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Hostile Thoughts, Presence and Violent Virtual Video Games

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Abstract

A recent study investigating virtual reality (VR) technology's influence on the effects of violent video games found that exposure to violent video games increased hostility. In contrast to expectations, however, hostility tended to be greater when participants simply observed a violent game than when they played the game in a virtual environment. This evidence was taken to support claims that violent content within a game creates distress in users and causes increased hostility. However, based on a belief that simply observing the violent game would be more boring than playing a video game, the present study attempts to test a rival interpretation of the findings suggesting that increased hostility resulted from boredom, not violent game content. Reanalysis of the original data along with newly data collected provide additional insight.

Participants took part in a lab experiment in which they were randomly assigned to one of four media environment conditions: playing a VR violent video game, playing a standard violent video game, observing a violent video game, and observing a non-violent video game. Following exposure to one of the four conditions, participants completed a self-report questionnaire measuring physiological distress and their experience of presence in the mediated environment, and a thought listing task which was later coded for frequency of hostile thoughts and indicators of boredom.

Two things stand out in the findings for this study. First, consistent with the notion that violent media content caused hostility, neither boredom nor physiological distress accounts for the impact of violent-game conditions on hostile thoughts. Second, though it doesn't account for hostility associated with game violence, physiological distress is a strong predictor of hostility.

Hostile Thoughts, Presence and Violent Virtual Video Games

Like most new media, the emergence video-game technology of has been greeted with concern about its possible effect on children and others. Controversy surrounding violent video game use has followed a path similar to that of violent television and claims about its relationship to hostility. With evidence on the impact of television violence beginning to produce more convincing arguments that the effect is indeed substantial (Paik & Comstock, 1994), it is not surprising that concern over video game violence is also increasing.

A recent study on video games attempted to extend research on video-game violence by considering whether virtual reality (VR) technology can intensify the effects of video-game violence (Tamborini, Eastin, Lachlan, Fediuk, Brady, & Skalski, 2000). As predicted, their study demonstrated that violent video games increased hostility. In contrast to expectations, however, there was a tendency for hostile thoughts to greater when participants observed a violent game than when they played the game in a virtual environment. The present study attempts to explain these surprising findings by reanalyzing the original data along with new data collected to provide additional insight. It builds on the General Affect Aggression Model (GAAM) developed by Anderson and Dill (2000).

The General Affective Aggression Model.

Anderson and Dill's (2000) GAAM is a multi-stage model that makes predictions about both the short-term and a long-term influence of exposure to violent media content. It indicates that exposure to violent media images will increase hostility in the short-term through the priming of aggressive scripts. These scripts activate affect and arousal,

influence appraisal processes, and lead to aggressive behavior. The long-term process shows how repeated short-term experiences impact long-term personality variables (e.g., development of aggressive traits) as well as the habitual exposure to situational conditions conducive to aggressive interactions. The present study limits itself to tests of short-term influences. However, to the extent that short-term experiences impact long-term processes, an impact on these habitual states can also be expected.

Within the GAAM framework video-game violence can be seen as having a strong impact on aggressive behavior. In particular, attributes of video game's associated with a *first-person* point of view and the user's *active role* in decisions to aggress are seen as powerful situational forces initiating the short-term processes of GAAM. The active role in decisions to aggress should lead to greater involvement with video games than is found with film or video in which the user assumes a more passive role. The first-person point of view should increase identification with the aggressor and promote modeling of hostile behavior found in the media's violent content (Leyens & Picus, 1973).

When applying this model to VR we can see that features unique to the technology seem directly relevant to a violent video game's impact on aggression. VR provides a quantum step forward in media's ability to provide the user with a first-person point of view and active involvement in decision making. These attributes should greatly enhance the experience of presence, the feeling that the user is actually part of the experience, and play a central role in determining a violent game's influence on aggression. Though some scholars have discussed the importance of user identification,

little attention has been given to studying its role in a video game's impact on aggressive outcomes.

Research on Violent Video Games

Some believe that the violence in video games places our children at risk. Nearly all children spend time playing video games (Anderson, 2000). For males, half of their favorite games are extremely violent games like Doom, Quake, and Duke Nukem (Pooley, 1999). While the average 7th grader plays for almost 4 hours a week, by the time they reach college many young men report playing these games more than15 hours a week. With even more alluring games looming in the form of virtual reality (VR) technology, concern about the environments in which these adolescents will spend their time seems well justified.

While some scholars claim that the past evidence on violent video games' show its impact on aggression to be minimal (Sherry, 1997), others argue that qualitative differences in the content and form of today's games renders research on their predecessors irrelevant (Walsh, 1999). This position seems supported by the original findings of Tamborini et al (2000) as well more recent studies by others (e.g., Calvert & Tan, 1994; Anderson & Dill, 2000). In their earlier work, Tamborini et al. (2000) use the General Affect Aggression Model (GAAM) to describe how violent video games can impact hostility, and how virtual reality can enhance the effect of these games. GAAM (Anderson & Dill, 2000) suggests that media features promoting identification with aggressive characters will increase resulting hostility. As such, to the extent that VR technology fosters identification with aggressive characters, increased hostility should result.

Of particular interest to us here are results of the study by Tamborini et al. (2000). Based on the belief that VR has the ability to increase identification with aggressive characters by creating a sense of *presence*, a VR violent video game's short-term impact on both the experience of presence and on aggressive behavior was predicted to be stronger than the impact of a traditional violent video game. Participants in the study took part in a lab experiment where they were randomly assigned to observe a non-violent video game, observe a violent video game, play a standard violent video game, or play a VR violent video game. Following exposure to one of the four conditions, participants completed a self-report questionnaire measuring physiological distress, the presence they experienced, and a thought-listing task that was later coded for frequency of hostile thoughts. Two observations stand out from the findings in this study.

First, as expected, greater presence was experienced by those controlling the media environment (the standard game and VR game conditions) than those simply observing the media environment (the violent and non-violent observation conditions). Surprisingly, however, patterns of physiological distress resulting from media environment did not mirror patterns in presence. Though physiological distress was highest in the VR game condition, the second highest level of distress was found in the violent observation condition, and this distress was significantly greater than that found in the non-violent observation control.

Second, consistent with Anderson and Dill’s (2000) GAAM notion that violent media content influences hostility, more hostile thoughts were found in the three violent media content conditions than were found in the non-violent media observation control. Yet in contrast to expectations, there was a tendency for hostile thoughts to be higher in

the violent observation condition than in the VR game condition. Adding to this surprise, the interaction between media environment and level of presence on hostile thoughts indicated that in the standard game condition high-presence players had very few hostile thoughts, while low-presence players had more hostile thoughts than any other condition.

Games, Presence, Distress and Boredom

Several alternative hypotheses were offered for the some of the unexpected findings in this study. For example, in explaining the unexpected relationships among distress, presence, and game condition the authors note that observed differences in physical distress cannot be explained by game condition and presence alone. Heightened distress in the VR condition might be attributed to participants wearing a headmount used to immerse them into the game environment. This type of full immersion is known to cause some equilibrium discomfort, and subsequent feeling of physical distress. However, the study also showed that the participants in the violent observation condition felt more physical distress than those in both the standard game condition and the non-violent observation condition. Since the presence experienced in the violent observation condition was lower than that in the standard game condition and did not differ from that in the non-violent observation condition, differences in physical distress cannot be due to presence alone. Instead, they were interpreted as resulting, in part, from violent game content. As such, the evidence is taken to suggest that the violence creates distress in the game player. This is an important interpretation in that it plays a part in later logic attributing the increased hostility resulting from game use to the violent content within game conditions. Though this interpretation seems reasonable, these findings could be explained by another alternative that unrelated to the violent content found in the

different game conditions. This interpretation is based on the possibility that boredom associated with different game conditions increased reports of physiological distress. If true, it might explain observed hostility as resulting from boredom, not violent game content. Confirmation of this alternative would greatly weaken support for interpretations of Tamborini et al. (2000) claiming that violent video content increased hostility. One goal of the present study is consider this possibility. Based on the belief that observing the violent game being played would be more boring than playing the standard video game, we attempt to test the original interpretation of the findings against this alternative. As such, the following research questions are offered.

RQ1) Will the experience of boredom differ among individuals playing a VR violent video game, playing a standard violent video game, observing a violent video game, or observe a non-violent video game?

RQ2) Can boredoms relationship to game condition explain game condition's impact on hostile thoughts?

Additionally, in order to investigate the suggestion that physiological distress from exposure to violent content helps explain game condition's impact on hostile thoughts (Tamborini et al., 2000) one final research question is posed.

RQ3) Does physiological distress associated with violent game content help explain game condition's impact on hostile thoughts?

Methods

Overview

The study discussed here involves analyses on a data set created from a combination of 92 participants described in Tamborini et al. (2000) and 13 additional

participants taken from the original sample frame. Along with the addition of these 13 participants, the data set here includes a new variable – boredom. Boredom was coded for all participants and used in analyses investigating the research questions proposed.

In the study, male and female college students participated in a study as part of a class research requirement. Participants were randomly assigned to one of four conditions: (1) playing a VR violent video game, (2) playing a standard violent video game, (3) observing a violent video game, and (4) observing a non-violent video game. Participants played one game three times. Subsequent to each exposure individuals completed one of the following: a thought listing task, a self-report measure of telepresence experience, and a game recommendation task. Participants' verbal responses to the thought-listing task were coded for the types and frequency of hostile thoughts and thoughts indicating boredom. These measures served as the dependent variables for analyses investigating the effect of violent media environments (VR game, standard game, violent observation, or non-violent observation) on thoughts and behaviors.

Participants

One hundred and five students from a large Midwestern University were recruited from an undergraduate communication course. Consistent with the population of communication students, participants were predominantly female (22 males and 83 females). Ages ranged from 18 to 23 (M=20.76, SD=. 96). Participants were informed that the investigation was designed to study the way people experience different types of media. They were told that some participants would play a VR game, some would play a standard video game, and some would watch a video program.

Procedures

Participants came to the lab in pairs and were greeted by one of three different male researchers and one of two male research assistants. During each session, one participant was assigned to one of the two game conditions (VR or standard), while the other participant was assigned to one of the two observation conditions (violent or non-violent). After administering a written consent form to the participants, the researcher then began the instructions for the procedure. All instructions given to the participants were audio taped ahead of time in order to ensure consistency across conditions and participants. Following the first set of taped instructions, the assistant took the participant assigned to one of the observation conditions into an adjacent room. At this time, the researcher continued to supervise the other participant as they received taped instructions in how to play the game.

Following these instructions and a brief practice session designed to allow the game player to become accustomed to the environment, the researcher left the participant in the game condition and let them play alone for five minutes. At this time, the participant in the observation condition watched either a feed of the game being played in the other room (violent observation), or a previously recorded game (non-violent observation). In both cases, participants in the observation condition were told that they were watching the game being played by the other participant. After five minutes, the assistant returned, administered the thought-listing task, and left the participants alone for four minutes. At the conclusion of four minutes, the assistant played a set of taped instructions and left the participants to play or observe for another five minutes.

Following this five-minute interval the assistant returned and administered the telepresence experience survey. When both participants had completed the survey

(typically about eight minutes), the assistant once again entered the observation and game-play rooms and collected the surveys. After another set of instructions the assistant left again and the third and final period of playing and observing began.

At the conclusion of another five minutes, the assistant entered each of the two rooms and administered a game recommendation questionnaire designed to evaluate how much the participant thought retailers could reasonably charge for the game. In this instance, the assistant stayed in the room while participants filled out the relatively short questionnaire. After collecting the game recommendation questionnaire, the assistant informed each participant that he would get the researcher to finish up the study. The researcher re-entered each room and played a taped debriefing statement. This was followed by a series of probing questions designed to identify any demand effects that may have occurred during the procedure. Participants were then thanked for their participation, given their course credit, and dismissed.

Manipulation of Violent Media Environment

Participants in the violent conditions were exposed to the video game Duke Nukem 3D in one of three media forms. In the VR game condition, participants played Duke Nukem 3D on a Forte Technologies Vfx1 virtual reality system. The system provides an immersive headmount system that isolates and delivers information through the audio and visual channels. A toy handgun modified to look realistic controlled movement in the environment and the firing of the weapon in the game. In the standard game condition, participants played Duke Nukem 3D on a standard IBM compatible personal computer using a toggle control device to manipulate all aspects of the game environment. In the violent observation condition, participants observed the output from

the participant playing Duke Nukem 3D (either in the VR or standard game condition) in the neighboring room. Participants in the non-violent observation condition watched output from the game CoolBoarders 3 that had been previously recorded on a CD-ROM. Participants in the standard game and both observation conditions viewed the output on a 14-inch color computer monitor adapted with stereo sound speakers.

The video game Duke Nukem 3D is a popular game available for both personal computers and home gaming systems. In the game, the player controls the main character (Duke) as he wanders through urban landscapes and indoor labyrinths while being attacked by heavily armed mutants. In order to move on to the higher levels of the game, Duke must kill these mutants and recover items such as keys to open doors and medical kits to heal injuries he has sustained. Along the way he can acquire weapons such as handguns, rocket launchers, chain-fed machine guns, and pipe bombs. For the purposes of this study, codes were entered to manipulate the game in such a way that Duke had all necessary weapons and tools at the outset. Additionally, a game mode known as “God Mode” was invoked. In this alteration of the game Duke cannot die. This was done to avoid the problem of having to restart the game during one of the five-minute game-play sessions.

The graphics are set up in such a way that the person playing the game is looking at the environment from Duke’s perspective, seeing no more of himself than a weapon extended outward. In this sense, the game contains a high degree of presence as the player is literally looking through the eyes of the character they are controlling.

Additionally, the portrayals of gore and carnage in the game are extremely graphic. When other characters are shot, they scream or yell in pain. Blood and entrails

are often clearly visible, and wounded characters will sometimes writhe in pain for several seconds before expiring.

CoolBoarders 3 is another popular video game for home gaming systems. Game players control any one of several characters that they can select at will. The object of the game is to successfully control their character as they snowboard down any one of a number of slalom and half-pipe courses, and to score points by executing maneuvers. Participants in the present study simply watched the game being played. This game was selected because it is fast paced and arousing, but does not contain any overt acts of violence in which one character purposefully attempts to injure or kill another. Additionally, the visual perspective is one in which game players actually see their character on screen, and are not looking at the game in the type of first-person perspective found in Duke Nukem 3D.

Outcome Measures

Four measures served as outcome variables in this study. These include responses to the thought-listing task coded for types and frequency of hostile thoughts and boredom, along with self-reported measures of telepresence experience and the experience of physiological distress. These measures served as the dependent variables in the study.

Hostile Thoughts and Boredom. Participants were asked to report what they were thinking during the media experience. The number of hostile thoughts, pleasant thoughts, and thoughts indicating boredom listed by the participant immediately after exposure to the media environment was recorded and coded following the thought-listing procedure described by Cacioppo and Petty (1981). Participants were told "to record only those

ideas that you were thinking during exposure to the video-game," to "state your thoughts and ideas as briefly as possible," and to "ignore spelling grammar, and punctuation." Participants were given exactly 4 minutes to write their thoughts. Coders blind to both the experimental conditions counted the number of hostile thoughts, and thoughts indicating boredom listed by each participant. A hostile thought was defined operationally as any word having a hostile connotation. Hostile thoughts included those sub-categorized as references to weapons, references to the use of weapons, references to destruction of property or physical harm, expressions of negative affect, verbally abusive terms, and profanity. A thought indicating boredom was defined operationally as any word expressing the feeling of being bored or the dullness or tedium associated with playing the game. Coders were trained in recognition of these types of hostile, pleasant, or bored words. An inter-coder reliability coefficient of $r = .91$ was obtained on sampled portions of the data set. Once this level of reliability was reached, single coders were used to code the remaining data. The summed frequency of words coded in each category was used as to create measures labeled hostile thoughts or boredom.

Experienced Presence. Presence was measured using the Presence Questionnaire (PQ) developed by Witmer and Singer (1998). The PQ is designed to measure a person's subjective experience in a simulated environment. It contains 32 items that assess the amount of control a person has over an environment, the number or sensory modalities and quality of sensory input received from an environment, the realism (in terms of connectedness and meaningfulness) of an environment, and the level of isolation created by the environment. It attempts to identify and measure the degree to which aspects of the virtual environment engendered a sense of presence. The PQ uses a 7-point response

scale that in format is based on the semantic differential principle (Dyer, Matthews, Stulac, Wright, & Yudowitch, 1976). Each item is end-anchored by opposing descriptors, but unlike the semantic differential, the scale includes an anchor at the midpoint. For this study, 21 items measuring sensory factors and control factors were averaged to create a measure labeled presence experienced (_ = .91).

Physiological Distress. To measure physiological discomfort and distress, a scale containing 18 items measuring various symptoms of physiological distress was created. The instrument provided a four point response scale measuring responses of "absent," "slight," "moderate," or "severe" for each of the following items: increased salivation, sweating, nausea, difficulty concentrating, stomach awareness, burping, fatigue, headache, eyestrain, difficulty focusing, blurred vision, fullness of head, dizzy (with eyes open), dizzy (eyes closed), vertigo, general discomfort, stress or tension, and adrenaline rush. Responses to all 18 items were summed to form the measure of physiological distress. Chronbach's alpha was .87.

Results

Analyses began with a test designed to establish that the relationships between game condition and hostile thoughts observed in the original tests by Tamborini et al. remained after the inclusion of additional participants. Once established, additional analyses were conducted to test the research questions proposed in the current study.

The experience of boredom as a function of video game condition – RQ1

In order to test the relationship expected to exist between game condition and hostile thoughts, univariate ANOVA was performed to inspect the impact of game condition (non-violent observation, violent observation, VR game, standard game) on

measures of hostile thoughts. As expected, a significant effect on hostile thoughts was found for media environment, F (3, 101)=9.15, p<.01, eta=.21. Results of LSD post-hoc analysis demonstrate that fewer hostile thoughts were observed in the non-violent observation (M=.53, SD=.80) than the other three conditions. There were no significant differences among the number of hostile thoughts found in the violent observation condition (M=4.55, SD=3.14), standard game condition (M=3.64, SD=3.02) or VR game condition (M=3.69, SD=2.14).

Once establishing the game conditions impact on hostile thoughts, ANOVA was performed on measures of boredom as a function of game condition in order to test RQ1. A significant effect on boredom was found for media environment, F (3, 101)=3.08, p<.05, eta=.08. Results of LSD post-hoc analysis demonstrate that less boredom was experienced in the non-violent observation (M=.24, SD=.28) than the violent observation condition (M=1.29, SD=.21). The boredom experienced in the standard game condition (M=.86, SD=.22) and the VR game condition (M=.86, SD=.21) did not differ significantly from any other conditions.

Boredom and game condition's impact on hostile thoughts – RQ2

RQ2 asked if boredom's relationship to game condition would explain game condition's impact on hostile thoughts. In order to investigate this issue, simple bivariate correlation was computed to first establish whether or not any relationship existed between boredom and hostile thoughts. Analysis showed that boredom was significantly correlated with hostile thoughts, r (105)=.27, p<.01. Once establishing this association, the effect of game condition on hostile thoughts was reanalyzed using boredom as a covariate. The results of this ANCOVA show that game condition remains a significant

predictor of hostile thoughts even after controlling for boredom, F (3, 100)=7.10, p<.01, eta=.17. As such, challenges to interpretations of the observed associations between violent game content and increased hostility based on the roles of boredom are not supported.

Physiological distress and game condition's impact on hostile thoughts – RQ3

RQ3 asked if physiological distress associated with violent game content helps explain game condition's impact on hostile thoughts? Once again, bivariate correlation was first computed to establish whether or not any relationship existed between game condition and physiological distress. For these analyses, game condition was dummy coded as follows: (4) playing a VR violent video game, (3) playing a standard violent video game, (2) observing a violent video game, and (1) observing a non-violent video game. Analysis showed that game condition was significantly correlated with physiological distress, r (103)=.34, p<.01. Subsequent ANCOVA was conducted using boredom, physiological distress and presence as covariates. The findings are informative. Results of ANCOVA shows that physiological distress accounts for significant variance in hostile thoughts, F (1, 96)=5.71, p<.05, eta=.06. However, once again, game condition remains a significant predictor of hostile thoughts even after controlling for physiological distress, boredom and presence F (3, 96)=5.83, p<.01, eta=.15. In this regard, the interpretation that observed associations between violent game content and increased hostility is in part a function of violent content's impact on distress appears consistent with the findings. Physiological distress contributes to predicted hostility, but game condition accounts for significant variance after the impact of distress is removed.

Discussion

Three things stand out in the findings for this study. First, neither boredom nor physiological distress can account for the impact of game condition on hostile thoughts. Second, though it is not an explanation for all hostility associated with game conditions, physiological distress is a strong predictor of hostility. Third, the game conditions used in this study were strongly associated with boredom.

Game Condition and Hostile Thoughts

The fact that neither boredom nor physiological distress can account for the impact of game condition on hostile thoughts provides support for the claim that video-game violence increases hostile thoughts. Consistent with Anderson and Dill's (2000) GAAM notion that violent media content influences hostility, more hostile thoughts were found in the three violent media content conditions than in the non-violent media observation condition even after controlling for these other variables. At the same time, it is important to note that the VR violent game condition did not lead to more hostile thoughts than other violent game conditions. The simplest interpretation of this is that VR technology is unrelated to our understanding of media induced hostility within the GAAM framework. Though the VR technology might be associated with elevated levels of presence, there was no evidence of a VR violent video game's short-term impact on presence related aggressive behavior. Nevertheless, we are not ready to reach this conclusion based on the present study. It is our belief that the novelty of the activities experienced by participants in this study prevents us from seeing the outcomes we might expect from attributes of VR associated with a first-person point of view and an active role in decisions to aggress. Since the VR technology is new to most people in general,

and even video-game use was uncommon for the sample in our study, it is unlikely that the psychological experience of deep involvement with the game characters was experienced by out participants. Eighty-three percent of the participants reported not being a video game player. As such, it seems plausible that those playing the game were preoccupied with learning the skills needed to play and not with the content itself. This would be even more the case for those in the VR game condition. Until this type of research is conducted with game players who have become accustomed to VR environments, it is unlikely that a clear understanding of how VR's ability to involve users in these violent experiences will impact hostile thoughts and behaviors.

Physiological Distress and Hostility

The ability of physiological distress to predict hostile thoughts may also have important implications for our understanding of violent video game effects. Unfortunately, it is difficult from the data here to distinguish among several plausible explanations for this finding. For example, one plausible explanation is that female participants bored with the violence or video game context of the experimental setting experienced this boredom as a form of distressed, and it was this boredom induced distress that led to elevated levels of the hostility. However, this interpretation seems inconsistent with the results of tests entering both boredom and physiological distress as covariates in ANCOVA on hostility by game condition. These findings show physiological distress to account for variance in hostility independent of that associated with boredom. A second plausible explanation is that the nausea and discomfort sometimes experienced by users of VR technology caused measures of physiological distress and hostility to covary. In this interpretation, the nausea resulting from VR

violent game condition would lead to expression of hostile thoughts. Once again, however, this interpretation seems inconsistent with the data. If the VR technology were the cause of both nausea and hostility, we would not expect to see the elevated levels of hostility found in the violent observation condition to covary with physiological distress. The fact that it does seems inconsistent with any VR based explanation for this finding. Instead, the most probable interpretation seems to be one based simply on the belief that the violent content found in the three game conditions was itself distressing to the participants, and that this distressing violence primed hostile thoughts. These were not thoughts associated with the boring nature of the game, but, consistent with the GAAM model, thoughts associated with violence-induced hostility. As such, we suggest that the most plausible interpretation of these findings is one consistent with the GAAM model.

Game Violence and Boredom

The fact that participants in the violent game conditions were considerably more bored that those in the nonviolent game conditions has important implications for studying the manner in which technology induced involvement impacts violent media's effect on aggression. In the present study, over 55% of participants in the violent game conditions provided unsolicited comments indicating their boredom with the game. Only 18% of the participants in the nonviolent game condition made mention of boredom. At first glance, this might be taken to indicate that the violent game used here was dull in comparison both to the nonviolent game and other activities. A more plausible explanation here, however, might be found by considering the sample used in this study. It seems likely that the disproportionately female sample (79%) was biased in terms of its indifference both towards violence media and video game use. The likelihood of his bias

existing among a predominantly female sample is supported not only by literature showing gender differences in video game use and preference for violent media, but also in the passing comments of female participants saying things like “my boyfriend would like this junk a lot more than I do.” What we can learn from this is twofold. First, it is important for us to study the relationships under consideration here with a sample selected from people who play these types of games. Though this might result in a male dominated sample, the results are likely to represent the population of greatest importance to us. Second, we should not overlook the fact that even with this biased sample, once boredom was controlled for, violent game condition was still a strong predictor of hostility.

Taken together, the findings in this study suggest that the effect of video-game violence on hostile thoughts is robust. It is not only found in samples unlikely to become involved in game violence, but it remains even after controlling for several spurious variable influences. Further, the findings are consistent with the predictions of GAAM (Anderson & Dill, 2000), and indicate this model’s suitability for the study of violent video games in particular, and perhaps violent VR technologies as well.

Future Research

Many issues regarding the study of violent video games in general and VR violence in particular call for our attention. The need to observe the experiences from samples of actual game players is apparent from the discussion above. Most central among these issues, however, is the impact of long term repeated exposure to violent video games. Using a repeated measures design, researchers could determine if violent video games’ effect on hostile thoughts attenuates, or if repeated use leads to the

development of aggressive traits and habitual behavior conducive to aggressive interactions. With longitudinal analysis, the learning curve would no longer threaten our ability to observe the theoretical processes under consideration. In addition, repeated measures of physical aggression and hostile thoughts would provide more sensitive data on the subtle impact of a violent virtual video game's extended use.

In terms of VR violence, we haven't really begun to accurately investigate the relationship of immersion to hostile thoughts and behavior. Initially, there is a need for procedures that do a better job of creating immersive environments for study. It is difficult to draw any conclusion about how VR technology contributes to the impact of violent media without observing the reactions of participants playing violent games in highly immersive conditions. Moreover, one critical factor greatly in need of consideration is the match between the type of violence experienced in VR environments and indicators of aggression observed in respondents following exposure. Though it is impossible to observe gun violence following immersion in shooter games like Duke Nukem, it may be possible to observe behaviors more closely matched to forms of violence contained in games promoting other forms of physical violence. For example, not only would a fight-fists VR game present a more realistic and involving activity for many adolescent males, but it also offers a greater possibility to observe subsequent participant aggression closely matched to the violence experienced. This provides a platform better suited to testing some of the theoretical rationales offered as explanations for aggression predicted by GAAM. According to GAAM, the learning of more complete aggressive scripts is an important facilitator of violent behavior. If the immersion and multiple sensory stimulation of VR games facilitate the learning of more complete

scripts, immersive environments where users punch enemies using game controlling hand and foot actions that match the natural actions of punching and kicking should lead to fully developed aggressive scripts. Further, these scripts should be strengthened through the repeated enactment of decisions to aggress while playing the game and the practice of these reproduced of motor behaviors. This feature of VR technology may be one that most distinguished it from other forms of media in terms of violent contents impact on aggression, yet no empirical research has been dedicated to its study. The potentially enormous practical implications of this theoretical distinction between the manners in which violence is experienced in VR versus other media environments calls for its close inspection.

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