

# Influences of driver visual distraction on unnecessary alarms and driver braking behaviour

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## Abstract

Automobile manufacturers have been developing forward collision warning systems (FCWS). Concern has been expressed about unnecessary alarms, which are defined as alarms occurring when a system is working as designed but the situation does not constitute a true collision threat. The problem with unnecessary alarms is that drivers may stop responding to alarms appropriately if the frequency of unnecessary alarms becomes too high. Moreover how drivers assess triggered alarms as unnecessary may be affected by whether they are visually distracted or looking ahead properly. The objective of this research was to clarify effects of driver visual distraction on alarm effectiveness and necessity for FCWS by comparing results obtained in two driving simulator studies. In the first driving simulator study, an alarm timing was proposed for decreasing unnecessary alarms by considering how to maintain time headway (THW) during car-following for individual drivers. In the second study, we investigated how alarm effectiveness for decreasing collision risk and subjective ratings of unnecessary alarms were affected by driver distractions. Results show that the presence of alarms induced decreases in collision risk when drivers were distracted. Contrary alarms could not lead to a decrease of risk when drivers were not distracted although alarms were given with the same timing. Moreover, subjective ratings of unnecessary alarms varied according to whether driver distraction occurred.

## Introduction

Automobile manufacturers have been developing forward collision warning systems (FCWS). FCWS are thought to be of great benefit to drivers who fail to pay sufficient attention to the road ahead, and so their introduction should result in a decrease in accidents (Alm & Nilsson, 2000). The criteria that determine alarm presentation are critical to the system design of FCWS for determining system effectiveness, as forward collisions normally occur in time-critical situations (Janssen & Nilsson, 1993). Early alarms have the potential to provide more effective warning of imminent collisions than later alarms in some situations (Lee, McGehee, Brown, & Reyes, 2002). However, concern has been expressed about unnecessary alarms (Dingus, Jahns, Horowitz, & Knipling, 1998), which are defined as alarms