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Extending the effective range of prevention by hazard and accident investigations in virtual reality

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Introduction

- Investigations of accidents and course of events serve
  - to reduce hazards, risks associated with human-system interaction
  - to improve safety and ergonomics in work systems design
- Virtual reality (VR) study on the usability of an additional safety measure for mobile elevating work platforms (MEWP)
  - task scenarios with operator-MEWP interactions in virtual settings
  - analysis of operator performance, workload and work activities

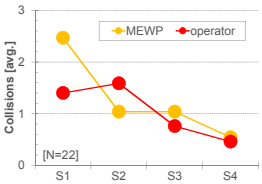
Methods

- Re-analysis of data from VR study (time series)
  - inspection and driving task performance in the work process (22 novice and professional operators in sessions of about 3 hrs)
  - analysis of operator control activities and MEWP movements
- Identification of course of events of accidents and near misses
  - accidents: collisions of operator and MEWP with environment
  - causal factors regarding interactions and information processing

Results

[Task setting in SUTAVE lab at IFA] [Photo: © Lungfiel/IFA]

[Hazardous situations for operator-MEWP interactions]



[Average no. of collisions in task scenarios]

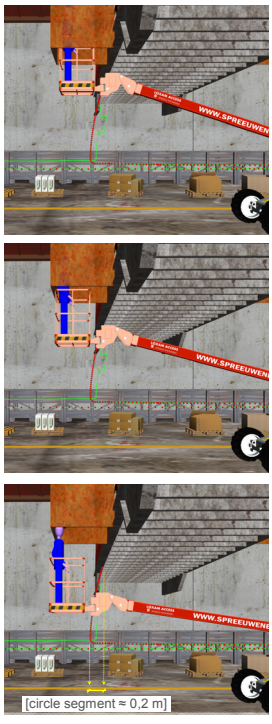
[MEWP movements during task performance]

[Working position for inspection]

[Reverse out of inspection position in circular arc (red dotted line)]

[Near miss collision of MEWP with environment]

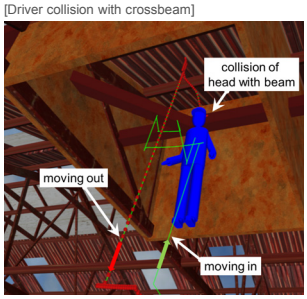
[Accident collision of operator with environment]



[High, narrow inspection area with crossbeam]

[Course of events of accidents and near misses, impairments of human information processing, ergonomics design requirements, safety measures]

[Driver collision with crossbeam]



Discussion

- Analyses of accidents and causal factors
  - reconstruction und modelling of course of events in VR
  - process of task performance, what when where, consequences
  - use of work equipment, displays and controls (interface design)
  - identification of accidents (some similar to those from reports), detection of near misses and safe interactions
- Impairments of human information processing
  - perception (hidden information, limited sight, darkness, VR)
  - action implementation (circular vs vertical down movement)

Conclusions

- VR extends analysis, design and evaluation for prevention
  - modelling hazardous work situations and processes
  - human-system interaction as work activities in progress
  - predictions for hazards and risks in given/future contexts of use
- Investigations of accidents and courses of events in VR
  - support systematic causal analysis
  - foster development of TOP safety measures
  - facilitate improved safety and ergonomics in machinery design