

Virtual Reality in HMI research: attentional and motor performance in 3D-space

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Abstract

Virtual reality (VR) offers the possibility to simulate reality and is highly controllable. Therefore, VR provides much potential for HMI (Human-Machine Interaction) research. Bülhoff, Foese-Mallot and Mallot (2000) describe the benefit of VR on three dimensions: control, realism and interactivity. One aspect of interactivity is the direct manipulation of virtual objects with our hands. This includes touching virtual objects without haptic feedback.

This paper presents an experimental study in which pointing movements were performed by 20 participants in VR. Psychomotor performance in three-dimensional space, as well as reaction time in two- and three-dimensional space was recorded. The virtual environment was displayed on a stereo rear projection screen. Hand and head movements were recorded with an optical tracking system. The influence of movement direction and attentional processes on virtual pointing movements as well as effects of validity and activation were analysed. Furthermore, attentional performance in a two-dimensional computer based test was compared with the attentional performance in virtual space (three-dimensional). Results show typical patterns for the orientation of attention in VR, which are comparable to results from standardised tests. Motor behaviour is affected by movement direction and it can be shown that pointing and touching is a very efficient manipulation possibility in virtual applications.

Introduction

Attention and motor performance

Attentional processes and psychomotor performance characterise human behaviour. In daily life we move our body in three-dimensional space and our movements depend mainly on information from our environment. All information has to be selected and combined to control our behaviour. Attention is considered to be an important aspect of those selection and control processes. We focus on information