# From imagination to implementation: The evolution of user preference research for automated vehicles in real-world operations

**Proposal**
**for a self-organized workshop at the IATBR 2024**

to be held parallel to other IATBR sessions (within the IATBR regular program, i.e., during the conference)

**Organization:**
A call for contribution will be issued, additionally to invited contributions

**Duration:**
3 hours

**Organizers:**
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## DESCRIPTION

The ever-increasing level of automation and digitalization trends is poised to significantly change the way we travel in the future. In the transportation sector, the most prominent vision of these trends is that (fully) automated vehicles (AVs) will become a reality on our roads – not only as privately owned cars, but also as part of on-demand services, operated by private companies or fully integrated in the public transportation system. Understanding how these new transportation options will change activity patterns and the way we conduct our activities, individual travel behavior, and travel demand has become a key topic in transportation research. The introduction of innovative technologies like vehicle automation holds the potential to improve the transportation system (e.g., by enhancing efficiency and sustainability), but also bears risks (e.g., rebound effects, such as increased VMT due to heightened comfort and lower cost). Moreover, the success of new technologies in terms of market-take up and their ability to improve the transportation system strongly depends on user acceptance and behavior. Consequentially, especially in the past decade, the number of studies aimed at understanding user preferences in the context of vehicle automation as well as the impact of the technology has increased exponentially (see Milakis et al., 2017, Harb et. al, 2021).

As the technology is not yet widely available in the market (with the exception of real-world pilots and small-scale operation of such vehicles in the US, China etc.), the research community has relied heavily on using stated preference (SP) methods to assess potential effects of AVs on mode choice preferences (e.g., Krueger et al., 2016, Haboucha et al., 2017, Kolarova et al., 2019, Correia et al., 2019, Etzioni et al., 2021, Yin & Cherchi, 2022). Empirical studies evolved not only with regard to the assessment and analysis methods, but also in the way new transportation concepts were introduced to potential users, including pictures, text, or short videos (e.g., Correia et al., 2019, Kolarova et al., 2019) in most of the surveys and utilizing more advanced techniques, such as virtual reality, in more recent ones (e.g., Yin & Cherchi, 2024). While there were several pilots of level 2 to level 3 automated vehicles worldwide, these still do not provide the level of maturity of the technology, so that study participants can actually experience real-world implementation of highly automated driving (e.g., studies within European projects, such as AUTOPILOT, AVENUE, SHOW[1]). These empirical studies have provided important insights into potential user preferences in the context of vehicle automation. However, a high degree of uncertainty remains given a potential hypothetical bias in such studies which we cannot estimate at this point. Moreover, due to differences in the evaluated automated vehicle concepts, operationalization of user preferences, and analysis methods, comparison between the studies is challenging.

In Europe, e. g., in Germany, and the U.S., e.g., Pittsburg and San Francisco, a "new generation" of research projects with a strong focus on testing on-demand automated vehicles / vehicle fleets under (close to) real-world conditions has begun. This opens new opportunities to capture user acceptance, preferences, and behavior, while also shedding light on the evolution of these aspects throughout a learning process that study respondents undergo as they engage with these vehicles over time. How does this new type of projects differ from the "SP era"? The most obvious dimension is that we have a more realistic experience of the technology by embedding it in a real-world (or very similar to real-world) context, so we are no longer evaluating a single-point acceptance of a technology, but a use case which encompasses the continuous usage context where preferences are based on actual experience. Another key difference is that by measuring stated preference we might be able to make a snapshot of potential decisions and the factors that influence these. Real-world operation research projects represent a dynamic situation (a learning process). We are then not only able to capture before experience *vs.* after experience preferences, but we can actually capture on a small scale an innovation diffusion process in progress rather

[1] AUTOPILOT: autopilot-project.eu, AVENUE: h2020-avenue.eu, SHOW: show-project.eu

than single-point measures. We can even test and validate potential technology introduction measures in a co-creation process. This means that qualitative methods for recording preferences, decisions and actions are becoming increasingly important for analyzing and understanding user behavior. The variety of qualitative methods used in scientifically supported projects is continually increasing, often in combination with classic quantitative methods.

Several questions arise with this new generation of research projects:

- What are the different dimensions between capturing preferences in a hypothetical situation compared to real-world operation research projects?
- What gaps in our understanding persist despite the insights gained from the "era of SPs"?
- Are SP surveys or realistic experiments in the field of automated driving reliable and valid?
    - Can they continue to be the method of choice?
    - Can the data gathered from surveys and experiments accurately reflect real-world user behavior? What behaviors can and cannot be understood?
- Under which circumstances/prerequisites must SP surveys and experiments be designed, so that they can be reliable?
- In the area of real-world pilots: what can we learn?
    - Can we solely rely on revealed preferences in such research projects, or do they only capture the early adopters´ phase of the introduction of the technology?
    - Can we capture 'actual behavior' in real-world operation research projects?
    - Are we able to capture longer-term diffusion processes, learning, or relocation choices?
    - What are the main data-sources, metrics, and analysis methods in this research era?
    - Do we have the 'right' approaches, what is missing, and what should we seek to improve?
- More broadly:
    - How can we ensure the transferability of research results?
    - How can the gap between realistic experiments or pilots and real-world behavior be bridged?
    - Is there potential for How traditional SP and RP methods can be further developed?
    - How can we best integrate SP and RP methods in the context of AV?

The workshop has a strong methodological focus, and aims to open up a broader discussion on the role of real-world operation research projects regarding the understanding of user preferences in the context of new technologies. While focusing on automated vehicles as a concrete use case, it also touches on several related emerging trends, for instance shared mobility. Moreover, it aims to evaluate what we have done well, which former insights may have misled us, and to identify areas in which we should expand our focus and methods in researching travel behavior.

The workshop invites researchers who work in the field of analyzing user preferences in the context of emerging technologies, such as automated driving, to discuss critical issues of the evaluation of the impact of these technologies on travel behavior.

**AGENDA**

**Part 0: Introduction, goals and agenda of the workshop (5 Min)**

**Part I: A brief reflection of what have we learned in "the era of SPs user studies" (60 Min)**

- Provide an overview of methods, insights and limitations (e.g., VoT studies in the context of AVs (Viktoriya), a brief summary and reflection from earlier IATBR and related Workshops (Yoram/Amanda/Joan), other relevant studies, ...) (20 Min)

- The "pre-real-world operation era": Studies with VR, serious games, chauffeur studies – selected examples, e.g. E. Cherchi VR experiments (10 Min)

- Discussion / Group work (30 Min): Small group discussion and summary of opportunity/limitations of past AV research and most pressing gaps.

***10 Min Break***

**Part II: Research questions, methods, challenges in "the era of real-world operation research projects" (95 Min)**

- Input: 3 Min Presentations (briefly mentioning: pilot description, research questions addressed in user studies, methods) (overall: 35 Min)

  *Potential contributors (additional call for contribution will be distributed among the IATBR community)*
  German projects with a focus on automated shared fleets including user preference studies: e.g., KIRA, AHOI, MINGA, ...; Private companies, such as MOIA
  Ann Arbor, Michigan Mcity
  Selected projects from Austria and Switzerland: e.g., ULTIMO project
  Selected works from the UK: e.g., Elisabetta Cherchi
  Singapore (e.g., new data-sources Prateek Bansal)
  Japan
  US
  (China)

- Group work (45 Min)
  - What are the most important behavioral/user research questions going forward?
  - What are (new) research questions that we can address in the 'era of real-world' CAV engagement?
  - What are the most important (new) types of data and measurements we now have access to?
  - What are (new) methods to be used?
  - What are the methodological challenges?
  - What can be solutions to these challenges?
  - ....

- Joint discussion (15 Min)

**Part III: Outlook (10 Min)**

## RELATED IATBR 2024 TOPICS

**The workshop addresses the following conference topics:**

- adoption, adaptation, and impacts of new technologies
- pattern recognition in decision-making processes
- psychometrics, attitudes, and perceptions

**and indirectly the following one:**

- transformative policy and behavioral change
- innovative data collection methods and alternative data sources

### Literature


Correia, G. H. d. A., Looff, E., van Cranenburgh, S., Snelder, M., & van Arem, B. (2019). On the impact of vehicle automation on the value of travel time while performing work and leisure activities in a car: Theoretical insights and results from a stated preference survey. Transportation Research Part A: Policy and Practice, 119, 359-382.

Haboucha, C. J., Ishaq, R., Shiftan, Y. (2017), "User preferences regarding autonomous vehicles, Transportation Research C No. 78, pp. 37-49.

Harb, M., Stathopoulos, A., Shiftan, Y., & Walker, J. (2021). "What Do We (Not) Know About Our Future with Automated Vehicles", *Transportation Research C,* 123.

Etzioni, S., Daziano, R., Ben-Elia, E, & Shiftan, Y., (2021) "Preferences for Shared Automated Vehicles: A Hybrid Latent Class Modeling Approach" Transportation Research C, 125.

Kolarova, V., Steck, F., & Bahamonde-Birke, F. J. (2019). Assessing the effect of autonomous driving on value of travel time savings: A comparison between current and future preferences. Transportation Research Part A: Policy and Practice, 129, 155-169.

Krueger, R., Rashidi, T. H., & Rose, J. M. (2016). Preferences for shared autonomous vehicles. Transportation research part C: emerging technologies, 69, 343-355.

Milakis, D., Van Arem, B., & Van Wee, B. (2017). Policy and society related implications of automated driving: A review of literature and directions for future research. Journal of Intelligent Transportation Systems, 21(4), 324-348.

Yin, H., & Cherchi, E. (2022). Willingness to pay for automated taxis: a stated choice experiment to measure the impact of in-vehicle features and customer reviews. Transportation, 1-22.

Yin, H., & Cherchi, E. (2024). Conducting Stated Choice Experiments within an Immersive Virtual Reality Environment: an Application to the Discrete Choice of Automated versus Normal Taxi. Transportation Research Procedia 76, 120-132.