

Telepresence and Video Games: The Impact of Image Quality

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ABSTRACT

This study investigates the impact of video game image quality on telepresence. Past research has demonstrated positive associations between television image quality and presence and video game technology and presence. No study to date, however, has examined the presence effects of video games played in high definition, which is becoming increasingly common due to the diffusion of new TV technologies into homes. This paper reports the results of an experiment in which image quality was manipulated. The results of the study provide some support for image quality affecting telepresence. Specifically, higher quality images in video games led to higher levels of immersion. These findings are discussed along with suggestions for future research.

Keywords: *Video Games, Telepresence, Presence, HD games.*

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1. Introduction

Video games have become one of the most popular forms of media in the United States and abroad. Global sales in the industry are projected to exceed \$46.5 billion dollars by 2010 (Kolodny, 2006), and 69% of American heads of households currently play video games (Entertainment Software Association, 2006). The popularity of games has been fuelled in part by advancements in gaming technology, a trend that has persisted since the earliest days of the medium (Skalski, 2004). Over time, games have evolved considerably in graphic richness and realism. The simplistic character representations in games like *Pac-Man*, for example, have now been replaced with the realistic human figures and environments in popular recent titles like *Grand Theft Auto IV* and *Halo 3*¹. These and other advances in game technology have important

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consequences for how games are experienced (Ivory & Kalyanaraman, 2007). In particular, they are expected to contribute to the sense of presence, or “perceptual illusion of nonmediation” (Lombard & Ditton, 1997), felt by users.

Presence (also referred to as “telepresence”) has recently been identified as a potentially important variable in video game research that may affect use and a variety of outcomes of exposure, ranging from enjoyment to aggression (Tamborini & Skalski, 2006; Lee & Peng, 2006). Few studies, however, have examined the relationship between exposure to game technology and presence. Tamborini et al. (2004) found that playing a game created a stronger sense of presence than just observing a game, presumably due to the addition of interactivity. Though many technological features of video games are expected to contribute to the sensation of presence, one that has received no attention to date is image quality. High Definition Television (HDTV) sharply improves the quality of TV images and, with TV and movie clips, has been shown to relate positively to the experience of presence (Bracken, 2005). But what about video games, which add the crucial feature of interactivity to HDTV and other high-quality imagery? Several video game systems, including the Sony PS2, Microsoft Xbox, and new generation Nintendo Wii, have an adapter that allows players to play games in improved image quality through a component video connection, resulting in lined doubled progressive scan or Enhanced Definition (ED) gaming. Additionally, the new generation Microsoft Xbox 360 and Sony PS3 consoles are capable of displaying High Definition (HD) images. Since HDTV is expected to diffuse rapidly in coming years (Dupagne & Seel, 2006) in part through game consoles, this type of gaming should become increasingly common in the future, raising questions about its effects on players.

This research investigates the effect of image quality on presence-related reactions to video games. Participants in this study played a game in either high definition/HD (higher image quality) or standard definition/NTSC² (lower image quality) and then completed measures of presence dimensions (spatial presence and immersion).

¹ In *Grand Theft Auto IV*, players assume the identity of a European immigrant named Niko Belic, who must fight for survival in the vast crime-infested streets of the fictional location Liberty City (modelled after New York City). *Halo 3* is the final instalment of a science fiction game trilogy in which players control a futuristic soldier helping to defend Earth from hordes of alien aggressors.

² National Television Systems Committee is the current analog Standard for television in the United States.

2. Telepresence

The concept of presence was introduced in the early 1980s as a sense of “being there,” (Minsky, 1980), and as a “sensation of reality.” The concept has been examined in research and theory in diverse fields. In an effort to develop a cohesive definition, an online discussion of presence researchers concluded that presence is “a psychological state or subjective perception in which even though part or all of an individual's current experience is generated by and/or filtered through human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience” (International Society for Presence Research [ISPR], 2000). While there is not a universal definition (see Lee, 2004; Lombard & Ditton, 1997 for more details), the ISPR's definition has been widely accepted. The field has moved away from earlier conceptualizations of self and personal presence (Biocca, 1997) and has generally accepted the existence of several sub-dimensions of presence (Freeman, 2004), with the numbering of dimensions varying from one to six (or more). Many of the competing conceptualizations include three similar sub-dimensions of presence - though terms employed vary. Freeman (2004) argues these can be classified consistently into spatial/physical presence, immersion, and social realism. *Spatial presence* refers to the sense of “being there” in the space of the media environment (Wirth et al., 2007). *Immersion* involves being perceptually and psychologically “submerged” in a mediated environment (Lombard & Ditton, 1997; Biocca & Delaney, 1995) *Social Realism* refers to the extent to which a media/artificial environment is comparable to the real world; this is sometimes identified as behavioral realism (Freeman, 2004). Spatial presence and immersion are most relevant for the current study because the video games selected for this experiment include behaviors and characters not seen in the real world, and the authors felt the assessment of social realism would seem excessively artificial.

The concept of presence has been applied to a variety of media experiences, including video games (Eastin, 2006; Eastin & Griffiths, 2006; Ivory & Kalyanaraman, 2007) and television viewing (Bracken, 2005; Lombard & Ditton, 2000). The role of presence has also been explored in relation to other media effects (i.e., media enjoyment [Green, Brock, & Kaufman, 2004; Lombard & Ditton, 2000]; impact of violent content [Tamborini et al., 2004]). The findings are somewhat consistent across studies, with media users who reported higher levels of presence typically experiencing higher levels of the other dependent variables investigated (e.g., sensations of presence lead

to higher levels of enjoyment). Further, presence has been attributed to the technological form of a medium (Lombard & Ditton, 1997) and to media users' characteristics (Hecht & Reiner, 2007). The current study examines the influence of media form (image quality).

2.1 Presence and Image Quality

Previous research has demonstrated that form variables can influence the sensation of presence experienced by media users. The most relevant form variable to the current study is image quality. High image quality was originally hypothesized as a form variable that could lead to increases in presence experienced by media users (Lombard & Ditton, 1997). Recent studies have provided causal evidence that higher image quality leads to elevated levels of presence. Specifically, in an experiment exploring television viewers' presence responses to varying image quality levels, Bracken (2005) used HD and NTSC television images to manipulate image quality. The higher image quality provided by HD led to increased levels of various dimensions of presence, including the immersion, spatial presence, social realism, and social presence-passive (i.e., perceptions of facial expressions and characters' style of dress) dimensions of presence.

Further, in a study exploring the impact of image quality on participants' perceptions of newscast credibility (Bracken, 2006), image quality was manipulated using a local newscast viewed in either HD or NTSC. Significant differences were found for some presence dimensions, namely for immersion and social presence. The results also demonstrated that participants who watched the newscast in HD rated it as significantly more credible than those participants who watched the newscast in NTSC. These studies demonstrate that audience members can distinguish between HD and NTSC images, and that varying image quality has led to differing levels of presence. However, all of these studies were conducted with television content and this study seeks to explore the differences in image quality with video games.

2.2 Telepresence and Video Games

The release of the Xbox 360 in November of 2005 by Microsoft ushered in what has been dubbed the "HD Era" of gaming (Cross, 2005). The higher image quality of games on the Xbox 360 and Sony PS3 is one of the main distinguishing features of this new generation of game consoles. The huge investment by Sony and Microsoft into improving game image quality suggests the importance of graphics to gamers.

Research has shown that players strongly prefer more realistic graphics in video games (e.g., Wood, Griffiths, Chappell, & Davies, 2004), and HD games have the capability to produce better graphics than ever, with potential effects on perceived realism (Shapiro, Pena-Herborn, & Hancock, 2006) and other important outcomes of game exposure. This study examines the impact of high and standard definition images on presence.

There are relatively few studies focusing exclusively on presence and video games, and most incorporate presence as one of several dependent variables. An example of this type of inclusion is an experiment examining the use of story narratives in first-person shooter video games (Schneider, Lang, Shin, & Bradley, 2004). The authors manipulated the existence of the storylines in four different video games, with two having storylines and two not having them. The results were that participants reported feeling stronger presence sensations and identified more with the video game characters when there was a story in the game. However, this study did not find the significant relationship between presence and violent thoughts identified in earlier research,

One study with a primary focus on video games and experiencing a sense of presence was an exploratory study using the “autoconfrontation method.” In this method, participants engage in an activity (e.g., playing a video game) and their performance is videotaped. After completion of the activity, they view the videotape of themselves along with the researcher. As they watch they are asked to comment on their experience and to rate a variety of presence dimensions (including immersion) as they viewed themselves playing the game. The participants reported feeling varying levels of presence, with higher levels of presence experienced by players who felt they performed well in the game (Rétaux, 2002).

The majority of the studies exploring presence and video games have investigated the relationship between video game playing, sensations of presence, and player aggression. In an experiment examining the relationship between video game exposure, presence, and hostile thoughts, Tamborini et al. (2004) compared participant responses to four gaming conditions: playing a virtual reality (VR) violent video game, playing a standard violent game, observing a violent game, or observing a nonviolent game. Game players in this study reported more telepresence (or “being there”) than non-players. In addition, prior violent game experience was found to be a significant predictor of telepresence. Further support for the relationship between players’

experiencing presence and reporting more aggressive thoughts has been found in more recent experiments (Eastin, 2006; Farrar, Krcmar, & Nowak, 2006).

Lastly, the effect of gaming technology on presence and aggressive feelings was examined by Ivory and Kalyanaraman (2007). Gaming technology was manipulated by exposing participants to either PC games from the mid-1990s or PC games created from 2001 to 2003. The authors explained that the advances in gaming technology allowed the newer games to have higher visual and auditory quality resulting in a more vivid playing experience. The findings demonstrated that improvements in gaming technology do lead to stronger sensations of presence. However, this study did not find a significant relationship between presence and violent thoughts that were identified earlier.

Together these studies provide evidence that video games can evoke a sense of presence in video game players. The following hypotheses are posited:

Hypothesis 1 Participants who play the HD version of a videogame will experience a higher level of *spatial presence* than those who play the NTSC version of the videogame.

Hypothesis 2: Participants who play the HD version of a videogame will experience a higher level of *immersion* than those who play the NTSC version of the videogame.

3. Methods

In a between-subjects experiment, 50 participants played a video game in either HD (1080i lines, component video) or NTSC (480 lines, composite video). The independent variable was image quality (HDTV versus NTSC). The video game was played on a rear-projection television with a 65-inch wide (16:9) screen. Using random assignment, slightly more than half of the participants played the videogame in HD (26 players) and slightly less than half played the game in NTSC (24 players). Participants played the game alone and the image quality was switched after every second participant.

3.1 Participants

The 50 undergraduate students who participated in this experiment were between 18 and 50 years old ($M = 23.02$, $SD = 5.14$). The vast majority were between the ages of 18 and 29 (94%). The participants were equally divided by gender, with 25 females and

25 males. In terms of race, 74% of participants reported being "White," 16% reported being "African-American," 4% reported being "Pacific Islander," and the remainder self identified as "Asian," "Hispanic" or "Other" (6%).

3.2 Stimulus

All participants played the game *Perfect Dark Zero* on the Xbox 360 console system. In *Perfect Dark Zero*, players assume control of a futuristic spy who battles minions of the evil corporation dataDyne. To help in this struggle, the spy has access to an arsenal of deadly weapons, including a pistol and automatic rifle.

Perfect Dark Zero falls in the popular *first-person shooter* game genre, meaning that the action takes place through the lead character's eyes. In line with predictions of presence scholars (Lombard & Ditton, 1997), the first-person point-of-view in this game was expected to increase the likelihood of presence being experienced. Players in this study began the game in a mountain environment where they were soon attacked by alien creatures.

3.3 Procedure

Each participant was met by the experimenter and provided with an informed consent form. Once the participant provided their consent they were escorted into a carpeted, 8 x 10 foot room that contained a television, a Microsoft Xbox 360, a videogame controller, and a comfortable chair that faced the television screen. Various other amenities, such as a decorative table lamp and pictures on the wall, made the environment similar to a living room. In both conditions, the chair was placed 6 feet from the front of the screen.

The experimenter explained that the participant would be playing a videogame and then completing a pencil-and-paper questionnaire. The experimenter then instructed the participant on how to use the controller and play the game. This was done first through a brief instructions sheet and then a short practice session. In the session, each participant was guided by the experimenter to the same point in the game. Depending upon prior gaming experience, this process took between 3 and 10 minutes. After the participant arrived at the designated point in the game the experimenter exited the room and the participant played the game alone for 10 minutes. After the allotted time the experimenter returned to the room and provided the questionnaire. The experimenter emphasized that there were no wrong answers and

that the participant should follow the directions in the questionnaire. The entire procedure took between 35-45 minutes.

3.4 Independent Measure

Image Quality. The image quality of the video game was manipulated with one group playing the game in HD (higher image quality) and the other playing the video game in NTSC (lower image quality).

3.5 Dependent Measures

Immersion. Participants responded from (1) to (7) for three items statements adapted from Lombard and Ditton (2000) to measure the extent to which media users feel a sense of being a part of the action or are connected when with media content. The items were : “How involving was the videogame”, “To what extent did you feel mentally immersed in the videogame environment”, and “I was so involved in the videogame environment that I lost track of time”. Cronbach’s alpha for the scale was .76.

Spatial Presence. Participants responded from (1) to (7) to three items adapted from Lombard and Ditton (2000) to measure the extent to which media users feel a sense of sharing a physical space within a mediated environment. The three questions were: “How much did it seem as if the objects and the people you saw/heard had come to the place you were”, “How much did it seem as if you could reach out and touch the objects or people you saw/heard”, and “How often when an object seemed to be headed toward you did you want to move out of its ways”. Cronbach’s alpha was .75.

4. Analysis and Results

A series of Independent Samples t-Tests were conducted with the independent variable image quality (HD versus NTSC) to test the hypotheses and research questions.

Hypothesis 1, which predicted that participants who played video games in HD would experience a higher level of spatial presence (being there in the video game) than those who played in NTSC, was not supported, $t(48) = .96$, $p < .34$, though the means were in the correct direction.

Support was found for Hypothesis 2, which predicted that participants who played video games in HD would report higher level of immersion than those who played the

video game in NTSC. The main effect was significant for immersion, $t(48) = 2.99$ $p < .004$), with those participants who played the video game in HD reporting higher levels of immersion ($M = 4.80$, $SD = 1.44$) than those who played the game in NTSC ($M = 3.65$, $SD = 1.24$).

5. Discussion

The results of this study provide initial evidence that image quality impacts both the level and types of telepresence dimensions experienced by video game players. The results strengthen the claim that image quality influences sensations of presence (Bracken, 2005; Lombard & Ditton, 1997). Further, the results support previous work examining video games and telepresence (Ivory & Kalyanaraman, 2007; Schneider et al, 2004; Tamborini et al, 2004; Tamborini & Skalski, 2006). In doing so, they add to the growing body of literature on video games, image quality, and telepresence and begin the process of synthesizing these important bodies of research.

Interestingly, the two telepresence sub-dimensions examined in this study were not affected the same by video game image quality. Spatial presence was not reported as significantly different for players but immersion was positively impacted by HD. Other studies have found that different stimuli increase different sub-dimensions of telepresence (e.g., Bracken, 2005).

There are several possible explanations for this finding. It may be that spatial presence is too big of a “leap” for game players to take without more advanced technology, such as virtual reality (VR). In other words, playing a video game on a HDTV may be enough to immerse players but not enough to make them feel “in” the space of a mediated environment, especially the type of environment used in this research (i.e., futuristic and non-photo realistic). Regardless, the mixed results observed in this study point to the importance of considering presence as a multi-dimensional construct in future research, as well as to the need to continue efforts at conceptualizing telepresence begun by others (e.g., Lombard & Ditton, 1997; ISPR, 2000; Lee, 2004).

The innovative nature of this experiment resulted in a few limitations that should be considered in future work. First, the interactive nature of video games should be controlled by including a viewing only condition.³ This would allow for a manipulation of

³ The authors originally designed the study to include this group, but the equipment necessary for recording HD was not available at the time of the data collection.

both vividness and interactivity, the two basic dimensions determining telepresence in Steuer's (1995) seminal work. Second, the skill level of the participants should be controlled, allowing a more direct comparison of the players' experiences.

6. Conclusion

The current study provides evidence that image quality in video games has an effect on participants' sensations of at least one dimension of presence. Future work should continue to address these relationships and the mediating/moderating role of presence dimensions on outcomes such as aggression and learning in response to advanced video game technology.

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