

Shaping In-Vehicle Behaviours through Activity-Centered Design

Ankit R. Patel

ALGORITMI Research Center
University of Minho
Guimaraes, Braga, Portugal
majorankit@gmail.com

Fjollë Novakazi

Centre for Applied Autonomous
Sensor Systems
Örebro University
Örebro, Sweden
fjolle.novakazi@oru.se

Pnina Gershon

MIT Agelab
Massachusetts Institute of Technology
Cambridge, Massachusetts, USA
pgershon@mit.edu

Sakura Akahoshi

Degree Programs in Systems and
Information Engineerin
University of Tsukuba
Tsukuba, Ibaraki, Japan
akahoshi@css.risk.tsukuba.ac.jp

Azra Habibovic

Scania CV
Gothenburg, Sweden
azra.habibovic@se.traton.com

Areen Alsaid

University of Michigan-Dearborn
Dearborn, Michigan, USA
alsaid@umich.edu

Kyungjoo Cha

Design and Engineering
Bournemouth University
Bournemouth, United Kingdom
kcha@bournemouth.ac.uk

Abstract

In today's fast-paced society, most individuals commute either by personal vehicle or public transportation. User preferences and requirements are crucial, with design playing a significant role. The nature of design should be such that it is both inclusive and assimilative, and its purpose is to propel innovation and progress while also improving the quality of life of the user. That is why a general focus was given to the user-centered design approach while developing vehicles, especially, cabin (cockpit) design. With prioritizing the user activities, it is interesting to explore how users' experience and behavior vary through the application of different design approaches. Nevertheless, existing literature has significantly overlooked the impact of design approaches on "human activity". Therefore, the main objective of the workshop is to examine the relationships between activity-centered design and user behavior.

CCS Concepts

• Human-centered computing → Activity centered design;

Keywords

Activity-centered design, In-vehicle technology, Personalization, User-centered design, Users' experience

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1 Goal and Topics

Improving the driving experience in vehicles, from passenger cars to freight trucks, has been a major challenge since the beginning of vehicle automation. The automotive industry continuously pushes the boundaries of vehicle design to meet driver's requirements, reflecting its changing phases. This process often involves applying a "human-centered design" (HCD) approach [4, 6, 8, 10]. Through active user engagement, HCD not only improves understanding of user needs, motivations, and concerns, but it also streamlines and adapts the design process.

An alternative approach to design is activity-centered design (ACD) which focuses on how a system generates an output as a consequence of certain activities [12, 16, 25]. In essence, ACD assumes that the user will acquire the ability to adapt to the in-vehicle features if it is created in accordance with the activities and tasks that are designed to be performed by the user [15].

Recently, it has been noted that there has been a significant growth in the number of features that are offered to drivers/users are included in vehicles [18, 22]. The reasons for this are multifaceted including giving users an aesthetically pleasing experience, respond to their interests and preferences, utilizing new technological capabilities, and taking into account the numerous other factors involved, just to list a few [17, 20, 21]. With these changes to the driving capabilities and environment, it is essential to establish an understanding of the potential consequences, particularly concerning distraction [2, 7], situational awareness [14, 23, 24], usability [1, 3, 13], cognitive burden [5, 19], accessibility [11], and enhanced user-experience [9].

By integrating and innovating HCD and ACD, this workshop explores the future development trends in design for in-vehicle cabins,

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with an emphasis on how these advancements will influence users' activities. For a better user experience, designers should provide different cabin designs for both passenger-cars and freight vehicles. This is particularly important when taking into consideration ways to promote engagement in safe behavior and a range of different user activities inside the cabin. We want drivers to be involved in an enhanced and appropriately designed journey. Therefore, the objective of this workshop is to deliver a more human-centric experience by drawing on different design approaches.

The aim of this workshop is to open up a discussion amongst scholars and practitioners in the automotive sector about the following topics, among others:

- User needs and requirements with various design environments
- User-friendly designs for user activities inside the cabin
- Human factors associated with different design features within cabin environments
- User behavior changes due to various design-based features
- Various design modules for in-cabin environments

2 Outcomes

With a focus on "users' activities," this workshop adds to the literature on UCD, ACD, human factors, and in-vehicle technology. Keeping this in mind, the workshop will seek to answer the following research questions (RQ):

- (1) **RQ1:** In what ways does the activity-centered design approach influence the behavior of the users?
- (2) **RQ2:** What factors define and shape human behaviors in terms of user knowledge, acceptability, user experience, and safe behaviors regarding future vehicles?
- (3) **RQ3:** How might future designs promote inclusion and assist people in varied activities?

3 Participants

The goal of the workshop is to re-invent design-centric activities inside the cabin of the vehicle. Therefore, the workshop is aimed at participants from various fields, including designers, psychologists, engineers, human factors, and usability professionals. We anticipate that around 25 to 30 participants will take part. We are reaching out to potential participants via emails, and social media (such as LinkedIn, Facebook, X, Instagram, etc.) to accommodate more researchers into the workshop.

4 Tentative Schedule

The workshop webpage is available at <https://www.majorankit.com/humantech-autoui2025-qut-brisbane> for more details. Below is a tentative workshop schedule considering the morning shift:

5 Expected Outcomes

The anticipated result of the workshop is to attract a diverse range of people who will engage in contemplation on the repercussions that are associated with design-centered human activities. The expected outcome of the workshop is a publication (e.g., AutoUI or journal) continuing to deepen the discussions from the workshop,

Table 1: The tentative schedule of the workshop.

Activity	Time slot	Description
Introduction	8:30–8:45	Introduction and discussion of the workshop's objectives. Expectation setting among the organizers and workshop participants.
Keynote Address 1	8:45–9:15	Ilse Harms: CBR (The Netherlands Driver License Authority), The Netherlands (Remote)
Keynote Address 2	9:15–09:45	Gemma Read: University of the Sunshine Coast, Australia (In-person)
Keynote Address 3	9:45–10:15	Jiayu Wu: Royal College of Art, UK (In-person)
Coffee Break	10:15–10:45	Time for a break and informal networking.
Session 1	10:45–11:25	Open discussion among participants (in groups) on various parameters/factors that play a pivotal role in human activities due to various design concepts.
Session 2	11:25–12:05	Informed by Session 1 discussion, participants will create an affinity diagram. More extensive discussion on the factors presented by the participants.
Closing	12:05–12:30	Discussion on the learning outcomes from the workshop, future challenges, and how to address these challenges and opportunities.

and developing it further, in order to increase awareness among the automotive community.

6 Support Requests

There is no specialized software or hardware required for the workshop. However, one keynote session will be conducted via Zoom. Other requirements include a projector with a screen and stationary such as marker pens, easel pads, and Post-it notes.

7 Biographies

Ankit R. Patel is currently associated with the University of Minho, Portugal. He served in various positions at international conferences, like ACM (CHI, OzCHI, NordiCHI, AutomotiveUI, GROUP, COMPASS, MuC, IMX, PDC, etc.), IEEE (IEEE/ASME JRC, ITEC, AFRICON, etc.), and IFAC CTS. His research interests lie in the fields of human factors and interactions, sustainable transportation, travel behavior and psychology, and socially inclusive transportation.

Pnina Gershon (PhD) is a Research Scientist at MIT AgeLab, Center for Transportation and Logistics, where she co-directs the Advanced Vehicle Technology (AVT) consortium and leads the naturalistic driving research. Dr. Gershon's research provides the theoretical and applied insights needed to develop solutions to next-generation transportation challenges and advance the future of safe, efficient, accessible, and sustainable mobility. Her research focuses on the impact of emerging technologies, automated and electrified mobility, driver distraction, impairment, and behaviors

of high-risk driver populations on driving safety. Dr. Gershon received the NIH Fellows Award for Research Excellence (2018) and the NICHD Collaboration Award (2017).

Azra Habibovic (PhD) is Technology Leader for Human Factors and Automation at TRATON R&D where she is responsible for defining and driving forward TRATON's early-stage research in the field of human factors and automated driving. Her research focuses on traffic safety and user experience, with emphasis on design and evaluation of interactions in and around automated vehicles.

Fjollë Novakazi earned her PhD in Human-Technology-Design in December 2023 at Volvo Cars, in collaboration with Chalmers University of Technology. Her thesis focused on drivers' perception of automated vehicles and human-centric design solutions. In March 2024, she joined the Centre for Applied Autonomous Sensor Systems (AASS) at Örebro University as a post-doctoral researcher. Her research explores the cognitive aspects of human interactions with automation and robotics, particularly in mixed-traffic environments and collaborative manufacturing settings. To understand these complex interactions, Fjollë employs mixed-methods approach, including surveys, interviews, co-design workshops, experimental setups, and field evaluations.

Sakura Akahoshi is a Ph.D. student at the University of Tsukuba, Japan. She was a research assistant for SIP-adus project from 2020 to 2022 and conducted a remote experiment to build educational content to enable the learning of knowledge about automated driving systems. Her research interests lie in the fields of human factors, authority distribution during automated driving, human-machine collaboration, and trust-building between humans and automated vehicles.

Areen Alsaid is an assistant professor of industrial and manufacturing systems engineering at the University of Michigan-Dearborn and the director of the User State Estimation Laboratory. Her research focuses on affective computing and user state estimation to facilitate human and automation teaming. Before joining UM-Dearborn, she worked as a research scientist and data scientist at Ford Motor Company, where she worked on developing in-vehicle technologies to increase trust and acceptance of automated vehicles. Areen earned her PhD in Industrial and Systems Engineering from the University of Wisconsin-Madison and MS degree in Industrial Engineering from the University of Central Florida.

Kyungjoo Cha is a Principal Academic in Product Design (User Experience Design) in the Design & Engineering Department at Bournemouth University. She possesses PhD in Design Research and Human-Computer Interaction funded by Jaguar Land Rover at Brunel University London. Her current research interests are with the human-centred speculative approach in the mobility sector to understand the emotional experience. She performed several funded research projects focused on user experience design for automobiles and facilitated a series of design workshops for students, commercial designers and engineers to practice scenario building, emotional experience mapping and product/system concept generation.

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