A three-level model of Situation Awareness for driving with in-vehicle devices

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Abstract

Based on theoretical considerations and empirical evidence on Situation Awareness (SA), a three-level model of Situation Awareness in using in-vehicle devices while driving is proposed: SA can be first measured at a “planning level” where the general willingness to additional task performance is influenced by the awareness of associated risk while using in-vehicle devices in different traffic situations and the awareness of own skills and abilities. On a “decision level” SA can be seen in the actual decision for performing a task based on the estimation of current situational demands. During secondary task execution a situationally aware driver monitors the development of the situation via short glances back to the road and adapts his behaviour according to the changed situational demands (“control level”). Evidence for the assumed levels is given by 24 participants completing a 1 hour test course in a motion-base driving simulator containing different complex situations on rural and urban sections. At predetermined points of the route an additional task was offered to the driver (reading numbers from a visual display aloud). Each time he or she had to decide whether the actual situation was suitable for starting a task and for how long it could be executed. The results show evidence for the influence of SA on all the three levels on secondary task performance while driving: Drivers rejected more tasks in demanding situations and adapted eye glance behaviour to situational requirements. Individual differences in compensation strategies were based on drivers’ risk perception of using in-vehicle devices while driving.

Theory

Extended research has been done on the effects of dealing with in-vehicle devices while driving. The overall result is that performance of an additional secondary task clearly reduces driving performance and safety. Typical effects are a decrease in lateral control (e.g. Törnros & Bolling, 2005) or delayed reaction times to sudden events (e.g. Strayer & Drews, 2004). On the other hand, compensation strategies in the primary task of driving can be monitored, e.g. reduction of speed (Horberry et al., 2006), an increase of safety margins (Ishida & Matsuura, 2001) or fewer lane changes (Beede & Kass, 2006). An often neglected fact is that drivers are also able to compensate additional workload by specific interaction strategies for dealing with the secondary task. As McCartt et al. (2006) argue: “phone and driving tasks are