

Overriding the ACC by keys at the steering wheel: positive effects on driving and drivers' acceptance in spite of a more complex ergonomic solution

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Abstract

Partial automation of the driving task by driver assistance systems (e.g. ACC) is often criticized for changing the driving task to a monitoring one. Therefore, it is in discussion to offer the driver additional possibilities of control. In this study, a new type of ACC (so-called "ACC-plus-keys") was introduced which allowed the driver to override the ACC temporarily. By pressing additional keys at the steering wheel the driver could choose between different ACC characteristics: a key on the left led to stronger deceleration at shorter distances, a key on the right initiated stronger acceleration. Twenty participants drove a motorway simulator-ride three times: without ACC, with ACC and with ACC-plus-keys. Each ride took about 20 minutes.

The ACC-plus-keys had positive effects on driving and drivers' judgements. Firstly, driving safety of ACC and ACC-plus-keys were comparable, although the additional keys were used frequently. Secondly, driving with ACC-plus-keys resembled manual driving more (e.g. while overtaking). Thirdly, drivers gave higher acceptance ratings for ACC-plus-keys. Thus, ACC-plus-keys is a successful attempt to give the driver control without losing the advantages of this assistance system.

Introduction

Introducing Advanced Driver Assistance Systems (ADAS) into a car implies a change in task requirements for the driver: whereas drivers are responsible for navigation, manoeuvring and stabilization of the car while driving without assistance (e.g. Bernotat, 1970), most ADAS take over defined parts of this task. Though numerous studies report beneficial overall effects of ADAS, it is often criticized that using ADAS might lead to a reduction in driving activity as well: the role of the driver changes from active and non-assisted driving to assisted driving plus monitoring the system, which is typically assumed to be less demanding for the driver. However, monitoring ADAS implies that the driver is no longer "in the loop" as he only has to take over and solve the situation himself in safety-critical situations (e.g. Lee & See, 2004; Muir & Moray, 1996; Parasuraman & Riley, 1997; Parasuraman, Sheridan, & Wickens, 2000). Therefore, monitoring ADAS presents different demands to the driver as compared to manual driving. Accordingly, ADAS

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