

Management summary

International eHMI workshop 19th of April 2018, Vienna

Contact

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On April 19th 2018, the interACT project organised an international workshop specifically dedicated to the growing research field on ***external human-machine interactions (e-HMI) between automated vehicles and human road users***. 20 leading international researchers represented the knowledge of current e-HMI developments and projects from industry and academia. They discussed today's major challenges regarding methodologies, design/ technology, as well as important areas that require further research. The goal of the workshop was to foster cross-continental knowledge exchange (Europe, USA, Japan), with a special focus on exchanging knowledge ***to identify the most important, urgent, and difficult issues in regards to building sustainable e-HMI solutions for automated vehicles***.

The half-day workshop took place as an ancillary meet-up next to TRA2018. The participants were split up into three groups, each of which had to come up with their own 'Board of importance' to cluster and rate the relevance of a challenge or research need. Several overlapping topic clusters between the three groups could be identified.

Reflections for designing e-HMI solutions

Building innovative e-HMI requires a more comprehensive understanding of traffic interactions. From existing studies, we know that humans rely on the vehicle movements and that explicit communication (such as gestures) is used only in specific situations. Thus, a better understanding of what kind of e-HMI and what form of implicit communication (e.g. vehicle movements) is essential in which situation is needed. In addition, we know only little about the scalability of e-HMI design (e.g. being comprehensible for a single person as well as for groups of pedestrians, being usable for less as well as more complex traffic situations), cross-cultural differences and multi-modal design approaches. Next, to these challenges, it was discussed how we can design e-HMI to be applicable to a standard (e.g. ISO), but remain open and flexible enough for different types of vehicles, driving styles and brands. Last but not least, technological feasibility remains a topic. In this regard, one open challenge to be evaluated and tested thoroughly throughout the coming years is sensor reliability. To enable a two-way communication between AVs and humans in the future, technology would need to be able to understand human cues such as hand gestures, body language etc.

Appropriate methodologies and metrics for developing and evaluating e-HMI solutions

As the design space is quite complex the question arose how we can tackle the complexity of different interaction scenarios, cultural and contextual differences, as well as design for different vehicle types with the methodologies we currently have. The ecological validity for controlled experiments was discussed and if the results are scalable and generalizable to naturalistic settings. This went along with the question of what the right metrics are to measure the impact of e-HMI on road user behaviour and to evaluate specific e-HMI designs. Even though multiple disciplines were represented at the workshop (predominantly human factor researchers, but also mechanical-, or ergonomic engineers, and techno-anthropologists), all three groups agreed that the research community has to conduct more studies and further international knowledge exchange to identify: when, where and for what exactly e-HMI will actually be needed in the future. To ensure a democratic technological development process, thus, it will become even more important to collaborate interdisciplinarily, and to include industrial partners, as well as several stakeholders and social groups, such as pedestrians, cyclists or the on-board user of the AV. Next, to these challenges, the workshop revealed that e-HMI research demands more clarity in the terminology definitions for this domain.

Future effects of e-HMI

One of the most important concern was raised in relation to the influence of e-HMI on traffic safety as e-HMI could potentially show negative, unintended effects like a pedestrian over-trusting an AV's advice to cross, not focusing on the rest of the traffic anymore. One of the most important clusters over all three expert groups addressed the need to study long-term effects, both, negative and positive ones as we do not know how the

interaction with AVs as a whole will change with the introduction of AVs and how e-HMI can potentially mitigate the adverse effects of a change.

Participants

Experts from the following organizations participated:

Experts from other projects and organizations	AIST Japan Automotive Human Factors Research Center	Satoshi Kitazaki
	Delft University of Technology Human Factors of Automated Driving (HF-auto)	Riender Happee
	Eindhoven University of Technology PhD User Centered Engineering	Debargha Dey
	Massachusetts Institute of Technology AgeLab, Center for Transportation & Logistics	Bobbie Seppelt
	Nissan Research Center Silicon Valley Human Understanding and Design Group	Erik Vinkhuyzen
	RISE Viktoria Cooperative and Automated Vehicle Systems	Azra Habibovic
	Toyota Research Institute Public Policy and Government Affairs	Jane Lappin
	University of California San Diego Computer Science and Engineering - Distributed HCI Lab	Colleen Emmenegger
	University of California San Diego Contextual Robotics Institute	Deborah Forster
	Würzburg Institute for Traffic Sciences	Dominik Mühlbacher
Volvo Group Trucks Technology Human Factors and Automation	Emma Johansson	
Experts from interACT	Aalborg University Copenhagen MSc. Techno-Anthropology (interACT Visiting Researchers)	Alexandra Vendelbo-Larsen Markus Röthmüller Pernille Holm Rasmussen
	BMW Munich HMI – Research, New Technology and Innovation (interACT Partner)	Florian Weber Ronee Chadowitz
	German Aerospace Center Institute of Transportation Systems (interACT - Coordinator)	Anna Schieben
	Technical University Munich Ergonomics – Mechanical Engineering (interACT Partner)	André Dietrich
	University of Leeds Institute of Transport Studies (interACT Partner)	Natasha Merat Yee Mun Lee