The new paradigm for coloring automated driving with human emotions. The SUaaVE approach

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One of the main causes of lack of acceptance in innovation is ignoring the needs and preferences of potential customers in the development phases. In the case of the connected automated vehicle (CAV), there is an important degree of user skepticism based on the awareness of the complexity and the risks of this technology. Public acceptance is a multi-faceted construct, tightly related to emotional processes and trust in a new technology, beyond the accomplishment of functional performance. However, the current approach based on the technology push threatens social viability of innovative technology like CAV, as it creates a gap between the well-thought technical reliability and public acceptance.

The SUaaVE project (SUpporting acceptance of automated VEhicle), funded from the European Union's Horizon 2020 Research and Innovation Programme, aims to make a change in the current situation of public acceptance of CAV by leaning on a Human-Driven Design approach, enhancing synergies social science, human factors research and automotive market by means of an iterative process of assessment, co-design and prototyping. Participatory process involves above 4,000 subjects (passengers, traditional and future drivers, VRUs) as well as 100 experts and stakeholders along the project. SUaaVE focuses on the human side, working to improve more "intangible" aspects as safety perception, attitudes and, in general, emotional appraisal of passengers in CAV.

The main ambition in SUaaVE is the formulation of ALFRED, defined as a human centered artificial intelligence to humanize the vehicle actions by understanding the emotions of the passengers of the CAV and managing corrective actions in vehicle for enhancing trip experience. ALFRED will use two sources for understanding the emotional state of the passenger. From the one side, the "EMpathY" Unit (EmY) will be aware of the contextual factors involving the experience in the Ego Car: The trip purpose (work travel, day shift, holidays, etc.), the state of road (density of cars, weather conditions, safety envelop, etc.). From the other hand, the Ego Car will be monitoring the passenger itself: behavioral aspects such as face expression, and bodily changes such as respiratory rate, heart rate and sweating. A different methodology will be used in the analysis of emotions of these two sources: The analysis of contextual factors will follow a categorical approach (The "OCC model"), whereas the monitoring of the passenger will use a dimensional approach. The data obtained via these two methods will be combined in order to achieve a more robust map of the passenger state.

The research to understand passenger emotions will be mainly based on experimental tests consisting in immersive experiences with subject's participation in a simulated CAV, specifically adapted to SUaaVE research purposes, and also monitoring current drivers and passengers in real driving conditions. The analysis of the physiological response of the subjects, based on the parameters arousal and valence obtained from the heart rate signal, as well as considering other additional biometrics (breathing rate, temperature, sweating) and behavioral (facial expression, blinking, etc.) will be used as a basis to build an emotion prediction framework for the automated vehicle.