

6th Workshop “Automotive HMI”: Vehicles in the Transition from Manual to Automated Driving

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Abstract

Automotive user interfaces and, in particular, automated vehicle technology pose a plenty of challenges to researchers, vehicle manufacturers, and third-party suppliers to support all diverse facets of user needs. To give an example, they emerge from the variation of different user groups ranging from inexperienced, thrill-seeking young novice drivers to elderly drivers with all their natural limitations. To allow assessing the quality of automotive user interfaces and automated driving technology already during development and within virtual test processes, the proposed workshop is dedicated to the quest of finding objective, quantifiable quality criteria for describing future driving experiences. The workshop is intended for HCI, AutomotiveUI, and “Human Factors” researchers and practitioners as well for designers and developers. In adherence to the conference main topic “Spielend einfach interagieren”, this workshop calls in particular for contributions in the in the area of human factors and ergonomics (user acceptance, trust, user experience, driving fun, natural user interfaces, etc.) and artificial intelligence (predictive HMIs, adaptive systems, intuitive interaction).

1 Introduction

Future advanced driver assistance systems (ADAS) and automated driving systems (ADS) promise to increase both road safety and comfort. However, while operated in potentially safety-critical environments, those systems must be accepted and trusted by highly diverse user groups (Häuslschmid et al., 2017; Wintersberger and Riener, 2016) and therefore consider both individual differences (age, gender, experience, culture, preferred driving style, etc.)

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and short-term personality traits (workload, fatigue, emotional and cognitive state, intoxication, etc.).

To assess the benefit of future ADAS/ADSs, new quality criteria need to be defined that allow quantifying their potential impact already in early development phases as well as virtual test processes (Riener et al., 2016). Simulator studies and virtual simulation testing methods used today usually evaluate ADAS/ADS quality using pure safety-related parameters. These parameters cannot describe if and to what extent those systems are accepted and perceived by potential users. In contrast to classical (active, passive or integral) safety systems that are active only for a small amount of time in critical situations, automated driving systems need a holistic consideration of all involved human factors & ergonomics and multiple aspects of user experience (UX) to achieve a wide spread acceptance in society. For instance, an ADS may succeed in all test cases from the safety perspective but can still be unacceptable for potential users if it does not fulfill their individual needs, e. g., account for operating within the limits of desired speed and acceleration - that might vary based on different individuals but also on concurrently performed non-driving-related activities (Pfleger, Rang, et al., 2016; Pfleging and Schmidt, 2015).

The proposed workshop thus focuses on the identification of quantifiable acceptance/quality criteria for automotive user interfaces and automated driving systems from the perspective of human occupants. We want to emphasize a more human-centered perspective on the topic including a holistic evaluation of experiences with driving systems in the transition from manual to highly automated driving. Potential quantifiable quality criteria may include (but are not limited to) vehicle speeds, lateral/longitudinal forces, headway distances, ergonomic aspects, user acceptance, trust in technology, ethical behavior in (crucial/non-crucial) traffic situations, brand expectations, and many more. In adherence to the thematic orientation “Spielend einfach interagieren” of the conference, this workshop pays particular attention on topics like artificial intelligence (predictive HMIs, adaptive systems, intuitive interaction), natural user interfaces, acceptance and accessibility for elderly and disadvantaged people, as well as driving fun in the age of driving assistance and automation.

2 Target Audience

This workshop is intended for researchers and practitioners as well for designers, developers and students in the domain of human-computer interaction, automotive user interfaces, and human factors. The main aim of the workshop is to discuss methods and models for the quantification of quality criteria for automotive user interfaces in the transition from manual to automated driving (human factors perspective). Its goal is to serve as platform for knowledge-exchange between university, automotive manufacturers, and third-party suppliers regarding measurements, methods and trends as well as critical discussions in the context of the rapidly changing field of road transportation. The expected outcome of the workshop are models or methods describing stable and reusable criteria for the quantification of quality aspects of automated driving experiences.

3 Workshop Summary

This workshop is run as whole day workshop organized in 4 thematic sessions, each of about 90 minutes in length. After the introduction into the workshop, in **session 1** authors of accepted papers will get a chance to *present their approach* and issues in the field. There is some time reserved for Q&A, which hopefully provokes lively discussions. After the coffee break, in **session 2**, *speed dating* will be used to allow for quick and effective introduction to each other. This format was identified as very beneficial in many previous workshops. After that, a *brainstorming session* will be followed to identify common terms, issues, problems, and challenges related to the quality aspects for automotive user interfaces or automated driving in general. The workshop co-organizers will group the collected PostIts on a *brainstorming wall* and compile, from the most mentioned keywords, questions for the interactive part in the afternoon.

After the lunch break, in **session 3**, participants will *split into groups* and work on a specific assigned topic (based on the result of the brainstorming wall). Each group will nominate a moderator and note taker. The group will perform a dive into the current problems and is tasked with producing a solution (proposal). Groups will get a chance to present the result of the discussions to the rest of the attendees. Presentation and discussion of group work results will further foster the exchange between participants. After discussions in the large group, workshop co-organizers will summarize the interactive part and collect the material created in the group works (posters, slides, prototypes). All documents will be provided to the workshop participants/contributors on a secured area of the workshop website (<http://ws-automotive-hmi.human-machine-interaction.de/>). In the **last session** of the workshop, participants will split into new groups and receive a specific task related to the workshop topic. The aim is, to build a *quick & dirty prototype* in just 60 minutes and to record a *short video* in the following 30 minutes. Results will be shown to the auditorium and made accessible via the workshop website. At the end of the workshop, both participants and organizers will discuss future plans, e. g., to continue with this workshop series at Mensch and Computer, AutomotiveUI, CHI and related conferences or try to setup a special issue in a renown journal in the broader area of pervasive/ubiquitous computing or automated driving.

4 Summary of Contributions

All papers submitted to this workshop were individually reviewed by 2 to 3 reviewers. Based on the review scores, 5 papers could be finally accepted for and invited to the workshop. Accepted contributions span a wide range of topics within the area of the workshop. Three papers were submitted in German language, however, for consistency reason, the summaries are subsequently provided in English.

In the first paper “Pilot study: Use of Mobile VR Applications in Constant and Steady Moving Transport Systems” (original title “Pilotstudie: Einsatz von mobilen VR-Anwendungen in gleichmässig und ruhig bewegten Transportsystemen”) by C. Wienrich, M. Zachoszcz, M. von Schlippe, and R. Packhäuser, the authors present an evaluation of VR experiences in moving

vehicles. Two 360 degree videos with different levels of dynamicity (a: static camera perspectives, only little motion in the video; b: dynamic camera perspectives and increased motion in the video) were presented to participants in a 7-minute drive and compared to the baseline condition in a non-moving vehicle. The gathered data (meCue, Comfort, SSQ, IPQ) of 40 subjects was evaluated, and based on the results, participants expressed positive attitudes towards VR experiences while showing only slight symptoms of simulator sickness. The authors conclude that VR can be a valuable addition to existing entertainment systems while traveling.

The paper “Autonomous Driving: A Dream on Rails?” by A. Mirnig, A. Meschtscherjakov, and M. Gärtner discuss problems related to the introduction of autonomous driving in society and raise questions of how this will be accepted by the society (e. g., how to communicate with other road users, how will autonomous vehicle services be compatible with the flexibility of day-to-day operation, etc.). Overall, the authors ask a simple but important question, “personal ownership of the car vs. autonomous traffic system like a train”. Indeed, different researchers and futurists have different visions about the future of autonomous vehicles, but we are not sure yet about its exact picture. We believe that this issue will contribute to vivid discussions at the workshop.

The third paper “A Robust Drowsiness Detection Method based on Vehicle and Driver Vital Data” by T. Kundinger, A. Riener, and N. Sofra contributes an overview of the state-of-the-art in detecting drowsiness in vehicles as well as an approach to use wearables in the future to infer drowsiness from physiological data. For the state-of-the-art report, authors provide a useful fragmentation in methods based on single and hybrid measures. Apart from the literature review, this paper makes a second contribution, that is a research agenda on how to employ wearables to detect driver drowsiness. As such, it could be a useful foundation for the brainstorming session.

The paper “Natural Eye Movements in the Vehicle Prior to the Ride” (original title “Natürliche Blickfolgen vor einer Fahrt im Fahrzeug”) by B. Hinterleitner and L. Gauer is an industrial contribution. It focuses on gaze sequences (collected from 20 participants) performed for typical in-vehicle procedures (such as seat preparation, ignition, etc.) in a static environment (i. e., actions in the time frame from entering the vehicle until start of the trip) to find out about drivers’ behavior in these tasks. The authors argue that due to the high amount of information and interaction concepts available in vehicles, systems could adapt to users’ behavior to give suggestions for proper interaction. The collected gaze positions were first mapped to specific areas of interest (e. g., steering wheel, dashboard, infotainment system) and then accumulated, finally leading to a model of transition probabilities. Summarized, research conducted in the frame of this work supports the assumption that drivers focus on relevant areas already some seconds in advance of an interaction.

The sixth paper “A User Interface for Assisted Parking” (original title “User Interface für assistiertes Parken”) by F. Koller and M. Dorn, again an industrial contribution, provides an overview of the development of graphical user interfaces for assistance functions in the vehicle with a focus on assisted parking. In particular, the paper capitalizes on the development of software, project management, and UI characteristics for a function called “Home zone”. With “Home zone”, the vehicle owner trains once how to park the car in the local garage. Further on, the car performs the parking maneuver automatically (initiated by a key press on the car key or

with a Smartphone app). During the maneuver, the driver can stay in the vehicle or observe the same from outside the car. This is a nice example, how questions related to usability and quality of interfaces are transferred from the research prototype to a product aimed for the market. The paper also contributes to the transition from manual to automated driving, by summarizing ideas and challenges derived from user studies with the “Home zone” interface.

5 Outcome and Conclusions

The expected outcome of this workshop is a list of obstacles as well as potential solutions related to the quantification of quality criteria for automated driving with focus on humans’ perspective. The organizers commit to provide a platform for future exchange of problems, ideas, and results related to the workshop focus. This way, we should be able to create a shared understanding of goals, challenges and potential ways to overcome them.

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6 Organizers



Andreas Riener

is a professor for Human-Machine Interaction and Virtual Reality at Technische Hochschule Ingolstadt (THI), Germany. He is heading the undergrad degree program “User Experience Design” (UXD). In addition, Andreas Riener has a co-appointment as research professor for “Human factors, ergonomics, and driver-vehicle interaction” at CARISSMA (Center of Automotive Research on Integrated Safety Systems and Measurement Area). His research interests include driving ergonomics, driver state estimation from physiological measures, human factors in driver-vehicle interfaces, and trust/acceptance/ethics in automated driving.



Bastian Pfleging

is a postdoctoral researcher at the Human-Machine Interaction Group at LMU Munich. His general research interests are multimodal and natural user interfaces. In particular, he explores novel human-computer interaction techniques in the automotive context. His current focus is on concepts for non-driving-related activities and tasks that drivers will be able to conduct during assisted, highly, and fully automated driving. In 2017, he is program chair for AutomotiveUI, the premier conference for UI research in the automotive domain.



Stefan Geisler

is professor for Applied Computer Science and Human-Machine Interaction at Hochschule Ruhr West, Germany. After he received his PhD. he worked for several years in the industry, at Ford Werke GmbH in Cologne. There he worked in different automotive HMI projects from research to serial development. In 2010 he was offered a professorship. In his research he continues working on automotive HMI, but also on usability of different kinds of technology in times of demographic change user interfaces for ambient assisted living systems) and for safety-critical systems. He works with user-centered design processes following the goals of the positive computing paradigm.

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Alexander van Laack

is a “Cockpit of the Future” project partner at Faurecia. In his role, he is identifying disruptive technologies and developing strategies for innovative interior concepts. Alexander van Laack has more than 9 years of automotive experience. He received his PhD in engineering from the RWTH University of Aachen, Germany and he previously held a position as interaction and technical design manager at Visteon.



Philipp Wintersberger

is a research assistant at the research center CARISSMA/THI and doctoral candidate at Johannes Kepler Universität (JKU) Linz, Austria. He obtained his CS diploma from JKU specializing in human-computer interaction and computer vision. He worked 10 years as software engineer/architect (in the fields of business process management, industry 4.0 and mobile computing) and was an invited speaker about mobile and software development at several conferences and events. In January 2016, he accepted a position as PhD candidate in the area of Human Factors and & Driving Ergonomics at THI (research group Prof. Riener).