Breaking Ground: Examining the Social Dimensions of AI Development and Trials in Automated Mobility

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Abstract

This paper explores the social dimensions of AI in automated mobility through an ethnographic case study of the 'Planzer – Dynamic Micro Hub with LOXO' project in Bern and Fribourg (Switzerland). Our findings highlight how teleoperation and software development relate to digital representations of the embodied sense of driving, a connection that is crucial for achieving reliable and accountable automated vehicles. Emphasizing social interactions, our research advocates for human-centered AI technologies that enhance human capabilities and foster user trust.

Keywords

artificial intelligence, automated vehicles, human-centered AI, pilot trials, robotics, sociology

1. Introduction: AI as a social phenomenon

The complex history of AI spans over 70 years [1]. Often defined as "the science and engineering of making intelligent machines" [2], AI is frequently associated with advances in machine-learning (ML) techniques [3, 4]. These definitions align with a cognitivist perspective on intelligence and learning, viewing them as qualities of the human mind to be replicated by computers. While problem-solving and cognitivism remain central to AI [5, 6, 7], critics highlight the need to ground AI in everyday life to understand it as a social phenomenon, advocating for technical developments that reflect this perspective. Phil Agre argued that "AI's whole mentalist foundation is mistaken, and the organizing metaphors of the field should begin with routine interaction with a familiar world, not problem solving inside one's mind" [8]. In the late 1980s, alternative approaches to AI emerged, inspired by phenomenology [9], ordinary language philosophy [10], and naturalistic anthropological research [11]. Maes [12] highlights the behavior-based conception of AI as a significant development, contributing to a predominantly humanistic, bottom-up approach, contrasting with the earlier rationalistic, top-down approaches [13, 14, 15].

These evolving contexts have given rise to various AI approaches across disciplines such as human–computer interaction (HCI), human–robot interaction (HRI), computer-supported cooperative work (CSCW), and science and technology studies (STS). These fields often emphasize that "the success of [AI] is not so much a technical as a social matter" [16]. Human-centered AI, a key initiative in HCI, argues that AI/ML algorithms must be designed with an awareness of their integration into larger social systems [17, 18]. This approach aims to empower and augment human skills rather than replace them [19, 20]. STS-based sociological approaches advocate for recognizing technological objects as integral participants in social life [21, 22, 23, 24, 25]. The extent to which AI represents a fundamental social transformation is a hotly debated topic in sociology and public discourse [26, 27, 28].

Contributing to these discussions and to the AI development, our paper presents an ongoing case study of the 'Planzer – Dynamic Micro Hub with LOXO' project[1], started in September 2024 as a

AI days HES-SO '25 January 27–29, 2025, Switzerland

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collaboration of a well-established Swiss parcel service Planzer, and a technology start-up LOXO based in Bern and with labs in Fribourg. They are currently conducting tests of highly automated driving in the city center of Bern. This project introduces a new sustainability aspect to urban logistics, particularly in middle-mile and last-mile parcel delivery. Developing the sociological approach to AI [29], we have been conducting video-ethnographic fieldwork in Bern and Fribourg to gain insights into the work involved in this project and related tests and development of the cutting-edge technology as a social phenomenon.

Automated Vehicles (AVs) have been hailed as a technology with the potential to profoundly change transportation and urban life. Research highlights both positive impacts, such as improved efficiency and safety [30] and spatial accessibility [31], and negative effects, including congestion [32] and social inequalities [33]. These aspects intersect in urban planning and social acceptance research, focusing on ethics, trust, and legislation [34, 35]. While private AVs have garnered significant attention [36], public transport and delivery AVs are a major focus of research in automated mobility and logistics [37, 38, 39]. Driverless shuttles have been piloted in numerous street trials worldwide over the past decade, aiming to understand interactions between new technology and established road users [40, 41], identifying societal challenges and areas for technical improvement. They typically operate at low speeds, free of fare, on short urban routes [42, 43].

Sociologically, a key theme in studies of AI is how human participants produce or challenge the "self-sufficiency" of AI-based technology in situational use, relating to agency and fundamental social trust [44, 45]. Existing research shows that people adjust their behavior when interacting with AI-based devices, learning to work and interact efficiently with them. For example, Pelikan et al. [46] describe this as "accommodation work," where people integrate novel technologies into their routine activities, such as walking or driving in the streets (see also [47, 48]). By examining the social phenomena surrounding AI development and trial deployment, we hope to contribute to the development of technologies that are not only innovative but also socially responsible. This ensures that AI solutions are designed with a human-centered perspective, ultimately enhancing their effectiveness and sustainability in real-world applications.

2. Background and methodology: Naturalistic video-ethnography

The main principles of our approach align with naturalistic studies of the situated organization of social activities developed in ethnomethodology and conversation analysis (EMCA). The notion of naturalistic studies is tied to the sociological naturalism outlined, for instance, by Edward Rose: "I like to watch people to see what they do and what they can do — just as any naturalist may watch other creatures" [49]. As expressed by Harvey Sacks, the founder of conversation analysis, the goal of such studies is "not to arrange things conveniently but to find out how they are arranged" [50]. The focus is on the situated production of institutional order, including sequences of actions, social categories (e.g., driver, pedestrian, cyclist), and practical reasoning involving talk, documents, software, or other tools and objects. The aim of EMCA is to access, describe, and explicate the relevant details of social activities that participants take for granted as part of their work [51, 52, 53, 54]. In short, EMCA investigates in detail "what makes activities what they are" – for their participants as members of society [55]. Contemporary approaches inspired by this perspective emphasize studying "distributed actors" [56] and "recentering the cognitive sciences around interacting minds" [57]. Contributing a radically non-cognitivist view in a largely cognitivist field of computer sciences, in the last five decades, EMCA has been very influential in social studies of technology and AI [58, 59], also in the context of HCI [60, 61].

The analysis of video-recorded data and other materials follows an inductive, data-driven procedure: (1) noticing phenomena of interest; (2) building collections of similar occurrences; (3) systematic comparative analysis; (4) precise description and explication of practical conduct [62, 56, 63, 64]. Approached in this way, aspects of situated action [65] are analytically observable but often unavailable through classic post-hoc inquiries like qualitative interviews or surveys. The relevant "phenomena of order" are typically not reflected upon or discussed by participants. However, the observational approach is often combined with qualitative interviewing to obtain adequate ethnographic knowledge about the studied setting [66]. EMCA studies of work and workplace aim to “come to terms with the distinctive practices that constitute professional and occupational activities” [67]. In addition to video and other direct records of social activities [68], talking with practitioners can also be used to obtain insights into the topical relevance structures of their practical knowledge and routine conduct [53].

Our point of departure is a radical shift of focus towards the practical competences upon which the pilot trials of AVs in public transportation depend, but which are often disregarded or mentioned only marginally in their outcomes. Our project aligns with STS, which have also addressed AVs from a social science perspective [69, 70, 71, 72]. Following these methodological leads, we propose that the established technical practice of pilot trials can be usefully revised as a social phenomenon, in line with Marres’ suggestion that “[w]e should examine if street testing can be re-purposed to enable the elicitation of societal aspects of innovation” [73, 74].

To become a social actor, the AV must be perceived by humans as reliable, competent, and accountable. “Accountability” means that the machine’s actions are seen as “reasonable” in terms of common sense and established social norms [75]. Therefore, the temporal and spatial structures of AI-based systems must be integrated into the routine organization of everyday life. This research is crucial for the societal integration of AI technologies, fostering acceptance and trust among users and other stakeholders. By understanding the social dynamics and ethical implications of AI deployment, including their testing “in the wild,” we can develop technologies that are not only innovative but also socially responsible and widely accepted. This approach ensures that AI solutions are designed with a human-centered perspective, ultimately enhancing their effectiveness and sustainability in real-world applications.

3. Findings: Embodiment as a digital object

Our first findings are based on ethnographic fieldwork with LOXO conducted in Fribourg and Bern during June and October 2024. In June, we discussed the autonomous vehicle and various aspects of the ‘Planzer – Dynamic Micro Hub with LOXO’ project during its preparation phase. By October, we had the opportunity to observe the testing and trials of the AV, which had commenced three weeks earlier. We collected video recordings from both field trips and analyzed them according to the methodological principles outlined above.

During our first visit in June, we were given a tour by Marc Gremaud, the project manager at LOXO. He provided a detailed explanation of the vehicle, which was currently in the depot in Fribourg for technical maintenance (Figure 1). In October, we had the opportunity to experience two actual test drives in Bern with Claudio Panizza, one of the co-founders of the start-up, as part of the technical development process (Figure 2).

This section presents mainly our initial findings related to riding along, teleoperation, and software development (observations conducted in October 2024). We highlight that a significant technical and social-organizational challenge in the pilot trials and development of AVs is achieving an adequate digital representation of the embodied work of driving, including the vehicle’s situated movement through the city’s physical space.

3.1. Riding along

At the beginning of the test drive in Bern (October 2024), Claudio telephoned Jonathan Péclat, one of the software developers at the company labs in Fribourg, and they remained on the phone for more than 40 minutes — the entire duration of the drives. This connection was crucial for real-time coordination. Two specific aspects were tested that day: teleoperation by Jonathan and the implementation of a new speed regulation system developed by another software developer, Nicolas Eichenberger. The drive consisted of two roundtrips to a location called “P1” (the first microhub), approximately 2 km from the depot where the AV is housed. Findings related to teleoperation (tested in the first roundtrip) and software development (tested in the second roundtrip) are further detailed in the next two subsections. Our observations document that driving itself is a social phenomenon, not an individual one, and to

Figure 1: Marc Gremaud showing us the AV in June 2024. The vehicle was in Fribourg for maintenance. Photograph by the authors.

Figure 2: Claudio Panizza demonstrating the AV in October 2024 (Bern). At this moment, the vehicle was driving autonomously. Photograph by the authors.

be properly grasped and digitally reproduced, this sociality has to be inherently taken into account: "The driving is not a separate driver's work. ... traffic flow [is] a cohort, it's a travelling company, and they're providing for each other's seeably safe and uninterrupted passage." [76]

3.2. Teleoperation

During our October visit, teleoperation of the AV was an ongoing technical challenge. During the ride, Claudio mentioned that the sense of speed is significantly different during teleoperation, making it "a bit scary," as one may feel that the vehicle is moving about 15-20 km/h faster than it actually is. In a later comment, he added that "the teleoperator can see and measure much more things than a normal human, he has access to sensors too, the reason is that is he is there to support the AV, customers or other humans in case of need. Primary use [of teleoperation] is at stop and low speed." When one of the authors reflected on what he observed during the test ride, the project manager Marc commented that teleoperation is "pretty hard with the current system." Later that day, Jonathan, the developer who tested teleoperating, specified that the main challenge is the different embodied sense of movement.

Although he is a skilled teleoperator (we talked with him extensively in June about his teleoperation experience in an earlier project), the trial we observed was only his second experience with this vehicle and the specific road, and he admitted that he was not feeling very confident yet. In the context of teleoperation, the embodied experience of the ride has to be adequately represented in real time of the driving. The process of obtaining competence and practical knowledge for teleoperators, including the digital on-screen representations of the embodied sense of driving the AV over larger distances, emerges as a crucial topic for further research.

3.3. Software development

After the teleoperation test, another software developer, Nicolas, tested a new system for vehicle speed regulation, collecting sensor and video data from the vehicle. This was conducted during a second trial ride to the "P1" location. Talking with us after the test, Nicolas explained that for his purposes, it didn't matter whether the vehicle was being driven by a human or in autonomous mode, as he was primarily interested in the optimal speed suggested by his algorithm at each moment of the journey. The novel approach to handling velocity can be described as dynamic, responding in real time to the current state of the environment. Jonathan, sitting next to Nicolas when we talked in Fribourg, explained that the vehicle speed is currently regulated by rule-based conditions, which is necessary for testing. These insights demonstrate how the embodied experience of the ride is captured and represented as a digital object, which can be retrospectively inspected in close detail for development purposes. This process is grounded in a distinction between the current state of the technology and its intended future operation.

4. Conclusion: The work to make AI work

Our study highlights the complex social dimensions of AI development and trials, particularly in automated mobility and logistics. Through our ethnographic fieldwork with LOXO, we observed the critical role of human interaction in the successful deployment of Automated Vehicles (AVs). Our findings provide first insights into the situated details of teleoperation trials and software development in achieving a seamless integration of AVs into urban environments. The challenges faced in teleoperation, such as the differing embodied sense of speed and movement, underscore the need for further research into the practical competences required to "break the ground" of the city into digital objects recognizable by the AV systems. Similarly, the dynamic speed regulation system tested during the observed trials illustrates the ongoing efforts to refine AI technologies to respond in real time to environmental conditions, rather than operate on hardcoded sets of predefined rules.

These insights are crucial for understanding how AI systems can be perceived as reliable, competent, and accountable social actors. By focusing on the situated production of social order and the practical reasoning involved in everyday interactions with AI, our research contributes to a more nuanced understanding of the social dynamics at play. This approach aligns with the broader goals of human-centered AI, which advocates for designing AI technologies that empower and augment human capabilities rather than replacing them. By focusing on the perspective of the developers working in collaboration with public stakeholders, we contribute to a more complex understanding of automated driving and AI-based technologies more generally. Our findings thus underscore the importance of transdisciplinary collaboration in AI research, bridging the gap between technical development and social science to create AI systems that truly benefit society.

Acknowledgments

We would like to thank everyone at LOXO for welcoming us at their premises, allowing us to observe their work and ask questions about it. Our research was funded by the Swiss National Science Foundation (SNSF) Spark grant CRSK-1_220950. We are grateful for this support.

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