



# What's beyond safety? Workshop on promoting well-being for mobility users in future hybrid societies

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## ABSTRACT

Recent advances in automated vehicle technology could lead to a “hybrid society” with close integration of traffic participants with different mobilities. This integration will likely impact their societal acceptance as well. While traditional methods of evaluating safety may be needed, consideration for the overall well-being of traffic participants is necessary. Transportation engineering and psychology researchers have considered the well-being of the overall travel experience. However, these methods need to consider well-being while interacting with mobilities. In the proposed workshop, we plan to define and characterize more precisely what should be considered while thinking about the well-being of traffic participants, how future interactions with semi-autonomous or automated mobility systems will interact in shared spaces, and the design considerations to facilitate cooperative interactions. Through this workshop, the organizers look to integrate the findings into a research agenda, which can lead to future collaborations initiated during this event.

## CCS CONCEPTS

• **Human-centered computing** → HCI theory, concepts and models.

## KEYWORDS

well-being, hybrid society, future mobility, prosocial automation

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## 1 INTRODUCTION

Advances in autonomous vehicle technology have led to a reimagining of future urban environments [20]. Recent efforts have looked to understand the requirements to realize these ‘hybrid societies’ [8] in the future. Hamann et al. [8] define *hybrid societies* as self-organizing, collective systems composed of natural and artificial parts (bio-hybrid) or human beings interacting with and through

socio-technical systems. In hybrid societies, advanced automation mobility systems are entwined with more contextual information gathering, allowing for seamless integration of automation systems [6, 20]. Several cities like Woven by Toyota [14] and Noem City in Saudi Arabia [5] are focused on coexistence between humans and robots. While imagining these future cities, researchers should preempt challenges toward the coexistence of humans and AI agents. To some extent, the challenges with integrating automated mobility in our society today present a prescient warning of the emergent challenges in future hybrid societies.

### 1.1 Challenge of co-existence between automated mobility and humans

Technologies enabling automation in mobility systems are becoming ubiquitous through the vast proliferation of AI and Robotics. With the ever-increasing focus on autonomous mobility, the development of these technologies is undergoing rapid progress. Several urban environments are actively testing and implementing mobility solutions that are not just personal cars but are also focused on environmentally-friendly mobility [13]. However, their societal acceptance has not necessarily been without their challenges [19]. The city of Paris recently banned e-scooters with 90 percent support from the residents [7]. Some other cities have had mixed responses, with San Francisco temporarily banning scooters for a short period before reintroducing them with several restrictions [18]. Other cities have been cautious by heavily controlling the use case for these mobilities, as observed in Portland [1]. Additionally, the rise in delivery robots will likely increase traffic on sidewalks [10], which may present challenges for pedestrians [9]. With limited space, these technologies can further complicate interactions between road users, and their lack of societal acceptance may complicate matters further. In principle, focusing exclusively on safety-related functions may not be sufficient, and it would require researchers to focus on values that can consider the challenges of societal acceptance by promoting the well-being of mobility users.

### 1.2 Beyond safety: Considering well-being of mobility users in future societies

Autonomous mobility systems promise to improve sidewalk mobility modes safety, such as e-scooters, delivery robots, etc. However, sidewalk micromobility modes may still be human-controlled. While safety is essential for the usability of these systems, their social acceptance requires methods to ensure the benefits of these interactions are not just limited to the physical safety outcomes but also look to assess whether these allow humans to feel comfortable while interacting with hybrid traffic participants in the future.

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A potential measure of such outcomes for humans in society could be the recognition of their well-being. Organizations like the Organization for Economic Co-operation and Development (OECD) have proposed the quality of life of its individuals while considering their health, emotional well-being, and personal fulfillment within a sustainable environment as a better proxy for assessing the state of the society against traditional metrics like GDP or Income [21]. The concept also has cultural underpinnings in Japanese culture, referred to as 'Anshin', which explains how people feel at ease under uncertain situations, as long as the situation is not drastically challenging [15]. This feeling makes traffic participants more comfortable interacting with different road users under different circumstances as long as there is no compromise on their physical sense of safety ('Anzen').

Psychological research has several contrasting perspectives on defining and measuring well-being. Ryff et al., [16] conceptualized eudaimonic well-being as achieving living through fulfilling one's potential, emphasizing personal development, a deep meaning towards life's purpose, and eventual self-realization. In contrast, Diener [2] characterized hedonic well-being as rooted in the immediate experience of pleasure, positive emotions, and the absence of pain and negative emotions. Given the characterization of the research problem and the time scale of evaluation, both frameworks present unique perspectives to understand how individuals may feel well-being, which could be beyond the immediate state of feeling safe and secure. There has been an exploration of the overall well-being of the traffic participants [4]. Similarly, while research in mobility and well-being presents unique perspectives on the overall experience of traffic participants, these mostly fail to characterize interactions between traffic participants and how that would impact their well-being.

## 2 GOAL AND TOPICS OF THE WORKSHOP

From the above discussion, it is essential to consider how to facilitate smooth interactions between humans and mobility systems equipped with automated technologies. Past research in mobility systems does not comprehensively consider individual well-being while considering outcomes. To some extent, the authors have characterized the state of well-being based on assessing interactions between personal mobility and other traffic participants [11, 12]. Some research in the past has considered methods to facilitate smooth interactions, like the gentleman driver study designed to put VRUs (vulnerable road users) at ease while interacting with the car [3]. A past workshop at Automotive UI focused on interactions while maintaining cooperative behaviors between VRUs and autonomous vehicles [17]. Our workshop proposal further extends the idea beyond safety and cooperation to elicit detailed outcomes for assessing the well-being of future traffic participants. The workshop provides an opportunity for designers, practitioners, researchers in HCI, and human factors towards an interdisciplinary approach for encouraging prosocial behavior amongst traffic participants and improving their well-being. The goals of the workshop are:

- Invite perspectives on the challenges of future mobility integration in urban settings while considering the well-being of different traffic participants.

- Propose methodologies to measure the state of well-being amongst traffic participants.
- Facilitating methods to promote societal acceptance of advanced mobility systems from the perspective of the human
- Present unique perspectives that are beyond the traditional scope (social, psychological, and ethical perspectives)

## 3 EXPECTED OUTCOMES FROM THE WORKSHOP

This workshop invites unique perspectives from researchers and designers within the AutoUI community who are considering pursuing values to provide additional values to future mobility users that could promote their well-being. We aim to learn about challenges in interactions with different types of road users (humans and autonomous mobility systems). Participants will discuss, share, and take away beneficial insights/strategies, novel research ideas, and a network of potential collaborators. We aim to summarize and submit the findings to a paper and invite perspectives from the participants that could create a special issue focused on promoting mobility users' well-being.

## 4 TENTATIVE SCHEDULE

Our workshop's target audience is researchers and practitioners working on autonomous technologies in the automotive domain. The workshop will be promoted through a dedicated website and community outreach through social media channels, mailing lists, and at the conference event. The sessions will be organized in the morning and afternoon in the Pacific time zone. The organization will be in person, which aligns with the conference format. To ensure the workshop is interactive, participants will actively engage in discussions using tools like Miro, etc.

- Welcome, introduction, and ice breaker (20 mins): The workshop goals will be introduced, followed by a round of quick introductions by the participants
- Keynote on Well-being in mobility (30 mins): The Speaker will introduce the concept of well-being in mobility and its importance in a future hybrid society
- Session 1 on Measuring Well-being (45 mins): Researchers will present the tools and methods that can be used to measure well-being in mobility
- Coffee break (15 mins)
- Session 2 on Prosocial behavior and well-being (45 mins): Presentation of factors and behaviors that improve well-being in hybrid societies.
- Group Discussions (50 mins): Participants will be separated into 3-4 groups. Each group will discuss the topics and questions based on the sessions as starting points.
- Presentation of group discussions (20 mins): Each group will present a summary of their discussions followed by Q/A.
- Closing Remarks (15 mins)

## 5 ATTENDANCE AND INFRASTRUCTURE REQUIRED

We expect approximately twenty-five participants, excluding the organizers. The workshop can accommodate more or fewer participants by changing the group sizes or the number of groups as needed. One table and projector with screen is required. The organizers will provide all other materials. All presentation slides and materials used within the workshop will be available for download at [https://honda-research-institute.github.io/autoui2024\\_wellbeing\\_workshop/](https://honda-research-institute.github.io/autoui2024_wellbeing_workshop/).

## 6 BIOGRAPHIES

### 6.1 Keynote speaker

**6.1.1 Prof. John D Lee.** Dr. John D. Lee is the Emerson Electric Professor at the University of Wisconsin-Madison in the Department of Industrial and Systems Engineering and director of the Cognitive Systems Laboratory. He also has an adjunct appointment in the Department of Civil and Environmental Engineering. His academic background includes a PhD in Mechanical Engineering, an MS in Industrial Engineering, and a BS in Mechanical Engineering and Psychology. Dr. Lee's research focuses on the safety of complex human-machine systems by considering how technology mediates attention. Much of his research considers how human behavior interacts with advanced automation to affect transportation safety. This research has been funded by NSF, NASA, ONR, NHTSA, FHWA, DOJ, Nissan, Toyota, Honda, and GM. He has written extensively about advanced transportation technology and the consequences for system safety. He is also the lead author of a popular textbook, *Designing for People: An Introduction to Human Factors Engineering*.

### 6.2 Organizers

**6.2.1 Shashank Mehrotra.** Shashank Mehrotra is a Senior Scientist at the Human Centered Intelligence group in Honda Research Institute, Inc., San Jose, California. He received his Ph.D. in human factors engineering from the University of Massachusetts, Amherst, in 2021. His research interests are studying technology acceptance in mobility systems, studying behavioral patterns in dynamic traffic environments, and understanding the safety impact on vulnerable population groups.

**6.2.2 Mengyao Li.** Mengyao Li is an Assistant Professor at Georgia Tech in the School of Psychology and director of the Hybrid Intelligence (HI) Lab. She received her Ph.D. from the University of Wisconsin-Madison in the Department of Industrial and Systems Engineering. Her research interests lie in the interaction of human and machine intelligence. Specifically, Dr. Li understands, predicts, and shapes human-AI communication, social cooperation, and long-term coevolution in safety-critical environments.

**6.2.3 Kumar Akash.** Kumar Akash is a Principal Scientist at the Human Centered Intelligence group in Honda Research Institute, Inc., San Jose, California. He received the B.Tech. degree in mechanical engineering from the Indian Institute of Technology Delhi, New Delhi, in 2015 and the M.S. and Ph.D. degrees from Purdue University, West Lafayette, Indiana, in 2018 and 2020, respectively,

all in mechanical engineering. His research interests are developing human-aware automated systems using dynamic modeling and optimizing human behavior and cognitive states.

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