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EXTENDED-ABSTRACT

Reality Check: Insights from Experienced Users of Current Automated Driving Systems for an Updated AutoUI Research Agenda

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Reality Check: Insights from Experienced Users of Current Automated Driving Systems for an Updated AutoUI Research Agenda

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ABSTRACT

Most of today's studies investigating the driver-vehicle interaction of automated driving systems are conducted in simulated environments like driving simulators or virtual reality. While this simulation-based experimental research can produce valuable and valid results, it is at the same time limited by the inherent lack of realism. Important insights into real-world driving experiences and repeated system usage are rarely collected due to the constraints imposed by time and financial resources. In a two-step research approach, we aim to connect the AutoUI research with real-world users. In the first step, we conducted qualitative interviews with 10 experienced, tech-savvy users of current automated driving systems (Waymo, Cruise, Tesla) and clustered the results into the most important topics from a human factor perspective. On this basis, the workshop now aims to bring these insights into the AutoUI research community to identify the most relevant and urgent issues that should be addressed in the coming years.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

Automated Driving, Real World Experiences, Interviews

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1 INTRODUCTION/ BACKGROUND

One of the major limitations of current user research in the field of automated driving is the notable deficiency in research focusing on the perspectives of experienced drivers [3]. Therefore, studies are missing the valuable insights that individuals with substantial driving experience can provide. Most of the AutoUI studies are taking place in simulated environments like driving simulator or virtual reality. Ayoub et. al. mentioned in *"From Manual Driving to Automated Driving: A Review of 10 Years of AutoUI"*, conducting research on automated driving, especially for SAE Levels 3-5, frequently presents challenges because of the limited availability of automated vehicles. Therefore, research with experienced drivers and real-world driving scenarios have so far only been examined to a limited extent [1]. Furthermore, Forster et al. investigated n = 161 scientific papers in the field of driving automation and found that 73.29 % (n = 118) of the reviewed studies were conducted in a lab environment. In addition, 71.32 % (n = 115) of the studies were conducted in a driving simulation environment. The authors also

mentioned that long-lasting effects of automated driving usage are scarce and future research efforts are necessary to find out about the impact and importance of real-world experience with automation on the user experience and usability evaluation of automated driving sytems[2].

2 PRIOR WORK

To change that, this workshop we propose to AutoUI'24 aims to address this gap by delving into the perspectives of experienced drivers of current automated driving systems. By exploring their experiences, attitudes, concerns, and expectations, it will enrich the understanding of how concepts of *trust* and *acceptance* as well as *transparency* and *explainability* are currently being evaluated by tech-savvy, experienced drivers and which issues should be addressed by automotive user research in the next years.

In the first step, the authors affiliated with THI Germany contacted experienced and tech-savvy users of current automated driving systems such as **content creators** of **YouTube Channels**, about automated driving and users of the Subreddit[1] **"r/SelfDrivingCars"** and invited them to share their experiences with these systems. We acquired 10 participants (9 male, 1 female) for the interviews, all of them were highly experienced either with the automated driving systems of **Waymo** (SAE L4), **Cruise** (SAE L4), **Tesla** FSD (SAE L2/3), or a **combination** of them. Some of them conducted as many as 200 automated rides, created over 200 automated driving videos or even worked for these companies as developers. We then conducted one-on-one semi-structured interviews and discussed their experiences with these systems from a human factors perspective. The interviews took place in the beginning of 2024, and lasted around 60-90 minutes per participant. The interview consisted of 36 questions and was categorized into the following topics (1) Demographics, (2), Overall (user) experience with automated driving systems, (3) Trust and acceptance of automated vehicles, and (4) Explanations about automated vehicle behavior. The interviews were audio recorded, transcribed, and are currently analyzed and summarized using MAXQDA to perform a qualitative data analysis [4].

3 WORKSHOP GOALS & RESEARCH QUESTIONS

The aim of the workshop at AutoUI 2024 is now to present the findings insights to the international and interdisciplinary AutoUI community, to discuss them together with experienced users, identify pressing human factor issues, and, finally, derive an updated research agenda. The specific research questions that will be addressed in the workshop are shown in fig. 1.

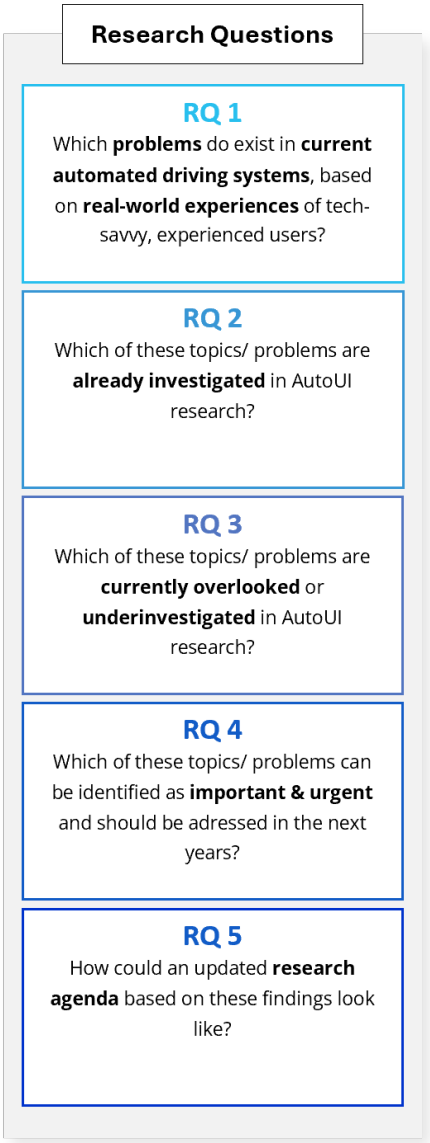

Figure 1: Overview of research questions that will be addressed in the workshop (based on the insights from experienced users).

4 TENTATIVE SCHEDULE

After welcoming the participants and introducing them to the workshop topic and goals, the main part starts with an introduction of each of the participants and an exchange of their experiences with automated driving systems. After that, the workshop organizers will present the conducted interview study with experienced drivers and the results in detail (**RQ 1**). This will be followed by a panel discussion and open Question & Answer session with some of the interviewed users who offered to share more of their experiences and opinions in the workshop. In this part, the creators' online content will be included as well, and exemplary driving situations will be discussed (**RQ 1**). After the following coffee/lunch break, the first group work will identify which of the mentioned topics are already covered in research and which important and urgent topics are currently overlooked and should be investigated (**RQ 2, 3 & 4**). The second group work is oriented towards an updated AutoUI research agenda for which, in an interactive world café style, each

[1] https://www.reddit.com/r/SelfDrivingCars/

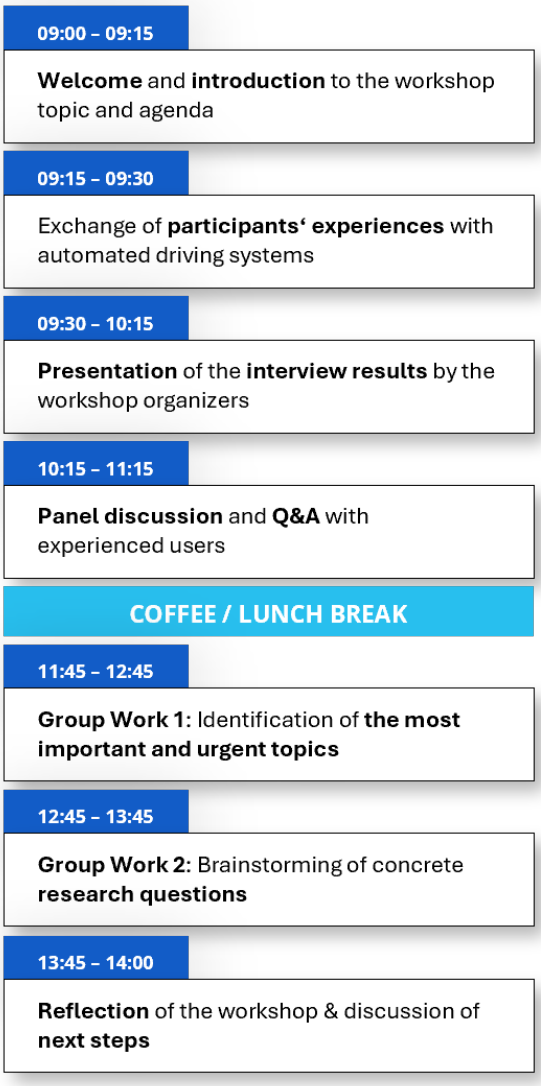

Figure 2: Tentative Workshop Agenda. Final times depend on the workshop day's general schedule and will be updated.

identified topic will be connected to concrete research questions (**RQ 5**).

An overview of the workshop agenda is listed in fig. 2.

5 ORGANIZATION

Pre-Workshop. A workshop website will be set up to distribute the organizational information and advertise the workshop.

Workshop Day. The workshop will take place as an on-site workshop at the AutoUI'24 venue at Stanford University, California. A lecture/meeting room for around 30-40 participants is needed, together with common workshop material, such as flipcharts, paper, and colorful pens.

Post-Workshop. The results of the workshop will be summarized and distributed to all of the workshop participants via e-mail. A recap article will be written and put on the website, together with the main findings.

Experience Self-Driving Waymo Taxis. Several of our interview participants are based in San Francisco and offered to share a ride with a self-driving Waymo taxi together. Based on their availability, we will try to organize some test rides before, during, or after the conference to offer interested workshop participants the opportunity to experience the discussed systems themselves.

6 EXPECTED OUTCOME

Finally, the insights from the interviews and the results of the discussions and group work activities at the workshop will be combined to derive a cohesive picture of the overall user experience in current automated driving systems and the topics and challenges that need to be addressed in the next years. All interested parties are encouraged and invited to take part in the further processing of the workshop results. This work is planned to be published as a journal or conference article at the end of this year and can then be accessed by the broader automotive user research community.

7 ATTENDANCE

We are planning a half-day workshop and expect about 20 participants (excluding the organizers). In addition to the AutoUI conference participants, we will make use of the organizers' broad and diverse network and reach out to practitioners and researchers who may be interested in the topic, mainly from industry and through the network of our interviewed AD users.

8 AUTHOR BIOS/ORGANIZERS

Carina Manger is a researcher at the research center CARISSMA/THI. Before she joined the Human-Computer Interaction Group, she obtained degrees in Psychology and Human Factors Engineering and worked on intelligent user interfaces in the automotive industry. Her current research concerns experimental user studies in simulated environments, with a strong focus on AI Explanations in automated driving.

Anna Preiwisch is a student of User Experience Design at Technische Hochschule Ingolstadt (THI). In several projects, she worked on improving the user interaction with automated vehicles, with a focus on shared automated vehicle concepts like shuttle buses.

Jakob Peintner is a researcher and PhD student at the Human-Computer Interaction Group (HCIG) at the CARISSMA Institute of Automated Driving (C-IAD), which is part of Technische Hochschule Ingolstadt. With a background in Industrial Design (B.A) and Human Factors Engineering (M.Sc TUM), in his research, he investigates cooperative interactions between human passengers in automated vehicles and the automated systems of these vehicles.

Nikolas Martelaro is an Assistant Professor at Carnegie Mellon's Human-Computer Interaction Institute. His lab focuses on augmenting designer's capabilities through new technology and design methods. He is currently conducting research on the future of public transit with increasing automation, AI assistance in engineering design tools, and community-engaged design of public

robots. He graduated with a Ph.D in Mechanical Engineering from Stanford's Center for Design Research, where he was co-advised by Larry Leifer and Wendy Ju.

Sven Krome is a researcher and designer specializing in human interactions with intelligent systems. He holds a Ph.D from RMIT and completed postdoctoral research at Cornell Tech, where he explored UX factors of advanced traffic models and contextual in-car interactions. He has worked at leading L4 ride-hailing companies like Waymo and Uber ATG, focusing on rider experience and driving behavior issues, particularly related to tertiary communication systems.

Debargha Dey is a postdoctoral researcher at Cornell Tech, with a research focus on human-automation interaction. He received his PhD in Industrial Design from TU Eindhoven and has 8+ years of experience in the domain of human factors for automated driving and traffic behavior. His current work focuses on the cross-cultural aspects of traffic interactions and its implications in the deployments of automated driving systems.

Andreas Riener is a professor for Human-Machine Interaction and Virtual Reality at Technische Hochschule Ingolstadt (THI) with co-appointment at the CARISSMA Institute of Automated Driving. He is program manager for User Experience Design and leads the UX/usability research and driving simulator labs. In 2017, he founded the interdisciplinary Human-Computer Interaction Group. His research interests include HF/ergonomics, adaptive UIs, driver state assessment, and trust/acceptance/ethics in automated driving. Andreas is steering committee member of ACM AutomotiveUI and chair of the German ACM SIGCHI chapter.

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REFERENCES

[1] Jackie Ayoub, Feng Zhou, Shan Bao, and X. Jessie Yang. 2019. From Manual Driving to Automated Driving: A Review of 10 Years of AutoUI. In *Proceedings of the 11th International Conference on Automotive User Interfaces and Interactive Vehicular Applications* (Utrecht, Netherlands) *(AutomotiveUI '19)*. Association for Computing Machinery, New York, NY, USA, 70–90. https://doi.org/10.1145/3342197.3344529

[2] Yannick Forster, Anna-Katharina Frison, Philipp Wintersberger, Viktoria Geisel, Sebastian Hergeth, and Andreas Riener. 2019. Where we come from and where we are going: a review of automated driving studies. In *Proceedings of the 11th International Conference on Automotive User Interfaces and Interactive Vehicular Applications: Adjunct Proceedings* (Utrecht, Netherlands) *(AutomotiveUI '19)*. Association for Computing Machinery, New York, NY, USA, 140–145. https://doi.org/10.1145/3349263.3351341

[3] Anna-Katharina Frison, Yannick Forster, Philipp Wintersberger, Viktoria Geisel, and Andreas Riener. 2020. Where We Come from and Where We Are Going: A Systematic Review of Human Factors Research in Driving Automation. *Applied Sciences* 10, 24 (2020), 140–144. https://doi.org/10.3390/app10248914

[4] Verbi GmbH. 2024. Max QDA Software 2024. https://www.maxqda.com/de/ Accessed: 2024-20-06.