Virtual Reality Support for Human Factors in Human-System Interaction

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Novel Technological Innovations for Occupational Safety and Health
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Agenda

• DGUV and IFA
• Virtual Reality
• Human Factors, Human-System Interaction
• VR projects
• Application areas
• Conclusions
German Social Accident Insurance – Independent Institutions

- 9 Institutions for trade and industry
- More than 4 million companies and institutions
- 24 Institutions for the public sector
German Social Accident Insurance – Research Institutes

IFA

Research / Consultation / Testing
Carrier: DGUV
Focus: Technology, chemical/biological hazards
  • Accident prevention
  • Machine safety
  • Personal protective equipment
  • Substance and exposure data

Research / Lecturing / Advice
Carrier: DGUV + BG RCI
Focus: Occupational medicine
  • Medicine
  • Epidemiology
  • Allergology / Immunology
  • Toxicology
  • Molecular medicine

Research / Consultation / Qualification
Carrier: DGUV
Focus: Qualification in OSH
  • Psychological damage and health
  • Work design and demographics
  • Evaluation
  • Learning and use of electronic media
  • Road safety
  • Profitability and business management
VR support for Human Factors in Human-System Interaction

Virtual Reality and OSH
• Simulation technique to support research into OSH
• Allows to study in hazardous and future environments

Human Factors in Human-System Interaction
• Research and application of human requirements to improve working conditions
• Information exchange processes referring to task, interaction and information interfaces
Human-System Interaction in OSH

SUTAVE – Safety and Usability Through Applications in Virtual Environments

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[IFA5112] [IFA5126] [IFA5127] [IFA5130] [IFA5138] [IFA5141] [IFA5142] [IFA515x]

HF/E, EngPsy

VR support for HF in Human-System Interaction  peter.nickel@dguv.de  15/10/2019  6
SUTAVE – Safety and Usability Through Applications in Virtual Environments

- Design of work processes and products (simulation technique, research tool, testing environment)
- Training (medial support)
- Visualisation (design reviews)
VR support for Human Factors in Human-System Interaction

... through Development and Design Reviews of Safety Concepts
(e.g. protecting future workplaces using 3D zone monitoring)
... in Future Work Environments Not Yet Available
(e.g. human information processing in human-robot interaction)
... in Hazardous Work Environments
(e.g. usable safety measures for elevating work platforms)
... by Prevention Through Design
(e.g. risk assessments during river lock planning stage)
... when supporting Training in OSH
(e.g. qualification modules for risk assessment of machinery)
Assessing New Technologies and Developing Safety Concepts

- Human perception and processing of 3D safety areas of Electro-sensitive protective equipment (ESPE) in context of use
- Minor differences in safety distances when using 2D and 3D safety areas
- Use of VR for development of safety concepts e.g. in manufacturing
- Project IFA5116 (DGUV Expert Committee “Woodworking and Metal Industries“, BGHM)
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Human Information Processing in Human-Robot Interaction

- Human Factors design requirements in human-robot interaction
- VR simulation for design of collaboration/interaction areas
- Behavioural effects of robot speed, distance and trajectory
- Behavioural effects of human-robot task-fit and indication of interaction demand
- MSc thesis (Psychology, University of Bonn)
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Product Safety and Usability in Hazardous Situations

- Usability evaluation of additional safety measures before marketing; investigations in hazardous situations without placing operators in danger
- Recommendation: redesign of safety measures built into joysticks
- Project IFA5118 (DGUV Expert Committee „Trade and Logistics“, BGHM, BGHW)
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Prevention Early in Planning and Development

- Risk assessment support early in design
- Assessments according to EU Directives
  - Machinery Directive 2006/42/EC
  - OSH Framework Directive 89/391/EEC
  - Construction Site Directive 92/57/EEC
- Design improvements and template development for assessments in reality
- OSH by PtD in river lock standardisation
  - dynamic VR simulation of future river lock
  - OSH assessments in context of use
  - risk reduction during planning stage
- Project IFA5135 (UVB, BMVI, BG Verkehr etc.)

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Systematic Development of VR Training Environments

- Develop, integrate and evaluate VR module in training courses on risk assessment
- VR media support for qualification contents
- foster self-directed and experience-based learning
- Risk identification, assessment and reduction

- Project IFA5146 (BGN, HSK)

- Human Factors concept for SDVE: Structured Development of Virtual Environments
Conclusions

• Safety and Usability Through Applications in Virtual Environments (SUTAVE)
• VR is a tool that becomes alive through the application context
• Human Factors concept on SDVE is crucial for prevention in OSH context
• VR support for training calls for simulation plus an educational concept
• VR extends the effective range of prevention through design (PtD)
Thank you very much for your attention!

Virtual reality in human-system interaction

What is virtual reality?

In VR (virtual reality) users experience a simulated environment in which they can move around and interact with objects. They are submersed in a virtual environment, and through their senses, they receive information with which they can change the virtual environment, and to which they can react as if it were real.

www.dguv.de/ifa/sutave

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