

## Autoconduct

### **Adaptation of the automation strategy of autonomous vehicles (levels 3-4) to driver needs and driver state under real conditions**

### ***Adaptation de la stratégie d'automatisation des véhicules autonomes (niveaux 3-4) aux besoins et à l'état des conducteurs en conditions réelles***

**Funding:** National (France)

**Duration:** Dec 2016 - Dec 2019

**Status:** Complete with results



#### **Background & policy context:**

Based on a users-centered approach, the AutoConduct project aims at designing a new Human-Machine Cooperation strategy adapted to the driver's state. This project proposes to provide advanced monitoring of the driver's state by combining different diagnostics in order to adapt the management of interactions between the driver and the automations of the vehicle in real time.

#### **Objectives:**

The main scientific and technological objectives are:

1. The assessment of acceptance (a priori acceptability and use acceptance) by drivers of the delegated vehicle in order to identify their expectations and needs (functional, HMI, training) as well as the development of innovative methodologies and adapted evaluation.
2. The design, the validation and the fusion of the driver states diagnoses through objective measures of indicators on three dimensions: physical state (characterized by posture), perceptual state (modeled by visual strategies ) and the internal state (characterized by physiological measures of attentional and emotional states).
3. The design and the evaluation of a progressive mode of shared control (by haptic interaction modality) based on a physiologically valid model of sensorimotor control.
4. The integration of all these diagnoses, modes of information and control in an adaptive management strategy of cooperation with the driver.
5. The integration into real vehicles to evaluate both the active functionalities on-track and the monitoring functionalities on-the-road. This approach will able to build and test an overall indicator of the driver's state.

**Other funding sources:** Agence Nationale de la Recherche

#### **Lead Organisation:**

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**Key Results:**

The first phase (December 2016-June 2018) has consisted in defining and making consistent the different states of the art, the use cases, the needs analyzes as well as the specifications of the diagnoses and strategies of human-machine cooperation.

1. A needs analysis was conducted through questionnaires on 2619 people and 6 focus groups. The results showed that the higher their acceptability of automated vehicles is, the more they choose high levels of automation. This choice is mainly important when individuals project themselves in a motorway driving condition rather than in a urban driving condition.
2. An analysis of the driver profiles, including age and driving experience, was conducted and different design proposals for Human-Machine Interactions for the final experimental vehicles were developed based on driver preferences.
3. Another objective being to create algorithms about postural diagnoses, visual strategies and internal states, specific data were collected in dedicated simulator experiments. In addition, another part of the work has focused on a new concept of shared control of the steering wheel with the aim of developing an evolutionary control law adapted to the problem of transitions between manual and automated controls and based on a cybernetic model of the driver.
4. In parallel, the specifications of the driving strategies and the principles of Human-Machine Cooperation were highlighted in order to define both the criteria and the methods of transitions between automated and manual modes taking into account the driver's monitoring. Finally, an architecture and the choice of an integration platform for all the data have been specified.

**STRIA Roadmaps:** Cooperative, connected and automated transport

**Transport mode:** Road transport

**Transport policies:** Safety/Security

**Geo-spatial type:** Other