TRANSPORTATION AND HUMAN FACTORS: AEROSPACE, AVIATION, MARITIME, RAILROAD, AND ROADS

Designing Interaction and Interfaces for Automated Vehicles

User-Centred Ecological Design and Testing

Edited by Neville A. Stanton, Kirsten M.A. Revell and Patrick Langdon

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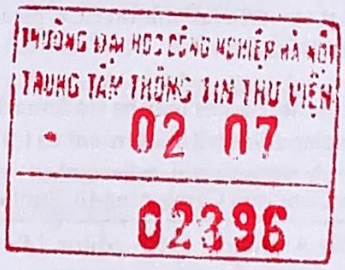

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Preface

This project has developed a new approach for the design of handovers between the vehicle automation and the human driver. The approach brings together a range of methods from user-centred design, inclusive design, and ecological interface design. This approach has been used to design customisable human–machine interfaces for automation–driver handovers and has been formally tested in driving simulators and in a Jaguar I-PACE on a British motorway. Validation studies were undertaken, and design guidelines were produced. This project discovered that there were links between customisation and user performance. In particular, the handover times were quicker (on average, but with a greater range) with customised settings than the defaults. Drivers much preferred the customised settings to the defaults, and there was no adverse effect on post-handover driving performance (in terms of lane and speed stability). This is one of the first studies of its type in the UK and Europe, with a genuine automated vehicle driving (rather than being driven by a surrogate driver from the passenger seat or rear of the vehicle).

New insights into the customisation of handovers between vehicle automation and the human driver have been generated. A new method for the design of driver–vehicle interfaces has been developed, called 'user-centred ecological interface design' (UCEID). Modelling of the handovers has been validated by comparing the predictions made in operator event sequence diagrams with videos of the behaviour of human drivers, both in simulators and on the road. An on-road comparison study (Tesla, Mercedes, I-PACE) has revealed the differences between the strategies of manufacturers and shown the way this affects the human driver. The research is being published in a series of peer-reviewed journal articles and this book.

This project has uncovered a number of important factors associated with the development of automated vehicles. Numerous key design requirements that Jaguar Land Rover (JLR) can take forward into their development process have been established. These include operator event sequence diagrams that describe the process of handover. This project has also developed intuitive human–machine interface proposals and evaluations that could form part of future vehicle interfaces. There are also novel findings around the topic of customisation that will potentially increase customer satisfaction with handovers in certain automated vehicle scenarios. This project has also created specific intellectual property for JLR that could be used in future vehicles related to the handover from automation to manual driving. Additionally, a process that goes from the basic scientific foundation through to the finalised, and evaluated, concept following a series of design iterations, called the 'UCEID process', has been defined and shared with JLR for use in future vehicle programme design. Guidelines for the design of handovers between the vehicle automation and the human driver have also been presented in the final chapter of this book.

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