IFA
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Equipment of the IFA's SUTAVE laboratory

1 Technical equipment

The interaction room in the virtual reality (VR) laboratory has a floor area of 7 m², thereby permitting human-machine interaction with large, stationary machines and within a realistic operating space. An essential technical element is the projection wall. This has a height of 3 m and width of 8 m, and covers a 164° segment described by a circle with a radius of 2.80 m. When viewed frontally, the curved projection wall covers the maximum range of depth perception of the human field of vision, and immersion in the artificial world is not impaired by views past the projection wall. Areas lying outside the projection wall are matt black, in order to prevent reflections. Acoustic dampening of the ceiling serves to absorb an echo along the projection wall. The information presented in the VR is generated by three pairs of Infitec™ stereoscopic back projectors and adaptation of the projection in real time to the user's body and head movement. A speaker system is installed by which acoustic information can be localized three-dimensionally during human-machine interaction. If necessary, additional real display and control instruments can be integrated for mixed reality. This enables processes of tactile information processing or additional detail displays to be incorporated into the VR.

Figure 1: Layout of the SUTAVE laboratory showing VR interaction room, projection wall and rear-projection equipment, and the room in front of the projection wall from which virtual work scenarios are controlled

The analysis of parameters for human-machine interaction and product design is to some degree already integrated into the VR projection software. Instruments for body and eye movement analysis are integrated into VR so that measures can also be taken relative to objects within the virtual environment. Human task performance can be recorded and interpreted continually and in real time. Human information processing during human-machine interaction can also be documented by means of observation techniques and simultaneous digital video recording. In addition, standard questionnaires and rating scales serve for the human operator's assessments of usability, immersion or simulation sickness. If necessary, a selection of other oculometric and psychophysiological parameters can be recorded continually for analysis of effects on human behaviour. Measures are chosen specifically with regard to the requirements of the project. The interpretation of results refers to the research questions at hand and should also result in practical recommendations in occupational safety and health.

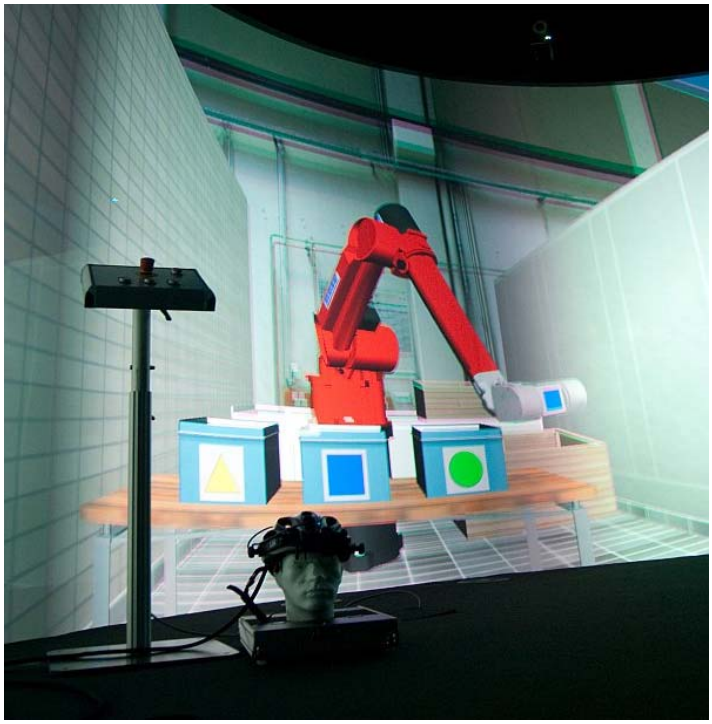

Figure 2: Projection wall, control panel and systems for recording of body and eye movement, in a scenario for human-robot interaction at the virtual workplace

A range of sophisticated software tools are available for use during the development of applications for specific tasks and work scenarios. Examples are tools for the modelling, conversion and animation of CAD data. Two and three-dimensional camera systems support the creation of workplace scenarios.

2 Personnel

The area of VR is interdisciplinary in nature, since expertise in engineering and in occupational and engineering psychology (such as mechanical engineering, IT, psychology) is needed for the creation, use and further development of VR. The technical facilities and practical experience of the SUTAVE team enable the SUTAVE laboratory to be used with a focus on practical solutions in occupational safety and health, in close co-operation with the customer.

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