User Perceptions of the Risks of Electric, Shared, and Automated Vehicles Remain Largely Unexplored

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POLICY BRIEF

Issue

Advocates of electric, shared, and automated vehicles (e-SAVs) envision a future in which people no longer need to drive their privately owned, petroleum-fueled vehicles. Instead, for daily travel they rely on fleets of electric, automated vehicles that offer travel services, including the option to share, or "pool," rides with strangers. The design, deployment, and operation of e-SAVs will require widespread willingness of users to share with strangers vehicles that are capable of fully automated driving. To achieve the environmental and societal goals of e-SAVs it is critical to first understand and address safety and security concerns of potential and actual users. Researchers at UC Davis reviewed the literature to understand potential users' perceptions of safety and security risks posed by intertwined social and technical systems of e-SAVs and proposed a framework to advance research, policy, and system design.

Key Research Findings

Multiple or missing definitions of basic terms limit our understanding of how users' and potential users' perspectives affect prospects for and implications of systems of e-SAVs. This research proposes definitions for several core concepts (See: Definitions of User Perspectives).

This research offers a framework that is more general than in literatures on automated vehicles. The automated vehicle literature largely limits "safety" to road safety, i.e., collision-avoidance, and "security" to cybersecurity, i.e., protecting data including virtual representations of people from intentional harm by system outsiders. The broader definitions offered here are

Definitions of User Perspectives

- *Safety* is being secure from accidental harm
- *Security* is being safe from intentional harm
- *Risk* characterizes situations in which there are multiple possible outcomes of an action
- *Uncertainty* is the extent to which those outcomes and their probabilities are unknown
- *Trust* is willingness to make oneself vulnerable to the actions of others; and,
- *Personal risk constellations* are arrangements of safety and security risks as perceived by users. Users and potential users of e-SAVs may be distinguished by differences in their personal risk constellations.

intended to allow for a richer description of the possible accidental and intentional harms to which users of e-SAVs may perceive themselves to be exposed.

Understanding potential users' risk constellations will improve the chances for successful transitions to e-SAVs. Past research reports a greater than 50% increase in the number of respondents who state they would be willing to use a "self-driving vehicle" when the framing shifts from a general willingness (40%) to do so to a more specific case of using a self-driving vehicle that "is as good a driver as [the respondent]" (65%).

Research into personal risk constellations should reveal motivations, attitudes, beliefs, feelings, and other antecedents of observed behavior. That some people will use pooled services doesn't mean they accept riding

with strangers in close quarters. People who have used pooled shared vehicle services are more likely than non-users to 1) use the pooled services because they believe they won't actually be required to share with a stranger for any given trip and 2) are more likely to disagree their motivation to use pooled services is because they feel safer if they did share the ride with a stranger.

Past research reports safety and security concerns are different for women and men based on their actual and prospective use of shared vehicle services. Women are less inclined towards sharing and less comfortable with automated vehicle technology in general. Few users of shared vehicle services view them as an opportunity to meet new people, but women were much less likely (12%) than men (23%) to agree this was a reason to use these services. Women were also three times as likely as men to report negative experiences with other riders on shared rides. In response, women were more likely than men to indicate they would like more information about who else might be in, or get into, a shared vehicle.

Potential users' demographics, attitudes, and motivations will affect their personal risk const-ellations and thus their willingness to adopt e-SAVs. Existing research has identified personal characteristics that serve as predictors of automated, electric, and shared vehicle adoption individually, such as men being more amenable to automation technology. However, those same associations may not hold true for e-SAVs. Users may evaluate the risk of purchasing a partially automated vehicle quite differently than sharing a fully automated vehicle.

Public polls from 2014 to 2019 show no increase in "comfort," "confidence," or "enthusiasm" regarding automated vehicles. The relative consistency of these polls' conclusions despite differences in study populations, means of sampling, and question wording suggests continued broad-based consumer reticence about automated vehicles.

Policy and Research Implications

Personal risk constellations are a means of coordinating research and policy making regarding diverse views of the risks and uncertainties of experiencing accidental or intentional harm to our person—physical, emotional, mental, as well as our digital representations. There is a lack of consistency in populations targeted with risk assessment studies, and when studies target similar populations, there is a lack of consistency in the concepts of safety, as well as the near absence of any concept of security other than cybersecurity. This makes generalizing across existing literature a challenge and the need for additional study apparent.

Further research is needed in conjunction with system integrators, mobility service providers, and regulators to evaluate the importance of personal risk constellations among user groups and target strategies to address the needs of the most vulnerable population groups. Continuing efforts to hear alternative perspectives, promote multi-disciplinary research, and incorporate direct user participation in imagining systems of electric, shared, automated mobility will allow decision makers to identify strategies to shift and lessen personal risk constellations.

More Information

This policy brief brief is drawn from "User Perceptions of Safety and Security: A Framework for a Transition to Electric- Shared-Automated Vehicles," a white paper from the National Center for Sustainable Transportation, authored by Kenneth S. Kurani of the University of California, Davis. The full paper can be found on the NCST website at https://ncst.ucdavis.edu/project/user-perceptions-safety-and-security-toward-framework-transition-electric-shared-and.

For more information about the findings presented in this brief, please contact Kenneth Kurani at knkurani@ucdavis.edu.

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