MAIF FONDATION

VINCI AUTOROUTES FONDATION
Pour une conduite responsable

PRESS RELEASE

2 FEBRUARY 2018

STUDY

(Re)learning how to drive using advanced driver-assisted systems to securely facilitate the transition towards self-driving vehicles

The increasing number of advanced driver-assisted systems (ADAS) in vehicles should significantly improve road safety in the years ahead. And yet, with ADAS, particular attention must be paid to taking back control of the vehicle in a risky situation. In this context, the VINCI Autoroutes Foundation for responsible driving and the MAIF Foundation have published the results of an unprecedented study conducted as part of their research programs. This work carried out in a laboratory by the Centre for neurocognitive and neurophysiological research (Ci2N) at the University of Strasbourg and the CNRS (French scientific research Centre), has enabled us to measure drivers' ability to take back control of their vehicle equipped with adaptive cruise control and a lane keeping system (LKS). In particular, the study reveals the longer reaction time and risks of lane departure before regaining complete control of the vehicle. It is therefore essential to raise drivers' awareness of the correct use of ADAS and support them through the transition phase towards self-driving vehicles.

- **Increased reaction time**
- **Lower attentiveness when ADAS are activated**
- **Significant risk of collision in the event of a non-detected obstacle**
- **Less accurate trajectory monitoring**

Conducted in a driving simulator, the study involved asking 60 subjects to complete a 53 km motorway trip. Starting at kilometre 10, the drivers had to permanently activate the adaptive cruise control and the trajectory monitoring system. They could take back control of the vehicle whenever they though the situation required to do so. Two successive random events occurred during the trip:

▶ **Event 1:** at kilometre 23, a truck followed in the right-hand lane pulled out into the passing lane to pass by a work zone. As the ADAS did not detect this on its own, the driver had to take back control of the vehicle travelling at 110 km/h to avoid hitting the cones and the work truck. **The purpose of this scenario was to test drivers' reactivity when they had delegated a function to the ADAS (in this case, adaptive cruise control and the inter-car distance detection).**

▶ **Event 2:** at kilometre 43, on a curve, the subject was warned by visual and then audible messages that the vehicle's automatic trajectory monitoring system would be deactivated and that the driver had to take back control to keep the vehicle in its lane. **The purpose of this scenario was to assess the effect that confidence in ADAS has on driver distraction and inattentiveness.**

"The results of this study show that a motor action requiring planning and complex execution may require a longer time when the brain must first disengage from other so-called distractive tasks."

Professor André Dufour, Director of Ci2N in Strasbourg

Semi-automated driving systems lead to longer reaction times and an increase in drowsiness episodes

Whatever the ADAS, when a driving function is delegated to the vehicle, **the reaction time is more than double compared with non-assisted driving** when the driver takes back control of the vehicle. For example, with the adaptive cruise control and inter-car distance detection system, the reaction time is 2.2 seconds on average, that is 67 metres travelled at 110 km/h, or 30 metres more than a normal reaction time (which is between 1 and 1.5 seconds).
When deactivating the lane keeping system (scenario 2), **the time required to safely regain control of the vehicle,** that is, the time between activating the vehicle controls after a warning and a complete re-adjustment of the trajectory, **is on average 4.5 seconds, that is, over 130 metres travelled** and up to 6 seconds for drivers aged over 60. Despite the visual and then audible warnings, this significant delay may reflect the driver's state of inattentiveness attributable to semi-assisted driving.
Fatigue measurements (objective - spectral power of cerebral oscillations – and subjective - Karolinska sleepiness scale) indicate **a drop in attentiveness within the first 10 minutes,** that is twice as quickly as with non-assisted driving[1] for all drivers.

Reflexes not always adapted to avoid risk situations

The analysis of trajectories and controls activation (steering wheel, brakes and accelerator) revealed inappropriate reflexes: **more than 1 driver out of 4 (27%) turned the steering wheel in the wrong direction.**
In the first scenario, these reflexes prevented the drivers from avoiding the work zone: **more than 1 driver out of 3 (35%) collided with the orange cones and 10% with the work truck ahead.** In the second scenario, **the drivers did not manage to keep the vehicle appropriately within the lane** to ensure their safety and that of other road users (on average, the vehicles swerve by 1.25 m).

"The rollout of ADAS will in the long term lead to a significant improvement in road safety. However, these functions currently should not incite drivers to disengage from driving and to rely wholly on these tools. At this stage, and for a few years to come, drivers must be able to take back control of the vehicle at all times in a completely safe manner."

Bernadette Moreau,
General delegate of the VINCI Autoroutes Foundation

"Vehicles with ADAS will undoubtedly make it possible to avoid certain accidents, but they are still far from being self-driving and may lead to drivers being overconfident and inattentive. This study shows exactly that. It is therefore essential to remain concentrated on the driving to handle emergency situations, which are by definition relatively unforeseeable."

Marc Rigolot,
Director of the MAIF Foundation.

Given these results and convinced that self-driving vehicles will eventually lead to progress in road safety, the VINCI Autoroutes Foundation and the MAIF Foundation wish to raise driver awareness on the proper use of ADAS. In particular, they strongly call drivers to :

- **remain attentive and avoid the use of distracting devices ;**
- **read all ADAS instruction manuals ;**
- **make sure they are well versed in how to activate and deactivate these systems ;**
- **avoid using these systems in risky areas (works zones, stop-and-go traffic, etc.) ;**
- **stop as the first signs of fatigue appear or at least every two hours.**

1. *Compared with a control group under equivalent conditions (Ci2N study on the impact of cruise control and speed limiters - July 2013).*

Methodology

Conducted on a driving simulator, this study involved 60 subjects divided into three groups of 20 drivers defined by their age: 20 to 30-year olds (young drivers), 40 to 50-year-olds (mature drivers) and over 60-year-olds (senior drivers). Each group had an equal number of men and women. In good health and physical condition, they met the attentiveness and caution levels required for the study: not on any medication, no sleep deprivation, no intense physical activity the previous day and no alcohol consumed in the 48 hours prior to the experiment. The subjects had to complete a 53 km motorway trip. The trip began on a motorway rest area before entering the motorway. The first 10 km were completed without activating the vehicle's ADAS systems. From kilometre 10, drivers had to activate and keep the advanced driver-assisted systems engaged (the adaptive cruise control and inter-car distance detection system and the lane keeping system). They were allowed to take back control of the vehicle if they thought that the driving conditions required so. At kilometres 23 and 43, two events occurred: respectively, the failure and deactivation of the ADAS. In the first case, as the vehicle approached a work zone, the subject had to take back control of the vehicle travelling at 110km/h to avoid colliding with the orange cones and the work truck, which had not been detected by the adaptive cruise control system. The driving parameters measured during the scenario were compared to a condition control from a previous study with the same scenario (Study on the impact of the cruise control and speed limiters on driver vigilance, VINCI Autoroutes Foundation). In the second case, travelling along a curve, the subject was warned by visual and then audible messages that the vehicle would deactivate the trajectory monitoring system. A manual driving control condition could obviously not be developed for this scenario; the reaction times have been referred to previous studies conducted by the Ci2N and to standards of scientific literature.

About the University of Strasbourg's Centre for neurocognitive and neurophysiological research (Ci2N) and the CNRS (French scientific research centre)
The Ci2N, headed by Professor André Dufour, is a laboratory reporting to both the University of Strasbourg and the CNRS (French scientific research centre). The research conducted by this laboratory concerns human cognition in the broad sense of the term, and more specifically the mechanisms of perception, memory and attention. The laboratory's researchers have more than 20 years' experience in creating experiment protocols and have applied their knowledge of how the human brain works to suggest innovative studies and applications in the area of automobile driving and road safety. Ci2N's research may be financially supported by the University of Strasbourg Foundation.
www.ci2n.fr
www.fondation.unistra.fr

About the VINCI Autoroutes Foundation for Responsible Driving
Created in February 2011, the VINCI Autoroutes Foundation for Responsible Driving is a laboratory, observatory and source of information specifically focused on improving road safety. It aims to help bring about change in driver behaviour and to encourage drivers to contribute to their own safety and to that of other road users. Its actions include: information campaigns to raise awareness of road risks; funding for innovative scientific research in certain areas of risky driver behaviour that have not been sufficiently explored or are poorly identified by road users; and finally support to initiatives from non-profit associations or citizen aimed at encouraging responsible driving.
www.fondation.vinci-autoroutes.com and Twitter account: **@FondationVA**
www.roulons-autrement.com and Twitter account: **@RoulonsA**

About MAIF Foundation
The MAIF Foundation is a FRUP (foundation with recognised public interest). As a non-profit organization, it aims to study human behaviour in the world around us in order to prevent the everyday risks that affect people and property. Its work is concentrated in four main areas: mobility risks, everyday life risks, digital risks and natural risks. Convinced that prevention is better than cure, the MAIF Foundation develops prevention and training tools, and implements concrete awareness actions targeting the general public and institutions. The effectiveness of these tools is based on the scientific analysis of risks and how they occur. This leads to a better understanding of the human, technical or natural origin of accidents and ways to prevent or mitigate the effect of better identified risks.
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