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Attitudes and concerns on automated vehicles

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ABSTRACT

People's mindset and attitudes exert a strong influence on how quickly a new technology is adopted, thus also affecting how well the benefits resulting from automated vehicles can be realised. In previous studies on people's attitudes towards automated vehicles, the number of respondents surveyed has been small, or alternatively survey's sample has not been representative. By describing the results of a large citizen survey (N = 2036), this study aims to fill this identified research gap and to reveal, whether people are ready for automated vehicles and what concerns people have that hinder the adoption of these vehicles. The study's results indicate that people's attitudes towards automated vehicles reflect the general adoption of technology well. We can assume that those who currently view automated vehicles positively are most likely to belong in the group of early adopters. We found that men, highly educated individuals, people living in densely populated area and those living in households without a car had a more positive attitude to automated vehicles than the other respondents did. The results indicate that traffic safety and ethical perspectives have a key role in the acceptance of automated vehicles. Developers of automated vehicles should also take into account the finding that currently most people consider that all automated vehicles must have the option of manual drive.

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1. Introduction

For a long time now, the automotive industry has been in the process of developing automated vehicles that do not require drivers to steer them, either at all or in a set of predetermined situations. The development of automated vehicles has been rapid, and several countries have allowed the use of these vehicles in road traffic in the 2010s, with certain restrictions (FT, 2017; NCSL, 2018). Nowadays, nearly all large car manufacturers as well as some operators in various fields of technology are running their own development projects for automated vehicles.

Several car manufacturers are already testing their highly automated vehicles. A high level of automation refers to vehicles of driving automation levels 4 and 5, defined in SAE's (2016) standard J3016, that can manage most or all driving tasks without a human driver having to interfere. A large number of manufactures believe they will be able to launch their automated vehicles in the 2020s. For example, the CEO of Nvidia has stated that the automation level 4 vehicle being produced through collaboration between Nvidia and Audi will be completed in 2020 (IEEE Spectrum, 2017). Similarly, Ford, BMW and Volvo, among others, believe they can launch their high-level automated vehicles in 2021 (Automotive Fleet, 2017; Reuters, 2016; Reuters, 2017).

Automated vehicles are expected to introduce notable benefits to the transport system, due to improvements in traffic safety and efficiency, for example (e.g. Andersson et al., 2016; Litman, 2018). Transport policy-making tends to cautiously welcome automated vehicles, which is reflected in legislative decisions and policy development. In 2016, for example, the European Union agreed that its member states would commit to drawing up rules and regulations that would allow for automated vehicles to be used on public roads (European Commission, 2016). Likewise, several states in the US have approved the limited testing of automated vehicles, subject to authorisation, within their territory (Techcrunch, 2016).

Some studies have been conducted on people's attitudes towards automated vehicles and how prepared they would be to begin using them (e.g. Kyriakidis, Happee, & de Winter, 2015; Schoettle & Sivak, 2014). Previous studies are typically conducted as online surveys and with non-representative samples (Becker & Axhausen, 2017). Generally, people's feelings and attitudes exert a strong influence on how quickly a new technology is adopted (Patel & Connolly, 2007), thus also affecting how well the benefits resulting from automated vehicles can be realised. Therefore, this study aims to reveal, whether people are ready for automated vehicles, which user groups are presumable early adopters, and what concerns people have that hinder the adoption of these vehicles. The following questions are used to achieve the goals of this study:

1. Are the perceptions of people in different demographics towards automated vehicles similar to general adoption of new technologies?
2. What is the general opinion of people towards automated vehicles and what concerns do people express regarding automated vehicles?

The study consists of a literature review and a wide-scope public survey on the subject. The literature review describes how new technologies are generally adopted and which user groups are early adopters of innovations. Especially, the study looks at surveys previously conducted on the attitudes and concerns towards automated vehicles. The public survey section will bridge the knowledge gap of the literature review with a data set comprising responses from over 2000 people, thus answering the research questions of this study.

2. Adoption of innovations and automated vehicles

The perceived usefulness, ease of use and costs of a technology, as well as the general attitudes towards it, are highlighted as important factors in models illustrating how new technologies become more mainstream (Patel & Connolly, 2007). With automated vehicles, the most important factors include the smooth functioning and reliability of the vehicles and related services, the cost of the vehicles and political decision-making (Fagnant & Kockelman, 2015). Political instruments, such as pricing and legislation, can be utilised to have a significant impact on how extensively automated vehicles are used. In addition, Choi and Ji (2015) emphasise the notable effect that people's trust in automated vehicles and therefore their attitudes towards them have on adopting this technology.

Certain recurring trends have been identified in the process of new technologies and innovations becoming more widely used. Typically, people can be divided into five groups based on how they adopt new technologies, i.e. innovators, early adopters, early majority, late majority and laggards. First, a new innovation is adopted by few people – the innovators and the early adopters. This is then followed by a phase where the innovation becomes more widely spread as the early and late majority begin adopting it. The last group to adopt an innovation will be the laggards. Thus, innovations spread out following an S-curve pattern. It is noteworthy that a certain innovation may only be adopted by a certain group, and the total adoption rate of an innovation is not likely to be 100% in the total population (Rogers, 2003).

Innovations can be related to technologies (e.g. electric cars or automated vehicles), but can also involve social habits and common practices (e.g. increased popularity of carsharing). However, not all innovations and technologies become mainstream. Some may only become popular among specific user groups while others are quickly replaced by new solutions (Pöllänen, Nykänen, Liimatainen, & Wallander, 2014).

According to Rogers (2003), people in a certain innovation adoption group share many common characteristics. Early adopters typically have a background of higher education and enjoy a better social status than later adopters. A person's social status is affected by factors such as income, wealth, standard of living and the perceived value of their profession. On average, earlier adopters are also more rational, intelligent, and have a more positive attitude towards science and change than later adopters.

However, age has not been found to have an effect on the adopter groups. Depending on the case, the earlier adopters may be younger or older than the later adopters. On average, a person's age does not seem to affect the adoption of new technologies and innovations (Rogers, 2003).

It is common that most of the people in the early and late majorities belong to the same group with nearly all new innovations. Nevertheless, the innovators and laggards in a particular change may belong to a different group, depending on the innovation. Therefore, we cannot presume that an individual would, regardless of the new innovation or technology, always remain an innovator or a laggard (Robinson, 2009). Therefore, there is a need to study the adopters of new technologies and innovations in different cases.

Adams, Farrel, Dalgarno, and Oczkowski (2017) have studied which factors would generally seem to affect the adoption of new technologies by ordinary households. As part of their research, they conducted a case study investigating the increasing