

ORIGINAL ARTICLE

# The Effects of Technological Advancement and Violent Content in Video Games on Players' Feelings of Presence, Involvement, Physiological Arousal, and Aggression

James D. Ivory<sup>1</sup> & Sriram Kalyanaraman<sup>2</sup>

<sup>1</sup> Department of Communication, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

<sup>2</sup> School of Journalism and Mass Communication, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599

*The possible impact of technological advancement on video games' effects—particularly in the case of violent games—has often been discussed but has not been thoroughly explored by empirical research. The present investigation employed a 2 3 2 between-subjects factorial experiment to examine the interplay of technological advancement and violence by exposing participants (N = 120) to either a newer or older version of a violent or nonviolent game and measuring these factors' effects on players' sense of presence, involvement, physiological arousal (measured by skin conductance), self-reported arousal, and affective and cognitive aggression. The results indicate that technological advancement increased participants' sense of presence, involvement, and physiological and self-reported arousal. Neither advancement nor violence had statistically significant effects on accessibility of players' aggressive thoughts, but there is some tentative evidence that violent game content increased players' state hostility. Theoretical and practical implications of findings are discussed, and recommendations are made for future research.*

doi:10.1111/j.1460-2466.2007.00356.x

Concern about the possible negative effects of violent video games has been accompanied by a boom in research, as is evident from meta-analyses identifying dozens of existing research reports, published over a period of more than 20 years, investigating the relationship between video games and aggression (Anderson, 2004; Anderson & Bushman, 2001; Sherry, 2001). Some scholars claim that enough evidence exists to conclusively link violent video games to real-life aggression (e.g., Bushman & Anderson, 2002), but others maintain that there is not sufficient support to establish a causal link between violent video game play and player aggression (e.g., Griffiths, 1999; Scott, 1995; Williams & Skoric, 2005).

---

Corresponding author: James D. Ivory; e-mail: [jivory@vt.edu](mailto:jivory@vt.edu)

One major issue frustrating reconciliation of the clouded body of research on violent video game play is the vast advancement in video game technology that has occurred over the years. Researchers agree that video games are advancing and changing rapidly (e.g., Calvert & Tan, 1994; Sherry, 2001; Tamborini et al., 2004) and that new games provide increasingly realistic play (Carnagey & Anderson, 2004; Gentile & Anderson, 2003). Scholars have also speculated that such advances in game technology may precipitate more dramatic negative effects. Bensley and van Eenwyk (2001), for example, conclude in their interpretive literature review that existing research evidence does not convincingly indicate effects of video game play on real-world violence, but add that more compelling support for such an effect might be found by research on “more recent and increasingly realistic games” (p. 256).

Although some studies have examined the effects of advances in video game content, such as whether a game is accompanied by a narrative storyline (e.g., Schneider, Lang, Shin, & Bradley, 2004), existing experimental research has not detailed the role of technological advancement in video games' effects on players. In response to concern about technological advancement possibly heightening negative effects of violent games, it is also necessary to study the effects of technological advancement in concert with those of violent content to investigate the interplay between these two video game dimensions (see Bensley & van Eenwyk, 2001).

The present study attempts to make a modest contribution to research on both video game effects and technological variables by examining the psychological effects of technological advancement in violent and nonviolent games. Specifically, we report results from a factorial experiment that manipulates both technological advancement and violent content to explore how they influence players' sense of presence, involvement, arousal, and aggressive thoughts and feelings. In the following sections, we review relevant literature, propose hypotheses, and detail the methods of an experiment designed to test the hypotheses. After discussing the experiment's results, we conclude by pointing out implications, limitations, and directions for future research.

## Literature review

### Technological advancement in video games

As media have become increasingly advanced, technological dimensions have grown increasingly pertinent to an understanding of media effects (see Eveland, 2003; Mundorf & Laird, 2002; Reeves & Nass, 1996). The role of technological advancements in a user's experience of video games similarly merits exploration to further our understanding of the medium's psychological and social impact. Schneider et al. (2004) conclude that “it is probably unwarranted to generalize the findings of video game research in the 80s and early 90s to the modern experience” (p. 362). Calvert and Tan (1994), Bensley and van Eenwyk, (2001), and Tamborini et al. (2004) express concern over the potential negative effects of increasingly advanced violent video games. Sherry (2001) reports a correlation between the effect size of violent

video game play on aggression and a study's publication year ( $r = .39$ ) and suggests that increased effects of newer and "more graphic" (p. 424) games on aggression might explain this trend. Although one study (Tamborini et al., 2004) found no significant differences between the effects of a virtual reality game and a traditional console game on players' hostile thoughts, the effects of advancement within traditional video game-play formats remain relatively unexplored.

In the absence of numerous studies specifically investigating the effects of video game advancement, research exploring the impact of technological form variables in other media can inform the present research (see Detenber, Simons, & Reiss, 2000). For example, increased interactivity (Sundar, Kalyanaraman, & Brown, 2003), animation (e.g., Lang, Borse, Wise, & David, 2002; Li & Bukovac, 1999; Sundar & Kalyanaraman, 2004), and download speed (Sundar & Wagner, 2002) have all been found to impact the effects of Web content on users. Similarly, increased audio and visual fidelity affects responses to film and television (Bracken, 2005; Reeves & Nass, 1996). The present research focuses on video game advancement's potential effects on three experience dimensions that have received particular attention in similar research on other media: presence, involvement, and physiological arousal.

### *Presence*

One important media experience dimension often linked to technological advancement is presence. Presence has been defined as the "perceptual illusion of nonmediation" (Lombard & Ditton, 1997) and "a psychological state in which virtual (para-authentic or artificial) objects are experienced as actual objects in either sensory or nonsensory ways" (Lee, 2004, p. 37). In other words, presence describes a media user's feeling that mediated representations are real. The presence experience is highly relevant to video game players' mediated interaction with an engrossing and interactive virtual environment (Lee, 2004). Some potential effects of presence identified by Lombard and Ditton include enjoyment, improved task completion efficiency, and increased tendency to respond socially to media, so the implications of advancements' effects on presence in video game players could be substantial.

Steuer's (1992) selection of vividness as a key determinant of presence suggests a causal relationship between technological advancement in video games and feelings of presence in their players. Steuer describes vividness as "the ability of a technology to create a sensorially rich mediated environment" (p. 80) composed of sensory breadth, or the number of sensory channels provided, and sensory depth, or "the resolution within each of these perceptual channels" (p. 81). Vividness has been found to increase feelings of presence and positive attitudes when used in studies dealing with Web marketing (Coyle & Thorson, 2001; Li, Daugherty, & Biocca, 2002). Other media presentation features conceptually related to vividness, such as television image quality (Bracken, 2005) and screen size (Lombard, Reich, Grabe, Campanella, & Ditton, 2000), have also been found to increase feelings of presence. Newer games feature more realistic and vivid representations, suggesting that advancements in video game technology may similarly contribute to a higher sense of presence in players.

H1: Newer video games will induce higher levels of presence in game players than will older games.

### *Involvement*

Witmer and Singer (1998) propose that involvement, which they describe as “a psychological state experienced as a consequence of focusing one’s energy and attention on a coherent set of stimuli or meaningfully related activities and events” (p. 227) is closely related to presence. It should be noted that this conceptualization of involvement pertains only to the intensity of a user’s engagement with a stimulus, unlike some conceptualizations in other contexts that extend the involvement concept to include antecedents to the user’s experience with a stimulus (e.g., motivation) or consequences thereof (e.g., message evaluation outcomes) (see Andrews, Durvasula, & Akhter, 1990; Petty, Cacioppo, & Goldman, 1981; Petty, Cacioppo, & Schumann, 1983; Slater, 1997). Technological advancements in other media, such as the World Wide Web (e.g., Kalyanaraman & Sundar, 2006; Li et al., 2002), have been found to increase users’ involvement with these media, suggesting that technological advancements in video games may also enhance users’ involvement while playing video games (see Tamborini et al., 2004).

H2: Newer video games will make players feel more involved than will older games.

### *Arousal*

Increased technological sophistication in media has also been linked to increased physiological arousal. Experiments involving video presentations have found both screen size (Lombard et al., 2000; Reeves, Lang, Kim, & Tatar, 1999) and motion (Detenber, Simons, & Bennett, 1998) to increase physiological arousal. In new media research, animation in Web advertisements has been found to increase physiological arousal (see Sundar & Kalyanaraman, 2004). Lombard and Ditton (1997) also consider arousal to be closely related to presence. In observing the effects of a narrative video game storyline on players’ feelings of presence, Schneider et al. (2004) found a corresponding increase in physiological arousal. These findings suggest that technological advancement in video games may increase players’ arousal as well.

H3: Newer video games will induce higher levels of physiological arousal in game players than will older games.

### *Video games and aggression*

According to some models of video games’ effects on aggression, advancement in video games may have negative implications as well (see Gentile & Anderson, 2003). Of several theoretical approaches that inform the possible effects of video game violence on aggression (see Sherry, 2001), those concerned with immediate effects of video game play on psychological states (as opposed to models of long-term effects) tend to focus on three psychological routes by which game violence may affect players: increased arousal, increased aggressive thoughts, and increased aggressive feelings.

### *The general aggression model*

A number of theoretical frameworks dealing with such routes have been incorporated into the general aggression model (GAM), which details the possible effects of violent video game play on aggression (see Bushman & Anderson, 2002). According to the GAM's model of an aggressive episode, preexisting personal factors (such as personality traits) and situational factors (such as an incentive for aggressive action) influence aggressive behaviors. Finally, the results of these behaviors cyclically influence personal and situational factors that contribute to the repetition of the process in the future.

The impact of personal and situational "input variables" on aggressive outcomes, however, is indirect in that it is mediated by the cognitive, affective, and arousal states induced by dispositional and situational input variables. These psychological states may include, for example, increased accessibility of aggressive thoughts (cognitive), increased anger (affective), or heightened physiological activity (arousal). Effects of violent video games on each of these key psychological states have been observed in some studies (see Anderson & Bushman, 2001; Dill & Dill, 1998), though such effects remain disputed (see Bensley & van Eenwyk, 2001; Griffiths, 1999; Williams & Skoric, 2005). A discussion of theoretical frameworks and findings pertaining to video games' effects on each of these three psychological states is presented below.

### *Arousal*

Zillmann's (1971) excitation transfer framework posits that arousal instantiated by exposure to exciting media content may be transferred to subsequent experiences intensifying emotional responses to those experiences. Although this residual arousal from earlier media exposure gradually dissipates with passage of time, it can intensify responses to later experiences even if the experiences are unrelated and the emotional response intensified is different than that evoked by the initial arousing experience. Although many stimuli can be arousing, violent content has received special attention as a generator of arousal in consumers (Sparks & Sparks, 2002). Anderson and Dill (2000) and Bushman (1995) also assert that violent movies and video games tend to be more exciting and conducive to arousal.

H4: Violent video games will induce higher levels of physiological arousal in game players than will nonviolent games.

Considering the effects of both advancement and violence on arousal, the effects of violent content on arousal may be uniquely pronounced with advanced violent games because the effects of technological advancement enhance the effects of violent content to produce a synergistically heightened state of arousal.

H5: Violent content's effect on arousal will be qualified by advancement, with advancement causing a greater increase in arousal for violent games than for nonviolent games.





































