Image versus Sound: A Comparison of Formal Feature Effects on Presence and Video Game Enjoyment

Paul Skalski [*][♦] and Robert Whitbred[♦]

[♦]Cleveland State University
(USA)

ABSTRACT

This study investigates the relative influence of two formal features of video games—image quality and sound quality—on presence and enjoyment. A 2 x 2 between subjects experiment was conducted manipulating image quality (high definition vs. standard definition) and sound quality (Dolby 5.1 surround sound vs. Dolby stereo). Results indicated that, while image quality had no effect on outcomes, sound quality almost universally impacted outcomes of interest, including several dimensions of presence and enjoyment. Implications of these findings are discussed.

Keywords: *high definition, surround sound, presence, video games, enjoyment*

1. Introduction

Video games have become a serious subject of scholarly inquiry in recent years, undoubtedly due in part to their growing popularity. In 2008, the game industry had record profits of $21.33 billion in the U.S. alone, up 19 percent from the previous year (Sinclair, 2009). Much of the rise in gaming's popularity can be attributed to technological advancements. Game industry growth has traditionally been fueled in part by technical innovation (Williams, 2002), and many exciting developments have happened in recent years, including the Nintendo Wii's motion controllers and more gradual improvements in graphics and sound that have persisted since the early days

[*] Corresponding Author
Paul Skalski
School of Communication
Cleveland State University
2121 Euclid Avenue
Cleveland, OH 44115
E-mail: p.skalski@csuohio.edu

of gaming (Ivory & Kalyanaraman, 2007). These latter characteristics are the focus of the present investigation.

Despite the many intriguing technological features of video games, including their interactivity, visuals, and sound, most of the literature on games to date has focused on game content such as violence. In a review of the gaming literature, Lee and Peng (2006) lament the lack of research on formal features and suggest that more attention should be paid to them, since some evidence suggests formal features may be as important as content in determining outcomes of media exposure (Reeves & Nass, 1996). This paper helps answer Lee and Peng's (2006) call. It presents the results of a study examining how two prominent features of contemporary video game technology—high definition (HD) visuals and surround sound—impact presence and game enjoyment.

2. Literature Review

As Tamborini and Skalski (2006) argue, an immediate outcome of exposure to advanced game technology should be the experience of presence, due to the rich combination of sensory and motor engagement games provide. This section begins by reviewing literature on the concept of presence and its relationship to the formal features under study.

2.1 Presence

The International Society for Presence Research (ISPR) (2000) defines presence as "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." Beneath this broad umbrella of "presence," scholars have identified even more specific types of the concept, including spatial presence, social presence, and self presence (Lee, 2004). Lombard and Ditton (1997) break presence down even further into immersion, realism, social richness, and other dimensions getting at subtle distinctions in presence experiences.

Several Lombard and Ditton presence dimensions will be focused on in this paper, specifically engagement, spatial presence, social richness, perceptual realism, and social realism. All of these share in common the notion of the "perceptual illusion of

nonmediation," which should more likely occur in response to certain technologies. Although the relationship between video game formal features and presence has received little attention to date, there are a few noteworthy studies that address the link between presence, image quality, and sound quality. These will now be reviewed.

2.2 Image Quality and Presence

Image quality has been the focus of several presence-related studies in this decade, due largely to the rapid diffusion of high definition (HD) television. HD television images (versus standard definiton images) have been shown to positively impact presence and related outcomes of TV exposure (Bracken, 2005; Bracken & Botta, 2010). In the case of games, only one published study to date has investigated the impact of high definition (HD) gaming on presence. In an experimental study, Bracken and Skalski (2009) found that a HD version of a video game led players to experience more immersion than a standard definition version of the same game, though spatial presence was unaffected.

Additional research on high definition gaming is important for several reasons. First, due to the mandated switch to HD broadcasting in the U.S. in 2009, more and more consumers will be purchasing and using televisions with HD capability. Second, the game industry has actively promoted HD as a prominent feature of the new generation of gaming consoles and is expected to produce increasingly realistic HD games in the coming years (Cross, 2005). As a result, game image quality remains an important formal feature in need of further inquiry.

2.3 Surround Sound and Presence

Compared to image-related variables like screen size and resolution, sound has received considerably less attention in the presence literature. In the most notable published study to date, Lessiter and Freeman (2001) found that a 5.1 mix (five sound channels plus bass) had a greater effect on presence than a stereo or mono mix. They concluded that the effect was likely due to the inclusion of greater bass. More recently, Pettey, Bracken, Rubenking, Buncher and Gress (2010) found that sound (delivered via headphones or speakers in response to a video clip) was an important factor affecting presence. No study to date has examined the impact of video game sound on presence, however, despite considerable advances in game sound over time. Games have progressed from very limited, technologically constrained sound in their early days ("beeps" and "bloops," essentially) to real synthesized music and sound today

(Zehnder & Lipscomb, 2006). In addition, the current generation of games incorporates cinema-like sound mixing allowing for multi-channel surround output, which is the basis for the sound manipulation in this study.

2.4 Formal Features and Presence Dimensions

There is reason to expect that the previously discussed formal features will relate in specific, positive ways to engagement, spatial presence, social richness, perceptual realism, and social realism, the five presence dimensions from Lombard and Ditton (1997) considered in this research. Each of these dimensions will now be addressed in turn.

High quality HD images and surround sound should create greater *engagement* or involvement with a medium by stimulating the senses more. Early scholarship on presence considered involvement to be part of the essence of experiencing telepresence (Witmer & Singer, 1998). This notion was expanded on by Tamborini (2000), who argued that the media formal features of vividness and interactivity should create a more engaging mediated environment. The positive link between media forms and engagement has subsequently been supported in a handful of studies, including on the use of subjective camera in sports (Cummins, 2009). This study addresses the engagement potential of HD images and surround sound in video games.

These features should affect *spatial presence*, or "being there" in a media environment, by presenting more vivid images and sounds that place the user more "in" the action of a game. Spatial presence is probably the most popular form of presence. In Lee's (2004) explication, he calls it one of three major types of presence, as mentioned earlier. Bracken and Skalski (2010) consider it to be one of two primary types of presence (along with social presence). A theoretical model of the structure of spatial presence has even been proposed (Wirth et al., 2007). Numerous studies have investigated the relationship between formal features of media and spatial presence, and some of these have specifically focused on video games. Skalski, Tamborini, Shelton, Buncher and Lindmark (in press), for example, discovered that interactivity in the form of more natural game controllers had a positive impact on spatial presence. Bracken and Skalski (2009), however, found no relationship between HD content and spatial presence. This study replicates their test and adds surround sound as another potential contributor to spatial presence experienced during video game play.

HD and surround sound are also expected to positively affect *social richness*, or the extent to which a medium is perceived as socially intimate and immediate, by more

accurately communicating the visual and verbal features of other social beings. This dimension of presence has received considerably less attention from researchers than spatial presence in recent years. Nevertheless, it is one of the earliest types of presence, dating back to work by Short, Williams and Christie (1976) on the social effectiveness of different channels of communication in organizations. This idea has been more recently been studied as media richness (Rice, 1992) but again mostly in organizational settings. This study extends work on this concept to the experience of social beings in video games.

Perceptual realism, which has to do with how perceptually real media representations seem, should be affected by giving users more visual and audio information in the form of HD and surround sound. This type of presence falls under Lombard and Ditton's (1997) category of "presence as realism." The concept of realism was studied as an outcome of formal features of media even before contemporary notions of presence. Realism was shown to be affected by screen size, for example (Neuman, 1990). Perceptual realism is a distinctly form-driven outcome. This research attempts to connect it to the manner in which audio-visual information from a video game are output to players. One study showed that perceptual realism (a "sensation of reality") was affected by video game-like consumer virtual reality systems, and the same type of effect is expected here as a function of two contemporary formal features of games.

Finally, *social realism*, or the extent to which a media presentation is plausible or "true to life," has a less certain relationship to formal features than the other presence dimensions in this study. It has to do with how realistic content seems. One could argue that it would be affected by HD and surround sound due to the increased visual and audio fidelity of situations that these formal features offer. But as pointed out by an anonymous reviewer of this manuscript, since social realism has to do with the social plausibility of content rather than its perceptual appearance, it should not be affected by formal features. Therefore, social realism is treated as a separate, comparison form of presence in this study with an uncertain relationship to HD and surround sound. Showing that this dimension of presence relates differently to such formal features would help validate it as a unique form of presence. It would also support the call from some in the presence community to treat dimensions of the concept separately in research (versus summing different dimensions into an overall "presence" construct) since dimensions of presence may relate differently to other variables in different situations (e.g. Bracken & Skalski, 2010).

Overall, presence sensations such as these should make media experiences more enjoyable. This study focuses on presence as it relates to enjoyment of video games.

2.5 Presence and Game Enjoyment

Recent attempts have been made to direct more attention to the study of media enjoyment (Oliver, 2004) given that it is perhaps the most basic reason for engaging in media use and has tremendous theoretical and applied implications. Some scholars have attempted to theoretically link enjoyment and entertainment to presence. Klimmt and Vorderer (2003) suggest that the relationship can be explained in part through such diverse perspectives as affective dispostion theory (Zillmann, 1996), simulation theory (Oatley, 1994), and the psychological theory of play (Vorderer, 2001). Although the exact mechanisms operating in specific entertainment contexts remain unclear, Hartmann, Klimmt and Vorderer (2010) argue that much of the contemporary development in media technology (such as HD and surround sound) seems to pursue an increase in presence as a route to enjoyment. Some research supports this connection (Skalski et al., in press), but more is needed. As Hartmann et al. (2010) lament, there is only modest clarity concerning the temporal and causal dependencies between presence and enjoyment. This study attempts to link specific dimensions of presence to video game enjoyment, both indirectly (as a function of formal features) and directly (as a mediating factor).

3. Hypotheses

The first hypotheses and research questions address the individual and joint effects of image quality and sound quality on presence dimensions, based on the logic presented earlier.

H1: High definition (HD) players will experience more presence (engagement, spatial presence, social richness and perceptual realism) than standard definition (SD) players.

H2: Surround sound players will experience more presence (engagement, spatial presence, social richness and perceptual realism) than two-channel sound players.

RQ1: What is the relative influence of image and sound quality on presence (engagement, spatial presence, social richness and perceptual realism)?

RQ2: Do the formal features in this study affect social realism?

The next predictions address the individual and joint effects of image quality and sound quality on enjoyment. Although the literature review does not give a rationale for a direct link between formal features and enjoyment, the expectation is that formal features will affect enjoyment through presence dimensions, which are untested mediators in these analyses (formally tested in the final hypothesis below). A direct link between formal features and enjoyment would also be in line with claims about the "power" of HD and surround sound from industry sources, who would likely argue that these modes of presentation will create more enjoyable experiences for consumers. This logic informs the next set of hypotheses and research question.

H3: High definition (HD) players will experience more enjoyment than standard definition (SD) players.

H4: Surround sound players will experience more enjoyment than two-channel sound players.

RQ3: What is the relative influence of image and sound quality on enjoyment?

A final hypothesis (H5) addresses the mediating role of presence dimensions (treated separately) in the relationship between formal features and enjoyment. It is depicted visually in Figure 1. This model posits that HD (versus SD) image quality and surround (versus two-channel) sound will positively affect engagement, spatial presence, social
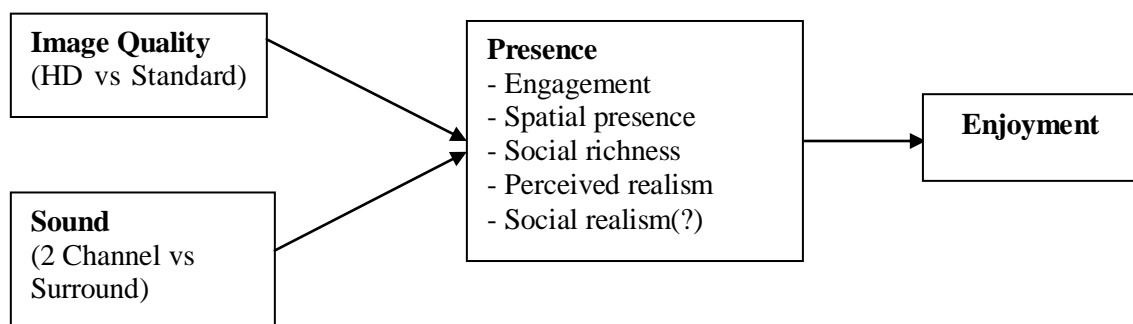

Figure 1. Conceptual Model of Hypothesis 5.

richness, and perceived realism, though the prediction for social realism is uncertain. The five presence dimensions, in turn, are expected to affect enjoyment of a game, based on the logic presented earlier.

4. Methods

In a 2 x 2 between subjects experiment, participants were randomly assigned to play a first-person shooter video game in either high definition (1080i lines) or standard definition (480 lines) and either surround sound (Dolby 5.1) or two-channel sound (Dolby stereo). They then completed measures of presence dimensions and game enjoyment, along with control variables.

4.1 Participants

Participants in this study (N = 74) were undergraduate Communication students at a medium-sized Midwestern university who received course credit for their participation. The age range was 18 to 26 years (*M* = 20.96; *SD* = 1.60), and 35 of the 74 participants (48%) were male.

4.2 Stimulus

Participants played the Xbox 360 version of the Tom Clancy video game *Ghost Recon Advanced Warfighter.* This highly realistic and highly rated first-person shooter title (www.metacritic.com) puts players in the role of a U.S. Army soldier from the near future that must battle insurgents in Mexico City (see screenshot, Figure 2). To avoid narrative elements and maximize experimental control, the game was set up on a multiplayer map simulating part of an urban environment, with a 10 minute time limit and 50 computer controlled "bots" for players to fight against. All players were equipped with an assault rifle, handgun, and grenades and started play at the same location in the city, after which time they were free to explore and eliminate as many enemies as possible. When players were killed, they respawned at the start and began again. This repeated until the time limit expired.

4.3 Procedure

Upon arriving at the research laboratory, participants were asked to fill out a consent form. They were then escorted into a 7 x 12-foot carpeted room containing a 52-inch

screen television and a comfortable couch, which sat 4.77 feet from the screen. Once seated, the experimenter briefly explained how to play and control the game. This process took approximately one minute per participant, after which time the game was started and the participant was left to play alone for 10 minutes. After the allotted time, the experimenter returned to the room and administered the questionnaire to the participant at a table away from the playing area. Once finished with the survey, the participant was debriefed and dismissed by the experimenter. The entire process took 30-40 minutes.

Figure 2. Ghost Recon Advanced Warfighter.

4.4 Independent Variables

Image quality was manipulated by randomly selecting participants to play the game in high definition (1080i lines) or standard definition (480 lines) before the study began. The Xbox 360 has a switch on the video cable that allowed for quick switching back and forth.

Sound quality was manipulated by randomly selecting participants to play the game with surround sound (Dolby 5.1) or two-channel sound (Dolby stereo). A Yamaha receiver with 5 speakers and a subwoofer was used for this manipulation. Volume was kept comparable through a dial on the receiver, which provided a precise digital readout of the levels.

In both cases, the intent was to compare features of a traditional gaming experience (i.e., standard definition, stereo) to features of a gaming experience with maximized

image and sound quality given current technology (i.e., 1080i HD, Dolby 5.1). This provided strong manipulations of both independent variables.

4.5 Dependent Measures

Five dimensions of presence were measured for this study, using the Temple Presence Inventory (TPI) (Lombard, Ditton, & Weinstein, 2009). The dimensions and their corresponding Cronbach's alphas were as follows: engagement (.73), spatial presence (.78), social richness (.82), perceived realism (.74), and social realism (.82).

Enjoyment was measured using eight items on a scale ranging from "1" (strongly disagree) to "7" (strongly agree). Indicators of enjoyment included "This was a fun game" and "I would like to play this game again." These items were summed to create an index of enjoyment, the reliability of which was $\alpha = .96$.

A variety of control variables were also accounted for in this study, including a pre-test of game playing skill using the GaPS scale (Bracken & Skalski, 2006) and post-test measures of sex, age, and game playing experience.

5. Results

A series of two-way analyses of variance with image quality and sound quality as independent variables were used to test the first four hypotheses and research questions. The control variables were included in the analyses as covariates. None of the control variables significantly related to presence dimensions except prior game playing experience, which was positively associated with social richness ($F(3,73) = 5.07$, $p < .05$) and perceived realism ($F(3,73) = 5.47$, $p < .05$).

Figures 3 and 4 illustrate the results for the first two hypotheses and research question one. Hypothesis one predicted players in the high definition condition would experience greater presence than those in the standard definition condition. The ANOVA analysis showed there were no significant differences for any of the five dimensions of presence. Hypothesis two predicted players in the surround sound condition would experience greater presence than those in the normal (two-channel) sound condition. Results show this was supported for a) engagement ($F(3,73) = 8.24$, $p < .05$); b) spatial presence ($F(3,73) = 6.79$, $p < .05$); c) social richness ($F(3,73) = 7.44$, $p < .05$); and d) perceived realism ($F(3,73) = 6.11$, $p < .05$).
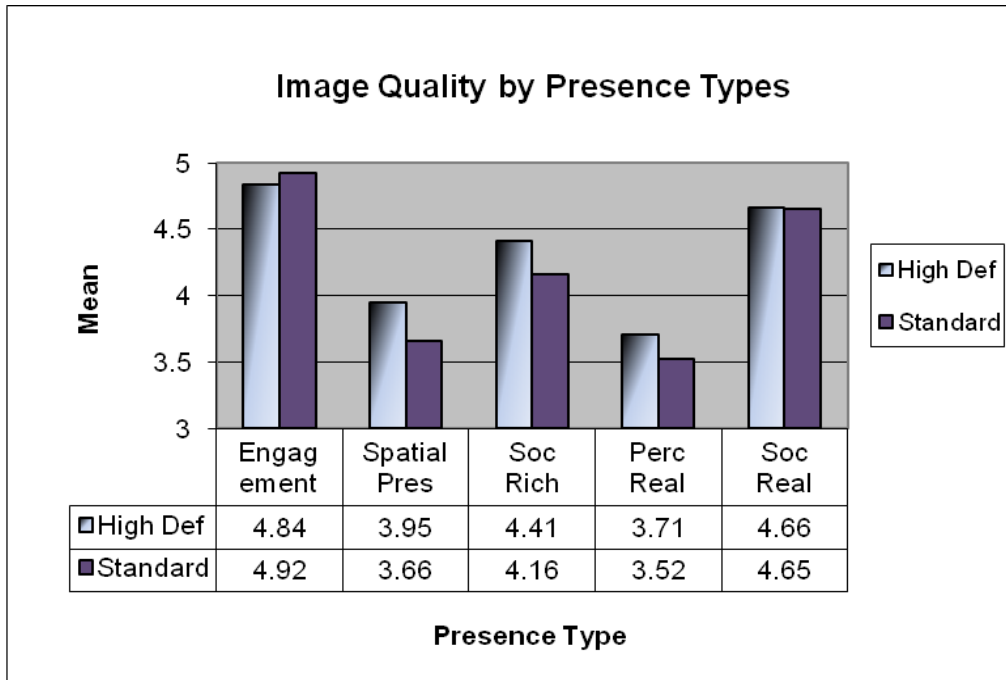
Image Quality by Presence Types

	Engag ement	Spatial Pres	Soc Rich	Perc Real	Soc Real
High Def	4.84	3.95	4.41	3.71	4.66
Standard	4.92	3.66	4.16	3.52	4.65

Presence Type

Figure 3. Image Quality by Presence Types.

Sound Quality by Presence Types

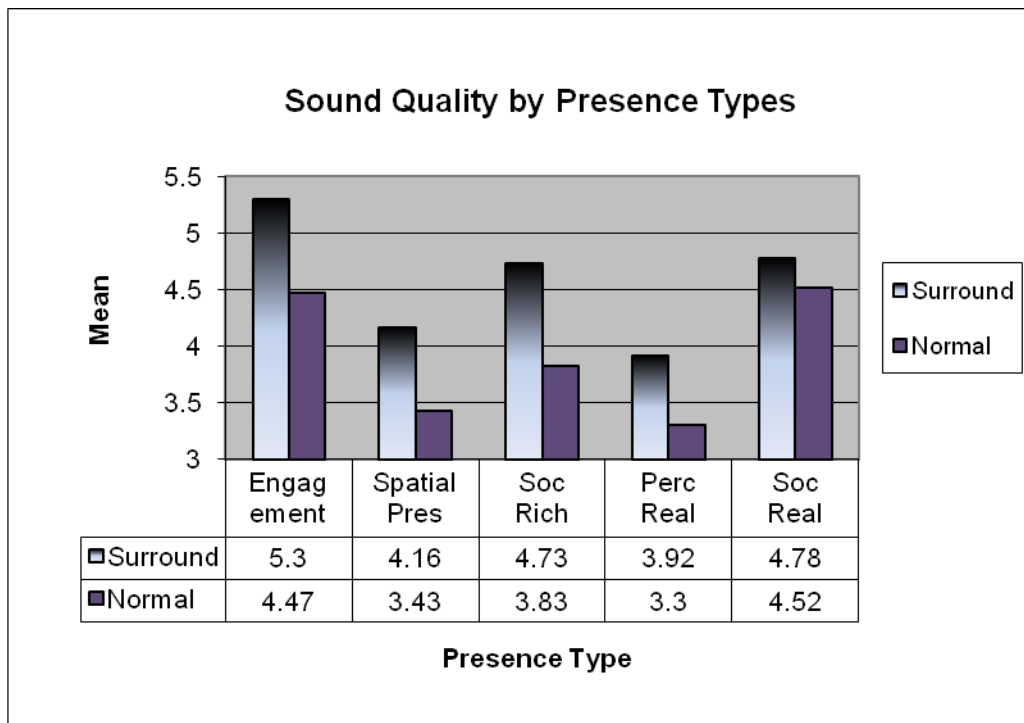|	Engag ement	Spatial Pres	Soc Rich	Perc Real	Soc Real
Surround	5.3	4.16	4.73	3.92	4.78
Normal	4.47	3.43	3.83	3.3	4.52

Presence Type

Figure 4. Sound Quality by Presence Types.

Only social realism was not significantly different as a function of sound ($F(3,73) =$ .54, n.s.). There were also no significant interactions.

Figure 5 illustrates the results for hypotheses three and four and the third research question, which predicted that enjoyment would vary as a function of image and sound quality. These findings were similar to those for hypotheses one and two. Specifically, while there was no significant difference between the high and standard definition video groups, participants who played with surround sound reported more enjoyment than those with normal sound (F(3,73) = 4.33, p < .05). There was no significant interaction.
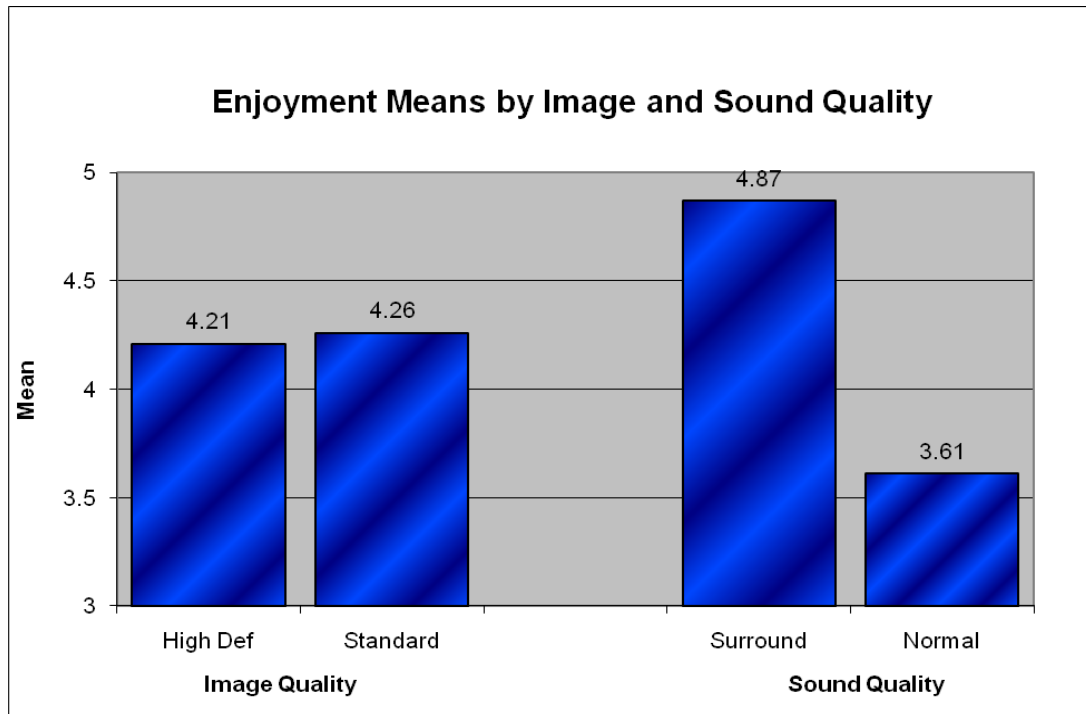
Enjoyment Means by Image and Sound Quality

Figure 5. Enjoyment Means by Image and Sound Quality.

To test the final hypothesis, five separate path analyses was performed on the model shown in Figure 1, with each presence dimension being analyzed separately. The models were tested using the least squares method, which involves estimating the sizes of the model parameters and testing the overall model fit. Parameter size was estimated by regressing each endogenous variable onto its causal antecedent, and model fit was tested by comparing estimated parameter sizes to the reproduced correlations (see Hunter & Gerbing, 1982, for a complete description of this analysis procedure). In short, a model that is consistent with the data is one which (a) has substantial path coefficients, (b) has differences between parameter estimates and reproduced correlations (errors) that are no greater than what would be expected through sampling error, and (c) passes a chi-square test of overall model fit. We also

looked for an unbroken chain of links between at least one formal feature and enjoyment to test for mediation.

Only two of the presence dimensions, engagement and social richness, successfully mediated the relationship between at least one of the formal features (surround sound) and enjoyment. Results for these models are shown in Figures 6 and 7. The differences between predicted and obtained correlations for all unconstrained bivariate relationships were examined, and none were significantly different than what would be expected through sampling error. The models also passed the overall tests of fit.
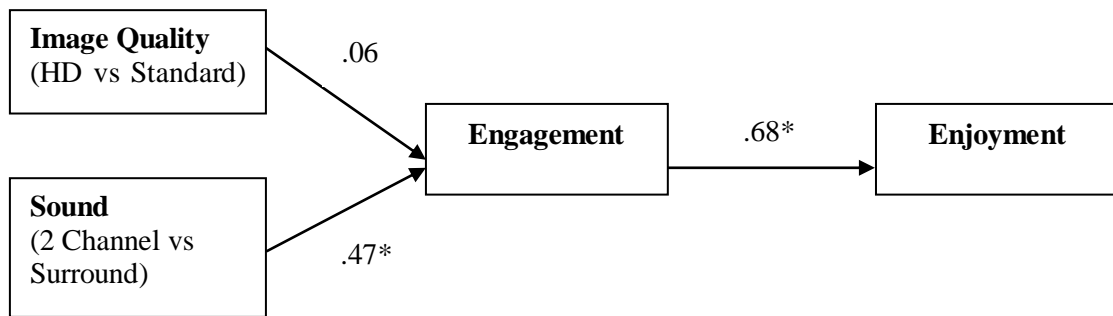

Figure 6. Path Analysis Results for Engagement
* = significant at p < .05
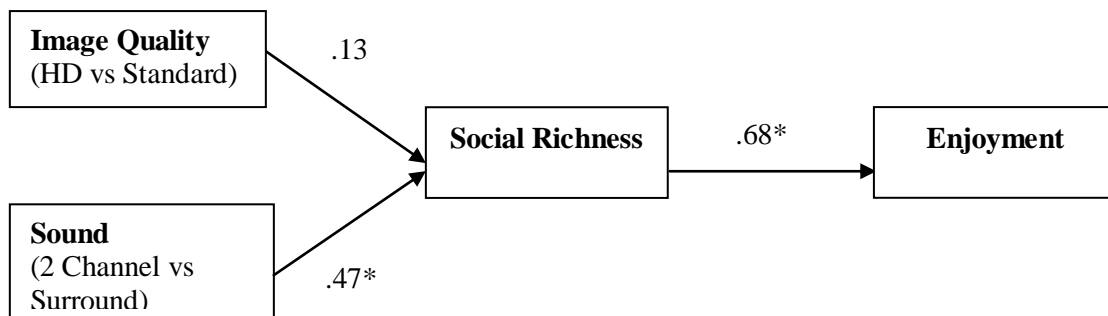χ^2 (2) = .03, p = .999.

Figure 7. Path Analysis Results for Social Richness
* = significant at p < .05
χ^2 (2) = .48, p = .785.

6. Discussion

A very clear pattern emerged in this study—surround sound had a much more pronounced effect on player presence and enjoyment than two-channel sound or image quality. The only dimension of presence not affected was social realism, and this

had an uncertain prediction to begin with. Since social realism has to do with content rather than form, it may have been that the violent nature of the game was so far removed from participants' realities that presence was not appropriate for this dimension. Regardless, the sheer number of significant findings for surround sound, which were well above what would be expected by chance, call attention to the importance of sound in the experience of video games. Even the non-significant finding for social realism was more favorable with surround sound and may not have emerged as significant simply as a function of statistical power or measurement error. The pattern of results in this study tells a story, and it speaks loudly in favor of the merits of sound.

Sound quality may indeed be more important to video game play than image quality, at least in the case of high definition versus surround sound. Although the game industry has been pushing HD with its latest generation of consoles (Cross, 2005), they may draw players in even more through sound, either by promoting the value of adding surround equipment to a gaming setup or by developing their own innovative technologies to engage the hearing of players. Given the recent focus on graphics and interface improvements, sound seems like a logical next "frontier" for the industry to explore.

The failure of image quality to affect outcomes in this investigation was surprising, given some evidence to contrary (Bracken & Skalski, 2009). Since HD gaming is still in its infancy, the differences between HD and standard definition game graphics may still not be pronounced enough to have an effect with certain titles, or as they do in the more realistic medium of television. As image quality improves even further in games and titles are developed to maximize this potential, these findings may change, and historical evidence comparing generations of games points to this likelihood (Ivory & Kalyanaraman, 2007). Aside from formal features, the user characteristic of prior game playing experience also related to some presence dimensions, consistent with past work on presence and gaming (e.g., Tamborini et al., 2004).

Additionally, the findings of this study suggest that presence dimensions do not function universally in mediating the relationship between formal features and enjoyment. Specifically, only engagement and social richness served as a mediator between surround sound and enjoyment. The failure of spatial presence and perceptual realism to affect enjoyment was surprising, given the direct relationships between surround sound and those variables. Perhaps spatial presence in such a violent, hostile world was not very enjoyable to some players due to its frightening

nature. It may also be that perceiving the gunfire, explosions, and other violent content to be real functioned in the same manner, whereas the increased audio realism served to heighten engagement leading to enjoyment. Whatever the case may be, these findings (along with the one for social realism) highlight the need to treat presence dimensions separately in analyses, as recommended by Bracken and Skalski (2010), instead of summing to create an overall "presence" variable.

There are some questions raised in this study that need to be addressed in subsequent work. First, the exact determinant of surround sound effects should be parsed out. Since the goal of this study was to create a strong manipulation of sound quality, it did not do this, but future research should test, for example, if bass was the primary determinant of the sound findings, as has been discovered in past work (Lessiter & Freeman, 2001). If bass *was* found to be the primary reason for the consistent effects on multiple presence dimensions *and* enjoyment observed in this investigation, this would raise many fascinating questions about bass, but until further work is completed we simply cannot be sure. Second, as suggested by Hartmann, Klimmt and Vorderer (2010), future research should attempt to account for the specific contexts under which presence dimensions affect enjoyment, if they affect it at all. It may be that, in some cases, presence is not necessary or desirable for entertainment, and these boundary conditions should be identified. Doing so can help advance entertainment theory.

Overall, this study advances knowledge of formal feature effects on outcomes of video game exposure. Research should continue to examine image quality, sound quality, and other formal features, along with their interaction with content and user characteristics, to gain a better understanding of the complex experience of video game play.

7. References

Bracken, C. (2005). Presence and image quality: The case of high definition television. *Media Psychology, 7*(2), 191-205.

Bracken, C. C., & Botta, R. (2010). Telepresence and television. In C. C. Bracken & P. D. Skalski (Eds.), *Immersed in media: Telepresence in everyday life* (pp. 39-62). New York: Routledge.

Bracken, C. C., & Skalski, P. (2006, August) Presence and video games: The impact of image quality and skill level. *Proceedings of the ninth annual international workshop on presence. Cleveland, OH: Cleveland State University.*

Bracken, C. C., & Skalski, P. (2009). Presence and video games: The impact of image quality. *Psychology, 7*(1), 101-112.

Bracken, C. C., & Skalski, P. (2010). Popular media and telepresence: Future considerations. In C. C. Bracken & P. D. Skalski (Eds.), *Immersed in media: Telepresence in everyday life* (pp. 229-236). New York: Routledge.

Cross, J. (2005). *"HD Era" coming to gaming*. ExtremeTech. Retrieved on June 26, 2009, from http://www.extremetech.com/

Cummins, R.G. (2009). The effects of subjective camera and fanship on viewers' experience of presence and perception of play in sports telecasts. *Journal of Applied Communication Research, 37*, 374-396.

Hartmann, T., Klimmt, C., & Vorderer, P. (2010). Telepresence and media entertainment. In C. C. Bracken & P. D. Skalski (Eds.), *Immersed in media: Telepresence in everyday life* (pp. 137-157). New York: Routledge.

Hunter, J. E., & Gerbing, D. W. (1982). Unidimensional measurement, second order factor analysis, and causal models. In B. M. Shaw & L. L. Cummings (Eds.), Research in organizational behavior (Vol. 4, pp. 267-320). Greenwich, CT: JAI.

International Society for Presence Research (2000). *The concept of presence: Explication statement.* 2000. Retrieved on June 20, 2009, from http://ispr.info/

Ivory, D. J., & Kalyanaraman, S. (2007). The effects of technological advancement and violent content in video games on players' feelings of presence, involvement, physiological arousal, and aggression. *Journal of Communication, 57,* 532-555.

Klimmt, C., & Vorderer, P. (2003). Media psychology "is not yet there": Introducing theories on media entertainment to the presence debate. *Presence: Teleoperators and Virtual Environments, 12*(4), 346-359.

Lee, K. M. (2004). Presence, explicated. *Communication Theory, 14*, 27-50.

Lee, K. M., & Peng, W. (2006). What do we know about social and psychological effects of computer games? A comprehensive review of the current literature. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 325-345)*. Mahwah, NJ: Lawrence Erlbaum Associates.

Lessiter, J., & Freeman, J. (2001, May). Really hear? The effects of audio quality on presence. *Proceedings of the 4th international workshop on presence.* Philadelphia, PA.

Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer Mediated Communication*, *3*, 27-50.

Lombard, M., Ditton, T. B., & Weinstein, L. (2009, November). Measuring (tele)presence: The Temple Presence Inventory. *Proceedings of the 12th international workshop on presence. Los Angeles, California, USA.*

Neuman, W. R. (1990, July). *Beyond HDTV: Exploring subjective responses to very high definition television*. A Research Report for GTE Labs and the TVOT Consortium. Cambridge, MA: MIT.

Oatley, K. (1994). A taxonomy of the emotions of literary response and a theory of identification in fictional narrative. *Poetics, 23*, 53-74.

Oliver, M. B., & Nabi, R. L. (2004). Exploring the concept of media enjoyment: An introduction to the special issue. *Communication Theory*, *14*(4), 285-–287.

Pettey, G., Bracken, C. C., Rubenking, B., Buncher, M., & Gress, E. (2010). Telepresence, soundscapes, and technological expectation: Putting the observer into the equation. *Virtual Reality, 14*, 15-25.

Reeves, B., & Nass, C. (1996). *The media equation.* Cambridge University Press.

Rice, R. E. (1992). Task analyzability, use of new medium and effectiveness: A multi-site exploration of media richness. *Organization Science, 3*(4), 475-500.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications.* London: Wiley.

Sinclair, B., (2009). NPD: 2008 game sales reach $21 billion, Wii Play sells 5.28M. *GameSpot*. Retrieved on January 19, 2009, from http://www.gamespot.com/news/6203257.html

Skalski, P., Tamborini, R., Shelton, A., Buncher, M., & Lindmark, P. (in press). Mapping the road to fun: Natural video game controllers, presence, and game enjoyment. Accepted for publication in *New Media & Society.*

Tamborini, R. (2000, November). The experience of telepresence in violent video games. *Paper presented at the 86th annual convention of the National Communication Association, Seattle, WA.*

Tamborini, R., Eastin, M. S., Skalski, P., Lachlan, K., Fediuk, T. A., & Brady, R. (2004). Violent virtual video games and hostile thoughts. *Journal of Broadcasting and Electronic Media, 48*(3), 335-357.

Tamborini, R., Skalski, P. (2006). The role of presence in the experience of electronic games. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives,*

responses, and consequences (pp. 225-240). Mahwah, NJ: Lawrence Erlbaum Associates.

Vorderer, P. (2001). It's all entertainment, sure. But what exactly is entertainment? Communication research, media psychology, and the explanation of entertainment experiences. *Poetics, 29*, 247-261.

Williams, D. (2002). A structural analysis of market competition in the U.S. home video game industry. *International Journal on Media Management*, *4*(1), 41-54.

Wirth, W., Hartmann, T., Bocking, S., Vorderer, P., Klimmt, C., Schramm, H., et al. (2007). A process model of the formation of spatial presence experiences. *Media Psychology*, *9*, 493-525.

Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence: Teleoperators and Virtual Environments, 7*, 225-240.

Zehnder, S. M., & Lipscomb, S. D. (2006). The role of music in video games. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 241-258). Mahwah, NJ: Lawrence Erlbaum Associates.

Zillmann, D. (1996). The psychology of suspense in dramatic exposition. In P. Vorderer, H. J. Wulff, & M. Friedrichsen (Eds.), *Suspense: Conceptualizations, theoretical analyses, and empirical explorations* (pp. 199-231). Mahwah, NJ: Lawrence Erlbaum Associates.