The multi-driver simulator – a new concept of driving simulation for the analysis of interactions between several drivers

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Abstract

Recently, there has been an increasing demand for test methods which encompass the dynamic interactions between road users. One way to respond to this demand is a new concept of driving simulation called "multi-driver simulation". This simulation consists of several cockpits with one driver controlling a simulated vehicle. Each of the drivers has the same virtual environment; all of the drivers can see each other and react to each others' behaviour. Aim of the present study was to identify new parameters to evaluate multi-driver tests regarding driving behaviour of the whole driver group. Using these parameters, traffic situations with several road users can be described. Therefore, four platoons of four subjects ($N_{total}=16$) drove a country road course two times. In one run, the drivers had to perform a cognitive secondary task while driving. For the single driver, the secondary task has positive effects concerning lane keeping. Regarding longitudinal control, the secondary task has no effect. These findings are the same for the entire platoon: The new parameters describing variability, dimension or coherence of the platoon reflect the results for the single driver concerning longitudinal and lateral control. These results confirm that the multi-driver simulation is an appropriate tool to describe the driving behaviour of a single driver and his/her interaction with other drivers as well as the driving behaviour of the entire group of drivers.

Introduction

Need for the analysis of driver interactions

In recent years, the developments in traffic and technology caused an increasing interest in the analysis of interactions between road users. For example, on German highways, traffic density and traffic intensity are increasing continuously (Fitschen & Nordmann, 2008). Therefore, drivers have to react to each other to a higher extent and to adapt their driving behaviour rapidly to the manoeuvres of other drivers. Up until now, several studies have dealt with this topic (e.g., Brookhuis, de Waard, & Mulder, 1994).

Due to the above-mentioned problem of higher traffic density, technical aids and solutions like Car2X-technology were developed (Kleine-Besten, Kersken,