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Watching vs. Playing: Effects of Violent Media on Presence, Physiological Arousal and Aggressive Cognitions

Younbo Jung, Marko Skoric, Joung Heum Kwon, Benjamin Detenber

Nanyang Technological University, Singapore
 {ybjung@ntu.edu.sg, marko@ntu.edu.sg, hkjyoung@ntu.edu.sg, tdetenber@ntu.edu.sg}

Abstract

In this study, we report a direct experimental comparison of the effects of violent content in movies vs. video games on presence, physiological arousal and aggressive cognitions. Participants were randomly assigned to one of the three conditions: watching a violent movie, playing a violent game or observing an experimenter play the same game. Using methodological triangulation involving self-reported measures, physiological measures and reaction time tasks, we found significant differences on the measures of presence, aggressive cognitions and arousal. The role of presence in the relationship between media violence and aggression is discussed.

Keywords---Violent Entertainment Media, Presence, Physiological Arousal, Aggressive Cognitions

1. Introduction

Over the last four decades, hundreds of studies have been conducted to examine the effects of violent media on aggressive cognitions, affect, and behaviours utilizing the experimental, observational and longitudinal designs. Although there is still a vibrant debate about a causal link between media violence and real-life aggression [1], the majority of studies indicate a relationship between the exposure to violent content on television or in video games and laboratory- and survey-based measures of aggression [2-3].

Until recently, media violence researchers predominantly focused on movies and television as sources of violent content, examining their cognitive, affective and behavioural effects. However, the increasingly prominent place of video games in the media entertainment ecology over the last decade has prompted the scholarly community to refocus its attention on video games.

In recent years, researchers have started to examine how different forms of mediated violence, in addition to

violent content, can affect the magnitude of post-exposure effects [4]. For instance, video games are equipped with increasingly realistic and sophisticated graphics and involve significantly more engaging and active participation from players, including naturally mapped input devices such as motion controllers and haptics [5-6].

Although media violence research includes both television and video games studies, researchers have rarely provided a direct comparison of the effects of different media. In addition, although theoretical models have been developed to account for differential effects of television vs. video games, they have not been rigorously tested empirically.

To complicate things further, in recent years there has been a trend of convergence in movie and video-game titles and franchises. Some video games were developed based on popular movies such as *Avatar*, *James Bond*, and the *Harry Potter* series. Conversely, some movies were derived from popular video-game titles such as *Tekken*, *Resident Evil* and *Max Payne*. Although these patterns in entertainment-media production are likely to continue and expand further, researchers have yet to capitalise on this opportunity to more robustly test the effects of different media, while largely keeping the content constant.

Notwithstanding what is known about the effects of violent movies and video games on aggression, there are still unanswered questions regarding how similar violent messages delivered over different media forms/platforms impact aggressive cognitions, affect and behaviours.

There are theoretical reasons to believe that interactive media like video games may result in a stronger impact than mass media (e.g., movies) on post-exposure aggression, because video games can simultaneously expose the player to modelling [7], reinforcement [8], rehearsal of behaviours [9], and the involvement of mediated interaction with an engrossing virtual environment [10]. However, these assertions have been largely made without strong empirical evidence to back them up. Thus, the purpose of this study is to directly investigate the effects of different forms of media on aggression, and to identify a psychological mechanism

that can explain such a difference by examining the relationships among individuals' arousal level, aggressive cognitions, and feelings of presence.

2. Literature Review

Of the different forms of media currently available, television is the most common influential media type in terms of violence. The effects of seeing violence on television or in movies have extensively been debated among scientists interested in post-exposure aggression. Paik and Comstock reviewed previous 217 studies to identify the potential effects of viewing media violence [11]. They concluded that violence viewing is significantly linked to aggressive and anti-social behaviour. The effects varied by research design, viewer attributes, treatment and exposure variables, and type of antisocial behaviour, but the overall pattern of influence was consistent.

Unlike traditional media such as movies, partaking of video games is highly active, requiring intense concentration and physical activity [12]. With violent video games, the media experience directly requires aggressive activities. Many researchers believe that media that actively engage the user in the violence have a greater impact than media that typically have users play a more passive role [13].

There are a number of reasons why violent video games might have a greater impact than violent television. As noted above, viewers of violent content on television and in movies tend to be passive observers of the aggressive acts. In contrast, video games by their very nature require active participation in the violent acts. Given that interactivity and sensory interfaces can enhance the sense of presence, hostile feelings within the context of violence may increase. Several studies support the assertion. For example, Tamborini and his colleagues found that heightened presence resulting from immersion in violent video game play strengthened hostile outcomes [14]. Similarly, Krcmar and Nowak demonstrated that presence experienced while playing violent video games was positively correlated with hostile intentions [5]. Although the concept of presence was not explicitly addressed in their study Persky and Blascovich found that the use of a virtual environment (presumably inducing a high level of presence) led to more self-reported aggressive feelings and more behavioural aggression than playing games on a traditional desktop computer platform [15]. However, Ivory and Kalyanaraman found that video games increased player's sense of presence, feelings of involvement, and arousal but did not significantly affect

aggressive thoughts or feelings [16]. Taken altogether, research on the relationship between presence and aggression is inconclusive, so the following research question is proposed.

RQ1: What is the effect of presence on aggression in the contexts of playing and observing violent media?

In terms of post-exposure aggression and physiological arousal, evidence for the difference between violent video games and televisions is equivocal. Calvert and Tan examined people's arousal levels and aggressive thoughts in two different modes, playing a virtual reality based game versus viewing it on an external monitor, and their results indicate that physiological arousal and aggressive thoughts are higher for participants than for observers of video games [17]. The study suggests that the mode of media interaction can have differing physiological and cognitive consequences. Similarly, Tamborini and colleagues compared the effects of playing a virtual reality based violent video game, playing a standard violent video game, observing a violent video game, or observing a non-violent video game on hostile thoughts. The findings revealed that hostility tended to be greater when participants simply observed a violent game than when they played the game in a virtual environment [14]. However, measures of physiological response indicated that playing a video game provoked a feeling of excitement more than the condition of simply observing the violent game. Although these two studies have conflicting results for aggression, both studies confirm that playing media experience makes users feel more excited and induces a higher level of arousal than observing mediated presentations. This leads to the following research question:

RQ2: Are there any differences in aggressive intent and physiological arousal after playing a violent video game and after watching the same violent movie?

In the study of violent media and aggression, previous research has used aggressive cognitions [18-20] and physiological arousal [21] as dependent variables. In addition, reaction times (RTs) to negative or aggressive words have been used to measure aggressive cognitions. For instance, when people are primed to have negative thoughts by being exposed to violent media content, they tend to show faster reaction times to negative or aggressive words [22-24]. Exposure to violent content is likely to prime cognitive-associative networks for aggression, which results in faster RTs to negatively valence words.

It is natural to show certain physiological responses when people have a hostile experience [17]. Although physiological arousal can be activated by various stimuli,

violent media content has received particular attention as a generator of arousal. With respect to the effects of violent media on physiological responses, studies have produced empirical evidence to support a significant association between violent content and increased physiological arousal [25]. Anderson and colleagues showed that physiological arousal (i.e., heart rate), which was provoked by hot temperatures, increased state hostility and hostile cognition, and confirmed the potential mediating role of arousal on behaviour [26]. Bushman asserts that violent video games tend to be more exciting and conducive to arousal than non-violent media [27]. Similarly, Barlett and colleagues have demonstrated that the amount of blood in a game was positively associated with the amount of physiological arousal and state of hostility [28]. As such, we operationalise aggression using two different measures in our study: RTs to negative words for aggressive cognition and physiological arousal. Taken together, we propose the following hypotheses with respect to the relationship among forms of violent media, aggression, and the sense of presence:

H1: Participants who play a violent video game will have the fastest reaction times to negative words followed in order by participants who watch someone playing a violent video game and watch the same violent movie.

H2: Participants who play a violent video game will have the highest level of physiological arousal followed in order by participants who watch someone playing a violent video game and watch the same violent movie.

H3: Participants who play a violent video game will have the strongest sense of presence, followed in order by participants who watch someone playing a violent video game and watch the same violent movie.

when the content is essentially the same. Three different conditions with a between-subject design were compared to test the hypotheses in a laboratory setting: watching a movie based on a video game, watching someone playing the video game, and playing the video game oneself. A total of 90 undergraduate students participated, with 30 participants in each condition and gender balanced across conditions (see Table 1). The age of the participants ranged from 18 to 24 years, and the average was 21.1. With respect to their media experiences, participants spent an average of 1.7 hours per week playing video games and 3.2 hours per week watching movies.

3.1. Procedures

Tekken is one of the most popular action-fighting games that has the option for a player to select his or her own game character from a line-up, and to engage in hand-to-hand combat with an opponent. Due in large part to its popularity in the video-game market, a movie based on the game was produced and released in February, 2010. The movie has a similar storyline to the original video game. The costume and appearance of characters in the movie is as also quite similar to that of the game characters, which provides us with a unique opportunity to conduct a comparison study between a movie and video game with nearly identical content (see Figure 1). For the study we selected three fighting scenes from the movie (i.e., Jin vs. Miguel, Jin vs. Fury, and Jin vs. Yoshimitsu), and edited them together to form a segment that was to approximately 15 minutes in length for the movie watching condition. To create greater equivalence across conditions, we set the game environment to match the movie clip (e.g., the same arena, background, and costume). We also assigned every participant in the game-

Table 1. Baseline Measures for the Three Different Modes of Media Experience

	Watching a Movie	Watching Someone Playing	Playing a Video Game
Gender	Female = 17 Male = 13	Female = 17 Male = 13	Female = 17 Male = 13
Age	$M = 21.03, SD = 1.49$	$M = 21.26, SD = 1.14$	$M = 21.1, SD = 1.37$
Exposure to Violent Games	$M = 5.5, SD = 4.07$	$M = 6.03, SD = 4.15$	$M = 5.9, SD = 3.71$
Exposure to Violent Movies	$M = 6.3, SD = 3.87$	$M = 6.3, SD = 3.87$	$M = 5.7, SD = 4.14$
Trait Hostility	$M = 3.46, SD = 0.74$	$M = 3.43, SD = 0.86$	$M = 3.33, SD = 0.85$

Note: M = mean, SD = standard deviation. The results of ANOVA showed that there was no significant difference among three conditions in all baseline measures.

3. Method

The purpose of this experimental study is to examine the effects of different media forms on a person's sense of presence, physiological arousal, and aggressive cognition

playing condition to be Jin, the game character, and let each participant fight with Miguel, Fury and Yoshimitsu respectively for about 15 minutes. In the watching someone else play condition, participants were asked to watch a confederate's game play. In order to ensure the same experience within this condition, the game play was

pre-recorded and played back from a digital recorder, similar to the movie watching condition. That is, the confederate only pretended to play the game while the participants watched a pre-recorded video of the same three fights scenes as presented in the other conditions. The video game and movie clip were displayed on a 52 inch plasma screen in a cosy room setting. The room was equipped with a comfortable chair and 5.1 channel speakers.

Upon arrival at the laboratory, participants completed an informed consent form, and were then connected to a bio-amplifier (Biopac MP-150). We collected participants' baseline recordings for physiological responses while they were seated and listening to calm music for several minutes. Afterward, each participant was randomly assigned to one of the three experimental conditions. Each session, including the baseline measurement and main experiment was administered individually by one experimenter and lasted approximately 30 minutes (see Appendix).



Figure 1. Screen-shots of Tekken from Video Game (left) and Movie (right)

3.2. Measurements

The measured variables include experience with violent media, trait level of hostility, sense of presence, the response of reaction-time task for cognitive aggression, and physiological responses for affective aggression.

3.2.1. Video Game Questionnaire. Exposure to violent video games and movies was measured separately by modifying the Video Game Questionnaire [18]. Participants were asked to report how often they played video games, how many hours per week they spent playing video games and watching films, what is the title of most played video game and watched film in recent months, and how violent or bloody the content is of this most played video game and watched film. Composite scores were obtained for video games and movies respectively by summing the score of the violence and

bloodiness level. Higher scores indicate more frequent exposure to violent video games and movies.

3.2.2. Presence. The sense of presence was measured with a scale for mental immersion adapted from the Temple Presence Inventory [29]. The composite measure has six items using a Likert-type scale with a seven-point metric (1 = not at all, to 7 = very much). The scale includes the aspect of immersion, involvement, sense of engagement, sensation of reality, and excitement (Cronbach's Alpha = 0.90). Higher scores indicate greater sense of presence.

3.2.3. Trait of Hostility. To measure the participants' trait hostility, we used the Buss-Perry aggression scale [30]. The scale includes 29 items with a seven-point metric (1 = extremely uncharacteristic of me to 7 = extremely characteristic of me). Higher scores indicate higher trait-level hostility (Cronbach's Alpha = 0.86).

3.2.4. Physiological Data Acquisition. Physiological responses were assessed with the measures of ECG and skin conductance. The physiological signals were obtained with Biopac MP-150. The device was set to acquire the samples in two second epochs, with a rate of 200 Hz, the buffer set at 1024kb, 2000 for gain, and in normal mode. The ECG was recorded with three disposable electrodes attached to two wrists and an ankle (Einthoven's Triangle). In addition, two reusable electrodes for skin conductance were wired to the medial phalanges of non-dominant fingers. The amplifier for skin conductance was set to DC mode, 5 umhos/v and 50 Hz. Customised analysis software (Acknowledgement 3.9) was applied to pre-process the recorded data and to remove movement-related artefacts. The average of heart-rate change (HR) and Galvanic skin resistance change (GSR) are used as indexes for physiological arousal with higher scores indicating greater physiological arousal.

3.2.5. Response Time Task. The Reaction Time (RT) Task is based on a simpler version of the Genov Modified Stroop Task [31]. This task is widely used to test for cognitive interference in categories of words using the stroop automatic processing paradigm. The 20 negative and 20 neutral words used in this experiment were previously used in research conducted by Sharma and McKenna [32]. The neutral words are *Gate, Note, Clock, Thumb, Field, Lever, League, Wire, Bread, Autumn, Anchor, Shop, Naval, Senior, Exceed, Link, Plate, Divide, Call, and Foot*. The negatively valenced words in this experimental study were: *Fear, Crash,*

Table 2. Correlation Matrix

	RT	Presence	GSR	HR
RT	-			
Presence	-.20*	-		
GSR	-.34**	.43**	-	
HR	-.36**	.16	.30**	-

Note: * $p < .05$, ** $p < .01$ (one-tailed). RT is an average response time to negative words (lower scores indicate greater aggressive cognition). Galvanic skin response (GSR) is an average change in the electrical resistance of the skin (higher scores indicate greater physiological arousal). Heart rate (HR) is an average change in the pulse of the body measured by the use of ECG (higher scores also indicate greater physiological arousal).

Grief, Death, Pain, Angry, Murder, Hate, Shock, Cancer, Enemy, Afraid, Misery, Evil, Kill, Tragic, Threat, Rage, Panic, and Beaten. Faster reaction time to negative words (i.e., lower scores) indicates more activated cognitive-associative networks for aggression [24].

4. Results

We initially conducted one-way between-groups analysis of variance (ANOVA) to test the equivalency of groups. The results confirmed that participants in three conditions were not significantly different from each other in terms of age, gender, pre-experience of violent media, and trait level of hostility (See Table 1).

In order to investigate RQ1, the effect of presence on aggression, the relationships among the measured variables were examined with a Pearson's correlation analysis. As depicted in Table 2, most variables were significantly associated with each other, with the exception of heart rate change (HR) and presence. These results indicate that the sense of presence, physiological arousal, and aggressive cognitions are related in a way that when an individual feels a stronger sense of presence, the individual is likely to experience a greater level of aggressive cognitions and physiological arousal.

To further investigate a possible interaction effect between presence and the modes of media experience, we conducted two-way between-groups ANOVA with the level of presence (dummy coded after a median split) and media experience (i.e., watching the movie, watching someone play, or playing the game oneself) as

independent variables and the priming of cognitive-associative networks related to aggression measured by reaction time task as a dependent variable. The results indicate that presence had no significant main effect on aggressive cognitions, $F(1,89) = 0.05$, ns. However, there was an interaction such that the difference in RT across media conditions was only significant in the low level presence condition, $F(1, 41) = 6.85$, $p < .01$. This result suggests that the difference across media in aggressive cognitions only manifests when participants experience less presence (see Figure 2).

To examine RQ2 and Hypotheses 1-3, we conducted one-way between-groups ANOVAs with post-hoc procedures (see Table 3). The analysis revealed that participants in the game playing condition registered faster reaction times for aggressive words ($M = 814.15$, $SD = 61.53$) than participants in the movie watching condition ($M = 872.58$, $SD = 86.79$), $t(87) = 3.15$, $p < .01$ and the watching someone's play condition ($M = 852$, $SD = 61.53$), $t(87) = 2.04$, $p < .05$. However, the difference between watching the movie and watching someone's play was not significant, $t(87) = 1.11$, n.s. Thus, H1 was partially supported.

Next, one-way between groups ANOVAs were conducted to investigate the effect of the modes of media experience on physiological responses. The means of both GSR and HR were higher in the game playing condition (GSR: $M = 2.22$, $SD = 1.62$; HR: $M = 10.35$, $SD = 9.19$) than those in the movie watching condition (GSR: $M = -0.18$, $SD = 0.71$; HR: $M = -0.54$, $SD = 9.92$), $t(87) = 8.47$, $t(87) = 4.80$, $p < .01$ respectively and the watching someone's play condition (GSR: $M = -0.49$, $SD = 0.67$; HR: $M = 4.98$, $SD = 6.86$), $t(87) = 9.55$, $t(87) = 2.36$, $p < .05$, respectively.

Somewhat inconsistent with previous results, the difference in GSR between watching the movie and watchingsomeone's play condition was not significant, $t(87) = 1.07$, n.s., while the difference in HR was significant between the two conditions as hypothesized, $t(87) = 2.44$, $p < .05$. Taken together, H2 was partially supported.

Table 3. Means and Standard Deviations of the Measured Variables

	Watching a Movie	Watching Someone Play	Playing a Video Game
RT	$M = 872.58, SD = 86.79$	$M = 85, SD = 61.53$	$M = 814.15, SD = 61.53$
Presence	$M = 23.8, SD = 7.53$	$M = 20.86, SD = 8.38$	$M = 30.53, SD = 4.90$
GSR	$M = -0.18, SD = 0.17$	$M = -0.49, SD = 0.67$	$M = 2.22, SD = 1.62$
HR	$M = -0.54, SD = 9.92$	$M = 4.98, SD = 6.86$	$M = 10.32, SD = 9.19$

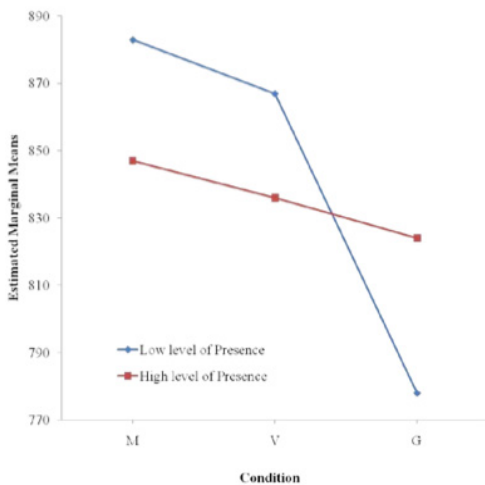


Figure 2. Reaction Time as a Function of Presence and Modes of Media Experience

Note. Lower scores in reaction time indicate more aggressive cognition. M = Watching a movie, V = Watching someone's playing a video game, G = Playing a video game

Finally, one-way between-groups ANOVA was performed to test the effect of the modes of media experience on the sense of presence. Similar to the patterns of previous results, participants in the game playing condition felt a stronger sense of presence ($M = 30.53$, $SD = 4.90$) than participants in the movie watching condition ($M = 23.8$, $SD = 7.53$), $t(87) = 3.68$, $p < .01$ and the watching someone's play condition ($M = 20.86$, $SD = 8.38$), $t(87) = 5.28$, $p < .01$. However, the difference in presence between watching the movie and watching someone's play was not significant, $t(87) = 1.60$, *n.s.*. Hence, H3 was partially supported with consistent patterns found in our previous analyses.

5. Discussion

To investigate the short-term effects of experiencing media violence in different forms of media, the current study examined individuals' physiological arousal, their sense of presence, and their level of primed aggressive thoughts.

As hypothesized, the results showed that participants who played a violent video game had the fastest reaction times to negative words, and the highest level of physiological arousal and presence, compared to those who watched someone playing the violent video game and who watched the movie version of the same game. However, there was no significant difference between the two watching conditions, which was consistent across all the measured variables. The results lend important support

to the proposition that playing violent games leads to greater priming of aggressive cognitions and physiological arousal than viewing violence. That is, if someone is not actively engaged in enacting the violence (e.g., controlling the fighting) then he or she is less likely to experience high levels of arousal and presence, and subsequently have more aggressive thoughts.

The reason for this difference could be that the ability to control a character and the interactive nature of the game create a greater sense of presence and heightened emotion. However, the pattern of interaction between presence and modes of media experience on aggressive cognitions suggests that the relationship is not so simple. As shown in Figure 3, those participants who were highly immersed into their entertainment experience, regardless of the forms of media, showed similar levels of aggressive cognitions.

However, when the participants felt a lower level of presence, the modes of media experience had an impact on the way the participants reported their aggressive cognitions: The participants who played the game showed the highest level of aggressive cognitions (i.e., lowest scores on RT). This result implies that playing a video game could prime aggressive thoughts to players even when they do not feel a strong sense of presence or are not totally immersed into their game play.

Although the findings suggest that greater concern should be directed at violent game play, the abundant evidence that viewing violent media content can have negative effects under some conditions indicates that watching someone's play may also have undesirable consequences. The heart rate difference between the two watching conditions suggests that more research is needed to investigate the effects of different modes of media experience.

6. Conclusions

The current study provides a direct test of medium differences, and reveals that actual playing of a violent video game results in a more arousing and immersive experience, as well as more aggressive thoughts, than watching someone's playing the game or watching a violent movie version of the same game. To better understand how presence is related to these negative outcomes in terms of causal directions, more research is needed. Given the increasingly complex and immersive nature of games featuring violence (e.g. L.A. Noire, Grand Theft Auto IV), we also suspect that longer-term play could also lead to significantly different effects than from simply watching similar movies. We suggest that

future research should capitalize on the opportunity to compare different media more directly than before in order to uncover causal mechanism behind the effects of violent content.

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