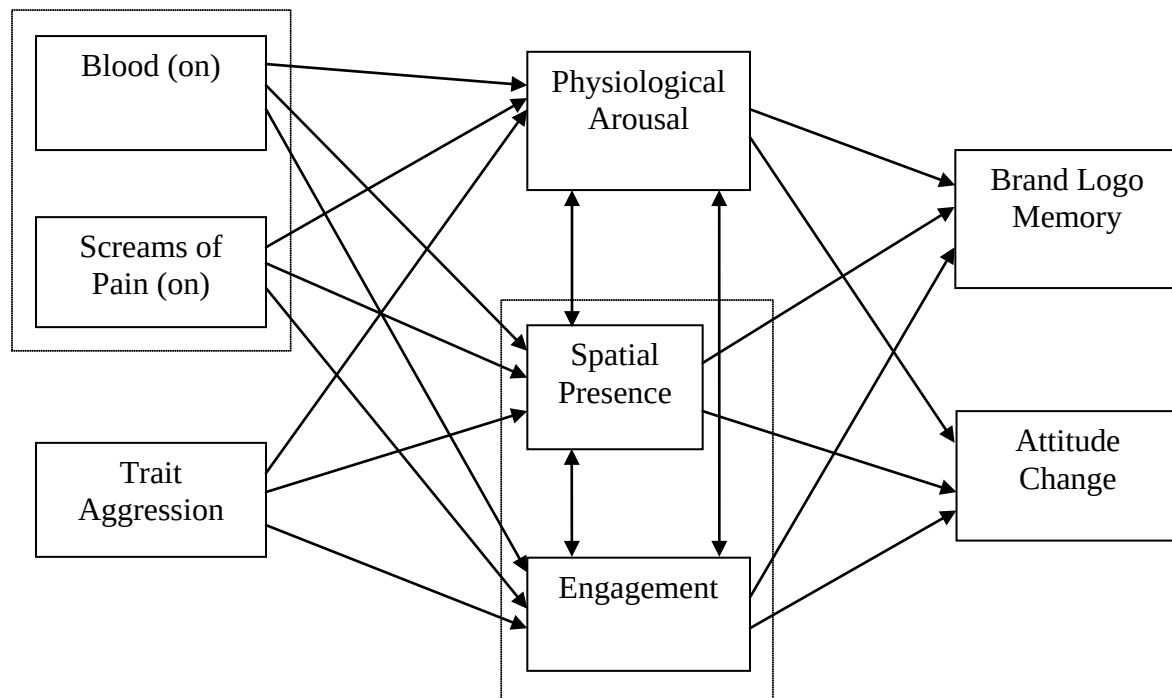


Figure 2. Path Model (1)

Method

Design and Participants

The experiment used a 2 (depiction of blood: on vs. off) x 2 (screams of pain: on vs. off) between subjects design. A total of 80 participants ($M = 20.6$ years, $SD = 2.48$; 55 males, 25 females) were recruited from Michigan State 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 conditions. In terms of sex, considering different gaming patterns between males and females, we used a stratified randomization. Each group was composed of 6-7 females and 13-14 male students. Participants received course credits for their participation in the experiment.

Stimulus Material

The experiment used the game *Half-Life 2*, which is rated “M” (Mature) by the Entertainment Software Rating Board because of violence, blood and gore. We modified the original game for the experiment using Garry’s Mod (www.garrysmud.com), which is a design tool that enables 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 brand logos of each location in the blood condition while the blood emitted by wounded enemies was either on or off, depending on experimental condition (see Figure 3).

Participants were instructed that they must shoot and kill the opponents to pass through

each corridor. Without killing the opponent, no participant could pass to another corridor since the opponent would shoot back and kill the participant in the game. Whenever participants shot and killed an opponent, screams of pain were heard in two of the experimental conditions. 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.



Figure 3. Killing Scene in the Game

Measures.

Trait Aggression. Trait aggression was measured by the Buss-Perry's Aggression Questionnaire, which consists of 29 items of 5-point scale (Buss & Perry, 1992). Buss and Perry (1992). Using the scale, Buss and Perry (1992) tested three models: (1) A global trait aggression model that assumes all items would load on one general factor; (2) a four sub-traits model assuming four correlated factors such as hostility, anger (or temper), physical aggression, and

verbal aggression; (3) and finally a hierarchical model that assumes the four sub-traits are sufficiently related to form a general, higher order factor of trait aggression. Their study showed that the second and third models had reasonably good fits, suggesting one of these should be used to maximize inclusiveness. The current study, thus, adopted the third, hierarchical model and used the second-order factor as trait aggression.

In order to verify the factor structure and determine reliabilities of the measure, we ran a confirmatory factor analysis on this scale. From the original Buss-Perry scale, four items (item 6, 15, 19, and 25) were dropped out because of poor reliability, and four items were loaded on different dimensions from the original scale (item 4 on hostility and item 9 on anger from physical aggression; item 16 on verbal aggression from anger; and item 23 on anger from hostility). Following the analysis, each dimension showed good reliability (hostility, 7 items, $\alpha = .77$; anger, 6 items, $\alpha = .78$; physical aggression, 6 items, $\alpha = .75$; verbal aggression, 6 items, $\alpha = .69$). Finally, trait aggression was calculated from the four dimension values (average of the means of the four sub-traits), which showed good reliability ($\alpha = .75$). The overall analysis showed adequate model fit ($\chi^2 = 78.63$, $p > .05$; RMSEA = .077; CFI = .912).

Physiological Arousal. For physiological arousal, galvanic skin response was measured through skin conductance levels (SCLs) using the Biopac MP150 system (Biopac Inc., Goleta, CA). The hardware settings for SCLs were 20 $\mu\Omega$ /volt filtering and a 1.0 Hz high-pass filter, and 200 samples per second. SCL baseline was measured for 3 minutes before beginning the game, and during play SCLs were measured continuously.

Spatial Presence and Engagement. Presence was measured by the ITC-SOPI multidimensional presence scale (see Lessiter et al., 2001). The questionnaire is composed of four sub-factors such as spatial presence, engagement, ecological validity, and negative effects.

We focused on two primary 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,” $\alpha = .93$), 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,” $\alpha = .88$).

Brand Logo Memory (Logo Recognition). For measuring brand logo memory a recognition memory test followed the game playing session. Each participant viewed a series of 40 brand logos: Twenty of them (e.g. *Samsung*, *Google*, *EastAir*, *Schwinn*, etc.) were in the game, but the other twenty were not in the game. The twenty brand logos that were in the killing sites of the game were experienced with blood emission and screams of pain, depending on condition. Each user’s memory score was summed from the correctly-answered scores of the twenty brand logos where the user could experience blood-splatter (on vs. off) and screams of pain (on vs. off). Participants were instructed to determine as quickly as possible whether they had seen each brand logo during game play or not.

Attitude Change toward Brands. To gauge the attitude change toward brands (change in brand attitude), participants provided ratings on the following dimensions: good, favorable, positive, and like (7-scale measure) (C. Yoo & MacInnis, 2005). The attitude test was conducted two times (pre- and post-test). The attitude change values were calculated by subtracting pre-test values from the post-test values. The attitude questionnaire for pre-test was taken about one week prior to the experiment. In the pre-test, there were 40 brands including both the brands that would be in the game and other brands not in the game to minimize effects on the memory test. After the experiment, the attitude questionnaire was taken again for the brands in the game (Pre-

Q: $M = 4.04$, $SD = .81$; Post-Q: $M = 4.50$, $SD = .66$).

Procedures

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 frequency of exposure to shooter games⁴, pre-attitude and familiarity⁵ toward brands, demographics, and trait aggression. 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 were no opponents at this level. Before beginning the game, participants completed a recording session for baseline physiological arousal during which they sat quietly and relaxed.

During the experimental phase, participants played one session of the 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 for measuring brand logo memory. Participants were asked to quickly decide whether they had seen the brand logos before or not. Finally, a questionnaire assessed participants' post-attitudes toward the brands encountered in the game.

Results

Manipulation Checks

Manipulation checks for two levels of blood (present or absent) and sound (present or absent screams of pain) were conducted by comparing means of perceived violence and realism

between the levels. Perceived violence was measured using four items on a five-point scale ($\alpha = .89$; e.g., “The game I played had violent graphics,” “The game was very violent,” “The game was for hard-core violent game users,” and “The game should be rated as adult games due to violence”); Perceived realism was measured using two questions on a five-point scale ($\alpha = .74$; “I felt that the killings were very realistic,” “It was believable to me as a real”). In perceived violence, the presence of blood showed higher scores ($M = 3.57$) than no blood condition ($M = 1.95$; $t = 3.71, p < .01$); the screams condition was higher ($M = 3.23$) than no screams ($M = 1.89$; $t = 3.39, p < .05$). Likewise, in terms of perceived realism, the blood condition showed higher scores ($M = 2.98$) than the no blood condition ($M = 1.83$; $t = 2.85, p < .05$); and the screams condition was higher ($M = 2.84$) than no screams ($M = 1.97$; $t = 2.47, p < .05$).

Interaction Effects: ANOVA tests

Before we present our path model, to test research question 1, we examined main and interaction effects of sensory realism cues (e.g. blood and screams of pain) and trait aggression on physiological arousal. To test the effects of sensory realism cues on physiological arousal (SCLs subtracted from baseline), we used one-way analysis of variance (ANOVA). Arousal was the dependent variable: The sensory realism cues (blood, screams of pain) and trait aggression were the independent variables. For this test, we split the trait aggression into two groups (higher vs. lower) using the median value (2.25).

The depiction of the two violence cues, blood and screams of pain, significantly increased players’ physiological arousal (blood, $F(1, 72) = 7.83, p < .01$; screams, $F(1, 72) = 4.13, p < .05$). Participants who saw blood ($M = .28, SD = .24$) displayed higher arousal than those who did not see blood ($M = .02, SD = .05$). Similarly, those who heard screams of pain (M

= .26, SD = .14) displayed higher physiological arousal than those who did not ($M = .05$, SD = .05). A player's levels of trait aggression had no significant relationship with those of arousal.

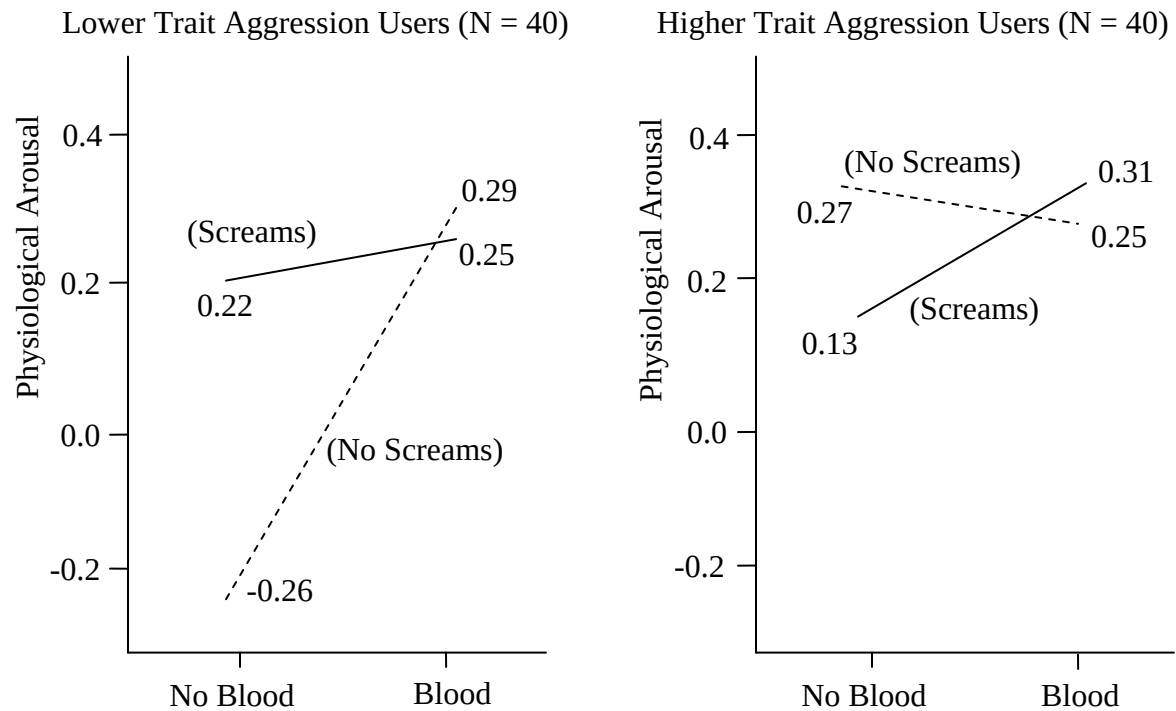


Figure 4. Interaction Effect between Blood and Screams on Arousal in Different Levels of Trait Aggression

We found two interaction effects on arousal: between blood and screams, $F(1, 72) = 15.05$, $p < .001$; and among blood, screams, and trait aggression, $F(1, 72) = 12.93$, $p < .01$. Contrast tests show that users in the no-screams condition showed higher arousal with the depiction of blood compared to the no-blood condition ($M = .29$ versus $-.18$ respectively, $F(1, 38) = 10.65$, $p < .01$), but arousal was not significantly affected by the depiction of blood in the screams condition ($M = .27$ versus $.20$, $F(1, 38) = .80$, NS). Figure 4 shows that low-aggression participants in the no-screams condition experienced higher arousal in the blood condition than

in the no-blood condition ($M = .29$ versus $-.26$ respectively, $F(1, 19) = 19.03$, $p < .01$). For higher trait aggression users, arousal in the screams condition showed higher arousal in the blood condition than in the no blood condition ($M = .31$ versus $.13$, $F(1, 20) = 4.19$, $p < .05$). There were no significant differences in other conditions.

Path Model: SEM tests

To test the path model, we performed a path analysis. The model specifies the effects of blood, screams of pain, and trait aggression on both physiological arousal and presence. In addition, it tests the relationship among physiological arousal, presence, brand logo memory, and change in brand attitude. Table 1 shows the correlations between key variables.

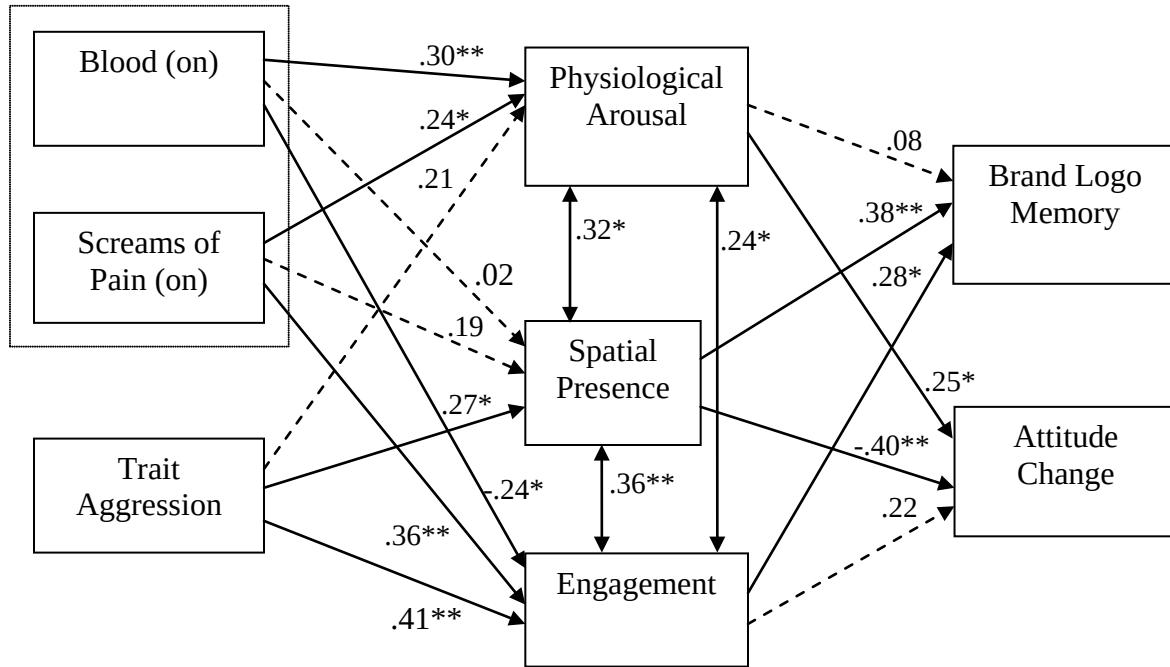
Table 1. Correlations between Variables

	<i>M (SD)</i>	1	2	3	4	5	6
1. Arousal (SCLs)	.15 (.14)	1.00					
2. Spatial Presence	2.72 (.79)	.32*	1.00				
3. Engagement	3.24 (.85)	.24*	.36**	1.00			
4. Brand Memory	10.25 (3.43)	.26*	.49***	.42***	1.00		
5. Attitude Change	.45 (.79)	.18	-.25*	.16	-.15	1.00	
6. Trait Aggression	2.34 (.44)	.27*	.26*	.36**	.22	-.05	1.00

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

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 (see Figure 5). For trait aggression, however, we

could not find any significant effect on physiological arousal.



* $p < .05$, ** $p < .01$

Note. The coefficients are standardized. Model fit: $\chi^2 = 15.31$, $df = 13$, $p > .05$;

RMSEA = .055; CFI = .965; IFI = .967

Figure 5. Path Model Analysis (1)

For spatial presence, only trait aggression showed a significant effect ($\beta = .27$, $p < .05$). For engagement, scream sounds had a significant effect ($\beta = .36$, $p < .01$); and blood condition had a significant (negative) effect on engagement ($\beta = -.24$, $p < .05$). Likewise, trait aggression showed a substantive effect on engagement ($\beta = .41$, $p < .01$).

Effects of Arousal and Presence on Brand Logo Memory. Players who reported higher levels of spatial presence remembered (recognized) more brand logos, $\beta = .38$, $p < .01$. Likewise,

the effect of one of the other dimensions of presence, engagement, on brand logo memory was also significant ($\beta = .28, p < .05$).

There was a significant correlation between physiological arousal and brand logo memory ($r = .26, p < .05$). However, when presence was controlled (spatial presence and engagement), the significant relationship between arousal and memory disappeared ($\beta = .08, NS$).

There was a significant correlation between physiological arousal and presence along both the dimensions of spatial presence ($r = .32, p < .05$), and engagement ($r = .24, p < .05$). The two dimensions of presence were strongly inter-correlated ($r = .36, p < .01$).

Effects of Arousal and Presence on Change in Brand Attitude. We tested the effects of arousal and presence on attitude change. Users who experienced higher levels of arousal reported greater change in brand attitude in the game ($\beta = .25, p < .05$). On the other hand, players who reported higher levels of spatial presence, displayed strong negative change in brand attitude ($\beta = -.40, p < .01$). Level of engagement did not significantly affect attitude change.

Table 2. Results of Hypotheses and Research Questions (1)

Hypotheses and Research Questions	Results
H1 (a/b): (a) Portrayal of blood and (b) screams of pain will lead to increased arousal compared to the no-blood portrayal and no-screaming conditions.	Approved
H4 (a/b): Higher levels of trait aggression will be related to higher levels of physiological arousal.	Rejected
RQ1(a/b): Will there be any interaction between depiction of blood, screams of pain, and individual trait aggression on physiological arousal?	On arousal
H5 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased feeling of spatial presence compared to the no-blood portrayal and no-screaming conditions.	Rejected

Table 2 (cont'd)

Hypotheses and Research Questions	Results
H6 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased engagement compared to the no-blood portrayal and no-screaming conditions.	H6b approved
H5/6 (c): Higher levels of trait aggression will be related to higher levels of user's (H5c) spatial presence, and (H6c) engagement.	Approved
RQ2 (a/b): Will there be any interaction effects among portrayal of blood, screams of pain, and trait aggression on (a) spatial presence and (b) engagement?	None
H7 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased degree of memory toward the brands embedded in the game.	Approved
H8 (a/b): (a) Depiction of blood and (b) screams of pain will lead to decreased degree of attitude change toward the brands embedded in the game.	Approved
RQ3 (a/b): Will there be any interaction effects among portrayal of blood, screams of pain, and trait aggression on (a) recognition memory and (b) attitude change toward the brands embedded in the game?	None
H9 (a/b/c): There will be significant relationships (a) between physiological arousal and spatial presence, (b) between spatial presence and engagement, (c) and between arousal and engagement.	Approved
H12 (a/b/c): (a) Arousal, (b) spatial presence, and (c) engagement will increase brand logo memory.	H12b, H12c Approved
RQ4 (a/b/c): Will the increase in (a) arousal, (b) spatial presence, and (c) engagement lead to negative attitude change toward the brands embedded in violent games?	(b) spatial presence
RQ6 (a/b/c): Will physiological arousal, spatial presence, and engagement mediate the effects of violence cues on (a) brand logo memory, and (b) attitude change?	On memory (engagement) On attitude (arousal)

Finally, we conducted an analysis of mediation effects. We compared the improvement of model fit between the path model and the other model that includes direct paths between violence cues and dependent variables (see Holmbeck, 1997). There was, however, no improvement of model fit between the two models: χ^2 change ($df = 4$) = 1.56, NS. The analysis

suggests there are two significant paths mediating the effects of the sensory cues of violence on brand logo memory attitude change: one path is through arousal mediating the change in brand attitude; the other was through engagement (an indicator of presence) mediating the recognition memory for brand logos. Table 2 describes the results of hypotheses and research questions.

Chapter Discussion

Does sensory realism cues of violence in violent games affect players' brand logo memory and attitude change toward brand logos in the games? Guided by the general aggression model, we looked at the impact of game related aspects of violence (i.e., realistic violence cues) and user centered tendencies towards violence and aggression (i.e., trait aggression) on the player's level of arousal during game play. In addition, we examined their effects on the user's immersive experience of the game (i.e., sense of presence). We finally tested whether the players' arousal and sense of presence significantly mediate the effects of violence cues on brand logo memory and attitude change for brand logos placed in a violent game.

We found the sensory realism of violence, specifically the depiction of blood and screams of pain, increased users' physiological arousal while playing. These results are consistent with previous studies showing that the mere presence of blood (e.g., Ballard & Weist, 1996) increases users' arousal and the general relationships between unpleasant sounds and arousal (e.g., Bradley & Lang, 2000). This is broadly consistent with the general aggression model which predicts the effects of situational inputs, in this case realistic violence cues, on the viewer's arousal.

Turning now towards properties of the user, trait aggression did not show any significant association with physiological arousal in the path analysis. On the other hand, those with higher trait aggression were more likely to feel spatial presence in the violent game. There

was an interaction of the player's level of trait aggression with the sensory cues of violence in the game. The result indicates that that combination of violence cues, blood and screams, increase arousal of the users with higher trait aggression. Overall, this indicates that although users with higher trait aggression are not more aroused than others by the violence cues, they feel more spatial presence in the game than those with lower trait aggression.

The more aroused a player was in the game, the more likely they were to have increased positive change in brand attitude. This is consistent with previous studies about the effect of arousal on user evaluation in hedonic content (e.g. Kempf, 1999; Mehrabian & Wixen, 1986). From the perspective of affect transfer and excitation transfer, the relationship between increased arousal and positive change in brand attitude is also predicted. First, for gamers, arousal is related to user pleasure from the emotional intensity (see Ravaja & Kivikangas, 2008). Second, in psychophysiology studies, high arousal and positive valence tend to be present when galvanic skin response (SCLs) is high (Mandryk & Atkins, 2007). However, without measuring the emotional variable, it has a limitation in fully explaining the result. Future studies need to check both user emotion and arousal levels for further explanation.

Increased arousal, however, did not lead to improved brand logo memory. This finding differs from previous studies reporting that arousing events are better remembered. One explanation could be the effect of interactivity in (dynamic) gaming environments. In most previous studies of arousal effects on memory, participants were exposed to passive environments, that is just watching static stimuli such as arousing pictures (e.g. bloody casualties, sexual scenes; Bradley et al., 1992; Maljkovic & Martini, 2005). Increments in arousal could not be as influential on memory in highly interactive environments as it is in low or non-interactive ones. Interactivity has been reported to affect memory or information processes through presence

in VR space (e.g., Skalski & Tamborini, 2007), but there is little research about its effect on memory considering arousal levels in virtual environments. Future studies could examine the arousal effect on memory in different levels of interactivity.

Brand logo memory, on the other hand, was significantly predicted by the user's sense of presence in the game. A player's level of spatial presence was the biggest predictor of brand logo memory in the game. This is consistent with previous studies showing a link between presence level and increased memory (Kim & Biocca, 1997; Lombard & Ditton, 1997). The current results imply that enhancing presence in violent games will lead to increased brand logo memory.

But it is important to note that although a player's level of arousal has a positive effect on brand attitudes, their level of spatial presence led to negative change in brand attitude in the violent game. It appears that a strong sense of spatial presence in violent games leads to negative changes in brand attitude but with an increase brand logo memory. Players remember the brand logos more, but with negative changes in brand attitude.

This was clearly evident for the highly recognized brand logos in this study. When we checked the correlation between recognition and attitude change for the logos that were highly recognized over the median of recognition (.49), there was a significant negative relationship to attitude change ($r = -.27, p < .05$)⁶. We refer to this result as a "boomerang effect" for the highly recognized brand logos, as it presents a paradox for advertisers interested in utilizing popular violent games. Higher spatial presence in highly immersive violent games could accompany negative attitude change toward the highly recognized brands.

Sensory realistic violence cues (blood and pain sounds) has an effect on the player's brand logo memory, but what mediated by the user's sense of presence, specifically the

engagement dimension. Of the sensory cues of violence, the audio cues led to increased brand logo memory as well as higher change in brand attitude compared to the visual cue, the presence of blood. The path model suggests that pain sounds may increase logo memory through engagement and enhance change in brand attitude via arousal. Although both blood and screaming increased physiological arousal, blood negatively impacted engagement while screams of pain had the opposite effect. It seems possible that graphic effects like realistic blood depiction may be more disturbing to users engaged in the game.

CHAPTER 4

Experiment 2: Aggression and Advertising Effects in Violent Games

Experiment 2 was conducted to replicate and extend the results of Experiment 1. The second experiment included two additional variables: user emotion (i.e., negative affect) and aggression (i.e., state aggression). As affect transfer hypothesis addresses, user affect was reported to influence user preference for various types of brands (e.g., Brendl et al., 2005). In addition, user affect was also reported to influence user memory (e.g., Bushman, 1998; Christiansen, 1992; Mayer et al., 1995). Therefore, the effect of arousal on brand memory and attitude change needs to be examined by controlling the level of user affect in the game.

In violent game studies, it seems necessary to check the degree of user aggression in investigating the entire mechanism of advertising effects of violence cues. As the general aggression model explains, negative affect and user arousal are influenced by violence cues and increases aggression. Examining the relationship between user aggression and advertising effects will bring forth a much clear explanation on the mechanism of advertising effects in violent games.

Therefore, the objective of the second experiment is to test how graphical and auditory realism of violence cues (realistic blood and pain sounds), as well as users' trait aggression, influence advertising effects (i.e., brand memory and attitude change) and users' aggression state through physiological arousal, negative affect, and presence. In line with this, the experiment additionally examines 1) the effects of sensory realism cues of violence and trait aggression on negative affect; 2) the effects of negative affect on brand memory, attitude change, and state aggression; 3) the relationships among negative affect, arousal, and presence; and 4) the

mediating role of negative affect between violence cues and the dependent variables using a path model (SEM, see Figure 6).

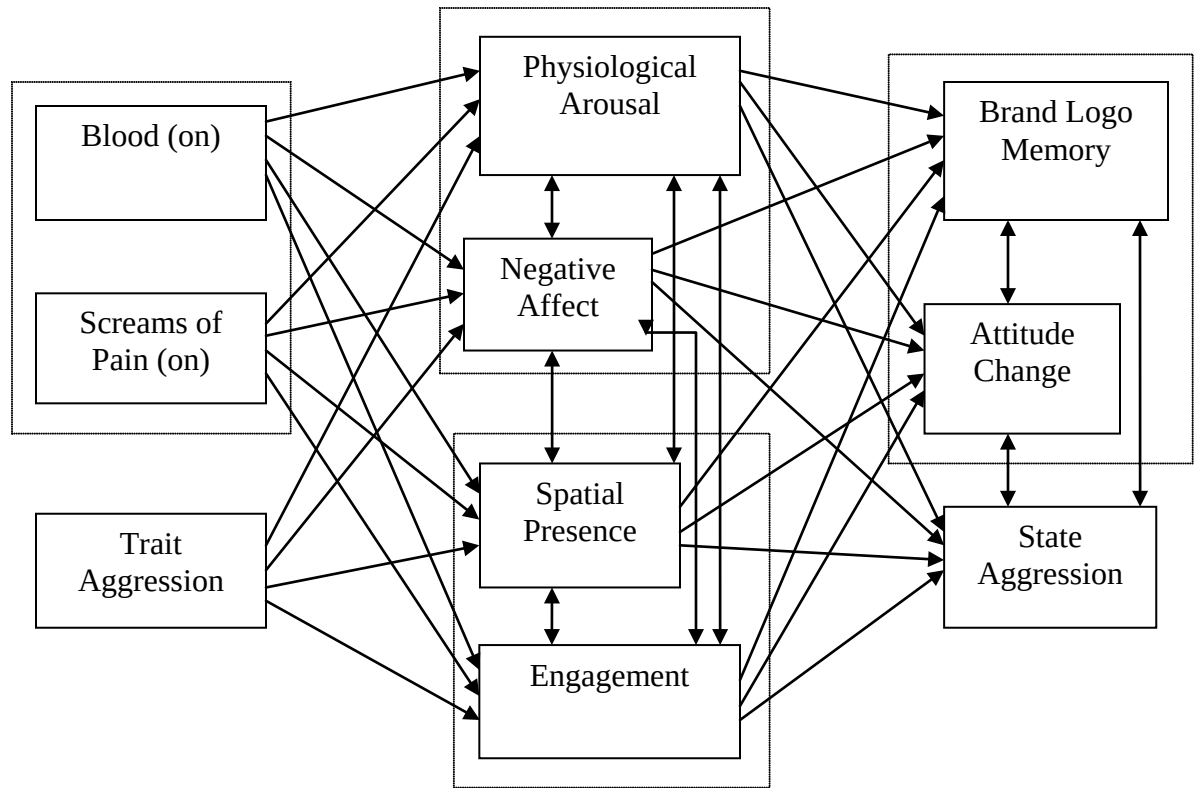


Figure 6. Path Model (2)

Method

Design and Participants

The experiment used a 2 (depiction of blood: on vs. off) x 2 (screams of pain: on vs. off) between subjects design, the same with the first experiment. A total of 88 participants ($M = 22.52$ years, $SD = 4.41$; 40 males, 48 females) participated in the experiment. All the participants were recruited from a major university in Korea via the university's official website on a voluntary basis. They were randomly assigned to one of the four conditions. Considering

different gaming patterns between males and females, stratified randomization was used in terms of sex. Each group had 10 males and 12 females. Participants received 5,000 KRW (about 5 USD) for their participation in the experiment.

Stimulus Materials

The experiment used a modified violent game, *Half-Life 2*, which is rated “M” (Mature) by the Entertainment Software Rating Board because of violence, blood and gore. Participants played for about 6 minutes to finish one session. Since we changed the length of each path, the total amount of play time was about 1 minute longer than that of the first experiment. The playing methods were identical with those of the first experiment. Players walked through 22 corridors to kill the opponents who blocked their way to the ending point. There were 20 sites where players have to fight against (a total of 20) opponents. The opponents were all males wearing military clothes. To ensure that all the subjects played the violent game at the same level regardless of their skills, the game was set at the “health mode” so that the participants could not be killed during the game.

All participants wore headsets during game play to block external noise and to maximize the clarity of auditory cues. In the blood condition, realistic (red) blood was splattered background brand logos of each location. Likewise, in the screams condition, realistic (screaming) sound was screeched by the opponents whenever they were shot by the players. Players were instructed to kill the opponents whenever they were confronted.

Measures

We used the same measures as in the first experiment: trait aggression, physiological

arousal (SCLs), spatial presence, engagement, brand logo memory, and attitude change towards the brands. Two new variables were added: negative affect and state aggression.

Negative Affect. Negative affect was measured using the Negative Affect subscale of the PANAS-X (expanded version of Positive Affect and Negative Affect Scale; Watson & Clark, 1994; Watson, Clark, & Tellegen, 1988). The subscale is composed of 10 adjectives (e.g., hostile, irritable, afraid, nervous, etc.) in the five-point Likert scale. We asked the questions about negative affect two times: before the experiment when they arrived at the experiment room (prior experiment affect, $\alpha = .88$), and right after the experiment when they finished the game (post experiment affect, $\alpha = .93$). The final value of negative affect was calculated by subtracting the prior experiment affect value from the post experiment value.

State Aggression. State aggression was measured using a revised version of Farrar and Krcmar's state aggression questionnaire (see Farrar & Krcmar, 2006). The original scale was developed as a modified version of Buss-Perry's Aggression Questionnaire (see Buss & Perry, 1992; Farrar & Krcmar, 2006). It was developed to measure "state aggression" for a short-term study, an experiment with an immediate posttest, which is as reliable as the original version and has adequate construct validity. For example, "I tell my friends openly when I disagree with them" was changed into "I would tell this person openly that I disagree with him or her." (Farrar & Krcmar, 2006). The scale measured four different feelings of aggression: state hostility, anger, physical aggression, and verbal aggression.

In order to verify the factor structure and reliabilities of the measure, a confirmatory factor analysis (CFA) was run on this scale. Similar to the trait aggression measure, we used the second-order factor value as state aggression. Even though no items were dropped out for reliability, two items were loaded on different dimensions from the original scale (item 15 on state

anger from state verbal aggression; and item 27 on state verbal aggression from state hostility). The four dimensions finally showed good reliabilities (state hostility, 7 items, $\alpha = .84$; state anger, 8 items, $\alpha = .88$; state physical aggression, 9 items, $\alpha = .84$; state verbal aggression, 5 items, $\alpha = .75$). The final value of each user's state aggression was calculated from the four dimension values (average value of the four sub-dimensions) with good reliability ($\alpha = .88$).

Physiological Arousal. As we did in the first experiment, we used galvanic skin response measured through skin conductance levels (SCLs) to assess physiological arousal. We used the Biopac MP150 system (Biopac Inc., Goleta, CA) by settings for SCLs with 20 $\mu\Omega$ /volt filtering and a 1.0 Hz high-pass filter, and 200 samples per second. Before the experiment game, we checked each user's SCL baseline for about 5 minutes. The SCLs were also measured continuously during each user play the game.

Spatial Presence and Engagement. As was used in the first experiment, the ITC-SOPI multidimensional presence scale was used to measure presence (see Lessiter et al., 2001). Two primary factors, spatial presence and engagement, were measured with total 33 items of 5-scale measure: spatial presence (20 items) and engagement (13 items). Three items were dropped out from the original questions for reliability (engagement 3, 4, and 11 item), and three items were loaded into different factor (engagement 7, 10, and 12 items into spatial presence). Final factors showed good reliability (spatial presence, $\alpha = .96$; engagement, , $\alpha = .89$).

Brand Logo Memory (Logo Recognition). The same measure of recognition memory was used in the second experiment. Each participant viewed a series of 40 brand logos: Twenty of them were in the game; the other twenty were not in the game. Each user's memory score was summed from the correctly-answered scores out of the 20 brand logos

Attitude Change toward Brands. Attitude change toward brands (change in brand

attitude) was measured by user ratings on the following dimensions: good, favorable, positive, and like (7-scale measure; C. Yoo & MacInnis, 2005). As was used in the first experiment, the attitude change values were calculated by subtracting pre-test values from the post-test values.

Trait Aggression. Trait aggression was measured using the Buss-Perry's Aggression Questionnaire, which consists of 29 items in a 5-point scale (Buss & Perry, 1992). A confirmatory factor analysis on this scale was run in order to verify the factor structure and determine reliabilities of the measure. Four items were loaded on different dimensions from the original scale (item 1 on anger from physical aggression; item 25 and 28 on anger from hostility; and item 26 on physical aggression from hostility). Following the analysis, each dimension showed good reliability (hostility, 5 items, $\alpha = .78$; anger, 10 items, $\alpha = .89$; physical aggression, 9 items, $\alpha = .74$; verbal aggression, 5 items, $\alpha = .65$). Finally, adopting the second-order factor value, the value of trait aggression was calculated from the four sub-dimension values (average of the means of the four sub-traits), which showed good reliability ($\alpha = .76$).

Procedures

The procedure for the second experiment followed similar steps as in the first experiment. Participants were asked by e-mail or phone to complete an online questionnaire three days prior to the experiment. The questionnaire was about the participants' previous game experience of shooter games⁷, pre-attitude and familiarity toward brands⁸, demographics, and trait aggression. Before playing the experiment game, each participant checked their state of mood (i.e., answered questions about their negative affect) and they practiced the experiment game by moving their character and using weapons for about three minutes. At the practice level, there were no opponents. Before beginning the game, participants also completed a recording session for

baseline physiological arousal during which they sat quietly and relaxed.

Participants played one session of the game. Physiological arousal (skin conductance levels) was measured while the participant played the game. After the experiment, the questionnaires were administered to assess the participant's negative affect, sense of presence (i.e., spatial presence and engagement) and state aggression. To measure brand logo memory, the recognition-memory test followed. Finally, a questionnaire was filled about the participants' post-attitudes toward the brands encountered in the game.

Results

Manipulation Checks

For the violent realism cues of two levels of blood (present or absent) and sound (presence or absence of screams of pain), manipulation checks were conducted by comparing the means of perceived degree of blood splattering and screaming sound in-between levels. The perceived degree of blood splattering was measured by using two items on a seven-point scale ($\alpha = .91$; e.g., "How much blood was splattered when you shot the opponents?", "How much blood was splattered onto the advertisements in the game?"). Perceived sound of screams were measured using two items on a seven-point scale ($\alpha = .83$; e.g., "How much did the opponents scream when you shot them?", "How much did you hear the opponents' screams of pain in the game?"). In the perceived degree of blood splattering, the presence of blood showed higher scores ($M = 5.53$, $SD = .92$) than the absence of blood ($M = 1.83$, $SD = .1.02$; $t = 17.66$, $p < .001$); the presence of screams was higher ($M = 5.62$, $SD = 1.37$) than the condition without screams ($M = 1.57$, $SD = 1.34$; $t = 13.89$, $p < .001$).

Direct and Interaction Effects: ANCOVA tests

In this section, we examined main and interaction effects of sensory realism cues (e.g. blood and screams of pain) on the variables (e.g., physiological arousal, presence, negative affect, brand memory, attitude, and state aggression). The analyses were conducted using one-way analysis of covariance (ANCOVA) by controlling trait aggression and prior shooting game experience as covariates.

The effects of sensory realism cues on physiological arousal (SCLs subtracted from baseline) were tested. The results showed that portrayal of the two violence cues, blood and screams of pain, significantly increased the players' physiological arousal (blood, $F(1, 79) = 4.33, p < .05$; screams, $F(1, 79) = 4.70, p < .05$, see Table 3). Participants who were exposed to blood ($M = .22, SD = .16$) displayed higher physiological arousal than those who were not ($M = .15, SD = .11$).

Likewise, participants who were in the scream condition ($M = .23, SD = .14$) showed higher arousal than those who were in no-scream condition ($M = .14, SD = .13$). A player's levels of trait aggression and prior experience of shooting games did not exhibit any significant relationship to their level of arousal. No interaction effects were found between the variables.

The effects of sensory realism cues were also tested on negative affect (subtraction of post-experiment negative affect from prior-experiment negative affect). The depiction of blood enhanced a user's negative affect ($F(1, 79) = 6.70, p < .01$), and screams increased negative affect ($F(1, 79) = 4.01, p < .05$, see Table 3). Participants who were in the blood condition ($M = 1.16, SD = .89$) scored higher in the negative affect than those in the no-blood condition ($M = .67, SD = .92$). Participants in the scream condition ($M = 1.12, SD = .82$) showed a higher degree of negative affect than those who were in the no-scream condition ($M = .73, SD = 1.00$).

With regard to spatial presence, sensory realism cues had no significant effect. No significant difference was found in the degree of spatial presence between participants in cues (blood or screams) conditions and those in the no-description conditions. However, one covariate variable, trait aggression, showed a significant effect on spatial presence ($F(1, 79) = 3.75, p < .05$, see Table 3). The higher degree of trait aggression a participant shows, the higher degree of spatial presence becomes ($r = .21, p < .05$).

Table 3. ANCOVA tests (1)

	Arousal	Negative Affect	Spatial Presence	Engagement
Blood	4.33*	6.70**	1.77	.12
Screams	4.70*	4.01*	.42	4.65*
Blood x Screams	.20	.10	1.08	3.30*
Trait Aggression	.05	.18	3.75*	1.48
Prior Experience	.42	.37	1.63	2.39

Note. All values are F values in each analysis

* $p < .05$, ** $p < .01$

Concerning engagement, the depiction of screams significantly increased user engagement ($F(1, 79) = 4.65, p < .05$, see Table 3), but that of blood did not change user engagement. There was an interaction effect between blood and screams on engagement ($F(1, 79) = 3.30, p < .05$, see figure 7). In the screams condition, the degree of engagement was higher in the no-blood condition ($M = 2.26$) than the blood condition ($M = 1.93$): In the no-screams condition, however, the degree of engagement was lower in the no-blood condition ($M = 2.74$) than in the blood condition ($M = 2.38$).

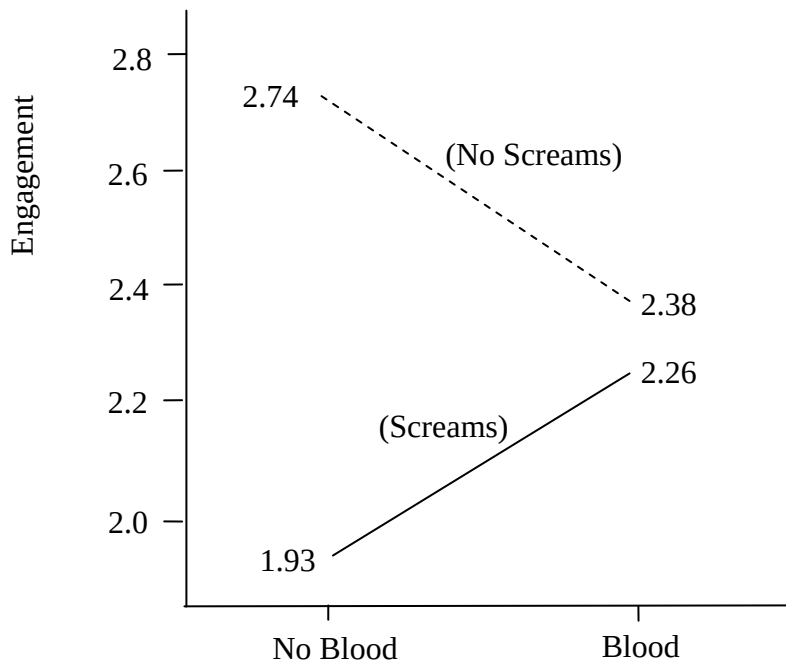


Figure 7. Interaction Effect between Blood and Screams on Engagement

Sensory realism cues significantly increased the scores for memory toward brand logos in the game. The depiction of blood increased memory scores ($F(1, 79) = 5.13, p < .05$): Likewise, presence of screams showed a significant effect on memory ($F(1, 79) = 3.29, p < .05$, see Table 4). Participants who were exposed to blood depiction showed higher scores of brand memory ($M = 13.34, SD = 3.75$) than those in the no-blood condition ($M = 11.71, SD = 3.39$). Similarly, participants in the scream condition ($M = 13.19, SD = 3.57$) showed higher scores of brand memory than those in the no-scream condition ($M = 11.91, SD = 3.66$).

Attitude change toward brands in the game showed significant difference between the screams condition and the no-screams condition ($F(1, 79) = 4.58, p < .05$, see Table 4). Participants who were in the screams condition ($M = -.21, SD = .51$) showed considerable negative change in attitude than those in the no-screams condition ($M = .01, SD = .48$). Prior

experience of shooting games also manifested a significant effect on attitude change ($F(1, 79) = 4.67, p < .05$). Participants who had more prior experience of shooting games exhibited more positive attitude change toward brands in the game ($r = -.20, p < .05$).

Table 4. ANCOVA tests (2)

	Brand Memory	Attitude Change	State Aggression
Blood	5.13*	2.22	3.17*
Screams	3.29*	4.58*	1.65
Blood x Screams	.11	.28	.34
Trait Aggression	1.10	.16	83.25***
Prior Experience	.49	4.67*	4.47*

Note. All values are F values in each analysis

* $p < .05$, ** $p < .01$, *** $p < .01$

Presence of blood had a significant effect on state aggression ($F(1, 79) = 3.17, p < .05$). Likewise, prior experience of shooting games ($F(1, 79) = 4.47, p < .05$) and trait aggression ($F(1, 79) = 83.25, p < .001$, see Table 4) manifested significant effects on the degree of state aggression. Participants who had a higher degree of prior experience showed lower levels of state aggression ($r = -.25, p < .05$). However, participants who had higher levels of trait aggression exhibited higher levels of state aggression ($r = .68, p < .001$).

Path Model Analysis: SEM tests

A path analysis was performed to test the model (see Figure 7). The path model specifies the effects of blood, screams of pain, and trait aggression on physiological arousal, negative

affect, spatial presence, and engagement. In addition, the model checked the relationships among physiological arousal, negative affect, spatial presence, engagement, state aggression, brand logo memory, and attitude changes toward brand in the game. In the model, we examined the direct effects of violence cues and trait aggression on physiological arousal, negative affect, spatial presence, and engagement. Additionally, the effects of arousal, negative affect, spatial presence, and engagement on the dependent variables (e.g., brand logo memory, attitude change, and state aggression) were examined. Finally, the mediation effects of arousal, affect, spatial presence, and engagement between violence cues and the dependent variables were tested. Table 5 shows the correlations between key variables.

Table 5. Correlations between Key Variables

	<i>M (SD)</i>	1	2	3	4	5	6	7	8
1. Trait Aggression	2.91 (.59)	1.00							
2. Arousal (SCLs)	.18 (.14)	-.09	1.00						
3. Negative Affect	.94 (.93)	-.03	.31**	1.00					
4. Spatial Presence	2.41 (.85)	.21*	.28**	.36**	1.00				
5. Engagement	2.32 (.83)	.17	.25*	.10	.57***	1.00			
6. Brand Memory	12.55 (3.65)	.05	.26*	.09	.33**	.27*	1.00		
7. Attitude Change	-.10 (.51)	.12	.11	-.36**	-.22*	.05	-.21*	1.00	
8. State Aggression	2.75 (.67)	.69***	.13	.21*	.22*	.10	.03	-.01	1.00

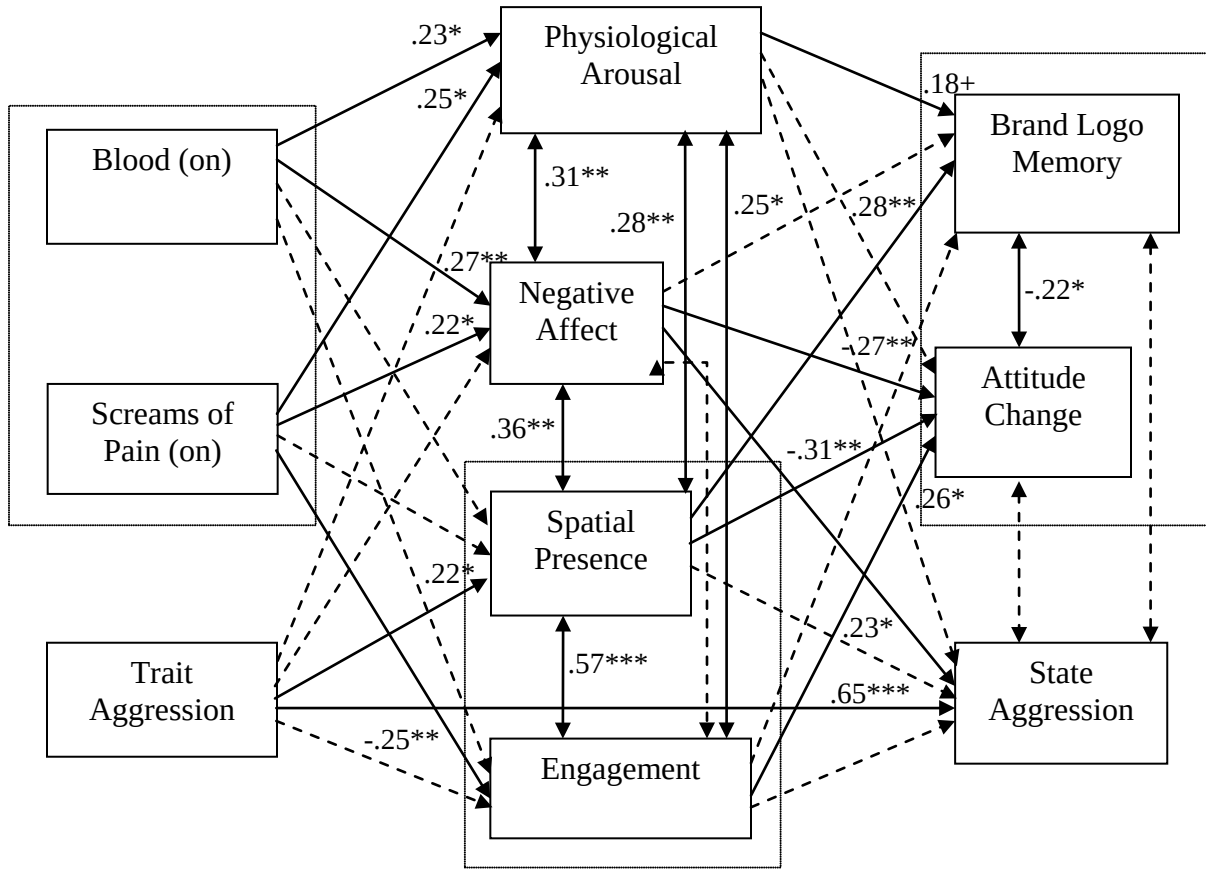
* $p < .05$, ** $p < .01$, *** $p < .001$

Effects of Sensory Realism Cues and Trait Aggression on Arousal, Negative Affect, and presence. Sensory realism cues (i.e., blood and screams of pain) exhibited significant effects on

physiological arousal (see Figure 8). Blood condition significantly increased the degree of arousal ($\beta = .23, p < .05$), while the screams condition also increased arousal ($\beta = .25, p < .05$). However, trait aggression did not show any significant effect on physiological arousal ($\beta = .02, NS$). For negative affect, both blood and screams of pain showed significant effects. Blood condition had a significant effect on negative affect ($\beta = .27, p < .01$), while screams significantly increased the degree of negative affect ($\beta = .22, p < .05$). Trait aggression had no significant effect on negative affect ($\beta = .05, NS$).

For spatial presence, sensory realism had no significant effect (blood, $\beta = .14, NS$; screams, $\beta = .09, NS$), but trait aggression showed a significant effect on spatial presence ($\beta = .22, p < .05$). On engagement, we found a significant effect from the screams condition ($\beta = -.25, p < .05$), which decreased the degree of user engagement. However, blood condition did not change engagement ($\beta = .03, NS$), while trait aggression also did not show any significant effect on engagement ($\beta = .15, NS$).

Effects of Arousal, Negative Affect, and Presence on Brand Logo Memory. Players who reported higher levels of spatial presence showed a significant effect on brand memory ($\beta = .28, p < .01$). The stronger players feel spatial presence, the more they remember brand logos embedded in the game. Similarly, physiological arousal had a marginal effect on brand memory ($\beta = .18, p = .07$). However, negative affect ($\beta = -.10, NS$) and engagement ($\beta = .13, NS$) did not show any significant effect on memory scores. There was a significant correlation between physiological arousal and presence: between arousal and spatial presence ($r = .28, p < .01$), and between engagement and arousal ($r = .25, p < .05$). Spatial presence had a strong correlation with engagement ($r = .57, p < .001$).



+ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Note. The coefficients are standardized. Model fit: $\chi^2 = 16.96$, $df = 12$, $p = .15$;

RMSEA = .061; CFI = .972; IFI = .978

Figure 8. Path Model Analysis (2)

Effects of Arousal, Negative Affect, and Presence on Change in Brand Attitude. Players who had higher levels of negative affect showed a negative significant effect on attitude change ($\beta = -.27$, $p < .01$). The players with higher levels of spatial presence also manifested a negative effect on attitude change ($\beta = -.31$, $p < .01$). On the other hand, engagement had a significant positive effect on attitude change ($\beta = .26$, $p < .05$), while arousal did not show any significant

effect on attitude change ($\beta = -.12$, NS). Negative affect was significantly correlated with spatial presence ($r = .36$, $p < .01$). Arousal was also correlated with negative affect ($r = .31$, $p < .01$) while there was no significant relationship between negative affect and engagement ($r = .10$, NS).

Effects of Arousal, Negative Affect, and Presence on State Aggression. The overall path model did satisfy the criterion of model fit by adding the direct path between trait aggression and state aggression. With the path between trait aggression and state aggression, negative affect had a significant effect on state aggression ($\beta = .23$, $p < .05$). Controlling for trait aggression, the more negative the users felt, the stronger they showed state aggression. Interestingly, trait aggression was the strongest predictor in the degree of state aggression ($\beta = .65$, $p < .001$) whereas the other variables did not show any significant effects (i.e., spatial presence, $\beta = .04$, NS; arousal, $\beta = -.02$, NS; and engagement, $\beta = -.06$, NS).

Finally, we tested the mediation effects of negative affect between sensory realism cues and dependent variables. Since there were two significant direct effects (i.e., screams of pain on attitude change, and blood on state aggression), we compared the improvement of model fit between the path model and the other model including the two direct paths (see Holmbeck, 1997). However, there was no improvement in model fit scores between the two models: χ^2 change ($df = 2$) = 1.02, NS. The analysis suggests that negative affect plays a mediating role between blood and state aggression⁹. It also shows there could be two significant paths mediating the effects of screams condition on attitude change: one through negative affect and the other through engagement. When we further regressed negative affect, engagement, and screams of pain on attitude change, only negative affect held the significant effect on attitude change (negative affect, $\beta = -.24$, $p < .05$; engagement, $\beta = .05$, NS) with disappearance of significant relationship between screams of pain and attitude change ($\beta = -.13$, NS). These results imply that negative

affect mediates between screams of pain and attitude change as well as between blood and state aggression. Table 6 describes the results of the hypotheses and research questions.

Table 6. Results of Hypotheses and Research Questions (2)

Hypotheses and Research Questions	Results
H1 (a/b): (a) Portrayal of blood and (b) screams of pain will lead to increased arousal compared to the no-blood portrayal and no-screaming conditions.	Approved
H2 (a/b): (a) Portrayal of blood and (b) screams of pain will lead the degree of users' state aggression compared to the no-blood portrayal and no-screaming conditions.	Rejected
H3 (a/b): (a) Portrayal of blood and (b) screams of pain will lead the degree of negative affect compared to the no-blood portrayal and no-screaming conditions.	Approved
H4 (a/b): Higher levels of trait aggression will be related to higher levels of (a) physiological arousal and (b) state aggression.	H4b approved
RQ1(a/b): Will there be any interaction between depiction of blood, screams of pain, and individual trait aggression on (a) physiological arousal, (b) negative affect, and (b) state aggression?	None
H5 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased feeling of spatial presence compared to the no-blood portrayal and no-screaming conditions.	Rejected
H6 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased engagement compared to the no-blood portrayal and no-screaming conditions.	Rejected
H5/6 (c): Higher levels of trait aggression will be related to higher levels of the user's (H5c) spatial presence, and (H6c) engagement.	H5c approved
RQ2 (a/b): Will there be any interaction effects among portrayal of blood, screams of pain, and trait aggression on (a) spatial presence and (b) engagement?	On engagement
H7 (a/b): (a) Depiction of blood and (b) screams of pain will lead to increased degree of memory toward the brands embedded in the game.	Approved
H8 (a/b): (a) Depiction of blood and (b) screams of pain will lead to decreased degree of attitude change toward the brands embedded in the game.	H8b approved

Table 6 (cont'd)

Hypotheses and Research Questions	Results
RQ3 (a/b): Will there be any interaction effects among portrayal of blood, screams of pain, and trait aggression on (a) recognition memory and (b) attitude change toward the brands in the game?	None
H9 (a/b/c): There will be significant relationships (a) between physiological arousal and spatial presence, (b) between spatial presence and engagement, (c) and between arousal and engagement.	Approved
H10 (a/b): Individuals with higher levels of (a) physiological arousal will show higher levels of state aggression than those with lower levels after the game.	Rejected
H11 (a/b): Individuals with higher levels of (a) spatial presence and (b) engagement will show higher levels of state aggression than those with lower levels after the game.	Rejected
H12 (a/b/c): (a) Arousal, (b) spatial presence, and (c) engagement will increase brand logo memory.	H12b approved
RQ4 (a/b/c): Will the increase in (a) arousal, (b) spatial presence, and (c) engagement lead to negative attitude change toward the brands embedded in violent games?	Spatial presence
H13 (a/b/c): The increase in negative affect will lead to (a) lower levels of brand logo memory, (b) negative attitude change toward the brands, and (c) higher levels of state aggression.	H13b, H13c Approved
RQ5 (a/b/c): Will negative affect correlate with (a) physiological arousal, (b) spatial presence, and (c) engagement?	With arousal & spatial presence
RQ6 (a/b/c): Will physiological arousal, spatial presence, engagement, and negative affect mediate the effects of violence cues on (a) brand logo memory, (b) attitude change, and (c) state aggression?	On attitude, State aggression (negative affect)

Chapter Discussion

The current study was designed to replicate and extend the results of the first experiment by including two additional variables on user emotion (i.e., negative affect) and aggression (i.e., state aggression). Based on the general aggression model and the excitation transfer theory, we investigated the effects of realistic violence cues on the player's level of

arousal and on negative affect controlling for the user's trait aggression. We also tested if they (i.e., arousal and negative affect) subsequently influence the levels of state aggression. In addition, we examined whether negative affect influences brand logo memory and attitude change for brands placed in the violent game controlling for the levels of sense of presence by testing a path model. This study eventually tested whether user emotion, arousal, and sense of presence significantly mediate the effects of violence cues on state aggression, brand logo memory, and attitude change.

Concerning negative affect, we found that sensory realism cues of violence increased the levels of users' negative affect. Increased negative affect in turn enhanced the degree of state aggression. In particular, the effect of realistic description of blood on state aggression was mediated by negative affect (one factor of users' internal states). These results are in line with the general aggression model, which explains that violent media increase user aggression by impacting user's internal state (C.A. Anderson & Bushman, 2001; C. A. Anderson & Bushman, 2002). The results also imply that the process of increasing user aggression by playing violent games occurs with the increase of users' negative affect mediating the effect of realistic visual cues (i.e., realistic description of blood) on user state aggression.

Contrary to our expectation, however, arousal did not increase state aggression. Arousal also did not mediate the influence of sensory realism cues on state aggression. Considering that negative affect increased state aggression and based on the general aggression model, user aggression could be affected not by arousal but primarily by affective or cognitive variables, or through interaction effects between the variables. However, in violent-game studies, these results are in line with those of Arriaga et al.'s study (2006). They reported that arousal (heart rate) did not significantly increase aggression (state hostility) when controlling for game content (violent

games). In addition, they showed that there were no mediation effects of arousal between violent game playing and state hostility.

Notably, even though both spatial presence and negative affect had a significant correlation with state aggression (spatial presence, $r = .22$, $p < .05$; negative affect, $r = .21$, $p < .05$), when trait aggression was added to the regression analysis on state aggression, only negative affect had a significant effect on state aggression. However, trait aggression did not have any relationship with physiological arousal in the path analysis. On the other hand, players with higher trait aggression showed a higher degree of spatial presence in the violent game.

The specific sensory cues of violence, blood and screams, increased users' physiological arousal in violent games. This finding supports the proposition that graphic and auditory realism in violence increases user arousal, which is consistent with previous studies about the blood effect on user arousal in violent games (e.g., Ballard & Weist, 1996)

Increased arousal showed a marginally significant effect on brand logo memory. This finding does not match with the results in previous studies that reported arousal is related to memory scores. Instead of physiological arousal, users' spatial presence predicted brand memory more strongly. This result corroborates the link between presence level and increased memory (Kim & Biocca, 1997; Lombard & Ditton, 1997). The result also implies that enhancing spatial presence in violent games will lead to increased brand logo memory.

The levels of spatial presence, however, led to a negative change in brand attitude in the violent game. This is in line with the result in the first experiment, which is called "boomerang effects." This result strongly highlights that increased spatial presence in violent games can result in negative changes in brand attitude with an increase in brand logo memory. The significant negative relationship between brand memory and attitude change verifies the competing effects

($r = -.21, p < .05$). Players in violent games remember brand logos in the game but they result in negative change in attitude toward the brands in the game.

Likewise, the increased negative affect from the sensory realism cues prompted a negative change in brand attitude. It is noteworthy that negative affect mediates between a sensory realism cue (i.e., screams of pain) and attitude change toward in-game brands. Considering that negative affect increased state aggression, this result shows that negative affect influences is a key variable affecting dependent variables (i.e., attitude change and state aggression) in violent games. One of the key variable in violent games is the affect variable felt by users since negative affect leads to negative change in brand attitude and to a significant increase in state aggression.

Regarding the influence of sensory realism cues on advertising effects, both visual and auditory cues showed significant direct effects on memory scores. Interestingly, the auditory cues were found to negatively affect attitude change while visual cues had no effect on attitude change. In addition, the effect of screams of pain on attitude change was mediated by negative affect.

In sum, the current study yielded some findings. First, sensory realism cues of violence increased both physiological arousal and negative affect, following the general aggression model. Second, negative affect was a key variable in effects of violent games by mediating the effect of screams of pain on attitude change negatively and by mediating the effect of blood on state aggression positively. Third, physiological arousal did not increase brand memory, nor did they affect state aggression. Finally, spatial presence most strongly predicted the degree of brand memory, but increased spatial presence leads to a negative change in brand attitude.

CHAPTER 5

General Discussion and Limitations

General Discussion

As brands and brand products increasingly appear inside violent games, does the sensory realism of violence inside the games potentially affect players' brand logo memory and attitude change for brand logos placed in the games? How do sensory realism cues of violence influence user aggression through physiological arousal, user emotion (i.e., negative affect), and sense of presence? Are there any mediation roles between the realism cues and the dependent variables (i.e., brand logo memory, attitude change toward the brands in the game, and state aggression after playing the game)?

Guided by the general aggression model, excitation transfer theory, and previous presence studies, this study examined the effects of sensory realism cues of violence and trait aggression on players' physiological arousal, negative affect, and presence. In addition, we examined the effects of arousal, negative affect, and presence on dependent variables (i.e., brand memory, attitude change, and users' state aggression). Finally, this study tested the mediation effects of physiological arousal, negative affect, and presence by using a path model (SEM). This model is based on our previous work that examined the effects of violence cues on brand memory, change in brand attitude, and state aggression through physiological arousal, negative affect, and presence.

Two experiments were conducted for the said purposes. The first study focused on the advertising effects (i.e., brand memory and attitude change) of sensory realism cues of violence in violent games. In this study, we examined the effects of sensory realism cues on user arousal

and presence (i.e., spatial presence and engagement). We investigated the mediating roles of arousal and presence between the violence cues and the advertising effect variables. The second experiment additionally tested their effects on users' state aggression after playing the violent game. This study also included the user emotion (i.e., negative affect) variable to determine the roles of arousal and presence on advertising effects by controlling the users' negative emotions in the game. The study examined the overall effects of variables and their relationships by testing a path model.

Looking at specific sensory cues of violence, we found that realistic depiction of blood increased users' physiological arousal in violent games. This finding supports the proposition that graphic realism in violence increases user arousal. This extends the findings in violent game studies that the mere presence of blood leads to higher levels of arousal than the absence of blood (e.g., Ballard & Weist, 1996; C. P. Barlett et al., 2008). This result is broadly in line with the general aggression model that predicts violence-related situational cues influence user levels of physiological arousal.

The realism of violence is also cued by auditory modality. Specifically, screams of pain were as influential as blood on the player level of arousal within the game environment. This finding is also consistent with previous studies about the general relationships between unpleasant sounds and arousal (see Bradley & Lang, 2000; Cassidy & MacDonald, 2007; Loeb, Holding, & Baker, 1982), which also broadly matches with the general aggression model.

Increased arousal seems to be related to brand logo memory in violent games. In the first experiment, physiological arousal showed a significant correlation with brand memory ($r = .26, p < .05$). Likewise, the relationship was significant in the second experiment ($r = .26, p < .05$).

However, controlling for the other variable (i.e., spatial presence) showed that the

increased arousal did not affect brand logo memory. This result is not consistent with previous studies that reported arousing events are better remembered. Arousal has been reported to influence the data accumulation in memory, such that higher arousal results in higher memory (Anderson & Phelps, 2001; Kensinger & Corkin, 2003; Maljkovic & Martini, 2005). In this study, however, arousal did not directly affect memory. Instead, arousal seems to have an indirect effect on recognition memory through spatial presence.

There are two different points in the experiment settings between previous research and this study. First, previous studies focused on the effect of arousal on memory without significantly considering presence. Second, previous studies mainly used static pictures for memory test by exposing them to passive (i.e., not so much interactive as games) viewers (e.g. Kensinger & Corkin, 2003; Maljkovic & Martini, 2005).

Considering the first difference, there could be a mediating role of presence between arousal and memory. In this study, the correlation between arousal and memory was significant ($r = .26, p < .05$). However, when we used it as an independent variable with spatial presence to predict memory, there was no direct causality between arousal and memory. Actually in this study, when we assumed the mediation role of spatial presence between arousal and memory, spatial presence satisfied required conditions to become a mediation variable (see Baron & Kenny, 1986) between arousal and memory¹⁰. However, this idea needs a theoretical foundation because the relationship between arousal and presence has been reported as correlated rather than being causally related.

The second difference could be explained by the effect of interactivity in (dynamic) gaming environments. In most previous studies of arousal effects on memory, participants were passive; they usually just watch static stimuli such as arousing pictures (e.g. bloody casualties,

sexual scenes) (e.g., Bradley et al., 1992; Maljkovic & Martini, 2005). Increments in arousal may not influence memory in highly interactive environments to the same extent as in low or non-interactive ones. In passive environments, aroused users (viewers) would focus more resources (attention) on central information than those in interactive (dynamic) environments. Users in interactive environments need to allocate comparatively more resources to their interactive activities as well (e.g., aiming at opponents, shooting).

Brand logo memory, on the other hand, was significantly predicted by the user's degree of spatial presence in the game. Spatial presence substantially predicted increased recognition memory for the brand logos in the game. This is consistent with previous studies showing a link between presence level and increased memory (Kim & Biocca, 1997; Lombard & Ditton, 1997). Presence is highly correlated with the individuals' ability to recall advertised materials in virtual space by providing vivid experience (Kim & Biocca, 1997). Such vividness is associated with users' identification experience with their avatars since presence enhances the identification with the user's virtual body (Tamborini, 2000). Therefore, in games, users feeling a strong sense of presence will have much identification with their avatars, and this strong identification will provide much vivid experience with the increase in memory effects. Considering the strong effect of spatial presence on memory scores, such identification seems to be derived from a strong sense of spatial presence regardless of user emotion levels. Therefore, the current results imply that enhancing spatial presence in violent games will lead to increased brand logo memory by providing users with vivid experience.

However, it is noteworthy that users' level of spatial presence negatively affected the level of users' attitude change toward brands in the violent game. It seems that a strong level of spatial presence in violent games causes negative effects in attitude change despite an increase in

brand logo memory. Players remember the brand logos more, but with negative changes in brand attitude.

In the first experiment, this was clearly evident for the highly recognized brand logos in this study. When we checked the correlation between recognition and attitude change for the logos that were highly recognized, there was a significant negative relationship to attitude change ($r = -.27, p < .05$). In the second experiment, the significant negative relationship between brand memory and attitude change verifies the negative effects ($r = -.22, p < .05$). Players in violent games remember brand logos in the game but they result in negative change in attitude toward the brands in the game. We refer to this result as a “boomerang effect” for brand logos, as it presents a paradox for advertisers interested in utilizing popular violent games. Higher spatial presence in highly immersive violent games could accompany negative attitude change toward the recognized brands.

The negative association between spatial presence and attitude change is in some ways consistent with previous studies. Cowley and Barron (2008) reported that prominent product placement in television programming led to a negative change in brand attitude for viewers who were highly interested in the program’s content. These reviewers may have been more sensitive to disruption by ad placement (see also Edwards, Li, and Lee 2002). In game studies, players higher in spatial presence are likely to enjoy the game more (see Lee et al. 2005), but could become more sensitive to disruption of their sense of presence by the occurrence of prominent real-world brand logos. This could lead to negative feelings toward these brands. In the current study, brand logos were made very prominent.

Like the strong negative effect of spatial presence on brand memory, negative affect influenced by the sensory realism cues led to negative change toward brands in violent games. In

addition, negative affect mediated the effect of screams of pain on attitude change. This result is in line with the general aggression model that posits the effect of violence cues on users' negative affect (C. A. Anderson, 1997; Bushman & Geen, 1990). It also matches results in previous advertising studies based on the affect transfer hypothesis (Russell, 1998; Singh & Churchill, 1987). Violence cues drive users to have negative emotion in violent games, and the emotion is transferred into the brands in the game, subsequently inducing a negative attitude change toward the brands. Considering that negative affect increased state aggression, one of the most influential factors in violent games is the emotion felt by users in that negative affect leads to a negative change in brand attitude and increased in state aggression.

Turning now toward the associations between sensory realism cues and psychological experience of game violence, we need to check the effects of sensory realism cues on state aggression through arousal and negative affect. As previously mentioned, sensory realism cues increased both user's physiological arousal and the levels of users' negative affect. The increased negative affect in turn enhanced the degree of state aggression: in particular, negative affect mediated the effect of blood on state aggression. These results are in line with the general aggression model that posits violent media increase user aggression by impacting the user's internal states such as arousal and negative affect (C.A. Anderson & Bushman, 2001; C. A. Anderson & Bushman, 2002).

However, in the two experiments of the current study, arousal did not increase state aggression. In addition, we could not find any evidence of the mediation role of arousal between sensory realism cues and state aggression. Following the propositions of the excitation transfer theory, the increased arousal from the violence cues should have increased the level of state aggression.

It seems that physiological arousal does not play a crucial role in predicting users' state aggression in virtual violence. From the general aggression model's perspective, the effect of violent media on aggression occurs by increasing arousal, or by increasing aggressive cognition, or by increasing negative affect. Thus, if arousal does not show any influential role on aggression, state aggression could be affected not by arousal but primarily by cognitive or affective variables, or through interaction effects between the variables. Therefore, considering the significant effect of negative affect on state aggression, the results imply that user affect plays a crucial role in increasing player aggression in violent games.

Another explanation for the insignificant effect of arousal on aggression could be that it is due to the interactive environment. Zillmann's experiments (e.g., Bryant & Zillmann, 1979; Zillmann, 1990, 1996; Zillmann et al., 1972) reported that increased arousal did induce increased aggression based on the excitation transfer theory. However, considering that the excitation transfer theory sufficiently explains displaced aggression (i.e., vented feelings of aggression from an earlier event towards an unrelated situation or person) that occurs typically by a source against which retaliation is impossible (C. A. Anderson, 2007), two important points draw our attention in the experiments.

The first point is that excitation transfer occurred if there was a provocation at an earlier event. The other point is that subjects who were aroused by a provocation were not able to retaliate during the earlier event in the experiments. It seems that the provocation was just provided at a non-interactive environment point where subjects could not actively respond (shoot or kill) to the stimulating agents (e.g. opponents, monsters, etc.). Actually, most experiments supporting excitation transfer theory were conducted in less-interactive environments (e.g., watching T.V., movie, or animation) rather than in highly interactive ones (e.g. playing games).

Players in violent games can or should retaliate on the instigating agents by shooting or hitting them. Such interactive environments could result in different user responses (e.g., less hostile to others) after playing. For further explanation, future studies need to investigate the arousal effect on aggression in different levels of interactivity.

From the perspective of public policy, the effect of sensory realism cues on user aggression through negative affect supports a public policy about sensory realism in game rating systems. A general motivation for some attempts to control the depictions of violence is the belief that there is a relationship between the way violence is portrayed and the effects on the user's experience. This is the rationale behind the seemingly arbitrary requirement in some countries to make the violence in games "less realistic" by substituting realistic blood with less realistic blood (e.g. blue or black blood color) or eliminating blood of the creatures that inhabit the virtual world of gaming. Consistent with the intuition that sensory realism cues affect the experience of violence, this study shows that the realistic depiction of blood and screams of pain affect the feelings of aggression (i.e., state aggression) through negative affect.

These results support the public policy assumption that more realistic description of violence is associated with higher levels of aggressive feelings. Specifically, the current study shows that sensory realism elements (i.e., realistic graphical and auditory cues) are influential factors affecting state aggression through negative affect. Therefore, we might say that this study's findings support the decision by the game rating boards in many countries (e.g., "Game Ratings and Descriptor Guide" in the Electronic Software Rating Board in USA, Computer Entertainment Rating Organization in Japan, Game Rating Board in Korea) to differentiate games targeted to adults and youths based on the realistic description of violent cues out of a concern regarding aggression of young users.

In sum, the current study exhibits the following results. First, sensory realism cues of violence affect both players' arousal (physiological arousal) and emotion (negative affect), which are in line with the general aggression model. Next, negative affect influences both attitude change negatively and state aggression positively. Negative affect mediated the effect of screams of pain on attitude change, and the effect of blood on state aggression. Third, arousal affected neither brand logo memory nor state aggression, which is not consistent with the excitation transfer theory. Fourth, brand memory was strongly affected by the degree of spatial presence, which is in line with the previous presence studies. Last, however, increased spatial presence leads to negative change in brand attitude even though it increases brand memory, which is called "boomerang effect" in this study.

For advertisers, the "boomerang effect" needs to be carefully considered. Brand memory was a key variable to increase user memory toward brand logos in the game, but increased spatial presence leads to negative change in brand attitude. Thus, even though the number of violent games is increasing, and will likely include a considerable number of blockbuster titles, advertisers should carefully consider the potentially negative outcome of advertising in violent video games.

Ethical Issues and Limitations

Some potential ethical issues should be considered in violent game research. Although sensory realism cues of violence were found to be related to brand logo memory in games, they could potentially cause negative effects such as aggressive feelings or behavior. In particular, the current study showed that sensory realism cues affect state aggression through negative affect. In addition, even though spatial presence was found to increase brand memory, it was also

significantly correlated to state aggression. Thus, the purpose of enhancing advertising effects in violent games could itself be considered problematic as an ethical issue. In the same context, enhancing the levels of presence and emotional levels in violent games for better advertising effects could pose another ethical issue. Future studies need to consider these ethical issues.

The current study has some limitations. One of the limitations is to the use of only explicit and not implicit memory. The recognition test as one way of explicit memory measures the degree of conscious retrieval of information from prior exposure (Shapiro & Krishnan, 2001). However, implicit memory measures task performance (e.g., word-fragment tests, preference or choice behavior tests) that is believed to be improved by the recently exposed information (Schacter, 1987). Even though incidental exposure to advertisements in the game led to no effect on explicit memory, it could potentially affect implicit memory when it comes to selecting brand preference and in filling fragmented words (Schacter, 1987; Shapiro & Krishnan, 2001; Yang et al., 2006). Thus, the advertising effects from exposure to in-game ads could be detected through implicit memory tests. Future studies about the effects of in-game ads need to use implicit memory tests in order to see the overall effects of brand exposure in the game.

Another limitation of this study is that the results are limited to college students in two countries. Recently, computer games have emerged as a general culture that transcends ages and generations such that diverse generations are also enjoying games. Thus, future studies need to conduct experiments for old participants and compare their effects.

Finally, future studies need to compare the short-term and long-term effects of in-game advertising in violent games. Explicit memory is affected by time delay while implicit memory lasts longer (Shapiro & Krishnan, 2001). In addition, some research in information processing suggests that the sleeper effect based on familiarity with the exposed information can be applied

to advertising studies (Moore & Hutchinson, 1985). They assert that mere exposure regardless of user emotion can have a positive effect on user memory and attitude due to the familiarity with the exposed information for a long time after exposure. Thus, even though the negative emotion from the violent experience changes brand attitude adversely, with an increase of familiarity with the brands, the incidental exposure could induce a positive change in attitude toward the brands as long-term effects. Future studies need to investigate long-term effects in brand memory and attitude change.

NOTES

1. Trait aggression measures a user's stable personality trait of aggression such as hostility and anger. Buss-Perry Aggression Questionnaire (1992) is one frequently used questionnaire of trait aggression, which measures four dispositional sub-traits of aggression: hostility "that consists of feelings of ill will and injustice, represents the cognitive component of behavior"; anger "which involves physiological arousal and preparation for aggression, represents the emotional or affective component of behavior"; physical and verbal aggression "which involve hurting or harming others, represent the instrumental or motor component of behavior" (Buss & Perry 1992, p. 457).
2. Arousal is defined as a physiological or psychological (perceived) state of being excited or activated. Physiological arousal is characterized by heightened activation of the autonomic nervous system, which is generally implies the degree of physiologically evoked arousal (response) to stimuli, determined by measuring physiological variables such as skin conductance, muscle movement, or heart rate (see Stein & Levine, 1987). Perceived arousal is a self-report measure often assessed using questionnaire.
3. Aggression (i.e., state aggression) will be measured using a modified version of Buss-Perry's Aggression Questionnaire (see Buss & Perry, 1992; Farrar & Krcmar, 2006). The scale measured four different feelings of "state aggression": hostility, anger, physical aggression, and verbal aggression. See more details at the Measure section (State aggression).
4. Participants were asked how often they play first-person shooter games. We used a 7-point scale, from never (1) to very frequently (7), which was used in the study of Farrar et al. (2006). Some examples of game type (e.g., *Counter-Strike*, *Half-Life*, *Doom*, etc.) were attached to the question ($M = 3.53$, $SD = 1.49$). We checked whether there were significant differences

between the four groups prior to the experiment, and no differences were found ($F(3, 76) = .98$, NS)

5. We asked familiarity toward brands prior to experiment (7-scale; $M = 3.95$, $SD = .82$). The brands in the game included both familiar (e.g. *Samsung*, *Google*, *Boeing*, *Continental*, etc.) and unfamiliar brands (e.g., *Ithaca*, *EastAir*, *Bando*, *Revero*, etc.). We checked whether there were differences in the means of the brand familiarity between four groups prior to experiment. There were no significant differences between the four groups ($F(3, 76) = .99$, NS).
6. For the higher recognition logos (over the median), we checked the coefficients of physiological arousal, spatial presence, and engagement on recognition and attitude changes by conducting regression analyses. The overall effects of the three variables on dependent variables were in line with the results in the path analysis of this study. On logo recognition ($R^2 = .20$), spatial presence ($\beta = .39$, $p < .01$) and engagement ($\beta = .25$, $p < .05$) showed significant effects whereas physiological arousal did not ($\beta = .09$, NS). On attitude changes ($R^2 = .21$), arousal ($\beta = .27$, $p < .05$) and spatial presence ($\beta = -.50$, $p < .001$) affected significantly while engagement did not ($\beta = .18$, NS). For the lower recognition logos (less than the median of recognition), however, the correlation between recognition and attitude change was not significant ($r = -.10$, NS) although the three variables showed similar patterns with the path model in their effects on logo recognition (spatial presence, $\beta = .38$, $p < .01$; engagement, $\beta = .32$, $p < .05$; arousal, $\beta = .05$, NS) and on attitude change (spatial presence, $\beta = -.25$, $p < .05$; arousal, $\beta = .21$, NS; engagement, $\beta = .23$, NS).
7. As a control variable, previous game experience was assessed with questions about participants' habits playing shooter games (within the past 6 months), such as "How many

hours a day do you play shooter games?” Participants rated their previous experience on an 8-point scale: 1 (none), 2 (less than 30 min.), 3 (more than 30 min. – 1 hour), 4 (more than 1 hour – 2 hours), 5 (more than 2 hours – 3 hours), 6 (more than 3 hours – 4 hours), 7 (more than 4 hours – 5 hours), 8 (more than 5 hours) ($M = 2.38$, $SD = .76$).

8. We also checked whether there were differences in the means of the brand familiarity between four groups prior to experiment. There were no significant differences between the four groups ($F(3, 84) = .82$, NS).
9. When we regressed both negative affect and blood on state aggression, negative affect held the significant effect ($\beta = .21$, $p < .05$), but there was no significant effect of blood on state aggression ($\beta = .11$, NS).
10. In the second experiment, when we regress arousal and spatial presence on memory, the arousal effect on memory shrinks (from $\beta = .26$, $p < .05$ to $\beta = .18$, NS) even though the other variable (spatial presence) holds its significance (from $\beta = .33$, $p < .05$ to $\beta = .27$, $p < .05$). All the direct effects among the variables are significant (arousal on spatial presence, $\beta = .26$, $p < .05$, spatial presence on memory, $\beta = .33$, $p < .05$). This explanation could suffice for both results of previous research and this study. Likewise, in the first experiment, when we regress arousal and spatial presence on memory, the arousal effect on memory shrinks (from $\beta = .26$, $p < .05$ to $\beta = .10$, NS), although spatial presence holds its significance (from $\beta = .49$, $p < .01$ to $\beta = .35$, $p < .01$). All the direct effects among the variables are significant (arousal on spatial presence, $\beta = .32$, $p < .05$, spatial presence on memory, $\beta = .49$, $p < .01$).

APPENDICES

Appendix A

Questionnaire for Measures of Trait Aggression

Using the 5 point scale shown below, indicate how uncharacteristic or characteristic each of the following statements is in describing you. Place your rating in the box to the right of the statement. 1 = extremely uncharacteristic of me, 2 = somewhat uncharacteristic of me, 3 = neither uncharacteristic nor characteristic of me, 4 = somewhat characteristic of me, and 5 = extremely characteristic of me.

1	Some of my friends think I am a hothead.
2	If I have to resort to violence to protect my rights, I will.
3	When people are especially nice to me, I wonder what they want.
4	I tell my friends openly when I disagree with them.
5	I have become so mad that I have broken things.
6	I can't help getting into arguments when people disagree with me.
7	I wonder why sometimes I feel so bitter about things.
8	Once in a while, I can't control the urge to strike another person.
9	I am an even-tempered person.
10	I am suspicious of overly friendly strangers.
11	I have threatened people I know.
12	I flare up quickly but get over it quickly.
13	Given enough provocation, I may hit another person.

14 When people annoy me, I may tell them what I think of them.

15 I am sometimes eaten up with jealousy.

16 I can think of no good reason for ever hitting a person.

17 At times I feel I have gotten a raw deal out of life.

18 I have trouble controlling my temper.

19 When frustrated, I let my irritation show.

20 I sometimes feel that people are laughing at me behind my back.

21 I often find myself disagreeing with people.

22 If somebody hits me, I hit back.

23 I sometimes feel like a powder keg ready to explode.

24 Other people always seem to get the breaks.

25 There are people who pushed me so far that we came to blows.

26 I know that “friends” talk about me behind my back.

27 My friends say that I’m somewhat argumentative.

28 Sometimes I fly off the handle for no good reason.

29 I get into fights a little more than the average person.

Appendix B

Questionnaire for Measures of Spatial Presence

Answer the following questions based on your experience in the game you played right before.

Please use the following: 1= Strongly Disagree, 2 = Disagree, 3 =Neither Agree nor Disagree, 4 = Agree, and 5 = Strongly Agree.

1 I felt I could have interacted with the displayed environment.

2 I felt like the content was “live”.

3 I felt that the characters and/or objects could almost touch me.

4 I felt that I was visiting the places in the displayed environment.

5 I felt I wasn't just watching something.

6 I had the sensation that I moved in response to parts of the displayed environment.

7 I had a sense of being in the scenes displayed.

8 I felt that I could move objects (in the displayed environment).

9 I could almost smell different features of the displayed environment.

10 I had the sensation that the characters were aware of me.

11 I had a strong sense of sounds coming from different directions within the displayed environment.

12 I felt surrounded by the displayed environment.

13 I felt I could have reached out and touched things (in the displayed environment).

14 I sensed that the temperature changed to match the scenes in the displayed environment.

15 I felt that all my senses were stimulated at the same time.

16 I felt able to change the course of events in the displayed environment.

17 I felt as though I was in the same space as the characters and/or objects.

18 I had the sensation that parts of the displayed environment (e.g., characters or objects) were responding to me.

19 I felt realistic to move things in the displayed environment.

20 I felt as though I was participating in the displayed environment.

Appendix C

Questionnaire for Measures of Engagement

Answer the following questions based on your experience in the game you played right before.

Please use the following: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Strongly Agree.

1 I felt sad that my experience was over

2 I had a sense that I had returned from a journey

3 I would have liked the experience to continue

4 I vividly remember some parts of the experience

5 I'd recommend the experience to my friends

6 I felt myself being "drawn in"

7 I felt involved (in the displayed environment)

8 I lost track of time

9 I enjoyed myself

10 My experience was intense

11 I paid more attention to the displayed environment than I did to my own thoughts
(e.g. personal preoccupations, daydreams, etc.)

12 I responded emotionally

13 The content appealed to me

Appendix D

Questionnaire for Measures of Negative Affect

Answer the following questions based on your experience in the game you played right before.

Please use the following: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Strongly Agree.

- | | |
|----|------------|
| 1 | Hostile |
| 2 | Irritable |
| 3 | Distressed |
| 4 | Afraid |
| 5 | Scared |
| 6 | Nervous |
| 7 | Upset |
| 8 | Guilty |
| 9 | Ashamed |
| 10 | Jittery |

Appendix E

Questionnaire for Measures of State Aggression

Instructions: Using the 5 point scale shown below, indicate how uncharacteristic or characteristic each of the following statements is when used to describe yourself. Place your rating ON THE NUMBER. 1 = extremely uncharacteristic of me, 2 = somewhat uncharacteristic of me, 3 = neither uncharacteristic nor characteristic of me, 4 = somewhat characteristic of me, 5 = extremely characteristic of me.

Imagine that you leave this building when you're done completing this survey. Someone bumps into you spilling your drink and the contents of your backpack.

1. I would not be able to control the urge to strike the person.

2. When frustrated, I would let my irritation show.

3. If somebody hit me, I would hit back.

4. I would have trouble controlling my temper.

After playing the game, how would you respond to the following prompts? Are these activities more or less uncharacteristic of your normal behavior?

5. When someone annoys me, I may tell them what I think of them.

6. If I had to resort to violence to protect my rights, I will.

7. If I disagreed with someone, I would tell the person openly.
8. If someone pushed me, I could come to blows.
9. If some of my friends saw me now, they would think I am a hothead.
10. Now, I feel like a powder keg ready to explode.
11. I can think of no good reason to ever hit a person.
12. In case I am frustrated, I could fly off the handle for no good reason.
13. When someone annoys me, I could not control my temper.
14. My friends would say that I am somewhat argumentative.
15. I could get into arguments when people disagree with me.
16. I could become so mad I could break things.
17. Even if I flare up quickly when someone made me frustrated, I may get over it quickly
18. Now, I seem to find myself disagreeing with people.
19. I could get into more fights than an average person would.
20. I could not threaten anyone whom I know.
21. Sometimes I could be eaten up with jealousy.
22. I wonder why sometimes I feel so bitter about things.
23. I think that other people always seem to be lurky.
24. I think that at times I have gotten the raw deal out of life.
25. If my "friends" saw me now, they would talk about me behind my back.
26. I agree that I am suspicious of overly friendly strangers.

27. I feel that sometimes people are laughing at me behind my back.

28. When people are especially nice to me, I would wonder what they want.

29. Given enough provocation, I might hit another person

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