Measurement of presence in virtual environments

Michael Krauss, Rainer Scheuchenpflug, Walter Piechulla, Alf Zimmer

Institut für Psychologie
Universität Regensburg
93040 Regensburg
rainer.scheuchenpflug@psychologie.uni-regensburg.de

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 exosceleton

Sponsored by the European commission GROWTH programme, Project VIRtual (Virtual reality systems for perceived ergonomic quality testing of driving task and design), Contract Nr. 1999-RD-11030. See the project's homepage at http://percro.sssup.it/projects/virtual. The images of Level 1-3 systems are courtesy PERCRO, Scoula superiore di studi universitare e di perfezionamento S. Anna, Pisa.