Presence in virtual driving simulators

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Abstract

The usefulness of driving simulators in ergonomic or psychological research depends upon the systems' ability to generate a sufficiently convincing impression of driving. Based on findings with virtual realities it is suggested to use the degree of perceived presence (an illusion of localisation) and immersion (completeness and coherence of the stimuli generated in the simulation) as an index of perceived quality of the driving simulation. A questionnaire was developed to measure these concepts. An item analysis based on 165 subjects who were experienced with virtual environments identified 3 subscales (spatial presence, interface quality, involvement). The instrument was applied in two virtual car driving simulators, where 36 male and female subjects from different age groups performed typical driving tasks. The two systems differed in display technology (wide screen projection vs. head mounted display). Using an head mounted display resulted in higher scores of presence on all subscales. In general, quality of the simulators was estimated as satisfactory; contrary to expectations there was no difference between genders and age groups. Thus, an instrument is available for measuring perceived quality of general simulator systems.

Introduction

Driving simulators are examples of virtual environments which are used for ergonomic and psychological research or for training purposes. The usefulness and acceptance of simulators depends upon their ability to generate a sufficiently convincing impression of actually driving a car on a road. In order to measure this ability and to compare the quality of different simulator systems, a questionnaire was developed to measure the degree of "Presence" generated by simulated environments. The concept of "Presence" as an important property of virtual reality implementations has been developed in research on the quality of virtual environments used in other contexts (psychotherapy, architecture, development; Draper, Kaber & Usher, 1998) and is defined as the "subjective experience of being in one place or environment even when one is physically situated in another" (Witmer & Singer, 1998, p. 225).

The first part of the paper describes the development of the questionnaire measuring this construct, the second part contains the results of an application.