Driving simulator experiments to analyse drowsiness and distraction: Study Protocol

Research Project funded by ANI named BBAI - Brain Behavior analysis using the most advanced Artificial Intelligence and Computer Vision

Bruno Cardoso[1], Luciano Moreira[2], Sara Ferreira[3]

1 –IC, Faculty of Engineering of the University of Porto

2 – CETAPS, CIQUP, Faculty of Arts and Humanities of the University of Porto

3 – CITTA, Faculty of Engineering of the University of Porto

The BBAI project (Brain Behavior analysis using the most advanced Artificial Intelligence and Computer Vision) is a copromoted project developed by Biometrid, the Faculty of Engineering of the University of Porto, the Instituto da Construção, and FMUP / CINTESIS (Faculty of Medicine of the University of Porto). Besides the goal of developing artificial intelligence algorithms to monitor driving, testing them with healthy drivers and drivers with a neurological pathology, we also aim to adapt the minimal group paradigm, which states that belonging to different groups or categories of a trivial nature is sufficient to elicit intergroup discrimination, to test the link between social identity and driver's distraction. To our knowledge, this is a novel approach because studies in the field usually do not include psychosocial variables. Data will be collected in two different experimental scenarios through the driving simulator and other instruments (e.g., heart rate monitor, eye tracker). The first scenario, which focuses on drowsiness, consists of a 90 min experimental session in a simulated road developed to induce drowsiness. Two different groups of participants will be invited to take part in this experiment: healthy individuals and individuals with multiple sclerosis. While driving, these participants will indicate their state according to the Karolinska Sleepiness Scale at a 5-minute interval. These experimental sessions will be scheduled at the same time of the day to minimize the influence of the circadian cycle on the results, and both groups will be requested to avoid stimulants or sleep aids that may influence their drowsiness as long as they are not associated with undergoing medical treatment. The second scenario adapts the minimal group paradigm to the context of driver distraction and lasts approximately 25 minutes. While driving, participants will receive four different messages through the simulator's IVIS system that will induce cognitive, manual, and visual distraction. Participants will be randomly divided into a "red group" and a "blue group", and the messages they receive will be identified as "blue" or "red" through audio and on-screen indications. Each participant will receive messages from both groups and interaction times will be measured to identify whether drivers are more likely to engage in distraction activities that are labelled as their group. Expected results will consist of the development of a commercial intelligent driver assistance system, compatible with mobile platforms, that may not only increase road safety as a whole but also promote equity between drivers. Also, it is expected that by

comparing the results of participants with multiple sclerosis and healthy participants relevant information that can aid similar projects in the future will be acquired. It is also expected that the results of the distraction experiment will show that social identity plays a role in driving performance that should not be neglected. Overall, these results may assist in the development of road safety campaigns and the directing of relevant policies, besides including and publicizing the relevance of psychosocial factors in understanding driving behaviour.

Acknowledgements: This paper is a result of project BBAI - Brain Behavior analysis using the most advanced Artificial Intelligence and Computer Vision, with reference NORTE-01-0247-FEDER-069809, co-funded by the European Regional Development Fund (ERDF), through the North Portugal Regional Operational Programme (NORTE2020), under the PORTUGAL 2020 Partnership Agreement.