

Accessible Automated Automotive Workshop Series (A3WS): Focus External Human-Machine Interfaces (eHMI)

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ABSTRACT

With modernizing traffic, a rise of automated vehicles (AVs) is expected. As AVs potentially need to communicate their intentions, external human-machine interfaces (eHMIs) seem to be an appropriate solution. While automotive research progresses quickly, people with special needs (PSN) are vastly underrepresented. With an aging population due to demographic changes and advances in medical treatments and with the stride towards equality and accessibility, the needs of these groups also have to be considered in the automotive domain. We provide an inclusive platform for interdisciplinary exchange on current and future topics, especially for academia, industry, and politics. This enables different perspectives with particular (but not exclusive) regard to user experience (UX) and psychology, product design, legislative concerns and, thus, support the communication and potentially founding of new topic streams. The aim is to create new interdisciplinary networks and collaborations to make future developments on vehicle-to-human (V2H) communication more inclusive.

KEYWORDS

accessibility, learning disorder, eHMI, automated vehicles, vulnerable road users

1 BACKGROUND

AVs are expected to alter traffic for all road users: from making traffic safer due to less human failure [13] over enabling novel non-driving related tasks within the vehicle [21] to altered communication needs for vulnerable road users such as pedestrians or bicyclists [14].

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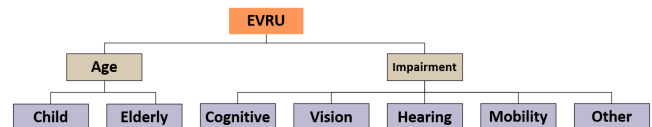


Figure 1: eVRUs as categorized by Holländer, Colley et al. [14].

eHMIs are seen as one solution to overcome the current availability of human drivers to engage with the outside world, for example, via gestures, eye-gaze, or speech [12]. Previous work on eHMIs evaluated numerous aspects of this communication: design spaces were created [7], the environment for example in the form of the sidewalk was included in the communication [5], the lack of scalability evaluations were shown [10], construction site scenarios were investigated [6], systematic comparisons were conducted [17], and anthropomorphic characteristics were introduced [3, 4].

Despite this work, the communication between AVs and vulnerable road users, especially with a focus on inclusion, is lacking [8, 9].

1.1 Especially Vulnerable Road Users

Vulnerable road users (VRUs) can be categorized as pedestrians, cyclists, and motorcyclists as done by the World Health Organization [19]. In general, VRUs are defined as not having a protective outside shield [25].

Holländer et al. [14] argued that VRUs are more diverse in the context of traffic and Human-Computer Interaction and, therefore, defined this group more granular. The first distinguishing factor is motorization (motorcyclist, personal conveyance versus pedestrian, personal conveyance, cyclist). Every defined class can be attributed “especially vulnerable” (see Figure 1). This can be due to age or disability [14]. In this workshop, we want to focus on this characteristic and help in making (future) traffic more accessible.

While it is already crucial to make traffic accessible for all people and their abilities, it will only become more important in the future with an aging population and better chances of surviving accidents and diseases. At the same time, the demographic changes already make it difficult to have enough medical and care staff to

support patients more than is essential for survival. Thus, inclusive automated traffic is not only the right thing to do from a moral perspective, but also necessary to keep people with disabilities as independent as possible because of a lack of care staff that would be needed to help with basic but important tasks like shopping to getting to a doctor's appointment.

1.2 Automated Vehicles

With ongoing deployment of AVs [20], traffic is expected to change to be more automated in the near future. Besides technical challenges of automation [15], the interaction with other road users, like pedestrians or cyclists [24] depends on being efficient [16] and trusted [26]. These needs are especially important to empower PSN in daily life activities [1, 23], including using shared spaces. Lower access to mobility reduces the possibility to socialize, to have access to health care, to go shopping, or even to gain employment [2, 22]. Therefore, improved automation is seen as a key enabler to enhance participation of PSN in everyday life.

2 ORGANIZATION & SCHEDULE

Only few publications have specifically dealt with the topic of inclusive AV-VRU communication [9]. Following up the objectives and preliminary work at the *WeCARE* workshop [18], we aim at:

- Providing an interdisciplinary forum for designers, practitioners, and researchers to discuss challenges and approaches for an inclusive approach to eHMI and create a platform for future networks.
- Discussing state-of-the-art research on inclusive eHMIs [8, 9] and how this can be enhanced and how this can be broadened
- Foster ideas and approaches to better integrate PSN into research and development of AVs
- Formulate a research agenda to support initiatives in research and practice to strengthen the accessibility of today's and future automotive designs

The key research questions we want to raise and discuss are:

- What are the main blockers hindering researcher to collaboratively work with PSN?
- How can we better include PSN into development and design?
- What are inclusive designs in the automotive context that can leverage today's advanced technology to support PSN?

Table 1 shows the planned schedule. It is separated into an "Inspiration" session in the morning, consisting of position papers and lightning talks, accompanied by two interactive sessions.

We will send out a call for contributions over multiple channels to contacts in academia, politics and industry. A peer review (min. 2 reviewers) will be performed by the workshop organizers and volunteers from the organizers' teams.

We accept position papers in English and German, but prefer the workshop to be in German to make it easier to reach potential participants outside the MuC community. However, it will not be a problem to switch to English if the background of the participants shows that this is the more appropriate language for all.

As a unique selling point of this workshop, we expect to be able to bring together people from the medical field and representatives

Duration	Topic
30 min	Pt. 1 Opening and participant introduction
60 min	Inspiration (Position Papers and Lightning Talks)
30 min	<i>Morning Break</i>
90 min	Interactive Session I
90 min	<i>Lunch Break</i>
90 min	Interactive Session II
30 min	<i>Afternoon Break</i>
30 min	Summary and Outlook

Table 1: The preliminary schedule of our proposed workshop.

of people with disabilities with the typical target audience of this conference (human-machine interaction specialists and usability experts) to get closer to the real needs of people with disabilities instead of just talking about them.

3 AUDIENCE

Our target group are researchers and especially practitioners working on AVs, e.g., with a focus on eHMIs as well as experts on inclusion and accessibility. To reach this target group, we plan to promote this workshop with a dedicated website, and we will reach the community via social media channels (e.g., Twitter, Facebook, and LinkedIn) and mailing lists (e.g., GI, or ACM SIGCHI). We will set up a workshop website at <https://a3ws.github.io/MuC2022/> including all relevant information and the accepted position papers. We also invite *Lightning Talks*.

4 EXPECTED OUTCOMES

Our primary goal is to connect practitioners and researchers from different areas to enable meaningful discussions about accessibility and inclusiveness for the automotive domain. Participants will discuss, share, learn approaches for an inclusion-based approach to research in the driving domain. Additionally, novel research ideas and a network of potential collaborators should be established. The outcomes of the workshop will be made publicly available. We plan to publish accepted position papers on the workshop's website. Additionally, the workshop is intended to start collaborations for future inclusive technologies. To this end, we want to open up communication channels for future contact. As this research area is still under-reported, we see the workshop as a starting point for high-impact publications. [11]

5 ORGANIZERS

Mathias Haimerl (corresponding author) is a PhD candidate at the Johannes Kepler Universität (JKU) Linz. His research at the Human-Computer Interaction Group (HCIG) of Technische Hochschule Ingolstadt (THI) focuses on inclusion in automated traffic.

Mark Colley is a PhD candidate at the University of Ulm in the Institute of Media Informatics. His research looks into communication possibilities between automated vehicles and vulnerable road users such as pedestrians and cyclists with a particular focus on accessibility. Mark Colley already co-organized two workshops at AutomotiveUI and MobileHCI.

Andreas Löcken is a postdoctoral researcher in the HCI group at the Technische Hochschule Ingolstadt (THI) and the CARISMA

Institute of Automated Driving (C-IAD). His research focuses on human-computer interfaces, and in particular on the interaction between humans and automated vehicles, including the perspectives of passengers and vulnerable road users such as pedestrians. He has co-organized five workshops and a tutorial, as well as six times the AutomotiveUI conference and once MuC.

Andreas Riener is professor for Human-Machine Interaction and Virtual Reality at Technische Hochschule Ingolstadt (THI) with co-appointment at the CARISMA Institute of Automated Driving (C-IAD). He conducts hypotheses-driven quasi-experimental research in HCI with focus on future mobility concepts. 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, CHI, and AutomotiveUI.

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