Development and Evaluation of Methods to Assess Controllability and Safety in Use Within the UR:BAN Project

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The subproject UR:BAN KON "Controllability" developed and evaluated methods which can be used to assess safety and controllability in early-stage development of new driver assistance systems. The empirical studies focused on assistance systems helping the driver to avoid collisions in time-critical scenarios. Although these advanced driver assistance systems get more and more "intelligent" and "efficient" they also get more complex which poses a great challenge for the assessment and evaluation of safety and controllability. Especially, emergency steering and evasion assistants require strong interventions which makes it more difficult to control a false positive activation. However, these advanced driver assistance systems could also help to avoid casualties, as in many cases it can be assumed that the driver would not have been able to avoid a collision at all.

Within the subproject KON we tried to address this problem by exemplarily analysing emergency steering and evasion assistants which help the driver to avoid collisions in time-critical scenarios. We could identify several factors like the available manoeuvring space, the drivers' attention and characteristics of the system design, which have an influence on controllability in case of a false positive activation and safety in use. To optimize efficiency of the safety and controllability assessment we evaluated the applicability of several existing research environments, like driving simulation, the so called Vehicle in the Loop (VIL), which combines elements of driving simulation and a real vehicle, and real vehicle testing on a closed test track. Additionally, new approaches to assess controllability were tested which focus on the reactions of the surrounding traffic instead of solely considering the reactions of the affected driver.

In the following chapters, we will start with methodological questions of controllability assessment (Chap. 25), which focus on the validity and applicability of different research environments. Using basic driving tasks as an example the results of a study will be pre-

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sented which compares driving simulators (static/dynamic) and the Vehicle in the Loop with real vehicle testing on a closed test track. The results will be discussed regarding potential application areas of the addressed research environments and whether it is possible to generalise the environment specific results.

Chap. 26 focuses on studies with the Vehicle in the Loop. Two studies will be reported. The first study analysed how occupied opposite lanes influence the drivers' reaction in case of an intervention of an emergency steering and evasion assistant. The second study dealt with the reaction of the surrounding traffic in case of steering system failures. Based on the results of this study it will be discussed whether the surrounding traffic can be considered when assessing controllability.

Chap. 27 dedicated to the methodological aspect of test scenario design. It focuses on the influence of the available manoeuvring space in case of a false positive activation. Additionally, methods to detect the drivers' override intention based on objective data will be presented and discussed regarding their applicability to differentiate between true positive and false positive interventions.

With respect to controllability aspects, Chap. 28 discusses potential intervention strategies which can be used to design an emergency steering and evasion assistant and summarises current findings. The results of real vehicle and driving simulator studies will be reported, which focussed on the effect of warning and driver intention/override detection concepts. Based on these results and a literature review recommendations for the design of emergency steering and evasion assistants will be given.

The last chapter (Chap. 29) addresses the influence of secondary tasks on the drivers' reaction in case of an erroneous steering intervention. Different ways to induce driver distraction will be discussed and two exemplary studies will be reported.