Objective and subjective assessment of warning and motor priming assistance devices in car driving

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Abstract

This paper deals with moderately intrusive driving assistance devices that intervene when lane departure is imminent. A previous simulator study (Navarro *et al.*, 2007) showed that motor priming devices were more effective in assisting drivers than other lane departure warning systems. Such motor priming devices prompt the driver to take action by means of an asymmetric steering wheel vibration. This current experiment is aimed at gaining a deeper understanding of motor priming mechanisms. It raises the question of whether it is more efficient because it provides motor cuing, because it provides directional information on the steering wheel, or because the haptic modality elicits a faster response from the driver. In addition, subjective data were used to assess drivers' acceptance of the assistance devices. Results confirm that motor priming devices are more effective than auditory and vibratory warning devices during recovery manoeuvres. Neither the site of stimulation, nor the modality used for conveying information, appeared to play a significant role in the results. Interestingly, subjective data showed that drivers globally preferred auditory warning devices to motor priming devices. These results support the hypothesis that motor priming devices directly intervene at the motor level, in contrast to more traditional warning systems that act at the level of situation diagnosis.

Introduction

A significant number of all road accidents can be linked to lane departure. Bar and Page (2002) have estimated that accidents following an unintended lane departure represent about 40 percent of all crashes and about 70 percent of all road fatalities. In order to reduce the number of such accidents, various types of assistance devices are being investigated. These are expected to help drivers maintain a safe position in their lane. They rank from a simple warning when the vehicle is about to leave its lane to a complete delegation of lateral control. In all cases, cooperation between the driver and the automation will take place (Hoc, 2001). Hoc and Blosseville (2003) put forward a four-level classification system in order to categorize types of car-driving assistance within the framework of human-machine cooperation. All the

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