9th Workshop Automotive HMIs: Natural and Adaptive UIs to Support Future Vehicles

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ABSTRACT

Modern vehicles allow control by the driver with multimodal user interfaces (UIs), touch interaction on screens, speech input, and mid-air gestures. Such UIs are driver-focused and optimized for limited distraction to not compromise road safety in manual driving. Nevertheless, they are often complex and it might be difficult to find specific features. Automated driving in L3+ will disrupt the design of automotive UIs as drivers become passengers, at least for certain parts along the way. Similarly, the car is being transformed into a social space where passengers can be granted control over systems because they can devote their full attention without imposing safety risks. The complexity of advanced driver assistance, in-vehicle information and interaction systems requires explanation to the user, e.g., in which state the system is, interaction possibilities, expectations from the driver or take over timing. We expect novel technologies to allow for natural interaction and adaptivity to design valuable and future-proof interaction concepts for the changing interior of (automated) vehicles. The goal of this workshop is, thus, to discuss how natural and adaptive user interfaces can help to solve the mentioned challenges and to identify opportunities for future research and collaboration.

CCS CONCEPTS

• **Human-centered computing** → *Interaction paradigms*; **HCI theory, concepts and models**.

KEYWORDS

Contextual UIs, Automotive HMIs, Automated Driving, Natural Interaction, Adaptive Interfaces.

1 PROBLEM STATEMENT & WORKSHOP AIM

The theme of natural and adaptive in-car user interfaces arises from a consolidation of preceding workshops on HMIs for automated

driving [7], emotionally adaptive automotive HMIs [3], and natural user interfaces [4]. We see a big potential for simplification through natural interaction, e.g., with speech assistants or natural conversational agents (CAs) that can support the driver just like a human co-driver would do. Such an assistant can adapt to users over time and assist in critical situations, even without explicit requests. While research in the past also has focused on Take-Over Requests (TOR), recently the possibility of a cooperative driving-mode has been explored. This would allow the driver and vehicle to work together in critical situations and solve those in a collaborative effort. This idea also raises the need for novel interaction concepts. We also encourage opening AVs to new user groups, e.g., to allow children or elderly to use natural language UIs to control AVs and the vehicle can, on-turn, monitor the well-being of vulnerable passengers. In order to counteract the constantly growing variety of system functions and interfaces, this workshop will discuss concepts for UIs that adapt to user needs, specific situations, a particular context, etc. and thus ensure a more clear understanding of the system. Similarly, novel types of adaptive user interfaces, such as shape-changing interfaces that adapt to the driving context and the driver's demands, are of interest.

In this workshop, we would like to bring together researchers and developers from academia and industry on innovative HMI research ideas to foster knowledge transfer and facilitate networking. Group work to come-up with (radical) new ideas and interactive sessions are an important part of this workshop and shall serve as a basis for future work, ideally as a nucleus for new cooperative projects.

2 TOPICS OF INTEREST

The main goal of the workshop is to discuss challenges and opportunities for natural interaction and adaptive systems in automotive user interface research, e.g., (1) Natural interaction in complex environments, (2) Adaptation to the driver state and driving context, (3) User experience design for automated vehicles, (4) User interfaces for novel user groups, (5) Inclusive interaction for social settings in the car, (6) Interaction concepts for collaborative/cooperative driving, (7) Methods and approaches to foster trust and acceptance, (8) Concepts related to pleasure of driving, (9) Personalization of vehicle behavior and interfaces and (10) Approaches that support situation awareness through design.

The following papers will be presented at the workshop:

1. Evaluating a Smart Car Interface in Terms of Usability, User Experience and User Acceptance. by Mario Avramidis, Christiane Kellner, Josefine Staudt, Verena Zimmermann, and Nina Gerber. This workshop contribution is a work in which a user interface for automated vehicles is prototypically implemented and subsequently examined. The UI is evaluated in a user study with n=22 participants. This is considerable for a workshop contribution. Although the presented/implemented user interfaces are oriented towards the industry standard or have already been shown elsewhere, the presentation of the paper is expected to lead to an interactive discussion in the topic area at the workshop. Reflection on state-of-the-art can always lead to new ideas, which are to be generated in the interactive session at the workshop.

2. Akzeptanz von Fahrerassistenzsystemen – eine qualitative Analyse und Konzeptualisierung von Probanden-Empfindungen. by Tim Driesen-Micklitz, Michael Fellmann, Adrian Merker, Alexander Stocker, and Carsten Röcker. In this paper, qualitative results of the evaluation of test data of real car trips are presented and discussed. The authors focus on the aspects of user acceptance and trust (positive and negative perceptions). The topic of the paper is interesting and may lead to many discussions at the workshop, however, due to the immense amount of data (N=100), the findings presented in the paper are still relatively unspecific and therefore difficult to interpret. As data analysis progresses, more specific findings, possibly presented as a list of recommendations, can be expected for the workshop.

3. A Platform for Rapid Prototyping and Evaluation of Concepts for Interactive In-Vehicle Displays for Automated Vehicles. by Aditya Dandekar, Lesley-Ann Mathis, and Bastian Pfleging. In this paper, the authors present a framework that is intended to make it possible to quickly implement and test various interactive concepts for automated vehicles by means of "rapid prototyping". This is realized by decoupling the actual driving situation from the user interface – so that in this way different UIs can be generated very easily, which then can react to the vehicle (Wizard-of-Oz or driving simulator) by means of events. The motivation for the development of this framework is clear and the approach interesting, unconventional, and highly relevant to this workshop. The authors did also a good job to distinguish their work from other related work, published for example by the research groups at QUT (Gerber, et al. [1]) or THI (Riegler, et al. [5, 6], Löcken, et al. [2]).

3 TENTATIVE SCHEDULE AND TARGET AUDIENCE

We aim for a three quarters day on Monday[1], starting after the opening keynote at around 11 AM, which is oriented towards discussions, interactive hands-on sessions, and presentations. The number of workshop participants will be limited to 40, including organizers.

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[1] we currently plan for a presence workshop; if the conference has to be held virtually, we adjust the schedule accordingly and reduce the duration.

In the beginning of the workshop, participants will be welcomed by the organizers and introduced to the workshop's goals (11:00-11:15). A speed-dating session (or any other group game/role play) will follow to allow for quick and effective introduction to each other. This format was identified as very beneficial in some of our previous workshops (11:15-11:30). The rest of the morning will be dedicated to presentations of accepted position papers, most likely in Pecha Kucha style. If there is time, all the other participants are also encouraged to introduce themselves with a few PowerPoint slides (affiliation, research interest, critical issues to be discussed in the workshop, etc.).After lunch, comments/questions noted down during presentations will be collected, discussed, and posted on a pin board. Next, a clustering on the brainstorming wall will follow and co-organizers compile questions for the interactive part while participants split in groups. Groups will then work on a specific topic, will get a chance to present intermediary results and are invited to come-up with an early prototype of their idea by the end of the day. Final results will be presented in short summary presentations (17:00-17:15). The workshop will be finished on or before 17:30. The last 15 min. are reserved for a wrap-up and planning of next steps. A detailed schedule of the day including pre-workshop tasks will be made available on the workshop website on acceptance.

This workshop is intended for researchers and practitioners as well for designers, developers, and students interested in human factors, interaction design, design, human-computer interface development, with particular focus on applications in automated driving. Its goal is to serve as a platform for knowledge exchange between academia and industry (automotive manufacturers, third-party suppliers, designers) regarding novel approaches for HMI research in the transition to automated driving. Another goal is to show opportunities around natural and adaptive user interfaces and to discuss problems and challenges in the field.

4 ORGANIZERS

Andreas Riener is professor for Human-Machine Interaction and Virtual Reality at Technische Hochschule Ingolstadt (THI) with co-appointment at the CARISSMA Institute of Automated Driving (C-IAD). He conducts hypotheses-driven quasi-experimental research in human-computer interaction in the broader context of mobility. He is steering committee co-chair of ACM AutomotiveUI and chair of the ACM SIGCHI German chapter. He has co-organized several workshops at Mensch und Computer [7, 8], CHI, and AutomotiveUI.

Bastian Pfleging is assistant professor for Future Mobility Systems and Services at Eindhoven University of Technology. His research interests especially include novel concepts for non-driving-related activities in the car and the user experience of vehicles in the transition to full automation. He is a member of the steering committee of ACM AutomotiveUI and organized several workshops and conferences in various roles.

Henrik Detjen is lecturer at the Hochschule Ruhr West and currently works in the project "NRW Competence Center for Automated Driving". His research deals with interaction in highly automated systems, his current focus is on the application of natural user interfaces within autonomous vehicles, user acceptance and automation transparency.

Michael Braun works on affective automotive interfaces at BMW Research and LMU Munich. He creates novel interaction concepts which adapt to the driver's personality and state in order to improve road safety and emotionalize the driving experience.

Jakob Peintner is a researcher at Technische Hochschule Ingolstadt and CARISSMA Institute of Automated Driving. He focuses on cooperative driving concepts and Augmented Reality HMIs in the context of automated driving.

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