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Video Game Experience: Perception of Self-Motion and Motion Sickness in the Virtual World

Ryan E. Harvey  
*Indiana University - Purdue University Fort Wayne*

Andrew H. Horton  
*Indiana University - Purdue University Fort Wayne*

Carrie E. Serna  
*Indiana University - Purdue University Fort Wayne*

Crysta A. Terry  
*Indiana University - Purdue University Fort Wayne*

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Abstract

We used 3D goggles to examine the effect of video game experience on motion sickness and perceived self-motion. Participants viewed a display of moving dots to simulate forward and backward movement. More video game experience was associated with increased self-motion only in the environment that simulated backward movement. Also, more video game experience was associated with significantly less motion sickness in the environment that simulated forward movement, but significantly more motion sickness in the backward condition. This shows how experience can shape perception of self-motion.

Introduction

Recently there has been increased interest in perception of self-motion (vection) in virtual environments. Bubka et. al. (2008) found less vection with visual stimuli approaching the viewer (simulated forward movement) than with visual stimuli receding from the viewer (simulated backward movement).

In another study, researchers found that people with video game experience are better at discriminating contracting visual stimuli than individuals with less video game experience, but no significant difference between the two groups at discriminating expanding visual stimuli (Hutchinson & Stocks, 2013). Contracting and expanding visual cues are used in video games to simulate backward and forward movement.

We examined effects of video game experience on vection, as well as motion sickness, with a moving dot display simulating forward and backward movement.

We predicted experienced video gamers would feel more vection with the display simulating backward movement than with forward movement. We assumed this because visual cues for backward movement are more common in video games than in real life.

Method

Participants

44 male and 88 female undergraduate students.

Procedure

In a 3D head-mounted display, participants viewed one of four displays of moving white dots against a dark background for 8 minutes. Dots were displayed in an expanding or contracting pattern to simulate forward and backward movement.

The task was to press the spacebar when a yellow crosshair appeared in the center at random intervals (20-40 s) and to press a foot pedal when they perceived self-motion.

We measured motion sickness using the Simulator Sickness Questionnaire before and after viewing the display. We also asked for ratings of motion sickness minute-by-minute during the display.

Participants rated their video game experience with a questionnaire prior to viewing the display.

Results

For vection (perception of self-motion), the results showed a significant interaction between direction of movement and video game experience, b= .38, t(125) = 3.51, p = .001. More video game experience was associated with significantly more vection in the backward movement condition, r(65) = .40, p = .001, but there was no significant relationship in the forward movement condition.

More video game experience was associated with significantly less increase in motion sickness in the forward movement condition with the before/after motion sickness questionnaire, r(63) = -.33, p = .008. Also, more video game experience was associated with significantly more motion sickness in the backward movement condition with the minute-by-minute ratings, r(62) = .31, p = .01.

Conclusions

We found that video game experience affected vection (perception of self-motion), but only in the backward movement condition. Because backward movement is more commonly experienced in video games than in the real world, there may be increased perception of self-motion for video gamers when visual stimuli recede from the viewer. However, everyone has experience with visual cues for forward movement in the real world, regardless of video game experience, and therefore there would be no effect of video game experience for the forward movement condition.

To explain our motion sickness findings, we observe that even in the virtual world, there is more exposure to the visual cues for forward movement than backward movement. A theory of motion sickness is that it is caused by sensory conflict between lack of vestibular feedback and visual cues for movement. Thus, experienced video gamers may have less motion sickness for the more familiar virtual cues of forward movement because of more experience with this type of sensory conflict.

With increased applications of virtual reality, it is important to be aware that previous virtual experience affects how an individual interprets virtual environments.