Human machine interface for a dual mode vehicle

Amon Rambaldini, Antonella Toffetti, & Claudio Arduino
Centro Ricerche Fiat CRF
Orbassano, Torino, Italy

Abstract

The European Project CityMobil is about automation in vehicles. CityMobil cars can have different levels of automation, from highly automated vehicles (e.g. Dual-Mode Vehicles in E-lane scenario) to innovative city cars with some kind of transition of driving controls. In particular, CRF simulated, in the Virtual Reality simulator, a multi-lane road mixed scenario with E-lane infrastructure with a fully automated driving and normal road tracks with complete manual driving. Fully automatic driving means that the drivers neither have to bother about the steering wheel nor the pedals. The aims of the CRF experiment were:
- To design a couple of user interface solutions through an iterative design process (typical for a user-centred design approach) with the purpose to define content, logic and layout to communicate to the drivers the shift of control between driver and automated vehicle;
- To conduct usability tests, involving drivers to find out the best interface solution. In particular, investigate users' attitudes and behaviours during the interaction with a Dual-Mode Vehicle, evaluate the perceived usability of a multi-modal interaction interface and highlight users' judgments and performance with the different interfaces.
This paper presents a description of the experiments (e.g. the virtual scenario, the different user interfaces, the primary and secondary tasks, the experimental design) and some of the obtained results.

Introduction

The purpose of this driving simulator experiment was to design and test a vocal versus a simple acoustic user interface for a dual-mode vehicle driving on a so-called eLane. In the acoustic condition, the human-machine interface was constituted by simple sounds ("beeps") and visual messages displayed at the right of the steering wheel. In the vocal condition an acoustic and visual interface were supported by vocal messages (i.e. spoken words). The main purpose of the interface was to support the transition of control between driver and automated mode of the vehicle, and vice versa, both initiated by the driver and by the system. The users' attitudes and behaviours during the interaction with the dual-mode vehicle and the interface were assessed with questionnaires and observational grids in order to analyze the driver performance.