

## Presence and Video Games: The Impact of Image Quality and Skill Level.

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Abstract

This pilot study investigates the impact of image quality and skill level on presence-related reactions to video games. Past research has demonstrated positive associations between image quality and presence and video game technology and presence, the “perceptual illusion of nonmediation” (Lombard & Ditton, 1997). No study to date, however, has examined the presence effects of video games played in high definition, something likely to become very common in the future as both technologies diffuse into homes. This paper reports the results of an experimental study in which 22 college students played a video game either in high definition (high image quality) or standard definition/NTSC (low image quality) and then completed several measures of presence and a measure of video game skill. Skill was included as a second independent variable in the study, and both image quality and skill were expected to relate positively to presence dimensions. The results of the study provide some support for both image quality and skill affecting presence, though not all results were in the direction expected. These findings are discussed along with suggestions for future research.

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“The big screen involved me more in the video game.”

“It was a nice experience for me playing with a control on a big screen because it felt as if I'm in the real world.”

“The game had really good graphics and sound effects.”

--comments from gamers who played the X-Box game *Halo* on a large-screen HDTV.

### *Introduction*

Video games have become one of the most popular forms of media in the United States and abroad. Global sales in the industry were projected to exceed \$30 billion dollars by the end of 2002 (Detroit Free Press, 2002, July 1), and half of Americans age six and older are currently estimated be playing (Entertainment Software Association, 2003). The popularity of games has been fueled in part by advancements in gaming technology, a trend that has persisted through 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 new titles like *Grand Theft Auto: San Andreas* and *Halo 2*. These and other advances in game technology have important consequences for how games are experienced. In particular, they are expected to contribute to the sense of *presence*, or “perceptual illusion of nonmediation” (Lombard & Ditton, 1997), felt by users.

Presence 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, in press; Peng & Lee, 2004). 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 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 High Definition Television (HDTV). 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 (Author, 2004). But what about video games, which add the crucial feature of interactivity to HDTV's high-quality images? One new video game system, the Microsoft X-Box, has an adapter that allows players to play games in HDTV. Since HDTV is expected to diffuse rapidly in coming years (Kovar, 2004), this type of gaming should become increasingly common in the future, raising questions about its effects on players.

This pilot study investigates the effect of image quality on presence-related reactions to video games. It reports the results of a study in which participants played a game in high definition (high image quality) or standard definition/NTSC (low image quality) and then completed a series of presence measures. It also examines how player skill affects presence. Skill is a variable unique to video games and other interactive media that may strongly impact how users respond to these technologies, though it has received little attention to date in empirical research. Thus, the study also includes a created measure of skill as a second independent variable. Both image quality and skill are expected to relate positively to presence

### *Presence*

The concept of presence was introduced in the early 1980s as a sense of "being there," (Minsky, 1980), and as a "sensation of reality." It has been examined in research and theory in diverse fields. A first attempt to integrate the various conceptualizations being used in the separate disciplines resulted in the defining presence as a "perceptual illusion of nonmediation" (Lombard and Ditton, 1997 "Presence Explicated" paragraph 1). While this definition was

originally widely lauded, there continues to be disagreement both about what presence is and what types of experiences should be included in the scope of presence research. Lee (2004) recently asserted that presence research needs to include all types of interaction (i.e., both mediated and non-mediated), while David (2004) has argued that in order to better define the concept researchers need to limit the definition of presence to mediated experiences. In an effort to reconcile this disparity an online discussion resulted in the following: 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” (ISPR, 2000).

While these disagreements continue, there is consensus that presence is a multidimensional concept. As the concept developed simultaneously in a variety of areas there are numerous terms for the similar dimensions. Lombard and Ditton (1997) stated there are six separate dimensions: social richness, realism, transportation, immersion, social actor within a medium, and medium as social actor. Not all these dimensions are appropriate for every medium or study, in this study we focus on the immersion and transportation dimensions.

#### *Presence and High Definition Images*

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 lead to elevated levels of presence. Specifically, in an experiment exploring television viewers' presence responses to varying image quality levels, author (in press) used high definition (HD) and standard definition (NTSC)

television images to manipulate image quality. The higher image quality provided by HD lead to increase levels of various dimensions of presence, including: immersion, spatial presence, perceived realism, and social presence-passive dimensions of presence.

Further, in study exploring the impact of image quality on participants' perceptions of newscast credibility (Author, 2003), image quality was manipulated using a local newscast in HD and in NTSC. The author found significant differences in presence dimensions, namely for immersion and social presence. The results also demonstrate 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 the varying the image quality has led to differing levels of presence. However, all of these studies were conducted with television and this study seeks to explore the differences in image quality with video games.

### *Presence and Videogames*

There are relatively few studies focusing exclusively on presence and video games, and most incorporate presence as one dependent variable. 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 games having storylines and the other two did not. 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 video game. However, this study only really examined immersion and not other dimensions of presence.

One study that has a primary focus on videogames and experiencing a sense of presence was an exploratory study using the "autoconfrontation method." In this method, participants are engaged in an activity (i.e., playing a video game) and their performance is videotaped. After the

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 (Rétaux, 2002). In this study participants were video taped as they played a video game. Afterwards the participant were asked 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. This study did not measure the skill level of the participants.

Finally, in an experiment examining the relationship between video game exposure, presence, and hostile thoughts, Tamborini et al. (2004) compared subject 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. Once again, however, the skill level of participants was not measured.

Together these studies provide evidence that video games can evoke a sense of presence in video game players. In addition, the importance of game playing experience to presence observed in the Tamborini et al. study suggests the need to explore variables unique to video games in gaming research, such as skill.

### *Presence and Skill*

While it makes intuitive sense that the skill of a video game player will influence not only how successful they are in a game, but also how much attention they give to their gaming experience, there has been little direct, if any attention, to this issue. A single study found differences between the skill levels of players and its impact on presence. In an experiment

exploring sensations of presence players experience while playing online virtual chess, Hoffman, Prothero, Wells, and Groen (1998), found that all players (including non-chess players) experienced a sense of presence. However, the greater the skill of the players the more fully immersed they were able to become in the environment. The explanation provided was that novice players were too absorbed in concentrating on how to play the game to attend to the environment or the other players.

This finding suggests the need to include skill in research on video game-induced presence. Gaming skill, defined here as the ease with which players are able to execute and perform actions in a video game, is especially relevant given the complexity of popular games and gaming systems of today. Most contemporary games require players to perform tens and sometimes even hundreds of actions using multi-button controllers. The controller for X-Box, for example, has more than 10 buttons, including a directional pad, analog stick, and triggers. This makes controlling games difficult for beginning and novice players, a problem compounded by the lack of experience most players have with the games used in experimental research. When players have problems getting their character to move and perform other actions, this lack of skill should have an adverse effect on presence since such problems call attention to the artificiality of the experience of “being there.”

Based on this and evidence presented earlier in the paper the following hypotheses are posited:

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

Hypothesis 1b: Participants who play the high definition version of the videogame will experience a higher level of *immersion* than those who play the NTSC version of the videogame.



Hypothesis 2: Participants who have a higher skill score will experience a higher level of presence than those who have a lower skill score.

## Method

### *Overview*

Twenty-two participants played a video game in either HDTV (1080 lines) or in standard definition (NTSC, 480 lines). The independent variables are image quality (HDTV versus standard television), and player skill (high versus low OR expert vs. amateur). The video game was played on the same television, a rear-projection television with a 65-inch widescreen (16:9) screen. The television is capable of displaying 1080 lines (high definition) and also 480 lines (NTSC). The experimental design was between subjects: Half of the participants played the videogame in HDTV (11 players) and other half played the game in NTSC (11 players). The participants played the game alone and the image quality was switched after every second participant.

### *Stimulus*

All participants played the popular game *Halo* on the X-Box console system. In *Halo*, players assume control of a futuristic soldier who must defend humanity against hordes of alien aggressors. To help with this, the soldier wears advanced body armor and has access to an arsenal of deadly weapons, including a pistol and automatic rifle. *Halo* 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 and 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.

### *Independent Measures*

*Image Quality.* The image quality of the video game was manipulated with one group playing the game in high definition (high image quality) and the other playing the video game in NTSC (low image quality).

*Skill Level.* Participants responded from (1) strongly agree to (5) strongly disagree to nine statements created for this study to assess their skill level. The items were: "I am a good video game player," "I often win when playing video games against other people," "I often win when playing video games against the computer," "I know a lot about video games," "A lot of my free time is spent playing video games," "I think about video game strategies," "I am familiar with different video game systems," "I read video game-related magazines," and "I visit websites and forums online to talk about video games." Cronbach's alpha for the additive index was .95. Once created, the index was dichotomized for analysis purposes.

### *Dependent Measures*

*Immersion.* Participants responded from very strongly disagree (1) to very strongly agree (7) for nine statements designed adapted from Lombard and Ditton (2001) to measure the extent to which media users feel a sense of involvement or connection when with media content. The items included 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 additive index was .86.

*Spatial Presence.* Participants responded from very strongly disagree (1) to very strongly agree (7) for three statements designed adapted from Lombard and Ditton (2001) 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 for the additive index was .87.

### *Participants*

The 22 undergraduate students who participated in the experiment were between 14 and 53 years old ( $M = 24.10$ ,  $SD = 7.12$ ). The vast majority were between the ages of 19 and 26 (86.5%). The participants were equally divided by gender 11 females and 11 males. In terms of race, 32% of participants reported being “White,” 27% reported being “African-American,” 14% reported being “Asian,” and the remainder said they were “Hispanic” or “Other” (27%).

### *Procedure*

Each participant was met by the experimenter and escorted into a carpeted, 8 x 10 foot room that contained a television, a Microsoft X-Box, 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

### Analysis and Results

A series of 2-way analyses of variance with the independent variables image quality (high [HD] versus low image quality [ NTSC]) and skill level (high versus low) were used to test the hypotheses and research questions. The specific results are presented in Table 1.

Hypothesis 1a, predicting participants who played video games with higher image quality would experience a higher level of spatial presence (being there in the video game) than those who played in lower image quality (See Table 1) was not supported

Some support was found for Hypothesis 1b, which predicted participants who played video games in higher image quality would experience a higher level of immersion than those who played the video game in lower image quality (see Table 1). The main effect was approaching significance for immersion with those participants who played the video game in higher image quality reporting higher levels of immersion ( $M = 4.37$ ,  $SD = 1.27$ ) than those who played the game in NTSC ( $M = 3.48$ ,  $SD = 1.51$ ).

Hypothesis 2, which posited that participants who had a higher gaming skill score would experience a higher level of presence than those who have a lower gaming skill score was not supported. In fact, there was a significant results in the opposite direction for immersion with participants with lower gaming skill levels ( $M = 4.43$ ,  $SD = 1.13$ ) than those who with higher gaming skill levels ( $M = 3.42$ ,  $SD = 1.56$ ).

However, there was a significant interaction between image quality and skill level for immersion. Specifically, the participants with higher gaming skill levels reported experiencing greater level of spatial presence when playing the video game with higher image quality (HD) than those with lower skill levels. The interaction is displayed in Figure 1.

## Discussion

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

The current study also introduced the use of measuring players' prior video gaming skills as a variable that may impact their playing experience and in turn the level of presence. While the evidence suggests that this is a variable worth future consideration, the results were not consistently in the direction expected. However, it may be that skill levels affect different dimensions of presence in unique manners. The nature of video games as interactive may, in part, be responsible for the lack of significant findings for immersion. Interactivity might be the reason that both skilled and non-skilled players reported feeling a sense of immersion. However, experiencing a sense of being there or of spatial presence was experienced by participants who possessed higher gaming skills and played the video game with the higher image quality. This result suggests that gaming skill is necessary for gamers to feel "part of the action" as promised by HD developers.

The exploratory nature of this experiment leads to a few limitations that should be considered in future work. First, gaming skill levels should be pre-determined via pretests and used to assign participants to experimental conditions, to ensure equal representation. Second, the interactive nature of video games should be controlled by including a viewing only condition

[FN – the authors originally designed the study to include this group, but the current equipment necessary for HD prohibits recording]. This would allow for a manipulation of both vividness and interactivity, the two basic dimensions determining telepresence in Steuer's (1995) seminal work.

The scale used in this study may be considered a final limitation. Though the present scale has yet to be rigorously validated, the development of a gaming skills scale allows for a whole new area of video game study. It calls attention to a variable unique to video games that may impact how these technologies affect users. Despite being constructed on the basis of face validity, the scale used here had high reliability and related to at least one outcome of video game exposure. Future work on video game effects should continue to address skill as well as other variables that make video games different than other, more traditional forms of media.

In conclusion, the current exploratory study provides a basis for the inclusion of a gaming skill scale in future studies. The results also provide evidence that image quality in video games has an affect on participants' sensations of some dimensions of presence. Though more work in this area is needed, this preliminary investigation shows the promise inherent in these areas of inquiry.

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Table 1

*Analysis of Variance Table: Image Quality and Skill Level for Presence Dimensions*

Source of Variation	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	$\eta^2$
<i>Immersion</i>					
Main Effects					
Image Quality	5.33	1	5.33	3.12+	.15
Skill Level	6.60	1	6.60	3.85 *	.18
Two-Way Interactions					
Image Quality x Skill Level	1.73	1	1.73	.33	.05
<i>Spatial Presence</i>					
Main Effects					
Image Quality	2.86	1	2.86	1.08	.06
Skill Level	2.04	1	2.04	.77	.04
Two-Way Interactions					
Image Quality x Skill Level	18.11	1	18.11	6.86*	.12

Note: + $p < .10$ , \* $p < .05$ , \*\* $p < .01$

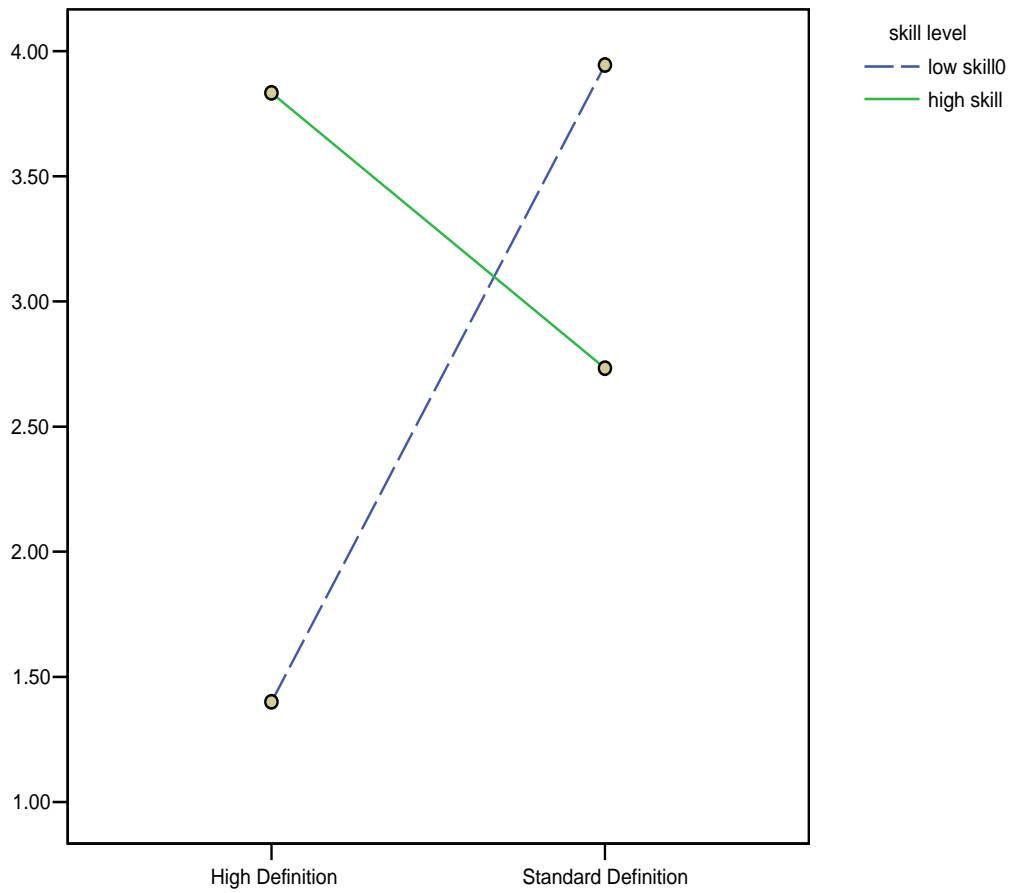


Figure 1: Interaction between Image Quality and Skill level for Spatial Presence

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