BRidging gaps for the adoption of Automated VEhicles

NEWSLETTER № 5 OCTOBER 2020

EDITORIAL

The project is heading towards its closure in February 2021, and we are now in the final stretch.

As many other EU-funded projects, BRAVE has been impacted by the Covid-19 crisis. But even at a slower pace, we have still been active and we are now fully back on tracks. In this fifth newsletter, you can find insightful content regarding a large population survey on acceptance, a VR walking simulator study, results from our Test session #5 and BRAVE proposals to regulation and EuroNCAP working groups.

Also, stay tuned for our final event, either organized on-site or online to wrap up the project and present our results.

Get on board and enjoy the reading!

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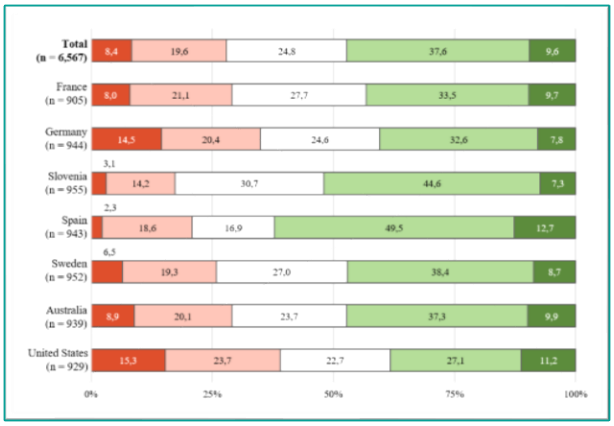
BRAVE population survey on the acceptance of and trust in conditionally automated cars

In BRAVE's work package 2 "Multidisciplinary study and specification of user's and stakeholder's requirements" the opinions of different road users groups – especially of the vulnerable road users (VRU) pedestrians, cyclists and motorcyclists – about conditionally automated cars (CACs) where explored by a population survey of road users that was conducted in the EU member states France, Germany, Slovenia, Spain and Sweden as well as in Australia and in the USA. The online survey was carried out from December 2019 to February 2020. In each of the seven countries participating in BRAVE, almost 1,000 respondents answered the questionnaire.

The findings on the general a priori acceptance of CACs indicate a rather positive attitude of the respondents. With a relative majority, the respondents expect CACs to increase road safety as well as to be useful, easy to use and easy to communicate with. Nevertheless, a certain scepticism of the respondents can be detected when assessing the own intention to use such a car or the future interaction of the road users with CACs on the roads.

The general trust in CACs is also rated as rather positive by the road users surveyed. Almost half of the respondents express that CACs will be dependable, will act reliably and that they will overall trust in CACs. The level of general trust in CACs differs between the gender of the respondents, their age, their country of residence and their main transportation mode.

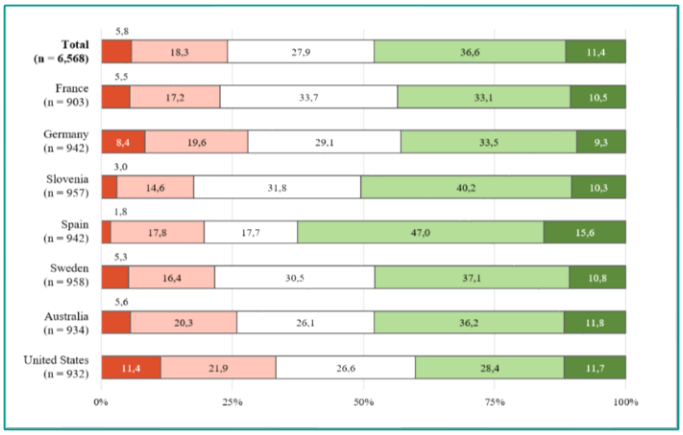


Results from BRAVE Population Survey to statement "Overall, I will trust conditionally automated cars"

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723021

A special focus of this study is on the acceptance of and trust in CACs from the perspective of the certain road user groups. To depict them, a fictitious interaction with a CAC in road traffic was described in the questionnaire that was specifically adapted to each road user group. In such a situation, respondents state that they would feel mostly neutral or safe. However, noticeable differences between the road user groups can be identified, with car drivers and pedestrians perceiving their subjective feelings as less safe than two-wheelers on a bike or a motorcycle.

Out of eleven listed benefits, the four most expected benefits of CACs relate to safer driving behaviour: sufficient distances to other road users, better emergency braking reaction times, stricter adherence to traffic rules and more predictable driving. Two-wheelers, whether on bicycles or motorcycles, more than pedestrians and car drivers expect the introduction of CACs to have an increased positive impact on themselves as road users. Males emphasise expected benefits of CACs more strongly than females.



Results from BRAVE Population Survey to statement "I think conditionally automated cars Will make roads safer"

The three concerns most strongly stressed are those relating to the reliable functionality of the CAC including the possibility of system failures, hacker attacks or the take-over situation of a CAC. The unresolved question of liability in the case of a crash and the technical ability to detect the behaviour of other road users are emphasised as further possible problems. Pedestrians and car drivers are often more strongly concerned than cyclists and PTW-riders. In addition, it is females who express concerns more strongly than males.

An ethical dimension of the introduction of CACs becomes apparent in the need to program the behaviour of the CAC in the case of an unavoidable crash. In the assessment of the ethical principles guiding the programming of the CAC, an inconsistency becomes observable: a vast majority of the respondents agree with an (utilitarian) approach which states that in the event of a crash the automated car should behave to minimize the overall number of fatalities. At the same time, most respondents prefer to sit in a car that protects the passengers against all other road users.

In its characteristic as a cross-sectional study, the BRAVE population survey can be used as a starting point for a future regular monitoring of the attitudes of the population of EU member states towards highly automated or autonomous driving. A detailed presentation and discussion of the findings of the BRAVE population survey can be found in Deliverable 2.3 "Report on the findings of the population survey", which can be downloaded from http://www.brave-project.eu/index.php/results/public-deliverables/

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On-road testing and perspectives

UTAC CERAM and UAH worked together in order to test the realised prototype in a safe environement. Recommandations were made by UTAC CERAM to UAH regarding their prototype so that it could become even more refined for the final demonstration in Barcelona.

Firstly, a primary indication of the automated vehicle's performance was provided within the February 2020 test campaign and it helped UAH to fine-tune its behavior. Then, the automated car was on-track tested within the July 2020 final test campaign, within a Euro NCAP testing frame. A total of 76 tests were done.

July 2020 final test campaign in UTAC-Ceram premises, within a Euro NCAP testing frame

Five realistic use cases, split into 12 different configurations, were defined to reproduce accident-like situations with which the vehicle will be face within it lifetime: VRU – 1 GRAIL; VRU – 2 Pedestrian; VRU – 3 Cyclist; VEH – 1 Cut-in; VEH – 2 False positive.

Overall, despite small speed stability issue and lateral deviation from the path, the autonomous BRAVE vehicle was able to face the testing requests. It also presented some novelties such as its exterior GRAIL IHM and is equipped with a high definition camera that detect information from far away. Overall, the high performance of the BRAVE vehicle should be highlighted, with full points awarded for all common ENCAP scenarios that were conducted.

Test protocols recommendations and proposals to regulation

Throughout the BRAVE WP5, five recommendations are to be retained regarding a vehicle safety assessment protocol enhancement purpose.

USE OF ARTICULATED PEDESTRIAN DUMMY

The representativity of a human pedestrian is improved: deeper testing scenarios could be set up and focus on the assessment of a vehicle's anticipation – pedestrian's reaction – level for example.

VRU – 1 GRAIL: LONGITUDINAL/CROSSING COMBINATION

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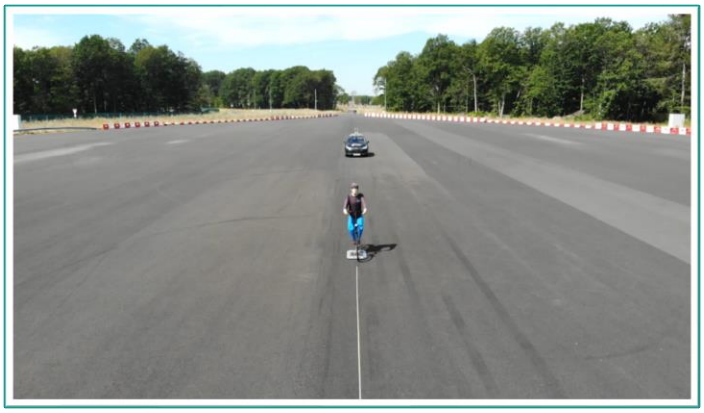
This pedestrian combination of a longitudinal and crossing scenario is based on face recognition to anticipate the pedestrian's behavior to best react in a smooth way. The use of a robotised platform, instead of a passive one (with belts) allows to reduce the lateral error.



Vehicle safety assessement – Testing in UTAC-Ceram premises

VRU – 2 PEDESTRIAN: OBSTRUCTED CROSSING

This ENCAP-inspired obstructed pedestrian crossing reflects the use case where an adult pedestrian would come out behind a parked car – perpendicularly to the VUT direction – and start crossing in front of a rolling vehicle. As part of the torso and head of the dummy will stick out from over the obstruction car bonnet, the tested vehicle should be able to early detect a possible danger.

VEH – 2 FALSE POSITIVE: C2C CROSSING

This false positive use case addressing a car-to-car crossing is constituted of two sub-scenarios and represents the approach of a vehicle on an intersection, with either crossing or turning of another vehicle in front of it.This use case should quantify to what extent the vehicle anticipates.

SMOOTH DRIVING

It might be interesting to implement an assessment based on the smoothness and the comfort provided by the vehicle. If protocols take the lead by implementing such ponderation, we can be sure that the automotive industry will follow and adjust their production to it.

Virtual Reality Study on Automated vehicles - Pedestrians Interaction

With the advent of highly automated vehicles, traditional driver-pedestrian interactions based on gestures or eye contact will disappear, and new solutions will be needed to convey vehicles' intentions. To ensure the safest interaction between pedestrians and automated vehicles, some critical questions need to be addressed first, like for example, what information is necessary and relevant for the pedestrians? Or, how should the information be communicated to ensure drivers understand it correctly?

Recently, some of these questions have been addressed in a study as part of the BRAVE project. This study aimed to investigate how the vehicle deceleration, a strong indicator of drivers' intention to stop or not, should

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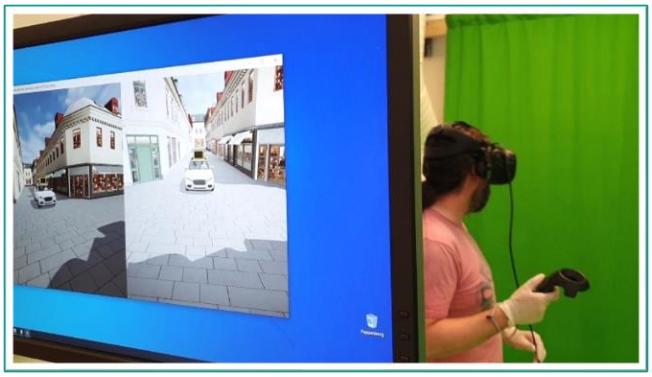
be integrated with the explicit information provided by an external human-machine interface (eHMI). By using a virtual reality walking simulator (see figure hereafter), 29 participants were presented with different automated vehicles in a crossing scenario. The vehicle decelerations and eHMI message presentations occurred at far or close distance to the pedestrians, and simultaneously (i.e., deceleration and eHMI message at the same time) or independently (i.e., early deceleration followed by a later eHMI message, or vice versa). Based on this, pedestrians had to infer the vehicle's intention and decide whether to cross or not.



Experimental setting in the walking simulator at VTI, Linköping

The results showed that the vehicle's intention is significantly more evident when the eHMI is early presented and accompanied by the vehicle deceleration (i.e., eHMI and deceleration simultaneously). This indicates that the vehicle dynamic remains as a strong cue to infer the automated vehicle intentions and therefore, need to be integrated into future eHMI systems.

TrustVehicle project: join their final event

TrustVehicle, a project funded under the same H2020 call for proposals as BRAVE, is coming to an end after more than 3 years of intense project work. Join them online in their final event to learn all about their results and achievements on the road to "Improved trustworthiness and weather-independence of conditionally automated vehicles in mixed traffic scenarios". The event will happen on Tuesday, 27October 2020, from 9 to 12 CET. More information and the detailed agenda can be found on the dedicated webpage: http://www.trustvehicle.eu/final-event/

BRAVE KEY FIGURES

Consortium: 10 partners from 7 countries (Spain, France, Germany, Slovenia, Sweden, U.S.A, Australia)

Project duration: 36 months

7 **work packages**

27 experts involved in the **Advisory Board**

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