Guest Editorial Preface

Special Issue on Automotive User-Interfaces (Part 2)

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It is widely recognized that the automobile is progressing towards the status of "computer on wheels" with greater connectivity to the outside world and higher levels of autonomy. As a consequence, not only will what we consider to be "driving" fundamentally change, but also a plethora of novel functions and services will become available to the users of future vehicles. The design of the automotive user-interface is/will be complex, dependent on many 'hard' (e.g. performance, safety) and 'soft' (e.g. likes/ dislikes) variables.

This, the second of a two part Special Issue of the International Journal of Mobile Human-Computer Interaction (IJMHCI) dedicated to Automotive User-Interfaces, continues to reflect this breadth and depth of challenges, ranging from specific user-centred issues facing industry now (e.g., relating to evaluation of distraction), through to longer-term perspectives, such as how to design user-interfaces for car interiors in which the "driver" spends large amounts of time not in control of his/her vehicle.

The eight papers in this special issue (split across this and the previous issue of the IJMHCI) are drawn from the highest ranking submissions to the Seventh International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI'15) which was held at the University of Nottingham, UK in September 1-3, 2015. Eighty papers were submitted to the conference of which 42 (53%) were accepted for aural/poster presentation. Authors for this special issue were invited to update their conference articles to include new data and analysis and also to provide further insights and conclusions from their work. The original papers were all reviewed by at least three experts in the area and a meta-review was also undertaken for the final journal papers by the guest editor.

The first two papers in this part of the special issue share a common desire with the last paper in part one of the special issue (thus nicely bridging the two installments) and that is the desire to understand how people might need to interact with future highly automated vehicles – particularly when moving in/out of control (the so-called handover problem). This is a major issue for NHTSA level 3 automated vehicles in which the driver will still need to have some role, for instance when a problem with a sensor is identified. In contrast to the last paper in part one of the special issue, Politis, Brewster and Pollick consider a broader range of possibilities for a warning system, including modality (visual, auditory and haptic), the nature of the information presented (either abstract or spoken words) and its location (in front of or to the side of the driver). Their low-fidelity driving simulator study with 20 participants found that the best user-interface was one in which abstract audio/visual cues were presented, that appeared to originate from the tablet where people were playing a game. Their results are important as they highlight the importance of warnings being directed to where the user's attention currently resides. In their paper, Telpaz, Rhindress, Zelman and Tsimhoni focus

on a single modality/location for handover information, a vibro-tactile (haptic) seat as a means of aiding a driver's situation awareness. In a driving simulator 26 participants experienced a series of situations in which handover from automated to manual mode was requested by the vehicle. In these cases, awareness of vehicles behind the driver was important, e.g., because a lane change would be needed. Results highlighted the potential of the haptic seat, as drivers responded more quickly to the handover request (e.g. through braking and glancing to the rear mirror) and drove more efficiently (e.g. smoother lane change) compared to the situation with no haptic feedback.

The final two papers for this special issue consider some important methodological issues for the automotive user-interface community. Alvarez and Rumbel focus on prototyping for in-vehicle user-interfaces and describe a novel platform to enable rapid iterative development of in-vehicle experiences. The interesting aspect of their platform (known as Skyline) is that it incorporates a driving simulator element to show how different user-interfaces might interact with the driving task via user testing. A series of case studies in which the tool has assisted in the development of new user-experiences are described and analysed in the paper. In contrast, Taylor, Griffiths, Bhalerao, Xu, Gelencser and Popham have built up a considerable database of driving performance data and utilized data mining techniques as a means of proposing user-interfaces that adapt in real-time to a driver's level of workload. Their data has arisen from several test track studies in which driver's had to undertake different secondary tasks of varying complexity. Comparisons are made with physiological data, such as heart rate/variability, skin conductance and electrodermal response frequency. They conclude that driving performance data on its own is insufficient to predict workload and further measures are required, e.g. eye movements.

As a whole these papers (together with those that appeared in part one) offer a significant contribution to our understanding of 'state in the art' for automotive user-interfaces. The research community will have considerable issues to consider over the coming years as vehicles become simultaneously more complex from a technology perspective, yet the task of the 'driver' will fundamentally change. It is interesting to reflect on the issue as a whole from a methodology perspective. In this respect, two points are quite apparent. Firstly, almost all of the studies were either conducted within driving simulators or were focused on the development of a simulator. This is perhaps understandable given the fact that the research is considering unproven user-interfaces, together with the clear experimental control afforded by a simulator. Nevertheless, one cannot help feeling that more road-based studies are required in this area, as a more ecologically valid means of understanding behaviour in context. Secondly, most of the studies adopt an experimental approach with manipulation of independent variables and precise measurements – mainly related to safety/performance criteria. This is important too, but there is clearly a place for qualitative studies too in this area, particularly as a means of investigating 'softer' issues concerning driver trust, acceptance, attitudes, motivations, and so on.

The guest editor would once again like to thank his co-chairs for the conference (Joe Gabbard from Virginia Tech, US; Paul Green from UMTRI, US; and Sebastian Osswald from Audi, Germany) who assisted in the choosing of the papers for the conference and for this special issue. He would also like to thank the 78 reviewers from across the world who gave up their time to read the original papers for the conference and provided insightful formative feedback in all cases. Finally, he would like to thank all those who helped with the organization of the conference, especially Diane Karim and Lesley Gray (Faculty conference management team) and Ayse Eren and Vicki Antrobus who worked tirelessly on the day-to-day planning and running of the event and acted as publication co-chairs. As before, all that remains now is to welcome you to the second exciting installment of this special issue.

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Gary Burnett has been investigating Human Factors issues since 1992, specialising on the human-related design issues for in-vehicle computing and communication systems, such as navigation, adaptive cruise control, vision enhancement, collision avoidance. His research has been funded by a range of organisations, including the UK Engineering research council (EPSRC), the UK Department of Transport and Highways Agency and the European Union. Most recently, he has worked closely on a range of projects concerning novel in-vehicle interfaces in collaboration with several vehicle manufacturers. He is an author for over 100 articles in peer-reviewed venues and was the general chair for the 2015 ACM conference on Automotive User-Interfaces (Auto-UI).