Mapping the way to fun: The effect of video game interfaces on presence and enjoyment

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Abstract

This study examines the potential for natural mapping to affect presence-related outcomes of video game exposure. Interactivity in the form of natural mapping has been suggested to be a possible contributor to presence, but few studies to date have investigated this potential, particularly as it applies to video games, which are expected to make extensive use of naturally mapped interfaces in the future. The present study addressed how the control system used to interact with a video game impacts the experience of the game, with the expectation that natual mapping would relate positively to spatial presence and game enjoyment. A total of 48 subjects took part in an experimental study manipulating the type of interface used to play a PC driving video game (steering wheel, joystick, or keyboard). They then completed measures of perceived interface naturalness (included as a manipulation check), spatial presence, and game enjoyment. Results of the study were consistent with expectations, though questions remain about the independence of the endogenous variables and causal direction of the observed relationships.

1. Introduction

The popularity of video game entertainment has soared in recent years. In 2005, the game industry reaped record profits of $10.5 billion in the U.S. [1], due in part to advances in game technology. Game industry growth has traditionally been fueled in part by technical innovation [2], and many such developments are on the horizon, including High Definition (HD) graphics and new game playing interfaces, the focus of this investigation.

Game playing interfaces have progressed considerably in capabilities over time, from single-button joysticks to the multiple-button and stick controllers of today [3]. Newer control devices allow players to interact with a game using a wider, more realistic range of actions conducive to the sensation of *presence*, "the perceptual illusion of non-mediation" [4]. Few studies to date have examined the impact of different game interfaces on presence, however, despite the considerable attention interfaces have received from the video game industry in recent years. Sony, for example, is expected to make the motion-tracking *EyeToy* interface a prominent feature of its upcoming *Playstation 3* console, and Nintendo's next generation *Wii* system is banking on a revolutionary new control device that works through natural hand and arm movements such as swinging [5]. These developments highlight the increasing role in gaming of an especially important type of interactivity, natural mapping.

Natural mapping is defined as "the ability of a system to map its controls to changes in the mediated environment in a natural and predictable manner" [6]. It has been suggested to be a key contributor to spatial presence experienced during video game play [7], in part because more naturally mapped interfaces allow players to access more complete mental models of real-world behavior [8]. More naturally mapped interfaces (such as a club for a golfing game or racket for a tennis game) should lead players to perceive more control naturalness, which should in turn relate positively to spatial presence, a mediating variable in this study. When players feel more spatially present in a video game environment, they should indicate more enjoyment of the game post exposure. Enjoyment is a particularly important consideration of the interactive entertainment industry, simply because enjoyed games are typically the most successful and profitable ones.

Based on the above rationale, the following hypotheses and research question are posited:

Hypothesis 1: Individuals who play a video game with more naturally mapped controls will perceive greater interface naturalness than those who play the same game with less natural mapping.
Hypothesis 2: Perceived interface naturalness predicts spatial presence experienced while playing a video game.
Hypothesis 3: Spatial presence predicts video game enjoyment.
Research Question 1: What else predicts video game enjoyment?

2. Methodology

A single-factor, between-subjects experiment was conducted manipulating the type of control device used to play a PC driving video game, *Need for Speed Underground II*. A total of 48 participants played the game for ten minutes using either a steering wheel controller (more natural mapping), a joystick (less natural mapping), or a keyboard (less natural mapping). They then completed measures of perceived interface naturalness (which also served as a manipulation check), spatial presence, enjoyment, skill, prior game use, and demographic characteristics.

3. Analysis and Results

ANOVA was used to test the first hypothesis, and multiple regression analyses were used to test the last two hypotheses and research question. Regression variables were entered in three blocks: skill and demographics, prior game use, and media condition/study exposure outcomes. By block three in both the spatial presence and enjoyment regression analyses, a significant portion of variance in the dependent measure was explained.

Hypothesis 1, which predicted that players of a game with a more naturally mapped control device would perceive greater interface naturalness than those who played the game with less natural mapping, was supported. Participants in the driving wheel condition perceived a higher level of interface naturalness (7-point-scale $M = 4.76$, $SD = 1.00$) than those who played the game using a joystick ($M = 3.09$, $SD = 1.59$) or keyboard ($M = 3.13$, $SD = 1.53$), $F(2, 45) = 7.83$, $p<.01$, $eta=.26$. A Tukey HSD post-hoc test confirmed that this effect was driven by the wheel condition.

Hypothesis 2, predicting that perceived interface naturalness predicts spatial presence, was also supported. When the final block of variables was added, the only significant predictor of spatial presence was the perceived naturalness variable, $\beta = .72$, $p < .01$.

Hypothesis 3, predicting that spatial presence relates to enjoyment, was also supported. When the final block was added, the strongest predictor of enjoyment was spatial presence, $\beta = .59$, $p < .01$.

In answer to Research Question 1, additional predictors of enjoyment included prior game play in general ($\beta = .43$, $p < .01$), prior driving game play in particular ($\beta = .43$, $p < .01$), and use of the Nintendo Entertainment System ($\beta = -.25$, $p < .05$).

4. Discussion

This study provides preliminary empirical support for the predicted positive relationship between natural mapping and presence [5, 7, 9]. It also offers evidence that spatial presence mediates the relationship between natural mapping and video game enjoyment. However, high observed associations between the perceived naturalness, spatial presence, and enjoyment scales raise questions about the dimensionality of these measures—it may be that all three scales are tapping aspects of presence. In the case of perceived naturalness, this seems especially likely, though it was treated as separate in this investigation to provide a manipulation check and more varied form of natural mapping. In the case of enjoyment, this would be consistent with conceptualizations of spatial presence that include enjoyment-related concepts [9].
This also raises questions about causality—if presence and enjoyment are second-order unidimensional, it may be that enjoyment is a necessary condition for a state of presence to be maintained, and not the reverse. Although the present study treated presence as a mediating variable influencing media enjoyment, future research should attempt to untangle these closely-related concepts to gain a better understanding of how both operate in media users.

Despite these questions/limitations, the core finding of this study—that perceived interface naturalness, spatial presence, and enjoyment are closely and positively associated—is important by itself. It points to the exciting potential of naturally mapped interfaces, both in gaming and in other contexts. Natural mapping and resultant spatial presence may not only positively impact video game enjoyment, but also other positive outcomes of presence such as training. In the case of training, natural mapping in simulators can provide users with a more complete mental model for how to perform the real-life actions they are learning, resulting in more skills transference. At the same, the downside of natural mapping must also be addressed. If natural mapping can enhance the learning of prosocial skills, it can also create stronger mental models for antisocial behavior, such as firing a weapon or punching and kicking, as players of highly-mapped violent video games might do. Future work should address these and other outcomes of natural mapping as it relates to presence.

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