MOVING

Method for the optimization of indoor guidance and navigation systems

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Train stations gradually evolve from transport hubs towards complex infrastructures also containing shopping facilities, offices and hotels. Such multiple functions as transport hub, commercial and service center constitute a major challenge for providing a consistent and accessible guidance system and spatial ordering principle matching the user needs in their different contexts. All aspects of a guiding system should be taken into account already in the planning phase. It is therefore crucial to understand how people perceive and interact with the environment and information sources, and how their perception influences orientation and navigation behavior.

The main goal of MOVING was to develop of a novel technique for evaluating and optimizing guidance systems and navigation solutions in public infrastructures tailored to the needs of persons mostly unfamiliar with the infrastructure. The virtual environment DAVE (Definitely Affordable Virtual Environment) at Graz University of Technology and Fraunhofer Austria has been enhanced with eye tracking (Figure 1). In the virtual test environment test persons have to accomplish different assignments related to navigation and orientation.

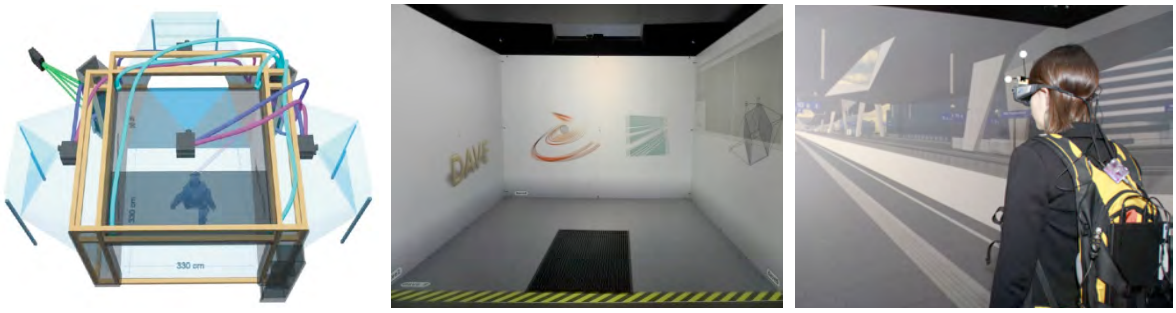

Figure 1. Immersive virtual environment DAVE and a test person equipped with eye tracking

The integration of an eye tracking system into the virtual environment enables not only a new level of data collection and data quality, but also a groundbreaking improvement and increased efficiency in the evaluation of eye tracking data applying a semi-automatic analysis. The intersections of the lines of sight with the 3D environment allow automatic identification of well-perceived objects. The perception of the objects can be visualized as point clouds in the 3D model (Figure 2). This visualization enables interactive exploration of

the users' attention in the 3D environment and helps to assess the perception of the guidance system in the tested infrastructure.

Figure 2. Test person in the virtual environment (left), eye tracking video frame with gaze point (center), visualization of attention (right)

Consolidating the perception information with the recorded motion data, thinking aloud comments uttered by the test persons during their motion, observations and interviews of the test persons reveals potential weaknesses in the guidance system and supports the development of improvements.

The 3D model of the main railway station in Vienna and the guidance system as planned in October 2013 served as a case study collecting data from 42 persons. In addition, a mobile navigation system was developed in order to test an alternative information provision. The results have been incorporated into a mathematical model for microscopic simulation of human wayfinding allowing a computer aided evaluation of guidance systems. The findings of the case study were compiled into guidelines addressing the current capabilities and shortcomings of the virtual environment and the simulation.

MOVING resulted in a technically functional virtual test environment allowing tests of highly realistic alternative scenarios already during the planning phase before implementation. The virtual test environment is still subject to some restrictions which need to be tackled (e.g. maximum height of the projection, delay in the response time of the navigation, simulation of dense crowds).

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