Ergonomic Issues of Data Visualisation with Semi-Immersive Virtual Environment (VE) Systems

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Abstract

New technologies for simulating environments (Virtual Environments, VE) have benefits for applications in various areas, especially for visualisation of complex data in a realistic and clearly understandable way. First applications of VE technology have been established in the areas of research and development, training and teleoperations. Today, VE is on the leap from research to application.

Nevertheless, there are diverse open questions in the areas of human factors and ergonomics for VEs. Research issues in these areas are mostly application dependent and include the areas of three-dimensional data visualisation, interaction with virtual scenes and co-operation in shared VEs. Out of these, data visualisation is essential, because without an error-free visualisation neither interaction nor co-operation would be possible. Therefore the projection models, their parameters, relevant depth cues and limits for three-dimensional data visualisation have to be studied. Another reason is that simple use of the well-known desktop metaphor with its Graphic User Interface (GUI) of (two-dimensional) desktop PCs has been found not to be useful.

The Research Institute for Communication, Information Processing and Ergonomics (FKIE) of FGAN carries out research studies in this area. The overall goal is to use such a VE-system as an advanced Tactical Situation Display (TSD) of a Command & Control (C²) system. The display should facilitate a real three-dimensional visualisation of tactical and geographic data and intuitive interaction with the scene. Therefore the traditional sandtable, as commonly used for military education and training, serves as metaphor.

This paper focuses on the ergonomic research issues of this project. With regard to the application and technology used, especially stereoscopic viewing models (on-axis and off-axis projection models) and depth cues are described. Further topics covered are interaction with virtual scenes and concepts of co-operation in shared VEs.