

# Measurement of presence in virtual environments

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The quality of a virtual environment depends on the feeling of "presence" induced in users. Visitors/users should have the illusion to "be" in the simulated environment.

We developed a questionnaire to measure the amount of presence experienced by VR users. In addition we examined items measuring the tendency to get immersed.

## Method

We asked experienced users of "first-person shooters" to participate. "First-person shooters" are computer games like "Quake", "Half-Life" or "Deus Ex".

Players of these games see 3-D-Worlds from the viewpoint of their avatar.

This is the most advanced piece of VR-technology available for a general public.

A posting in relevant newsgroups and forums induced 170 persons (mean age 21.8) to participate. They were directed to a website consisting of 73 items which had to be answered on 7-point-scales.

## Presence

13 (of 55) items were deleted because of low item-total correlations. Reliability of the reduced scale is 0.85 (Cronbach's alpha). A factor analysis (principal components, varimax rotation) identified 3 factors:

Factor:

Typical item:

● Spatial presence

"During the simulation, my body was in the room, but my mind was inside the world created by the simulation."

● Quality of the user interface

"How natural was the mechanism which controlled movement through the environment?"

● Emotional Involvement

"After having mastered tasks successfully I felt relieved."

## Immersive Tendency

6 (of 18) items were deleted because of low item-total correlations. Reliability of the reduced scale is 0.78 (Cronbach's alpha). The factor analysis identified 2 factors:

● Tendency to get emotionally involved "Have you ever gotten excited during a chase or fight scene on TV or in the movies?"

● Degree of involvement "Do you easily become deeply involved in movies or TV dramas?"

Factor structures of both measures coincide with findings in the literature.

## Application

The questionnaires will be used to compare the quality of different VR driving simulators, built to perform ergonomic assessments in future vehicles. Three different VR systems will be compared:

### Level 1:

a nonimmersive stereo projection system with a traditional mockup of primary controls

### Level 2:

an immersive system with virtual controls without haptic feedback

### Level 3:

an immersive system with virtual controls and haptic feedback via an exoskeleton