Encylopedia of Mobilities (Edward Elgar, 2026)

25. Autonomous vehicles

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Introduction

Autonomous vehicle evangelists promise a bountiful 'hands-free' future. Relieved from steering, drivers can now do what they want: relax, watch TV, shop online, or chat to fellow passengers. Detractors see something different altogether: the voracious appetite of big tech, newly fetishized commodities, and the catastrophic environmental effects of continued car dependency. Regardless of perspective, however, whether autonomous vehicles will ever reach the masses remains an open question, with a suite of political, social, and technological concerns about how and why driving should be automated.

An arms race?

Most of the key debates around autonomous vehicles concern a battle between automotive manufacturers (Daimler, Ford, General Motors, Volkswagen) and big tech firms (Alphabet, Amazon, Nvidia), with AI start-ups, university research centres, and government departments, somewhere in-between. Whilst the distinctions are sometimes blurred (Tesla was founded in 2003, acting more like a big tech firm than an automotive manufacturer), many of the organizational, technological, and economic differences concerning autonomous vehicles can be fit into these boxes. One of these differences concerns the development of 'fully-autonomous' vehicles versus 'driver-assist' systems. Whilst big tech firms and AI start-ups are harnessing expertise in collecting huge volumes of data, automotive manufacturers with the help of trusted suppliers (Bosch, Intel), have utilized what they know best: how to design, assemble, and integrate specific modules and systems into vehicle models. Ultimately, these distinctions appear more as a continuum: 'more' or 'less' autonomy (accelerating, steering), in greater or fewer situations (urban areas, motorways), for more or less complex tasks (parking, lane merging).

Sensing, autonomy, decision-making, and power

Agency is a core concept. Complicating the heuristic distinction between full autonomy and driver assistance, control might be variously granted to specific vehicle modules or systems, depending on circumstances. 'Autonomous' vehicles might have trouble with particular junctions, struggle with pedestrians or cyclists, or be unable to perform some manoeuvres without handing control back over to human operators. Rather than autonomy being either 'on' or 'off', agency is best understood as being distributed between human and machine.

Decision-making is also important. Autonomous vehicles are equipped with knowledge of how to make decisions through 'machine learning' (ML). ML models define their own rules for making decisions, based on 'training data'. Data derived from on-board sensors provides the raw material for these algorithmic processes, comprising the accumulated knowledge of past manoeuvres and vehicle interactions. Varying sensor assemblages are being developed:

from high-resolution cameras (Tesla), to interconnected lidar and camera systems (Waymo), or 'bolt-on' external devices (Mobileye).

Political and economic power matters: who benefits from automation, who captures and accesses data, whether training data is diverse and inclusive, and how public spaces and infrastructures are being designed, built, and used to accommodate autonomous vehicles. Big tech monopolies found across social media, online advertising, and web hosting threaten to envelop the mobility world too as autonomous vehicle 'platforms' streamline mapping, sensing, navigation, advertising, and driving operations to extract greater profits.

Shows, tests, crashes, data, and communities

Fascinating methodological opportunities abound. Autonomous vehicle concepts are routinely shown at both motor shows and electronics shows, with firms showcasing their 'game-changing' innovations. Together with textual material, they provide an insight into developmental blueprints and speculative visions. Autonomous vehicles are also routinely tested. Such trials may take place in simulated environments, on private test tracks (emulating real-world road layouts), on delineated public roads, or across whole city-regions, subject to attaining legal permission (such as in Arizona, USA). Hypothetical or actual crashes – such as those simulated in Waymo's virtual tests, or the crash involving an Uber ATG vehicle that killed a pedestrian in Tempe, Arizona in 2018 – also invite further opportunity to 'open up' the black boxes of autonomous vehicles through the release of technical papers, safety reports, or crash investigations. Sensor data generated by autonomous vehicles can also be captured, analysed, and visualized to understand of how these vehicles perceive the world, and make decisions in it. Certain automotive brands (Tesla) and driver-assist devices (Comma) are already cultivating online communities that offer insights into the forming of new driving cultures around autonomous vehicles.

Conclusion

Autonomous vehicles are extremely unlikely to ever 'arrive'. However, this has not prevented huge, speculative investments that promise their materialization. A whole range of actors are involved in the incremental work of developing autonomous vehicles at present, from capturing data on 'typical' driving behaviour, to testing machine learning models, and re-writing regulatory frameworks. As the development of vehicles with more-or-less autonomous capacities continues, this work will arguably consolidate. Automotive manufacturers are already partnering with tech firms, AI start-ups are striking agreements with mapping companies, and device suppliers are becoming data providers. But with a shifting arrangement driven by a mix of technical know-how, persuasion, blind-faith, and promotional spin, the work itself will likely continue unabated, drawing more people in to 'fix' arguably intractable social, political, technological, and environmental problems of automating vehicles.

Further reading

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- Marres N (2020) Co-existence or displacement: Do street trials of intelligent vehicles test society? *British Journal of Sociology* 71 (3): 537-555.
- Stilgoe J (2017) Seeing like a Tesla: How can we anticipate self-driving worlds? *Glocalism: Journal of Culture, Politics and Innovation* 3: 1-20.