The effects of preliminary information about adaptive cruise control on trust and the mental model of the system: a matched-sample longitudinal driving simulator study

Matthias Beggiato & Josef F. Krems
Chemnitz University of Technology
Chemnitz, Germany

Abstract

Advanced driver assistance systems, such as adaptive cruise control (ACC), aim to support the driver by automating driving subtasks, for example, speed and distance control. In order to adequately make use of such systems in a safe manner, a correct mental model of the system's functionality is required. The present study investigated the effects of preliminary information about an ACC on the mental model and trust in the system over time. A matched sample of 51 participants drawn from 396 applicants was assigned to three experimental conditions. Every group received one of three different descriptions of an ACC, realistic, idealistic and wrong. The realistic scenario informed participants of all potential system failures; the idealistic one contained no information about possible failures; and the wrong scenario gave additional information about potential failures that, however, did not occur. All participants drove the same 56-km track of highway in a driving simulator three times within 6 weeks. Results of the sampling process, effects of preliminary information on the mental model as well as changes in trust over time are presented.

Introduction

From the perspective of cognitive psychology, driving a car is a very complex task. A driver has to perceive and understand all of the relevant characteristics of a situation to make appropriate decisions about taking the best course of action. Advanced driver assistance systems (ADAS), such as adaptive cruise control (ACC), aim to support drivers by automating driving subtasks such that comfort and safety are enhanced. ACC partially automates speed and distance control by maintaining a driver-set vehicle speed. Additionally, the system adjusts vehicle speed in relation to a preceding vehicle, in order to maintain a pre-selected time headway. However, ACC detection problems may occur in some situations, such as in navigating narrow bends, in bad weather conditions or when small vehicles precede the driving vehicle. In these cases driver intervention is required. The positive effects of the automated system may be furthermore diminished or even inverted by unintentional changes in user behaviour. Behavioural adaptation, which is induced by the use of automated ADAS, is a well-known phenomenon. However, results are heterogeneous regarding

In D. de Waard, N. Merat, A.H. Jamson, Y. Barnard, and O.M.J. Carsten (Eds.) (2012). *Human Factors of Systems and Technology* (pp. 63 - 74). Maastricht, the Netherlands: Shaker Publishing.