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## Abstract

Enjoyment of frightening content is a paradoxical issue in communication research. Revising Zillmann's model of suspense, we propose a three-factor model examining the audience appeal of horror content in a virtual reality (VR) survival horror game. In a laboratory study, participants played a VR horror game. The results show significant effects of the three-way interaction among horror self-efficacy, physiological arousal, and fear on enjoyment and future intentions to play similar games. Horror self-efficacy interacts with fear to affect enjoyment only among high-arousal participants. Among high-fear participants, higher horror self-efficacy leads to significantly greater enjoyment than lower horror self-efficacy. We measured enjoyment through self-reported ratings, future intentions to play similar games, and the behavioral choice of subsequent games to demonstrate the appeal of horror content. Horror self-efficacy in coping with mediated fright is the key to explaining the conditional positive association of fear and enjoyment in the gaming context.

## Keywords

Arousal, enjoyment, excitation transfer, fear, horror game, self-efficacy, virtual reality

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Over the last three decades, the appeal of frightening media content has been understood as paradoxical (Hoffner and Levine, 2005; Zillmann, 1980). Researchers have been intrigued by the appeal of mediated fright and suspense in popular horror movies. Why do people both fear and enjoy mediated horror content? A variety of approaches have examined this issue by focusing on the personality traits that dispose people to enjoy such content (Zuckerman, 1996) or by explaining the psychological mechanisms underlying mentally healthy individuals' enjoyment of frightening and horrific content (King and Hourani, 2007; Zillmann, 1980).

A meta-analysis showed that individual differences are significant factors in determining *what* types of people enjoy horror content (Hoffner and Levine, 2005). However, few empirical studies have examined *why* audiences enjoy frightening content. Zillmann's excitation transfer theory and model of suspense enjoyment have received the most attention but have led to inconsistent results. For example, Zillmann argued that the negative affect produced by suspenseful moments in horror films generates increasing levels of arousal, which are transferred to intensify subsequent enjoyment at the resolution of threat in the film. Therefore, audiences experience negative emotions during the film but feel relieved after the satisfying resolution, which intensifies their enjoyment through transferred arousal (De Wied et al., 1995; Zillmann, 1980). However, although other studies (Hoffner and Cantor, 1991; Sparks, 1991) found associations between negative affect and the enjoyment of watching horror films, resolution of threat did not moderate this association.

From the limited previous research, three major constructs have emerged as explanations of viewers' enjoyment of horror films: negative emotion, resolution of threats, and arousal. One reason why so few studies have directly addressed this issue is the difficulty in manipulating horror films' resolved and unresolved endings. In addition, some horror films fail to provide clear resolutions or satisfying endings, leaving audiences to wonder about the myriad potential possibilities (Thurman, 2016).

Whereas previous studies have been limited in manipulating the resolution of horror in the narrative storyline, video games have become a popular approach to engage audiences in mediated horror content through agency (Madsen, 2016). Video game contexts present a promising venue for academics to more fully examine the appeal of mediated horror content (Lynch and Martins, 2015). Several popular survival horror video game titles that have sold more than 5 million copies have been made into films, such as the *Resident Evil* and *Silent Hill* series. Players experience anticipatory, in-game, and lingering fright as they directly control their character while immersed in a highly suspenseful narrative (Lynch and Martins, 2015). More importantly, video games provide abundant variations for players to adopt different approaches when coping with threats, resulting in different "solutions" to threats that lead the player to die, suffer injury, or successfully survive in the game. Specifically, the commercialization of virtual reality (VR) technology has brought horror video games to the highest level of immersion and presence, generating more arousing mediated experiences (Madsen, 2016). Several horror movies, such as *Paranormal Activity* and *The Conjuring 2* in 2016, have adopted VR games as marketing techniques to promote their "frightening narrative" by directly terrifying players. Nonetheless, almost no empirical studies have examined the enjoyment of mediated fright in video games.

This research employed a laboratory study using a VR survival horror game to examine the appeal of mediated horror content, players' future intentions to play games in this genre, and their subsequent actual game choices. The authors argue that players' horror self-efficacy in addressing threats in the game is a key to explaining the appeal of these games. We discuss how players' horror self-efficacy and physiological arousal interact with their fear and affect their enjoyment, leading to our proposed model of the enjoyment of fright in VR games.

## Horror in video games

Similar to horror films, video games have incorporated horror elements into their narratives. In 1992, *Alone in the Dark* was considered a pioneering survival horror game. In the game, players explore a haunted house to investigate the death of a character's uncle. Accompanied by the creaking of the wood floor and frightening music hinting at lurking monsters, the narrative and the third-person view mimic the camera angles typical of horror films. The suspense is heightened by the uncertainty of upcoming threats.

Popular titles such as the *Silent Hill* series and the *Resident Evil* series feature disfigured monsters and zombies that require avoidance strategies and combat skills. A survey (Lynch and Martins, 2015) asked university students to recall video games that were particularly frightening. Among the 53 titles, the *Resident Evil* series was at the top of the list and the *Silent Hill* series ranked fifth. With respect to more recent games, the *Outlast* series features psychological horror narratives that include being chased by a crazy doctor in a psychiatric hospital. The game has received rave reviews, has frequently been streamed as a game play choice on Twitch (the largest game streaming site), and has appeared on the Conan O'Brien Show, an entertainment talk show that periodically features digital games.

In 2016, with the commercialization of VR technology, the survival horror genre was touted as part of the "must-experience" appeal of VR games (Prasuethsut and Charara, 2016). The survival horror genre in VR usually features a first-person view with zombies or monsters approaching from different directions to attack players. Players are surrounded by threats and are usually surprised and frightened by sudden attacks from behind. Most current VR horror games are set in dark places, and players can hear the directional sounds of clues, such as footsteps, creating intense suspense. This genre is designed to disempower players by limiting their control.

## Mediated fright in video and VR games

Among the various types of negative affect induced by mediated horror content, fear has received the most attention (Hoffner and Levine, 2005). Past research has posited mediated fright as a negative emotion (Mikels et al., 2005). Lynch and Martins (2015) defined fear as "a multidimensional reaction composed of immediate emotional and subsequent cognitive responses to a perceived threat stimulus in the environment" (p. 299). Fear itself is an instinctive reaction to threats and assists us in either directly confronting danger or avoiding it by activating aversive and inhibiting appetitive systems (Lee and Lang, 2009). Studies have indicated that self-reported fear is as accurate as (Lee and Lang,

2009) or even more sensitive than (Rogers, 1983) physiological data. Research (Lynch and Martins, 2015) has indicated that more than 60% of university students have experienced fright in video games. However, few studies have examined fear in video games (Lynch and Martins, 2015).

VR horror games afford the greatest interactivity for players by allowing them to experience the narration from a first-person perspective in a fully immersive environment. Compared to non-interactive films, video games allow players to control the characters and have greater identification with them; thus, players experience heightened emotions (Lin, 2013). Unlike video game players, VR players directly face threats as they experience that reality, thus leading to greater agency and presence (Madsen, 2016). The greater presence in VR affords players increased levels of fear. Day (2015) found that people who played a VR horror game experienced more fear (measured on a scale assessing eight emotions, including fear, fright, and worry) than those who played the same horror game with a traditional screen. In another study, Madsen (2016) found that players of a VR horror game showed a higher respiratory rate, skin conductance, and heart rate changes than players of a normal video game.

What is the association between fear and the enjoyment of horror games? If fear is a negative emotion, it should negatively predict enjoyment. Unlike playing through a character, VR games allow players a greater degree of freedom to confront threats as a monadic “self” (Klimmt et al., 2009). In video games, players empathize with their characters because those characters face dangers, which create mediated emotions. VR games, in contrast, simulate a “real” situation and provide “true mediated enactive experiences” for players. Therefore, the induced fear should directly influence whether players enjoy such an experience. Studies have shown that when fear is perceived as a negative emotion, the result is decreased enjoyment (Hoffner, 2009; Sparks and Sparks, 2002).

## Appeal of mediated fright

In contrast to previous research, several studies have reported a positive association of fear and enjoyment of mediated content in films depending on the narratives and the participants’ arousal (Bantinaki, 2012; De Wied et al., 1995). To explain this paradoxical relationship, Zillmann presented a model of suspense in which the resolution of threats and arousal are two important moderators in this association. In this affective dispositional perspective, audiences are aroused due to the suspense and experience negative emotions if a liked character is threatened with victimization. However, when the liked character has a satisfying ending or successfully overcomes the threats, audiences experience positive emotions, and the accumulated arousal is transferred to intensify this enjoyment (Zillmann, 1996). This model stresses the role of a satisfying resolution of previously encountered threats as a central factor in enjoyment. If the resolution is unsatisfying or unresolved, arousal carries over to exacerbate the disappointment or dysphoria (Zillmann, 1980).

This model has received partial and mixed support (Hoffner and Cantor, 1991; Sparks, 1991). Several studies (De Wied et al., 1995; Zillmann, 1980) have provided evidence that greater distress induced by seeing liked characters in great danger did not foster greater enjoyment when the resolution of the suspense was unsatisfying. In another study

(Zillmann et al., 1975), children watched an animated adventure movie that provided different levels of suspense. Their physiological arousal, facial expressions (as emotional indicators), and fondness for the program were positively associated with greater levels of suspense when the threat was resolved. However, other studies (Hoffner and Cantor, 1991; Sparks, 1991) have indicated that although research has shown positive relationships between negative affect and the enjoyment of film, this association is not influenced by the resolution of the film or lack thereof.

Three major constructs are important in this model: fear, threat resolution, and arousal. Two issues have limited the power of previous studies to explain the appeal of frightening content. First, arousal was not always included in examinations of the association between fear and enjoyment. Because arousal plays an important role in moderating the effects of fear and the resolution of threats on enjoyment (e.g. the excitation transfer process), arousal is key to explaining the appeal of mediated fright (Zillmann, 1980, 1996). Second, the resolution of threats seems to have limited ability to explain the appeal of mediated fright. As studies have shown, audiences enjoy horror content even without resolution.

## **The appeal of VR horror games: a three-factor model**

### *Horror self-efficacy*

To explain why Zillmann's suspense model cannot account for the enjoyment of suspense without a satisfying resolution, we first argue, based on Zillmann's model, that horror self-efficacy might be a more precise construct. Zillmann (1980) stressed that "the transfer paradigm projects the intensification of euphoria after empathetic distress only if euphoria is cognitively achieved" (p. 148). Therefore, the lack of a happy ending does not necessarily indicate cognitive dysphoria. Because audiences experience "mediated" fright, their self-efficacy, manifested in their ability to watch the depicted horror, constitutes the resolution of the threat. Self-efficacy is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997: 3). In the context of mediated fright, a similar concept is "mastering horror" (Sparks and Sparks, 2002), which describes whether an individual can endure the horror content depicted in a movie. Horror self-efficacy is therefore defined as the belief in one's ability to endure and face the challenges presented in media. In the video game context, believing oneself to be able to successfully cope with suspense and effectively confront immediate threats can be considered the "resolution" of the challenges presented. If successfully enduring the horror content produces "cognitive euphoria," audiences' arousal transfers the previous intensity of suspense into enjoyment when the game is over. This can happen regardless of whether a satisfying conclusion to the threat is experienced.

Lee and LaRose (2007) found that players who confront a high degree of challenge in a video game with high self-efficacy reported greater levels of enjoyment than those with non-optimal levels of self-efficacy and challenge (such as high self-efficacy and low challenge, low self-efficacy and high challenge, and low self-efficacy and low challenge). This finding indicated that when facing greater challenges in games, players' greater self-efficacy leads to greater enjoyment.

In the context of horror games, when facing the same challenges, players with different levels of fear may experience different levels of enjoyment of the game. In addition, a player may report a high level of horror self-efficacy but eventually die in the game because of errors or accidents. Therefore, as with mastering horror, the focus is whether one believes in one's ability to endure the mediated fright and experience the relieving "safety" after being challenged by the threats in the game. We argue that the appeal of frightening content lies in the *process* of dealing with threats and game challenges and is not limited to the *end* results of such narratives. From this perspective, players might enjoy frightening content—even when there are no resolutions—because they have high self-efficacy in confronting the danger. Therefore, even when they experience high levels of fear, players with high self-efficacy can experience game enjoyment. Therefore, we further propose that horror self-efficacy and arousal moderate the effects of fear on enjoyment.

### *A three-way interaction*

With respect to the association of efficacy and fear, we argue that horror self-efficacy interacts with fear to affect enjoyment in that the enjoyment of low-fear players is not influenced by self-efficacy. However, because of their perceived lack of confidence in enduring the fear induced by the immense threats confronted in the game, high-fear players with less horror self-efficacy experience substantially less enjoyment than do high-fear players with more self-efficacy. When zombies surround a terrified player who has "lost control," fear leads to a negative appraisal of the experience, thus leading to decreased enjoyment relative to that experienced by players who also feel fear but who exhibit high self-efficacy.

Does the above-mentioned two-way interaction vary when arousal is considered? Arousal has been conceptualized not as a completely independent emotion but as representing "levels of activation within separable appetitive and aversive motivational subsystems underlying emotion" (Potter and Bolls, 2012: 110). Arousal is associated with attention, consciousness, and information processing. When arousal is high, it leads to attention narrowing, forcing players to pay attention to the arousing details of the stimuli. It also indicates intense responses toward threats. When arousal is low, players may not experience intense activation and may not focus on the horror details of the stimuli. Arousal and fear have different theoretical foundations; the former is based on the dimensional theory of emotion (Bolls, 2010), whereas the latter is based on discrete emotion theory (Nabi, 2010). Mikels et al. (2005) presented various negatively valenced photos and asked participants to identify the emotions they represented. A total of 11 photos identified as "fear" included images with various arousal ratings. Therefore, high levels of fear are not necessarily accompanied by high levels of arousal. Audiences can demonstrate high levels of fear but perceive low levels of arousal, perhaps because their focus is on resolving the current situation (Mikels et al., 2005). In the context of VR horror games, a player may experience a high level of fear due to the suspense while remaining calm when confronting each zombie, thus generating lower skin conductance responses (SCRs) than other players. A player may also experience a low level of fear of the game content but be unexpectedly "surprised" by zombies attacking from the back several times, triggering greater SCRs.



Based on Zillmann's work, we thus argue that arousal further moderates the effect on enjoyment of interactions between fear and horror self-efficacy. Low-arousal players are not "excited" by threatening stimuli. The lack of arousal does not transfer any altered positive appraisal to later enjoyment, and fear thus does not interact with horror self-efficacy to affect enjoyment. For high-arousal players, horror self-efficacy does not influence those who have low fear of the game because they may be aroused by the game play but not fear the content. Since there is no negative emotion deriving from fear generated during game play, arousal does not transfer any emotion to the subsequent appraisal. However, for high-fear players, only those with higher horror self-efficacy achieve cognitive euphoria. Among high-fear and high-efficacy participants, high levels of arousal therefore carry the intense fear over to subsequent positive appraisal, leading to greater enjoyment. Individuals who feel high levels of fear but have a lower level of horror self-efficacy do not experience cognitive euphoria. Arousal transfers the original negative fear to the subsequent appraisal, leading to decreased enjoyment.

Therefore, modifying Zillmann's model of suspense, we expect a three-way interaction among fear, horror self-efficacy, and arousal that affects enjoyment (H1). Fear significantly interacts with horror self-efficacy to affect enjoyment among high-arousal players but not among low-arousal players. Among high-arousal players, horror self-efficacy affects high-fear players in that lower self-efficacy decreases these players' enjoyment. In contrast, horror self-efficacy does not affect low-fear players. Furthermore, players' preference for the horror game genre is a strong predictor of their enjoyment of horror game play (Dekker and Champion, 2007). Therefore, a preference for horror games is the covariate in this study.

## **Enjoyment: perception, intention, and behavioral choice**

Prior studies examined only self-reported ratings of the perceived enjoyment of horror content. This study extends enjoyment to future intention to play and behavioral selection of game play. Future intentions to play similar games have been validated as an effective indicator of players' enjoyment of the current game (Peng et al., 2012). We expect a three-way interaction similar to that posited in H1 on future intentions to play similar VR horror games. Therefore, we expect a three-way interaction among fear, horror self-efficacy, and arousal that affects future intention (H2). Fear significantly interacts with horror self-efficacy to affect future intention among high-arousal players but not among low-arousal players. For high-arousal players, fear affects players with lower horror self-efficacy in that higher fear decreases future intentions to play similar VR games for players who have lower self-efficacy. This interaction does not exist among low-fear players.

The choice of whether to play a horror game when provided the opportunity to choose a VR game would be a clear indicator of the appeal of this content and would offer insight into game choice behavior. To extend the literature on the appeal of horror content, we explore the associations of fear, horror self-efficacy, arousal, and enjoyment in the previous game with players' choice of the next VR game (RQ1). In addition, we ask whether individuals who chose to play horror games differ from those who chose non-horror games in terms of their fear, horror self-efficacy, arousal, and enjoyment of the previous game (RQ2).



## Method

### *Design and sample*

We employed a laboratory study to explore the effects of fear, horror self-efficacy, and arousal on enjoyment. All three independent variables were derived naturally from the participants. Recruitment invitations were sent via campus announcement to all undergraduate students. We first recruited participants through a screening questionnaire to determine their willingness to play various types of games. Those who indicated zero willingness to play horror video games were excluded (those who responded 1—"completely not willing"—on a 7-point scale). Other invited participants were informed that they would be playing a VR game that contained "stimulating" elements. A total of 145 university students were enrolled in this laboratory study. Excluding those who had missing ( $N=3$ ) or incomplete arousal data due to wireless transmission interruption ( $N=9$ ) or missing time tags ( $N=14$ ) and those who terminated the game during the 4-minute play ( $N=17$ ),<sup>1</sup> 102 (56 males, mean age of 22.58, standard deviation [ $SD$ ]=2.73, 70.34% of the entire sample) participants provided complete arousal data and served as the sample.

### *Stimulus*

A VR survival horror game, *The Brookhaven Experiment*, was chosen for this experiment. This game was played on an HCT VIVE VR machine, which affords a room-scale or standing approach to VR game play. We set the enclosed game space as  $3 \times 2.5$  m for this experiment. Players could walk freely inside the set space.

We employed the early-release demo version of the game, which includes five waves of zombies walking toward the player from every direction in the  $360^\circ$  environment. In this game, players have limited bullets and a flashlight, with limited power to defend themselves. This demo has no narrative. Players find themselves in a deserted town hall with an empty area surrounded by trees and grass. It is dark with gloomy lighting. Players can hear the faint sounds of zombies approaching and see the vague shapes of zombies walking toward them. It is difficult to shoot precisely at a distance; thus, close-range shots to the head are an effective way to kill the zombies. This game design creates suspense as players hear the sounds but do not see the zombies, which builds tension as players spot the zombies at a distance. Finally, this design requires players to effectively cope with the threat of zombies closing in from every direction. Therefore, this survival horror game suits the purpose of this study. This game was played on a brand-new computer equipped with a NVIDIA GeForce GTX1080 graphics card, and the participants wore Sony stereo headphones. Sound effects were directional and detailed.

### *Procedure*

Invited participants arrived at the lab, signed the consent form, and rested for 5 minutes. The research team helped participants put on a wristwatch, Empatica, to record their baseline arousal. Participants then completed a short questionnaire that collected their demographic information and watched a trailer of the upcoming game as a preview (i.e. forewarning in Sparks, 1991). We included the trailer for two reasons. First, to protect

invited participants based on institutional review board (IRB) guidelines, this trailer informed them about the upcoming game. Second, this trailer set up the participants' self-efficacy, a key construct in this study. A detailed PowerPoint illustrating the game controls was presented after the trailer. HTC VIVE controllers were employed in this game, with one serving as a gun and the other as a flashlight.

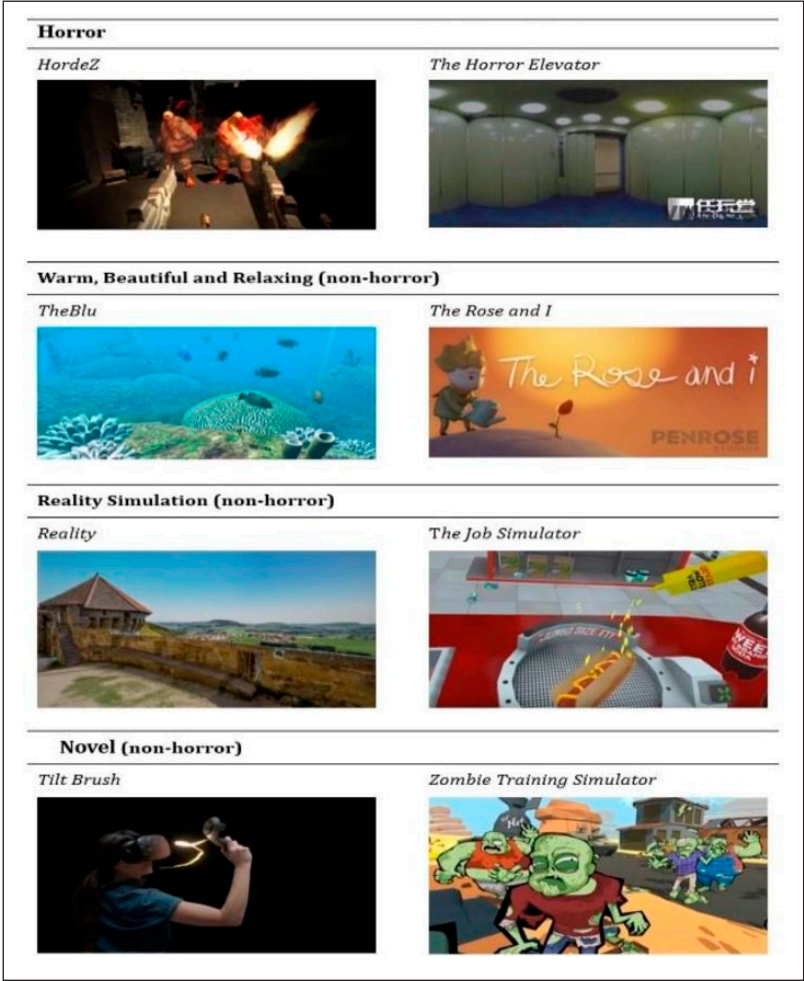
Participants were assisted in wearing the VR goggles and practiced shooting, reloading the gun, and turning the flashlight on and off in the main menu of the game. They practiced through the first wave of the game (approximately 2 minutes if they survived, though the time varied among participants if they died early) and rated their horror self-efficacy after the practice round. They then began the formal 4-minute game session. The 4-minute length was suggested by participants in the pilot test as an endurable duration of game play for most participants who experience VR for the first time (84.3%). After 4 minutes of game play, participants were instructed to remove the goggles and complete a post-stimuli survey asking about their fear, enjoyment, and future intention to play this genre.<sup>2</sup> Upon finishing the survey, participants were shown a paper with a photo and a title for each of the eight VR game or video options (see Figure 1). Participants were informed that they could select any game they wanted to play for the next 5 minutes. Upon completing the 5-minute game play, participants were debriefed and compensated with snacks. The entire study required 40 minutes to complete for each participant.

## Measurements

*Independent variables.* Fear was measured using a three-item scale ( $\alpha=.87$ ,  $M=3.69$ ,  $SD=1.41$ ) adapted from Cantor et al. (2010) and Day (2015). Participants rated their fear during their game play on a 7-point scale ranging from 1 (very low) to 7 (very high) using three statements: "the degree of fear I feel," "the degree to which I was frightened," and "the degree to which I do not want to recall the experience." The exploratory factor analysis showed that these items loaded on a single factor and explained 71% of the variance.

Horror self-efficacy ( $\alpha=.91$ ,  $M=4.22$ ,  $SD=1.35$ ) was assessed using a three-item scale adopted from the well-established self-efficacy scale (Zhang and Schwarzer, 1995). Participants rated their degree of agreement (1 = strongly disagree and 7 = strongly agree) with statements such as "I believe that I can calmly face challenges in the games," "No matter what happens in the game, I can effectively deal with it," and "I am confident that I can effectively respond to sudden events in the game." Efficacy<sup>3</sup> was measured after the practice round and before the 4-minute game play.

Arousal was measured through skin conductance (Schneider et al., 2004),  $M=22.40$ ,  $SD=16.92$ , range = 0–91, using the Empatica E4 wireless electrodermal activity (EDA)/galvanic skin response (GSR) wristband, which passes a small amount of current through two dry silver-coated electrodes with a sampling rate of 4 Hz. It was worn on the wrist of the participant's non-dominant hand. Wrist-worn sensors have been validated and provide consistent physiological data in clinical trials (Van Dooren et al., 2012). Recent literature also validates the Empatica wristband for emotion and stress monitoring (Picard, 2015), and the wristband allows participants' continuous arousal to be measured as they move in the VR game. We employed the frequency (counts) of SCRs as the indicator of arousal (Schneider et al., 2004). SCR was calculated in Acknowledge software (version



**Figure 1.** The eight VR games and videos participants could choose after playing the VR horror game. In the study, participants did not see the categories, and the order of presentation was random. Participants saw the titles and photos, which clearly present the horror or non-horror content.

4.2) because it considers baseline arousal when determining the SCR count (i.e. it analyzes phasic signal counts based on baseline arousal to determine whether there are valid SCR counts). Higher SCR counts indicate greater levels of arousal. Skin conductance was measured during the entire 4 minutes of game play.

*Dependent variables.* Enjoyment ( $\alpha=.93$ ,  $M=5.01$ ,  $SD=1.35$ ) consisted of four items, including three items that were modified for the game context from the fun subscale (Oliver and Bartsch, 2010): “It was fun for me to play the game,” “I had a good time playing the game,” and “The game was entertaining.” One item was added: “I enjoyed

playing this game.” Participants rated the statements on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Participants also indicated their future intention ( $M=5.11$ ,  $SD=1.85$ ) to play horror survival VR games on a 7-point scale ranging from 1 (completely unwilling) to 7 (completely willing) with a single question: “How willing would you be to play similar games in the future?”

To examine choice behavior, the research team chose eight games based on the limited game choices available when the experiment was conducted. These eight games can be categorized into four major types, as shown in Figure 1. For our analysis, we further categorized these eight games into horror and non-horror. An additional 47 university students rated the level of horror based on the eight photos and titles of these eight games shown in Figure 1. *HordeZ* ( $M=4.44$ ,  $SD=1.85$ ) and *The Horror Elevator* ( $M=4.72$ ,  $SD=1.93$ ) received an average rating higher than 4 on a 7-point scale and were thus coded as horror games. The rest of the games received ratings between 1.04 and 2.12 and were coded as non-horror games. Among these eight games, *HordeZ* shared the most similarities with *The Brookhaven Experiment* with respect to play mechanism and design.

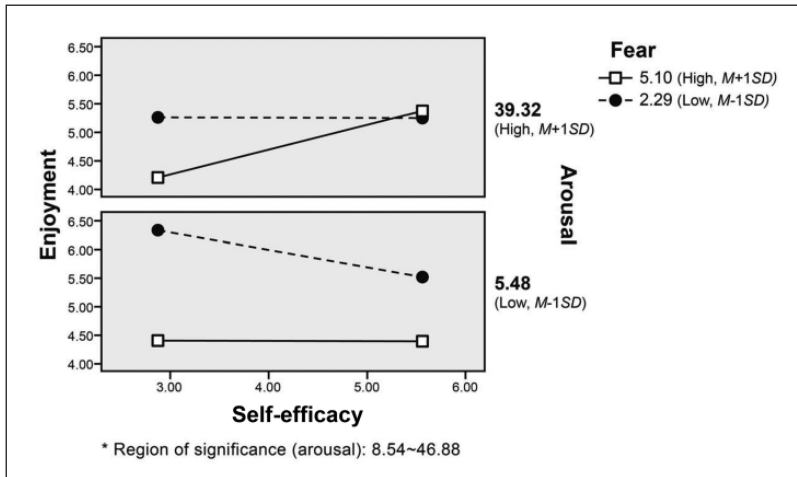
**Covariate.** Participants reported their preference for the horror genre ( $M=3.75$ ,  $SD=2.22$ ) by answering the question, “How much did you like playing horror games in the past?”, on a 7-point scale ranging from 1 (did not like it at all) to 7 (like it completely).

## Results

H1 concerns the three-way interaction effects of fear, horror self-efficacy, and arousal on enjoyment, controlling for the effects of horror game preference. Because all variables were measured in continuous data, a moderated linear regression analysis was conducted to examine the three-way interaction among fear, self-efficacy, and arousal with preference for horror games as the covariate. A significant three-way interaction among fear, horror self-efficacy, and arousal on enjoyment was found ( $\beta=.63$ ,  $p=.019$ , partial  $r=.25$ ). In addition, there was a significant two-way interaction between fear and horror self-efficacy on enjoyment ( $\beta=.34$ ,  $p=.007$ , partial  $r=.28$ ). Furthermore, both fear ( $\beta=-.91$ ,  $p<.0$ , partial  $r=-.49$ ) and horror self-efficacy ( $\beta=-.48$ ,  $p=.007$ , partial  $r=-.277$ ) were significant predictors of enjoyment. Preference for the horror game genre was a significant covariate ( $\beta=.32$ ,  $p<.0$ , partial  $r=-.39$ ). The model had an adjusted  $R^2$  of .52,  $p=.0$ .

We employed simple slopes analysis to further interpret the three-way interaction. Using model 3 in the PROCESS macro developed by Hayes (2013), graphs of simple slopes (Figure 2) and the region of significance were produced via the Johnson–Neyman technique, 8.54 (28.43%)–46.88 (92.16% below). Following the recommendations in the literature, values from both moderators that consisted of continuous data were positioned at  $\pm 1$   $SD$  from the mean.

We further conducted a slope difference test and found that among high-arousal participants, fear significantly interacted with self-efficacy to affect enjoyment,  $t=4.19$ ,  $p=.000$ . As predicted, for high-fear participants, high self-efficacy led to significantly greater enjoyment than low self-efficacy. However, for low-fear participants, low versus high self-efficacy did not affect reported enjoyment. In contrast, among low-arousal participants (Figure 2), the two-way interaction of fear and horror self-efficacy did not have a significant effect on enjoyment (because it was outside the region of significance). Fear

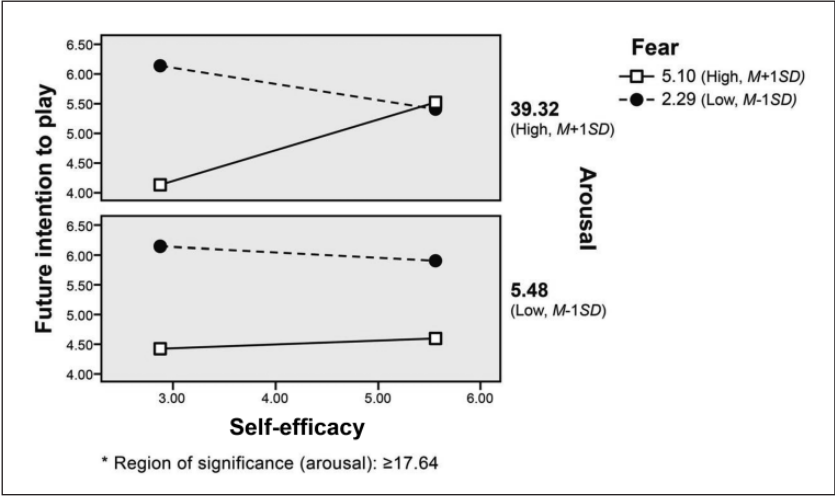


**Figure 2.** Enjoyment of playing a VR horror game as predicted by the two-way interactions between fear and self-efficacy at low and high levels of arousal.

was a significant predictor of enjoyment among low-arousal participants regardless of the level of horror self-efficacy,  $t = 3.28$ ,  $p < .001$ . Further slope difference tests indicated that among high-fear and high-arousal participants, high self-efficacy participants demonstrated greater enjoyment than low self-efficacy participants, but this differed significantly from the results for low-arousal participants. Enjoyment did not differ between levels of efficacy among high-fear and low-arousal participants. Thus, H1 is supported.

H2 addresses the three-way interaction effects of fear, self-efficacy, and arousal on future intentions to play VR horror games. Employing the same moderated linear regression as in H1, the results showed that the three-way interaction effect among fear, horror self-efficacy, and arousal on future intention was significant,  $\beta = .61$ ,  $p = .028$ , partial  $r = .24$ . No significant two-way interactions were found. Fear ( $\beta = -.72$ ,  $p < .0$ , partial  $r = -.38$ ) was a significant predictor of enjoyment. Preference for the horror game genre was a significant covariate ( $\beta = .33$ ,  $p < .0$ , partial  $r = .38$ ). The model had an adjusted  $R^2$  of .46,  $p = .0$ .

Using the same steps to interpret the three-way interaction as in H1, the plot in Figure 3 shows the patterns (region of significance:  $\geq 17.64$ ). The figure indicates that the three-way interaction for future intention had patterns similar to those for enjoyment. The simple slopes analysis and the slope difference tests showed that among high-arousal participants, fear significantly interacted with self-efficacy to affect future intention,  $t = 3.34$ ,  $p < .001$ . As predicted, for high-fear participants, high self-efficacy led to significantly greater future intention than low self-efficacy. However, for low-fear participants, low versus high self-efficacy did not affect reported future intention. In contrast, among low-arousal participants, fear did not interact with horror self-efficacy to affect future intention. Fear was a significant factor for future intention regardless of the level of self-efficacy,  $t = 2.24$ ,  $p = .023$ . Further slope difference tests also indicated that among high-fear participants,



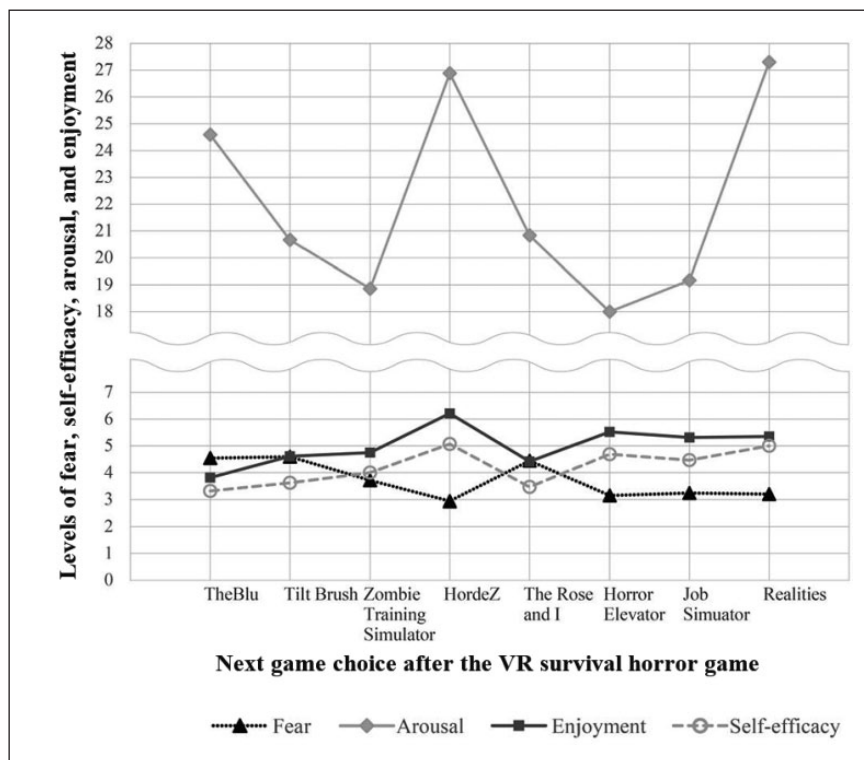
**Figure 3.** Future intention to play a VR horror game as predicted by the two-way interactions between fear and self-efficacy at low and high levels of arousal.

self-efficacy had a significantly greater influence on future intention among high-arousal participants than among low-arousal participants. Thus, H2 is also supported.

Regarding behavior in choosing games, we first employed analysis of variance (ANOVA) to explore the associations of each chosen game with players' fear, self-efficacy, arousal, and enjoyment from the previous game (RQ1). As shown in Figure 4, significant differences were found between these games regarding fear, self-efficacy, and enjoyment. No significant differences were found regarding arousal. Regarding self-efficacy, high self-efficacy participants chose the horror game *HordeZ* ( $M=5.07$ ), and low self-efficacy participants chose relaxing and recovering interactive experiences such as *theBlu* ( $M=3.32$ ) and *The Rose and I* ( $M=3.47$ ). Regarding fear, those who chose *HordeZ* rated their fear in the past game the lowest ( $M=2.94$ ), followed by those who chose *The Horror Elevator* ( $M=3.15$ ). Regarding enjoyment, those who chose to play *theBlu* rated their enjoyment of the previous VR horror game the lowest ( $M=3.82$ ), followed by those who chose to play *The Rose and I* ( $M=4.42$ ) and *Tilt Brush* ( $M=4.61$ ). Those who chose to play *HordeZ* rated their previous enjoyment the highest ( $M=6.21$ ), followed by those who chose to play *The Horror Elevator* ( $M=5.52$ ).

For RQ2,<sup>4</sup> we employed  $t$ -tests to explore differences in fear, self-efficacy, arousal, and enjoyment among those who chose to play horror games and those who chose non-horror games. The results showed that except for arousal ( $p=.80$ ), all factors differed significantly among those who chose horror or non-horror games. Those who chose to play horror games had significantly lower fear ( $M=3.12$ ,  $SD=1.13$ ), higher self-efficacy ( $M=4.92$ ,  $SD=1.28$ ), and higher enjoyment ( $M=5.92$ ,  $SD=.83$ ) than did those who chose to play non-horror games (fear,  $M=3.90$ ,  $SD=1.43$ ; self-efficacy,  $M=3.35$ ,  $SD=1.31$ ; enjoyment,  $M=4.62$ ,  $SD=1.39$ ).





**Figure 4.** The association among fear, self-efficacy, arousal, and overall enjoyment from the previous VR game and players' choice of their next VR game.

## Discussion

This study examined the paradoxical issue of the appeal of horror media content in a VR survival horror game. Revising Zillmann's model of suspense, we argued that players' perceived self-efficacy in coping with horror content during game play is key to explaining the conditional positive association of fear and enjoyment. We proposed a three-factor model with the interaction of fear, perceived horror self-efficacy, and arousal as the mechanism explaining the enjoyment of horror content.

The results supported our proposed three-factor model. They also highlighted variations among participants regarding the association of fear and enjoyment. The positive association of fear and enjoyment is conditional and only occurs for those with high self-efficacy in playing the game and those with high arousal. Therefore, perceived horror self-efficacy is a crucial factor in determining the positive effect of fear on enjoyment only among high-arousal participants. Conceptually, perceived self-efficacy is similar to "mastering horror" (Sparks and Sparks, 2002). It focuses on audiences' perception of whether they can cope with the mediated fright *during* exposure. This perception is a source of cognitive euphoria leading to enjoyment. Various levels of self-efficacy determine the source of positive emotions among high-fear players, turning the original



negative appraisal into positive appraisal. This finding extends Zillmann's excitation transfer theory to the horror context by explicating the process and identifying the factor that influences cognitive euphoria.

Arousal further moderates the effect on enjoyment of the two-way interaction between fear and self-efficacy. As indicated in the results, a significant two-way interaction occurs only among players with high arousal and is not found among low-arousal players. For low-arousal players, only fear negatively predicts enjoyment. For high-arousal players, high-fear and lower-efficacy players reported the lowest enjoyment, suggesting that the play was "overwhelming" and exceeded their optimized level of comfort in confronting mediated fright in VR games.

The three-way interaction also suggested that arousal may play a role in "transferring" intense fear to later enjoyment, as evidenced by the significant differences among those who reported high arousal and high fear. High versus low efficacy among these players demonstrated significantly higher and lower enjoyment compared with high-arousal and low-fear participants (e.g. comparing the two white lines in the graphs and slope difference tests that indicated significant differences). This is because the arousal generated from high fear was transferred and transformed to later enjoyment and future intention based on whether cognitive euphoria was present (i.e. self-efficacy). Among participants with lower self-efficacy, high arousal further intensified the effect of a high level of fear on their subsequent reported enjoyment and future intentions significantly more than among low-fear participants. Among participants with high self-efficacy, the slope difference tests and the graphs both showed that high-fear players reported slightly more enjoyment than low-fear players did, indicating the intensifying role of arousal.

A further question is how long arousal influences this cognitive euphoria in later evaluations of enjoyment. Immediate enjoyment was affected by higher levels of arousal through intensified fear depending on the presence of perceived self-efficacy. When considering players' future intentions to play the game, such patterns existed among high-arousal players. However, among low-arousal players, players with low fear levels and high self-efficacy reported a significantly higher intention to play similar games in the future than high-fear and high self-efficacy players. This finding suggests that when arousal is low, the euphoria from self-efficacy during game play only affects immediate enjoyment. However, fear also had main effects on immediate enjoyment and subsequent evaluations of future intention. Arousal does not intensify the cognitive euphoria derived from self-efficacy *long enough* to lead to future intention. Therefore, although the participants felt able to cope with horror in the game, they were also affected by a high level of fear without experiencing arousal. When a lack of arousal resulted in an inability to transfer high efficacy to later appraisal, players indicated a lower intention to play similar games.

The behavioral results showed interesting patterns. Those who chose to play the similar VR horror game *HordeZ* experienced the highest self-efficacy, enjoyment, and arousal as well as the lowest fear among all participants. In contrast, those who experienced the highest fear and lowest self-efficacy and enjoyment from the previous VR horror game chose to play the beautiful, relaxing, and peaceful VR game *theBlu*. This pattern received additional support when we compared those who chose horror games with those who chose non-horror games. Although the three-way interaction was not significant in the logistic regression, the above results suggest that the behavioral decision represented the appeal of horror content in VR games.

This study demonstrated that VR games are a suitable venue for researchers to examine the appeal of mediated fright, as evidenced by the strong arousal signals reported in this study. Compared to horror movie viewing, VR game play provides strong stimulation and abundant variety to explore various conditional effects. Because players, as agents, directly encounter threats and immediate danger to experience mediated fright, VR games serve as a promising tool that academics can use to further research players' emotions and behavior.

Zillmann's suspense model originated and was heavily tested in the context of narrative-rich films, whereas we tested this model in a non-narrative VR game. We argue that narrative is the "spice" that establishes the suspense and that resolution matters in films. In VR games, suspense was generated through various elements, such as darkness, a lack of clues concerning the direction from which the zombies were approaching and eerie sounds. Game play may also have a "resolution," such as surviving or not, which may influence players' enjoyment. In this study, we measured players' perceived competence regarding their game play performance (performance competence; i.e. whether players believed they performed well or not) after the game play. The analysis showed that performance competence did not have a three-way interaction with fear and arousal affecting enjoyment ( $p = .18$ ) or future intention ( $p = .54$ ). Since performance competence is not equivalent to the play results (survival or not), we call upon future research to continue to examine how these factors influence audiences' enjoyment and to test the role of horror self-efficacy in films to explain why audiences enjoy horror content even when the narratives do not have satisfying resolutions.

The role of self-efficacy has been demonstrated to explain media consumption (LaRose and Eastin, 2004) in the Internet context. This study demonstrated that horror self-efficacy affects the appeal of mediated fright in a three-factor model related to horror content and enjoyment. An alternate interpretation could be that high self-efficacy interacts with arousal in predicting enjoyment, though only when fear is high. More research is needed to explore this aspect. Furthermore, the importance of self-efficacy could be applied to a broader context of VR training or fear conditioning. Future VR programs could design mechanisms to afford various levels of self-efficacy and arousal in order to achieve better effects or training correct attitudes for participants when facing disasters (e.g. earth quakes) or conflicts (e.g. war and terrorism).

This study revised Zillmann's model of suspense and examined the model in a VR game, which allows for variety in emotions and arousal. Nevertheless, several limitations should be considered when interpreting the results. First, we assessed three factors in participants via self-report and physiological measurements before and during game play. Self-efficacy was reported before the main game play, and fear was self-reported information reflecting experiences during game play. Arousal was measured throughout game play using skin-conductance equipment. As the data indicated, a single game can generate various responses from participants. Therefore, we followed the approach employed in previous horror film studies (De Wied et al., 1995) to examine how differences in these responses influence enjoyment using the same experimental stimulus (i.e. the same game). Based on this initial exploration with the proposed model, future research could further manipulate players' self-efficacy prior to the game play and examine its influence with fear and arousal. Second, video game play is more interactive and

engaging than video watching (Klimmt et al., 2009). Especially in VR survival horror games, the time between the generation of suspense and direct confrontation may be only 10–15 seconds. Therefore, we do not differentiate the nuances of different stages, such as uncertainty, suspense, and confrontation/avoidance at the end of the game. It would be intriguing to segment the stages and to explore how arousal varies among them. Furthermore, some may suggest that prior VR game experience and general video game competence are factors affecting enjoyment. In this study, prior VR game experience was not a significant factor in the model, and it did not affect the results. General video game competence could influence how people evaluated their self-efficacy. Future research should examine these factors as potential covariates. Third, behavioral game choice is a complicated decision (Reinecke et al., 2012) and may represent various motivations. For example, participants may have chosen to play the novelty games (e.g. the three-dimensional [3D] drawing game *Tilt Brush*) because they have limited opportunities to play VR games. Future studies could reduce the choices to two games (either horror or relaxing games rather than novel games) to examine the behavioral appeal of mediated fright.

This study contributes to the investigation of the appeal of horror content by proposing horror self-efficacy as a significant factor and revising Zillmann's model of suspense to explain the association between fear and enjoyment. We argue that "resolution of horror" is not limited to the "end results" in the video game context and can be viewed as the perception of whether one can cope with the challenges *during* game play. We position fear as a factor that influences enjoyment, with self-efficacy moderating the relationship. Furthermore, this association occurs only in high-arousal players, indicating the intensifying role of arousal in the appeal of mediated horror content. We employed self-reported ratings of the immediate appraisal of game play, future intention, and actual behavioral choices to reflect various dimensions of enjoyment and to demonstrate the "appeal" of horror. Finally, we demonstrated that VR games are promising media for horror research. More studies are needed to examine the proposed model and boundary effects.

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## Notes

1. These players reported high fear ( $M=5.81$ , standard deviation [ $SD$ ]=1.07) and low enjoyment ( $M=2.27$ ,  $SD=0.91$ ). Based on the observations of the research team, these players quit because they were too scared.
2. Additional measures, including ratings of fear elements and coping reactions, were collected for a larger project.

3. In this study, we measured horror self-efficacy twice: immediately after the trailer but before the virtual reality (VR) practice round and immediately after the VR practice round. The within-subjects repeated-measures *t*-test showed that self-efficacy did not differ between these two time points ( $F=0.99$ ,  $p=.32$ ), indicating that the trailer indeed reflected the game content. Therefore, we adopted the self-efficacy reported after the practice round as the most accurate reflection of participants' efficacy in the upcoming VR game.
4. We conducted binary logistic regressions to explore the effects of three-way interactions on behavioral choice. The results were not significant (approaching significance,  $p=.069$ ).

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