

Workshop on Prosocial Behavior in Future Mixed Traffic

Citation for published version (APA):

Sahin, H., Mueller, H., Sadeghian, S., Dey, D., Löcken, A., Matvienko, A., Colley, M., Habibovic, A., & Wintersberger, P. (2021). Workshop on Prosocial Behavior in Future Mixed Traffic. In *AutomotiveUI '21 Adjunct: 13th International Conference on Automotive User Interfaces and Interactive Vehicular Applications* (pp. 167-170). Association for Computing Machinery, Inc.. <https://doi.org/10.1145/3473682.3477438>

Document license:

TAVERNE

DOI:

[10.1145/3473682.3477438](https://doi.org/10.1145/3473682.3477438)

Document status and date:

Published: 22/09/2021

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.



Workshop on Prosocial Behavior in Future Mixed Traffic

Hatice Şahin
hatice.sahin@uni-oldenburg.de
University of Oldenburg
Oldenburg, Germany

Heiko Müller
heiko.mueller@uni-oldenburg.de
University of Oldenburg
Oldenburg, Germany

Shadan Sadeghian
shadan.sadeghian@wininfo.uni-siegen.de
University of Siegen
Siegen, Germany

Debargha Dey
d.dey@tue.nl
Eindhoven University of Technology
Eindhoven, The Netherlands

Andreas Löcken
andreas.loecken@carisma.eu
Technische Hochschule Ingolstadt
Ingolstadt, Germany

Andrii Matviienko
matviienko@tk.tu-darmstadt.de
Technical University of Darmstadt
Darmstadt, Germany

Mark Colley
mark.colley@uni-ulm.de
Institute of Media Informatics, Ulm
University
Ulm, Germany

Azra Habibovic
azra.habibovic@ri.se
RISE Research Institutes of Sweden
Göteborg, Sweden

Philipp Wintersberger
philipp.wintersberger@tuwien.ac.at
TU Wien
Vienna, Austria

ABSTRACT

“Prosocial Behavior” means cooperating and acting in a way to benefit others. Since more and more diverse road users (such as electronic bicycles, scooters, etc.) but also vehicles at different levels of automation are sharing the safety-critical road environment, acting prosocial will become increasingly important in the future for both human and automated traffic participants. A few papers so far have already begun to address this issue, but currently, there exist no systematic methodological approaches to research this area. In the proposed workshop, we plan to define more specifically what characterizes prosocial behavior in future traffic scenarios where automated and manual vehicles meet and interact with all kinds of vulnerable road users. We further want to identify important scenarios and discuss potential evaluation methods for researching prosocial behavior. Ultimately, these findings will be integrated into a research agenda actively pursued by cooperation initiated during this event.

CCS CONCEPTS

• **Human-centered computing** → **Social engineering (social sciences)**; **Participatory design**.

KEYWORDS

prosocial behavior, vulnerable road users, automated vehicles

ACM Reference Format:

Hatice Şahin, Heiko Müller, Shadan Sadeghian, Debargha Dey, Andreas Löcken, Andrii Matviienko, Mark Colley, Azra Habibovic, and Philipp Wintersberger. 2021. Workshop on Prosocial Behavior in Future Mixed Traffic.

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

AutomotiveUI '21, September 13-14, 2021, Virtual Conference

© 2021 Copyright held by the owner/author(s).

ACM ISBN 978-1-4503-8641-8/21/09.

<https://doi.org/10.1145/3473682.3477438>

In *13th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI '21), September 9–14, 2021, Leeds, United Kingdom*. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3473682.3477438>

1 INTRODUCTION

Even though traffic is a highly regulated environment, many situations require informal coordination in order to resolve conflicts where formal rules are insufficient. This, for example, can include non-compulsory means (signals, horns, etc.) but also anticipatory action, facial expressions, eye contact, or body movements [12]. Acting prosocial in such situations benefits all the traffic participants and may help in resolving the possible conflicts in a good time and manner.

In a broad sense, prosocial behavior is defined as “*actions that benefit others*” [29] and, consequently, it comes into play in everyday traffic situations. Prosocial behavior in traffic scenarios requires acting by taking the well-being of other traffic participants into account and promoting effective cooperation with others such as drivers, passengers, pedestrians, and cyclists [14]. Acting prosocially in traffic benefits all traffic participants in positive ways, and it helps to resolve traffic conflicts easily and effectively (especially in non-rule-based traffic situations). This happens, for example, when searching for parking lots or letting pedestrians etc. cross the road, when merging lanes effectively, and in many other situations.

In the future, prosocial behavior will become even more relevant as both the types (i.e., new forms of micro-mobility like e-scooters, e-bikes, hoverboards, etc.) but also the numbers of traffic participants (especially so-called “vulnerable road users”, see below) steadily increase. Consequently, there is a need to support prosocial behavior both at the individual and societal level, with the goal to foster cooperation but also safety. Still, fostering prosocial behavior is not necessarily straightforward. First, it must be made clearer what defines prosocial behavior in traffic and what the key features are (i.e., which maneuvers, behaviors can be considered as prosocial?). Second, methodological approaches (for example, scenarios and

assessment methods operationalizing the concept) need to be developed. Third, the behavioral expectations of automated vehicles (AVs), especially in the context of prosocial behavior, are yet to be discovered.

In the proposed workshop, we want to address these issues. Our goal is the formulation of a research agenda to guide future directions at this important intersection of mobility, social sustainability, prosocial behavior, and automated driving.

1.1 Vulnerable Road Users

Vulnerable road users (VRUs) are often described as pedestrians, cyclists, and motorcyclists, for example by the World Health Organization [28]. Other definitions highlight their vulnerability as they do not have a protective outside shield [34]. Recently, Holländer et al. [15] defined this target group with regards to the needs in Human-Computer Interaction more granularly. They first distinguish between motorized (motorcyclist, personal conveyance) and non-motorized (pedestrian, personal conveyance, cyclist) VRUs. Every class can contain the attribute “especially vulnerable”. This can be due to age or disability [15]. Alternatively, previous work tried to assist vulnerable road users by augmenting bicycles [22], helmets [24, 32], and surrounding environments [23, 25] or by measuring their perceived safety using head movements [26]. However, the communication between AVs and VRUs remains unexplored, and is important to explore this design space even further.

1.2 Automated Vehicles

The On-Road Automated Driving Committee of SAE and the ISO workgroup on Intelligent transportation Systems define an automated vehicle as a (motor) vehicle system that is capable of executing a part or all of the dynamic driving task on a sustained basis [27]. With the provision of advanced automation systems converging to full automation (SAE Level 5), the role of the human driver becomes increasingly irrelevant. In a highly- or fully-automated vehicle, the vehicle’s occupant can no longer assume responsibility for the driving behavior or the intention of the vehicle. As a result, common human-centric interaction protocols such as attempting to look inside the vehicle for confirmation of the driver’s situational awareness are moot [13, 17]. This leads to a communication gap, especially in situations where the vehicle’s driving behavior in the traffic context is not enough to disambiguate the intention of the vehicle.

Research on the interaction between AVs and other road users have proposed external Human-Machine Interfaces (eHMIs) as a viable solution in addressing this communication gap, and evaluations of eHMIs have shown promise in mitigating ambiguity [7, 10], increasing trust [16], enhancing perceived safety [11], and improving the user experience [9]. Anticipating surrounding traffic behavior, adapting to environmental factors, and operating in a social context is critical. Therefore, beyond just the functional eHMI, it is important the aspect of pro-social behavior is considered in the design of eHMIs from the earliest stage.

2 GOAL AND TOPICS OF THE WORKSHOP

Given the considerations above, it becomes clear that most research on interactions between AVs and VRUs has focused on pragmatic

aspects like safety, trust, or UX, in limited settings (mostly from the perspective of pedestrians). As so far, only a few works (such as [30, 33]) have been focusing on prosocial behavior, and we want to address this emerging issue in the proposed workshop. In particular, we aim at:

- providing an interdisciplinary forum for designers, practitioners, and researchers in HCI to discuss interaction concepts to enhance prosocial traffic behavior.
- discussing state-of-the-art research on prosocial traffic behavior [14, 30, 33], and how this can influence everyday life and interactions in future vehicles.
- discussing individual (positive) experiences of prosocial behavior and how these examples can be integrated in the design of automated vehicles.
- exploring new interaction paradigms that support prosocial traffic behavior.
- formulating a research agenda to develop initiatives in research and practice to exchange ideas in overlapping areas of automated driving, mobility, prosocial behavior, and social sustainability.

To initiate and guide the discussion, we propose a (non-exhaustive) list of potentially interesting research questions (to be extended during the workshop):

- What are the key features of prosocial behavior in traffic?
- Which scenarios and measurements can be applied for operationalizing prosocial behavior in traffic?
- What assumptions, beliefs, and values do people hold about Automated Vehicles?
- What type of prosocial behavior is expected from Automated Vehicles?

3 EXPECTED OUTCOMES

By bringing together researchers and designers who intend to work at the intersection of prosocial behavior and automated vehicle technologies, we aim at getting a detailed overview of recent challenges important in interactions between vulnerable road users, automated vehicles, and/or manually driven cars, and potential ways to overcome them. Based on such insights, we want to extend the problem space of cooperating in dynamic traffic environments and embed prosocial behavior as a key issue. Participants are expected to discuss, share, and take away beneficial insights/strategies, as well as novel research ideas and a network of potential collaborators. We further aim to touch upon the effect of individual and cultural differences on prosocial behavior.

We will set up a workshop website at <https://www.prosocialws.uni-oldenburg.de>, which will feature videos and overviews of the discussions. Further, depending on the success of the workshop, it is planned to compile a survey paper about the “Grand Challenges”, issues, approaches, etc. discussed at the workshop to communicate the state-of-the-art in prosocial interaction between VRUs and automated vehicles to the community (ACM Computing Surveys).

4 WORKSHOP ORGANISATION AND SCHEDULE

Our main target group are researchers and practitioners working on automated vehicles, e.g., with a focus on external human-machine interfaces. We will promote this workshop using a dedicated website and reach out to the community via social media channels (e.g., Twitter, Facebook, or LinkedIn), mailing lists (e.g., GI, or ACM SIGCHI), and at the AutomotiveUI'21 conference. We plan to organize the sessions in the morning or afternoon time in Central Europe. This will allow participants from other parts of the world to join our workshop at reasonable times.

Following suggestions for virtual workshops [1], we plan to keep our participants engaged in the workshop by limiting the time of exhausting synchronous video-meetings below 90 minutes while preferring interactive formats, such as discussions in break-out groups. In addition to Zoom, we will make participants actively use Miro boards during the workshop activities to give ideas, feedback or answers. The schedule is presented below:

Day 1

- Opening and participants introduction (30 min)
- Interactive session 1 (50 min)
- Discussion (10 min)

Day 2

- Recap (10 min)
- Interactive session 2 (60 min)
- General discussion on future directions (20 min)

In the first session, we introduce the topic and use break-out groups to explore expectations with regard to prosocial behavior in current traffic situations. Between the two sessions, workshop participants will be asked to continue thinking about the topic add some some answers on questions like “What does automated driving mean to you?” asynchronously. The second session focuses on the expected prosocial behavior of automated vehicles. We will discuss this topic in break-out groups that focus on different traffic participants.

5 BIOGRAPHIES

Hatice Şahin (corresponding author) is a doctoral candidate at Carl von Ossietzky University of Oldenburg, in the Media Informatics and Multimedia Systems Group. Her research focuses on the interaction between VRUs and AVs and prosocial behaviour in traffic.

Heiko Müller is a postdoctoral researcher at Carl von Ossietzky University of Oldenburg, in the Media Informatics and Multimedia Systems Group. His research interest lies in the future of transportation.

Shadan Sadeghian is a postdoctoral researcher at the University of Siegen in Germany. Her research focuses on designing multimodal user interfaces in automated vehicles and socially and environmentally sustainable mobility [30, 31].

Mark Colley is a PhD candidate at the University of Ulm, Germany. His research looks into communication possibilities between AVs and VRUs such as pedestrians and cyclists [4–6] and human factors of automated driving [2, 3].

Debargha Dey is a postdoctoral researcher at Eindhoven University of Technology, Netherlands. He has a background in Human-Computer Interaction and his research interest lies in automotive human factors. His research focuses on human behavior in traffic and Human-Machine Interfaces for automated driving.

Andrii Matviienko is a postdoctoral researcher in Telecooperation Lab at Technical University of Darmstadt, Germany. His research focuses on the assisting technology in urban environments using mixed reality and multimodal interfaces.

Andreas Löcken is a postdoctoral researcher in the HCI group at the Technische Hochschule Ingolstadt (THI). His research focuses on Ambient Displays for Human-Computer Interaction in general, and specifically the interaction between AVs and VRUs (e.g., [8, 19, 21]) or passengers (e.g., [18, 20, 36]).

Azra Habibovic is senior researcher at the independent and nonprofit organization RISE Research Institutes of Sweden and research area director for road-user behavior at the research center SAFER. Her research focuses on improving traffic safety and user experience by means of automation and connectivity. A special interest is design and evaluation of interactions in and around automated vehicles, including interactions with vulnerable road users.

Philipp Wintersberger is a researcher at TU Wien. His publications focus on trust in automation [35], attentive user interfaces [37], transparency of driving algorithms, as well as UX/acceptance of automated vehicles. Currently, he serves as Technical Program Chair for AutomotiveUI'21.

ACKNOWLEDGMENTS

REFERENCES

- [1] Zoe M Becerra, Nadia Fereydooni, Andrew L Kun, Angus McKerral, Andreas Riemer, Clemens Schartmüller, Bruce N Walker, and Philipp Wintersberger. 2021. Interactive Workshops in a Pandemic: The Real Benefits of Virtual Spaces. *IEEE Pervasive Computing* 20, 1 (2021), 35–39.
- [2] Mark Colley, Christian Bräuner, Mirjam Lanzer, Marcel Walch, Martin Baumann, and Enrico Rukzio. 2020. Effect of Visualization of Pedestrian Intention Recognition on Trust and Cognitive Load. In *12th International Conference on Automotive User Interfaces and Interactive Vehicular Applications* (Virtual Event, DC, USA) (*AutomotiveUI '20*). ACM, Association for Computing Machinery, New York, NY, USA, 181–191. <https://doi.org/10.1145/3409120.3410648> accepted.
- [3] Mark Colley, Benjamin Eder, Jan Ole Rixen, and Enrico Rukzio. 2021. Effects of Semantic Segmentation Visualization on Trust, Situation Awareness, and Cognitive Load in Highly Automated Vehicles. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21)*. Association for Computing Machinery, New York, NY, USA. <https://doi.org/10.1145/3411764.3445351>
- [4] Mark Colley, Stefanos Can Mytilineos, Marcel Walch, Jan Gugenheimer, and Enrico Rukzio. 2020. Evaluating Highly Automated Trucks as Signaling Lights. In *Proceedings of the 12th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI '20)*. ACM, Association for Computing Machinery, New York, NY, USA. <https://doi.org/10.1145/3409120.3410647>
- [5] Mark Colley and Rukzio Rukzio. 2020. A Design Space for External Communication of Autonomous Vehicles. In *Proceedings of the 12th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI '20)*. ACM, Association for Computing Machinery, New York, NY, USA. <https://doi.org/10.1145/3409120.3410646>
- [6] Mark Colley, Marcel Walch, Jan Gugenheimer, Ali Askari, and Rukzio Rukzio. 2020. Towards Inclusive External Communication of Autonomous Vehicles for Visually Impaired Pedestrians. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, Hawaii USA) (*CHI '20*). ACM, Association for Computing Machinery, New York, NY, USA. <https://doi.org/10.1145/3313831.3376472>
- [7] Shuchisnigdha Deb, Lesley J. Strawderman, and Daniel W. Carruth. 2018. Investigating pedestrian suggestions for external features on fully autonomous vehicles: A virtual reality experiment. *Transportation Research Part F: Traffic Psychology*

- and Behaviour 59 (nov 2018), 135–149. <https://doi.org/10.1016/j.trf.2018.08.016>
- [8] Debargha Dey, Azra Habibovic, Andreas Löcken, Philipp Wintersberger, Bastian Pflöging, Andreas Riener, Marieke Martens, and Jacques Terken. 2020. Taming the eHMI jungle: A classification taxonomy to guide, compare, and assess the design principles of automated vehicles' external human-machine interfaces. *Transportation Research Interdisciplinary Perspectives* 7 (2020). <https://doi.org/10.1016/j.trip.2020.100174>
- [9] Debargha Dey, Kai Holländer, Melanie Berger, Bastian Pflöging, Marieke Martens, and Jacques Terken. 2020. Distance-Dependent eHMIs for the Interaction Between Automated Vehicles and Pedestrians. In *Proceedings - 12th International ACM Conference on Automotive User Interfaces and Interactive Vehicular Applications, AutomotiveUI 2020*. <https://doi.org/10.1145/3409120.3410642>
- [10] Debargha Dey, Andrii Matviienko, Melanie Berger, Bastian Pflöging, Marieke Martens, and Jacques Terken. 2020. Communicating the intention of an automated vehicle to pedestrians: The contributions of eHMI and vehicle behavior. *it-Information Technology* 1, ahead-of-print (2020). <https://doi.org/doi:10.1515/itit-2020-0025>
- [11] Stefanie M. Faas, Lesley Ann Mathis, and Martin Baumann. 2020. External HMI for self-driving vehicles: Which information shall be displayed? *Transportation Research Part F: Traffic Psychology and Behaviour* 68 (jan 2020), 171–186. <https://doi.org/10.1016/j.trf.2019.12.009>
- [12] Berthold Färber. 2015. *Kommunikationsprobleme zwischen autonomen Fahrzeugen und menschlichen Fahrern*. Springer Berlin Heidelberg, Berlin, Heidelberg, 127–146. https://doi.org/10.1007/978-3-662-45854-9_7
- [13] Azra Habibovic, Victor Malmsten Lundgren, Jonas Andersson, Maria Klingegård, Tobias Lagström, Anna Sirkka, Johan Fagerlönn, Claes Edgren, Rikard Fredriksson, Stas Krupenia, Dennis Saluäär, and Pontus Larsson. 2018. Communicating Intent of Automated Vehicles to Pedestrians. *Frontiers in Psychology* 9, August (2018). <https://doi.org/10.3389/fpsyg.2018.01336>
- [14] Paul B Harris, John M Houston, Jose A Vazquez, Janan A Smither, Amanda Harms, Jeffrey A Dahlke, and Daniel A Sachau. 2014. The Prosocial and Aggressive Driving Inventory (PADI): A self-report measure of safe and unsafe driving behaviors. *Accident Analysis & Prevention* 72 (2014), 1–8.
- [15] Kai Holländer, Mark Colley, Enrico Rukzio, and Andreas Butz. 2021. A Taxonomy of Vulnerable Road Users for HCI Based On A Systematic Literature Review. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) (CHI '21). Association for Computing Machinery, New York, NY, USA, Article 158, 13 pages. <https://doi.org/10.1145/3411764.3445480>
- [16] Kai Holländer, Philipp Wintersberger, and Andreas Butz. 2019. Overt trust in external cues of automated vehicles: an experimental investigation. In *Proceedings of the 11th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*. 211–221.
- [17] Victor Malmsten Lundgren, Azra Habibovic, Jonas Andersson, Tobias Lagström, Maria Nilsson, Anna Sirkka, Johan Fagerlönn, Rikard Fredriksson, Claes Edgren, Stas Krupenia, and Dennis Saluäär. 2017. Will There Be New Communication Needs When Introducing Automated Vehicles to the Urban Context? Springer International Publishing, 485–497. https://doi.org/10.1007/978-3-319-41682-3_41
- [18] Andreas Löcken, Anna-Katharina Frison, Vanessa Fahn, Dominik Kreppold, Maximilian Götz, and Andreas Riener. 2020. Increasing User Experience and Trust in Automated Vehicles via an Ambient Light Display. In *22nd International Conference on Human-Computer Interaction with Mobile Devices and Services* (Oldenburg, Germany) (MobileHCI '20). Association for Computing Machinery, New York, NY, USA, Article 38, 10 pages. <https://doi.org/10.1145/3379503.3403567>
- [19] Andreas Löcken, Carmen Golling, and Andreas Riener. 2019. How Should Automated Vehicles Interact with Pedestrians? A Comparative Analysis of Interaction Concepts in Virtual Reality. 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, 262–274. <https://doi.org/10.1145/3342197.3344544>
- [20] Andreas Löcken, Wilko Heuten, and Susanne Boll. 2016. AutoAmbiCar: Using Ambient Light to Inform Drivers About Intentions of Their Automated Cars (AutomotiveUI '16 Adjunct). Association for Computing Machinery, New York, NY, USA, 57–62. <https://doi.org/10.1145/3004323.3004329>
- [21] Andreas Löcken, Philipp Wintersberger, Anna-Katharina Frison, and Andreas Riener. 2019. Investigating User Requirements for Communication Between Automated Vehicles and Vulnerable Road Users. In *2019 IEEE Intelligent Vehicles Symposium (IV)*. 879–884. <https://doi.org/10.1109/IVS.2019.8814027>
- [22] Andrii Matviienko, Swamy Ananthanarayan, Shadan Sadeghian Borojeni, Yannick Feld, Wilko Heuten, and Susanne Boll. 2018. Augmenting Bicycles and Helmets with Multimodal Warnings for Children. In *Proceedings of the 20th International Conference on Human-Computer Interaction with Mobile Devices and Services* (Barcelona, Spain) (MobileHCI '18). Association for Computing Machinery, New York, NY, USA, Article 15, 13 pages. <https://doi.org/10.1145/3229434.3229479>
- [23] Andrii Matviienko, Swamy Ananthanarayan, Stephen Brewster, Wilko Heuten, and Susanne Boll. 2019. Comparing Unimodal Lane Keeping Cues for Child Cyclists. In *Proceedings of the 18th International Conference on Mobile and Ubiquitous Multimedia* (Pisa, Italy) (MUM '19). Association for Computing Machinery, New York, NY, USA, Article 14, 11 pages. <https://doi.org/10.1145/3365610.3365632>
- [24] Andrii Matviienko, Swamy Ananthanarayan, Abdallah El Ali, Wilko Heuten, and Susanne Boll. 2019. *NaviBike: Comparing Unimodal Navigation Cues for Child Cyclists*. Association for Computing Machinery, New York, NY, USA, 1–12. <https://doi.org/10.1145/3290605.3300850>
- [25] Andrii Matviienko, Swamy Ananthanarayan, Raphael Kappes, Wilko Heuten, and Susanne Boll. 2020. Reminding Child Cyclists about Safety Gestures. In *Proceedings of the 9TH ACM International Symposium on Pervasive Displays* (Manchester, United Kingdom) (PerDis '20). Association for Computing Machinery, New York, NY, USA, 1–7. <https://doi.org/10.1145/3393712.3394120>
- [26] Andrii Matviienko, Florian Heller, and Bastian Pflöging. 2021. Quantified Cycling Safety: Towards a Mobile Sensing Platform to Understand Perceived Safety of Cyclists. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) (CHI EA '21). Association for Computing Machinery, New York, NY, USA, Article 262, 6 pages. <https://doi.org/10.1145/3411763.3451678>
- [27] On-Road Automated Driving (ORAD) committee. 2021. *Taxonomy and Definitions for Terms Related to Driving Automation Systems- J3016*. Technical Report.
- [28] World Health Organization. 2019. Protecting vulnerable road users. <https://www.who.int/china/activities/protecting-vulnerable-road-users>. [Online; accessed 24-MAY-2021].
- [29] Stigmatized Persons. 2010. Stigmas and Prosocial Behavior. *The Psychology of Prosocial Behavior* (2010), 59.
- [30] Shadan Sadeghian, Marc Hassenzahl, and Kai Eckoldt. 2020. An Exploration of Prosocial Aspects of Communication Cues between Automated Vehicles and Pedestrians. In *12th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*. 205–211.
- [31] Shadan Sadeghian Borojeni, Susanne CJ Boll, Wilko Heuten, Heinrich H Bühlhoff, and Lewis Chuang. 2018. Feel the movement: Real motion influences responses to take-over requests in highly automated vehicles. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–13.
- [32] Tamara von Sawitzky, Philipp Wintersberger, Andreas Löcken, Anna-Katharina Frison, and Andreas Riener. 2020. Augmentation Concepts with HUDs for Cyclists to Improve Road Safety in Shared Spaces. In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–9.
- [33] Nicholas J Ward, Kari Finley, Jay Otto, David Kack, Rebecca Gleason, and T Lonsdale. 2020. Traffic safety culture and prosocial driver behavior for safer vehicle-bicyclist interactions. *Journal of safety research* 75 (2020), 24–31.
- [34] Fred Wegman, Letty Aarts, and Charlotte Bax. 2008. Advancing sustainable safety: National road safety outlook for The Netherlands for 2005–2020. *Safety Science* 46, 2 (2008), 323–343.
- [35] Philipp Wintersberger, Anna-Katharina Frison, Andreas Riener, and Tamara von Sawitzky. 2019. Fostering user acceptance and trust in fully automated vehicles: Evaluating the potential of augmented reality. *PRESENCE: Virtual and Augmented Reality* 27, 1 (2019), 46–62.
- [36] Philipp Wintersberger, Frederica Janotta, Jakob Peintner, Andreas Löcken, and Andreas Riener. 2021. Evaluating feedback requirements for trust calibration in automated vehicles. *it - Information Technology* 63, 2 (2021), 111–122. <https://doi.org/doi:10.1515/itit-2020-0024>
- [37] Philipp Wintersberger, Clemens Schartmüller, and Andreas Riener. 2019. Attentive user interfaces to improve multitasking and take-over performance in automated driving: the auto-net of things. *International Journal of Mobile Human Computer Interaction (IJMHCI)* 11, 3 (2019), 40–58.