Evaluating Stereoscopic 3D for Automotive User Interfaces in a Real-World Driving Study

Abstract. This paper reports on the use of in-car 3D displays in a real-world driving scenario. Today, stereoscopic displays are becoming ubiquitous in many domains such as mobile phones or TVs. Instead of using 3D for entertainment, we explore the 3D effect as a mean to spatially structure user interface (UI) elements. To evaluate potentials and drawbacks of in-car 3D displays we mounted an autostereoscopic display as instrument cluster in a vehicle and conducted a real-world driving study with 15 experts in automotive UI design.

The results show that the 3D effect increases the perceived quality of the UI and enhances the presentation of spatial information (e.g., navigation cues) compared to 2D. However, the effect should be used well-considered to avoid spatial clutter which can increase the system's complexity.
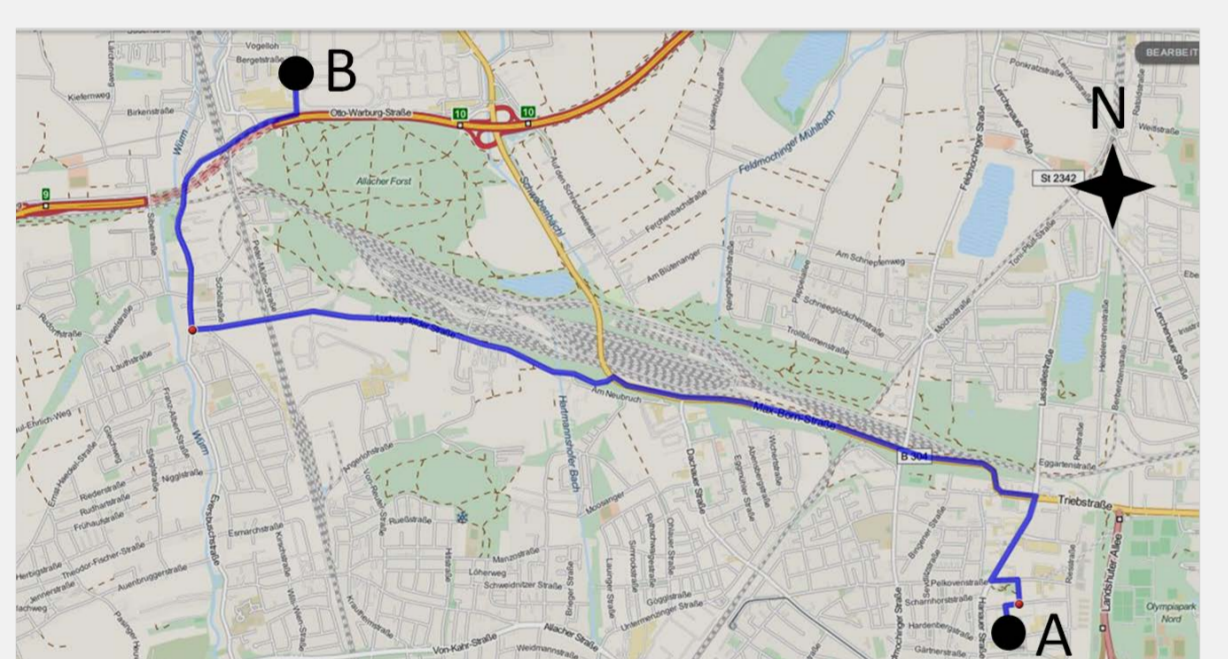
Test vehicle

The test vehicle is equipped with a 13.3" autostereoscopic display as instrument cluster. The display uses lenticular lenses and eye tracking technology to adjust the sweet spot.

Instrument Cluster Concept
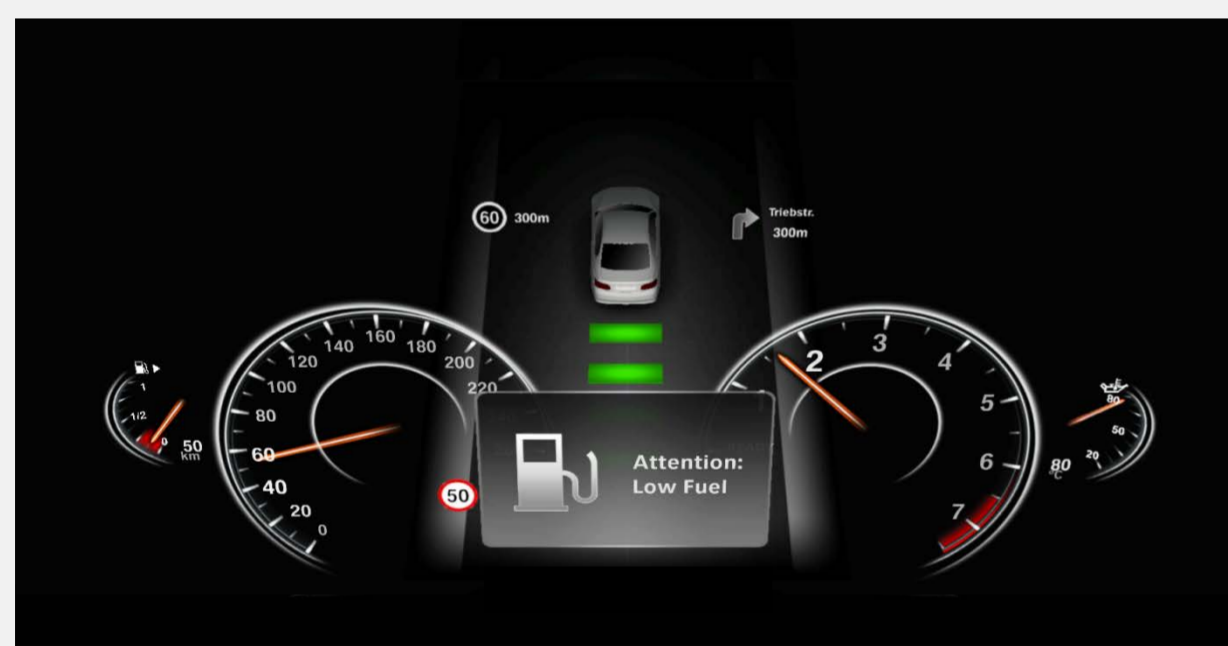
The depth layout of the instrument cluster follows the current importance of the UI elements.
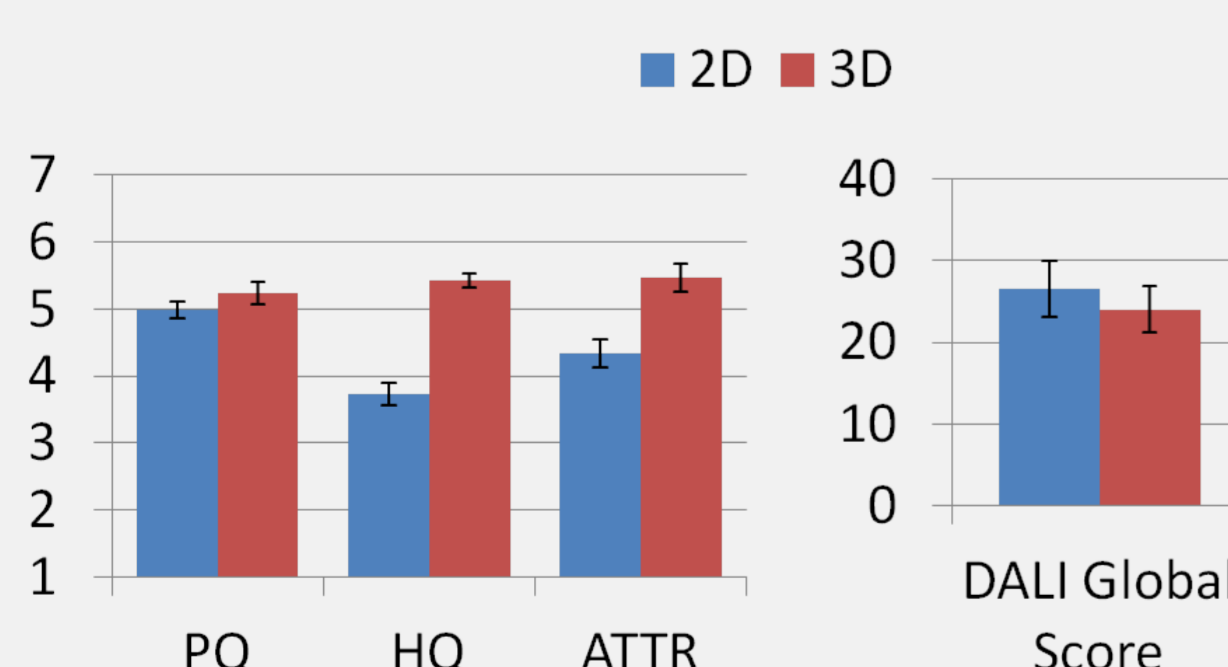
Test Track

For the real-world study the participants drove a defined test track in a city environment. They conducted two drives: the first from A to B and the second from B to A.

Participants

We choose experts as participants for two reasons: First, to maximize road safety. Second, to get feedback from experienced professionals.

AttrakDiff and DALI

The results of the AttrakDiff and DALI show that 3D increases the hedonic quality and the attractiveness of the system while it does not negatively influence the driver's load.

Expert Evaluation

- 15 participants aged 28 to 43 (M = 32.6, SD = 4.48)
- Experts in developing novel user interfaces for cars
- Real-world driving scenario
- Two drives: One with a monoscopic (2D) and one with a stereoscopic (3D) version of the instrument cluster
- Evaluation using AttrakDiff, DALI, and semi-structured interviews

Results of the real-world study

- Evaluating a 3D user interface while driving in the real world shows similar results as former lab studies.
- 3D increases the hedonic quality and communicates spatial relations in an unambiguous way.
- A well-considered use of 3D depth can declutter the displayed content.
- However, unexpected depth positions of objects and many depth layers can induce spatial clutter.

Side view of the instrument cluster showing the depth layout of the UI elements.

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