

# How to interact with a highly automated vehicle

## Generic interaction design schemes and test results of a usability assessment

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### **Abstract**

With increasing technical feasibilities in the automobile domain more and more driving tasks can be automated. That makes the introduction of several assistance functions up to highly automated driving possible. The focus of this paper is on the interaction design for highly automated vehicles presenting selected results of a usability assessment that was conducted with a first prototype of such a vehicle in a fixed-based driving simulator. In this paper, the key interaction design principles for a highly automated vehicle are presented that were developed within the EU-project HAVEit. One essential issue of highly automated driving are the transitions between different levels of automation. Selected results of a usability assessment testing the design principles for the transitions with eight users in a fixed-based driving simulator are presented. For normal transitions the results showed overall good subjective ratings regarding the ease of understanding and the handling quality. Some usability problems were detected with one of the tested switching devices. For automation initiated transitions (take-over requests) some problems occurred with a too conservative interaction design for take-over situations. Refused transitions were always recognized and handled in a safe way by all participants. The overall acceptance of highly automated vehicles was quite high.

### **Introduction**

During the last decades more and more driver assistance systems were brought into vehicles to increase driving safety and driving comfort. Some of these driver assistance systems do not only offer assistance but allow for automation of one or more aspects of the driving task. Examples are the Adaptive Cruise Control System (ACC) that can control the vehicle at a preselected speed and maintains an adequate time headway to a lead vehicle or the Lane Keeping System (LKS) that can apply relatively strong steering torques to keep the vehicle in the lane.

One approach to combine the different assistance systems that are already available in serial vehicles and to enrich it with further capabilities of automation are so called highly automated vehicles. Highly automated vehicles have automation capabilities in a spectrum from manual up to highly automated driving or even fully automated driving (Figure 1). In these vehicles the driver can switch between different levels of

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