Different alarm timings for a forward collision warning system and their influence on braking behaviour and drivers' trust in the system

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Abstract

Alarm timing for a forward collision warning system plays an important role in system effectiveness. It is necessary to determine the appropriate alarm timing by considering a driver's response to not only true alarms but also how drivers respond when an alarm should have been issued but was not (missed alarms) to evaluate both the increased system effectiveness and decreased over-reliance on the system. By using a driving simulator, two different alarm timings were compared to investigate the braking behaviour toward alarms and the driver's response to missed alarms according to two different alarm timings: (1) adaptive alarm timing, in which an alarm is given based on the ordinary braking behaviour of the individual; and (2) non-adaptive alarm timing, in which an alarm is given by using a particular alarm trigger logic (e.g., Stopping Distance Algorithm) as a common timing for all drivers. As a result, the timing of non-adaptive alarms was earlier than that of adaptive alarms in this study. The results show that, in comparison with adaptive alarm timing, non-adaptive alarm timing induced early braking behaviour independent of the degree to which a collision was imminent. However, adaptive alarm timing did not impair the driver's subjective ratings of trust. In addition, adaptive alarm timing contributed to consistent trust, even if missed alarms occurred.

Introduction

The reduction of traffic accidents is an important research goal, and rear-end collisions are one of the most common types of accidents. The Forward Collision Warning Systems (FCWS) may be of great potential benefit to drivers who do not pay sufficient attention to driving, because these systems may reduce the number of traffic accidents (Alm & Nilsson, 2000; Ben-Yaacov et al., 2002). However, rear-end collisions tend to occur in time-critical situations; therefore, the expected results depend on when the alarm is triggered (Janssen et al., 1993). When determining the alarm timing, the Stopping Distance Algorithm (SDA) is often used (ISO, 1999). SDA is so termed because a warning distance is defined based on the difference

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