Driverless Cars and the Semantics of Mobility: Technical, Legal and Social Challenges

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Abstract

Driverless Cars embrace cutting-edge technologies in Intelligent Transport Systems (ITS), establishing a new era in mobility. Traditionally, for a driver the efforts made to uphold the situational awareness are compensated by some sort of gratification, e.g. driving pleasure and sense of adventure. This kind of reward is instead missing for the passenger of an autonomous vehicle. In this paper, we argue there is a lack of personal involvement in fully autonomous cars, especially if paired with Mobility as a Service (MaaS) platforms, hence we challenge technical, legal and social implications of such perspective. Our aim is to shape a model of analysis suitable to balance not only security and transparency, but also ethical sustainability and social acceptance.

Author Keywords

Mobility; Travel; Situation Awareness; Intelligent Transport Systems; Driverless Cars; Mobility as a Service; Social Robots; Security; Social Aspects.

ACM Classification Keywords

I.2.9 [Artificial Intelligence]: Robotics---Autonomous Vehicles.

Introduction: Mobility in Contemporary Age

In present times "mobility" can be considered a sort of synthesis between two conditions: nomadism and settlement. Especially in urban areas, people move continuously without being affected by a permanent displacement. In general, three kinds of phenomena can be related to the idea of mobility: geographical or "horizontal" mobility, social or "vertical" mobility and personal or "existential" mobility. Geographical mobility is a way to gain freedom and opportunities in the pursuit of a better life. Concerning social mobility, it is worth noting that, in the current society, mobility from lower class to middle class and from middle class to upper class is increasingly difficult. As such, the increase of geographical mobility has also the meaning of representing individuals' reactions to social steadiness. Personal mobility, especially in many industrialized societies, has represented a possibility for multitudes to fight against the sense of stagnation, to make life more meaningful and adventurous, to experience new cultures and to construct genuine international networks of like-minded people. In short, mobility has become, as Fortunati and Taipale argue [5], a strategy of compensation for too rigid and stable social structures. Likewise, in the globalization context, mobility has entailed the possibility to have a more flexible and cosmopolitan labor force ready to commute and travel.

Technology and Mobility: the "Loss of Meaning" in Traveling

Technology shapes our experience and meaning of mobility. Among its several benefits, it has allowed for example to move further, to radically reduce travel time, to increase the security of vehicles. As for the drawbacks, in this paper we intend to focus on the fact that technology has affected the epic connotation of travel, such as the adventure connected to the unknown. From this perspective, mobility represented the grass-root level reactions to social and individual predictability. For instance, cars have represented a powerful way to exercise the freedom of deciding where to go, when and with whom.

Situation Awareness: Level of Attention and Travel Experience

From the perspective of the traveler, two aspects should be carefully separated: the awareness on the purpose and the social context of the travel, and the situation awareness. The latter is defined by understanding whether and how the surrounding environment is critical for safety. Since the Nineties, situation awareness has become a major area of research on task-oriented interactions between humans and technical systems [2]. In this regard, human cognitive capability has incredible strengths but also limitations in the field of attention and memory. Its limits are identified as a bottleneck to satisfy the requirement of regular acquisition and correct interpretation of information supporting decision-making. In such context, automation has represented a solution to deliver increased reliability and performance by delegating specific tasks, or whole activities, to the system. As Endsley observed, "instead of performing tasks, the human's job has become that of monitor over an automated system – a role that people are not ideally suited to" [2]. In few words, it seems that situation awareness is strictly connected with the subjective driving experience, including the related sense of adventure and driving pleasure. Once not driving, to what extent the monitoring tasks will influence the overall subjective travel experience?

Driverless Cars: Full Delegation and Boredom

Many are the expected benefits from the shift towards autonomous driving, the next step in mobility automation currently in progress. They can be epitomized by the dramatic reduction of accidents, which are proved to be mostly related to human error [8]. As a matter of fact, state-of-the-art driverless car technology currently reaches the level of "conditional automation", corresponding to the level 3 out of 5 as indicated by the international SAE standard J3016 [9]. At such level, the automated driving system monitors the driving environment but, in some situations, it may require the human driver to take back the driving control (i.e. fallback performance of dynamic driving task). These "transitions" are particularly problematic because "*even engineers supervising self-driving vehicle testing lose situational awareness*" [1]. Apart from technical details, we may say that automation weakens the original concept of travel: if in the past travelers were in full control of their own vehicle and its circulation, passengers of self-driving vehicles end up delegating the driving functions to electronic chauffeurs, hence being carried and monitored by third-party technologies. In this sense, adventure is replaced by the boredom of mere surveillance. Since partial autonomy will not work in practice, key players of driverless cars, starting with Google's Waymo, are convinced that driverless cars will need to be fully autonomous (SAE Level 5) and without driver controls of any kind. In other words, the proposed solution to the situation awareness problem is to remove the human from the driving loop. An important implication this would have is the definitive termination of the sense of "unknown" in travels.

Mobility as a Service (MaaS): Shared Vehicles and the Loss of Intimacy

Driverless cars are expected to be an important pillar of emerging mobility models such as Mobility as a Service (MaaS) [6, 7]. In this scenario, the social need of transportation is fulfilled by a third-party service provider offering a fleet of driverless vehicles to be shared among a vast number of users. The expected benefit of MaaS is a significant decrease of owned cars, at the cost of implementing a complex, multi-stakeholder solution for satisfying people's mobility needs through a unified platform combining offers from various service providers. In such perspective, travel ends to be a personal and intimate experience, being shared with other people, mostly strangers.

Discussion

We argue that the identified challenges should be tackled rather than ignored by imposing full autonomy of cars. Key actors should concentrate their efforts in re-building a new meaning of travel in contemporary mobility, especially in urban areas. To achieve such goal, several implications should be considered from the technical, legal and social perspectives.

From the *technical perspective,* situation awareness should be considered from a broader perspective than the traditional one, since it includes additional aspects about the monitoring of the external environment such as the working conditions of the vehicle, the navigating instructions, and the defensive measures deployed to ensure cyber security. From the *legal viewpoint*, the issues can be summarized in the conflict between two opposite interests, namely transparency and security. Transparency could be qualified as the legal right to be claimed and enforced by customers, for instance via the

"open data" legal framework [3]. On the other hand, there may be situations in which the right to transparency is sacrificed for the sake of security, to defend the vulnerabilities of the whole technological platform and to guarantee confidentiality, for example when required in case of incident by forensic analysis. Considering the *social* meaning of driverless cars, it is important to point out that they can be considered as a form of social robot – encompassing various forms of interaction. In this context, the theme of automation has been largely debated and increasingly from an interdisciplinary perspective [4]. In this research community, there is growing consensus to strive for partial or limited autonomy to overcome the challenges, especially ethical ones, connected to fully autonomous technologies. The meaning of mobility will be increasingly about activities carried out while on the move and their impacts on people's lives. It would be simplistic to regard the car just as an extension of home or the office, as one could judge from the advertised in-car Internet of Things (IoT) services (e.g. edutainment, home control). Travel and mobility is much more than that. This calls the research community to identify meanings and activities that should be supported in the driverless car world. In parallel, efforts should be done to investigate the potential implications in terms of horizontal, vertical and existential mobility.

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