

Autonomous Mobilities and Social Meanings: The Case of New Zealand

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ABSTRACT

Social perception and acceptance are crucial for the large-scale adoption of autonomous vehicles (AVs). Using the theoretical lens of the mobilities paradigm, this paper explores the social meanings, structure of feeling, and cultural habits that may influence the adoption of AVs in New Zealand (NZ) cities. The data was collected from NZ social media Facebook pages between the time period 2015–2020 when the AV debate gained momentum. Qualitative content analysis was conducted for 57 Facebook posts and 4,270 comments. The findings show that AVs are associated with meanings of safety, (un)employment, freedom and control, whilst reporting concerns for cybersecurity risks. The findings also reveal that the “structure of trust feeling” tends to be overly complex, multidimensional, may evolve over time, and could influence AVs adoption. It was also found that AVs may increase productivity by introducing new practices and experiences whilst on the move, suggesting that travel time is not dead time. In conclusion, the NZ society has wide-ranging and complex meanings associated with AVs. The NZ public currently tends to be inclined towards accepting AVs with lower automation levels. Understanding social meanings, cultural habits, and their influence on AVs adoption is of great importance for governments when making decisions about AVs policy and infrastructure investment.

Keywords: Social Meanings; Autonomous Vehicles; Structure of Feeling; Trust; Cultural Habits; Driving Experience.

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1. INTRODUCTION

Autonomous vehicles (AVs) are commonly presented as highly impacting technologies that could drastically disrupt cities, social practices, and economies. The deployment of AVs could potentially improve road safety, relieve congestion, reduce parking demand, promote shared mobility and higher accessibility, increase fuel efficiency, reduce air pollution, develop intelligent infrastructure, and generate economic growth (Fagnant & Kockelman, 2015; Clements & Kockelman, 2017). However, attaining these benefits will depend significantly on mass social acceptance as this would enable large-scale adoption of AVs (Moody et al., 2020).

Public perceptions of AVs have been widely explored worldwide such as in the UK, USA, China, Japan, India, Europe, Canada, North America, and parts of the Middle East, etc. (Nikitas et al., 2021; Schoettle & Sivak, 2014; Kyriakidis et al., 2015; Moody et al., 2020). Most of the aforementioned studies have employed surveys and quantitative methods that focus on participants' awareness, acceptance, attitudes, and willingness to use and buy AVs, while comparatively fewer papers used qualitative approaches (Bjørner, 2019; Zandieh & Acheampong, 2021). However, it is argued that there is a “need in transport and mobility research to reach beyond individual attitudes [and instead provide] a better understanding of the complexities of daily life practices and decisions” related to AVs adoption (Fraedrich & Lenz, 2014, p. 1). The mobilities paradigm, for instance, provides a lens into the social meanings, structures of feeling, cultural norms and practices that could uncover some of embedded complexities in adopting AVs from a social perspective (Bissel et al., 2017). Previous transport and mobility studies have explored social meanings associated with cycling (Aldred & Jungnickel, 2014), running (Cook et al., 2016), non-commercial carsharing (Nitschke, 2020), private car adoption (Fitt, 2017), and travel mode choice (Fitt, 2018). However, studies that explore the social meanings of automated mobilities remain scarce.

In New Zealand (NZ), the Ministry of Transport (MoT) acknowledges the potential benefits of AVs on transportation systems and cities, and subsequently has drafted an AV Work Programme in 2020 (MoT, 2020). However, the current MoT's transport policy documents indicate that the uncertainty around social acceptance of AVs is one of the barriers in developing a target AV policy (MoT, 2019; MoT 2016) as this has direct implications on how AVs are regulated. This paper aims to fill this gap by using the mobilities lens as an analytical tool to explore the influence of social meanings, emotions, and cultural habits on adopting AVs in NZ. The findings of this paper may help guide the government decisions regarding shaping the AV policy and the infrastructure investment plans in the future, highlighting the salience of this research to the literature, policy, and practice.

2. THEORETICAL FRAMEWORK

This paper uses the mobilities paradigm as a theoretical framework. This includes social meanings, emotions, and cultural practices as detailed in the following pages.

2.1 Social Meanings

Traditional transport studies portrayed travel as basic movements from A to B (Adey, 2017). However, the mobilities concept recognises the complexity of movements and argues that mobility is “more than a physical movement” between destinations; rather it entails meanings and significance. For instance, Mansvelt et al. (2020) explored the meanings of using communication technologies by the aging population in NZ, and found that some elderlies use technology as means of “competence and confidence”, whilst others associated it with meanings of being “modern grandparents”. Therefore, social meanings are usually interpreted “within a wider context of established societal norms, codes of conduct, belief systems and ideologies”, (Adey, 2017, p. 63) which may influence transport choices and the adoption of AVs technologies.

2.2 Emotions and Structure of Feeling

Mobilities scholarship also considers the relationship between movements and emotions. Sheller (2004, p. 227) asserts that “motion and emotion [...] are kinaesthetically intertwined and produced together through a conjunction of bodies, technologies and cultural practices”. However, in some cases, the feelings of the movement could be difficult to be observed or articulated. In the example of driving the car, Sheller (2004, p. 227) describes how the act of driving, speeding at corners, hearing the engine sound, cruising in various neighbourhoods, and sensing the breeze may be associated with a host of emotions such as “happiness, excitement or anticipation”, although others may feel “fearful, anxious or sick to the stomach”. This chain of emotions usually produces sensations and an attachment to the car, which feeds into peoples “motion and emotion”. In this paper, it is crucial to understand the “feeling-states” embodied in riding AVs (e.g., the driving pleasure/trust) as they are enrolled into “wider economies and industries selling sensations, feelings and experiences” that could influence the adoption of AVs (Adey, p.197).

2.3 Cultural Habits and Practices

Mobilities paradigm is also concerned with cultural practices and habits. The term *habitus* refer to “the way in which a person's socialisation embeds in them a set of durable tastes, habits, and dispositions that then guide their later choices and practices” (Fitt, 2018, p. 228). Habits can also happen through a “space-time” pattern of movements that is linked with people’s experiences and practices whilst on the move. Mobilities paradigm presumes that activities happen while travelling (Lyons & Urry, 2005) and considers travel as places of and for activities. For instance, Collin-Lange (2013) explored people’s practices and experiences while car cruising in Iceland. It was found that the typical activities range from listening to music and dancing in the car, to buying ice cream and sharing food with other passengers whilst in the cruise. In this paper, the *habitus* concept is used to explore the influence of habits on AVs adoption as well as exploring the new practices that AVs could offer for its users compared to driving a conventional vehicle.

Overall, this theoretical framework allows us to place automated mobilities at the core of social and cultural life to generate deeper understanding of the complexities embedded in adopting AVs. It examines the meanings and significance of AVs in people lives, the inner-worldly feelings and emotions attached to riding AVs, as well as the embodied nature and experience of driving and sharing the road with AVs. Therefore, the mobilities lens emphasises the need to move beyond the simple ‘public attitudes’ towards AVs to unveil previously unknown aspects of how and why the society would (or would not) adopt AVs.

3. METHODS

This paper undertakes qualitative content analysis to explore the social meanings of AVs in NZ using Facebook data. The data in this paper was collected in November 2020 from NZ social media Facebook pages between the time period 2015 – 2020 when the AVs debate gained momentum. Initially, this search of keywords has retrieved 239 posts and 24,737 comments. After screening the relevant posts, only 57 posts and 4,270 comments were selected for analysis. To maintain the privacy and anonymity of participants, only the initials of the participants’ names will be used in this paper. For instance, a participant with the name “Jack Sparrow” will be referred to as “Participant J.S.”

4. RESULTS

The findings are categorised into three main themes: (1) social meanings; (2) emotions and structure of feeling; and (3) cultural habits and practices.

4.1. Social Meanings

This section covers meanings of safety, employment, freedom, and control.

4.1.1 Safety

AVs were associated with meanings of safety. Many participants stated that most crashes are usually caused by drivers’ inattention or distraction, using cell phones, being drunk, tailgating, and “not knowing where to stop”. Participants indicated that AVs may not be completely error free, but the rate and severity of collisions will be significantly smaller than human drivers:

“The margin of error that these [autonomous] cars could potentially have is still smaller than that of a human being. Having these [autonomous] cars removes the hazard of intoxicated drivers, learners/inexperienced drivers, ageing drivers and foreign drivers right away - some of which cause some of the most serious crashes in our country. Even if they do have glitches, the death toll on our roads would probably still be smaller if our cars do the driving.” (*Participant A.P., 2016*).

Some participants also referred to the popular autonomous Uber car crash that killed a cyclist in Arizona, 2018. These participants have created a new terminology for Uber called “Ubinator”, which is a blend of Uber and Terminator. If riding in Uber AVs are associated with those meanings of the Terminator (threatening mankind lives), this may result in people’s fearing to use autonomous ridesharing services such as Uber and be more comfortable using conventional vehicles:

“Ubinator the exterminator.” (*Participant E.S., 2018*).

Although this accident may discourage some people from riding AVs, some participants indicated that this incident could be another reason to “push for AVs” instead of avoiding them. Participants indicated that Tesla AVs have had one crash in their self-driving cars (at the time of this Facebook comment was made), and that was “at a rate of one third the deaths per kilometres driven” compared to a human driven car:

“One fatality over 210 million kilometres. That's a fantastic record. Think of how many people have died just this month in vehicle accidents compared to the amount of people killed or injured over the last 10 years of self-driving vehicles. <100 people injured [and] 1 Death. That's some solid statistics.” (*Participant A.S., 2016*).

4.1.2 (Un)Employment

Automation is expected to bring benefits as well as risks. Some participants stated that AVs would create new job opportunities in the building, design, and maintenance of AVs as well as the R&D. However, AVs were also associated automation with job losses, and those who work as truck and bus drivers hoped that AVs would take longer to arrive as they were fearful of losing their jobs:

“I just hope it happens after I retire.” (*Participant G.L., 2017*).

The findings revealed that even some non-drivers might resist accepting AVs, suggesting that the society has collective responsibility towards saving jobs:

“The job issue is real. However, we do have a choice over this, just as we have a choice to save jobs by never going through a self-checkout.” (*Participant G.W., 2018*).

Overall, automation is seen by many commentators as an inevitable future. However, the short-term focus of the society is to work towards addressing potential unemployment risks associated with AVs deployment.

4.1.3 Freedom

Automated driving may offer a higher degree of travel freedom, especially for those with health conditions that prevent them from driving safely or driving at all:

“Yay! After a lifetime of not being able to drive due to epilepsy it's great to see the next generation will have more freedom than I did.” (*Participant R.M., 2018*).

Freedom can also be seen as a form of convenience for parents, whilst simultaneously promoting a degree of independence for school children:

“Can you program it to take your kids to school so you can have a lie in - oh the possibilities?!!” (*Participant J.E., 2018*).

This shows how AVs can have obvious implications for both parents' and children's lifestyles. Not only AVs would give parents the freedom from personal commitments and family demands, but also grant children their right to be independently mobile and help them meet their physical, social, and mental needs.

4.1.4 Control

AVs can be associated with meanings of social control. In situations where AVs are used as mobility as a service (MaaS), this could enable some governments to restrict people from accessing certain places or even restrict their entire movements. The possibility of using AVs as extended platforms of surveillance might make society members feel they are locked up in a prison, producing ‘new places of immobility’ within the city:

“Driverless cars are a continuation of the march to a situation where the whole of society is one great prison. It’s the state trying to take away free movement of the people so as to control us all totally, utterly” (*Participant J.O., 2016*).

However, some participants stated that having no control of AVs is similar to having no control over other means of transportation such as public transport:

“People need to understand that they regularly get into transport that they have no control over. Think trains, buses, aeroplanes, taxis etc. Now imagine your driver on those forms of transport is replaced by someone 1000x better at driving, 1000x more intelligent and 1000x quicker at reacting. I know which bus I would be getting on.” (*Participant B.T., 2018*).

Overall, adopting AVs may be resisted by some society members due to meanings associated with social control by the government. Thus, several participants have stated that if they were forced to have their vehicles connected to the internet, they would do “whatever it takes” to sever that connection.

4.2. Emotions and Structure of Feeling

This section covers emotions of trust and the driving pleasure.

4.2.1 Trust

Trusting the AV Technology

Trusting AVs may be influenced by factors that exist before interacting with AVs. Many respondents who tended to trust AVs commented on how safe and reliable AVs are based on their pre-existing knowledge on the topic of AV. By contrast, other participants indicated that they cannot trust AVs due to risks associated with software malfunction or cyberattacks, which mainly came from reading articles about AVs and watching YouTube videos about machines and automation:

“I’m reading heaps on the possible concerns & problems with these vehicles, but came across an interesting blog about them on YouTube recently entitled ‘The driverless car scam’” (*Participant T.M., 2018*).

Previous experiences of situations in which technology has been used is another factor that influences trusting AVs. People relate the technical errors that they have experienced in using their mobile phones or GPS technology to the software crashes that may occur in AVs, stating:

“Can’t even trust a GPS to take us to the right destination sometimes.” (*Participant S.R., 2019*).

A third trust-influencing factor is related to cultural practices. Many commentators who tended to trust AVs have stated that they often use airlines, which are “self-automated most of the time”. On the other hand, people who are usually not comfortable with using technologies, even in the smallest scales, tend to less likely trust AVs:

“I barely trust an automatic transmission to be in the gear I want let alone a self-driving car.” (*Participant D.G., 2019*).

While trusting AVs can be related to factors that exist before experiencing AVs (such as pre-existing knowledge, previous experiences with technology, and cultural practices), trust can also be influenced and developed after interacting with AVs:

“I experienced this in a Tesla going from L.A to Palm Springs. It's not as scary as it sounds. There are all kinds of safety features involved. That said, I was glad not to be the one driving.” (*Participant V.S., 2019*).

This suggests that trust can be gradually developed after interaction with AVs, indicating the importance of conducting public trials of AVs.

Trusting Technology Developers

Our data analysis revealed that having trust for technology developers may influence AVs uptake. Commentators frequently mentioned the name “Elon Musk”, who is the current CEO of the Tesla carmaker that produces electric and autonomous cars. Many participants tended to trust him and trust the design features of Tesla AVs regarding safety and reliability:

“[You may] google Elon Musk, you might know the name from PayPal, Tesla, SpaceX, Solar City. If Musk says it's safe it will be safe.” (*Participant C.F., 2017*).

Trusting the leaders of carmakers and technologies could lead to higher adoption of their products. An example of Elon Musk’s influence on people is when he appeared on stage in Nov 2019 to present a demo for a future electric pick-up truck called “Cybertruck” with automation features. This demo has resulted in approximately 150,000 car sales in one day only:

“146K orders in 24 hours. That’s \$15M in money already put up. Which other car company sells close to 150K cars in 24 hours without advertising?” (*Participant M.W., 2019*).

By the contrary, truck drivers tended to have greater ability to negotiate the promotional discourse of the AV industry and the “media hype” since they have extensive experience in driving trucks. They often see driving trucks as an “achievement” especially when navigating in complex driving environments such as “through hills” and “coastal areas”:

“Good luck to them. We have skills, highly attained skills. Why then are we achieving Modules of Master Drive Certificates? 5 achieved thus far.” (*Participant G.W., 2017*).

Trusting the Government

The relationship between the community and the government may also play a role in developing trust for AVs. Some participants tended to show less trust for the government’s regulations on how the data collected by AVs will be used and shared. Trusting the government

regarding collecting and accessing facial recognition data is an important factor in accepting AVs:

“What the hell is the matter with this govt.? They’re systematically eroding our privacy!” (*Participant A.A., 2020*).

Another area of concern for the community is the government’s role in addressing the job risks associated with AVs deployment. Some participants doubted the government’s ability and commitment to address the financial needs of the displaced drivers:

“National [government] doesn’t care” (*Participant L.P., 2017*).

Overall, the data analysis does not suggest that society members have trust issues with the government, but it merely indicates that the relationship of trust between the government and the community is an influential factor in adopting/accepting the AV technology. In summary, the trust feeling is overly complex, multidimensional, could evolve overtime, and would influence AVs adoption.

4.2.2 Driving Pleasure

The Driving pleasure is another feeling that influences the adoption of AVs. Many participants who described driving as their “passion” showed some resistance in accepting AVs:

“I love to drive [...] the power is in my hands. It drives the senses. The thrill of life. This will all be lost when robots have all control.” (*Participant G.M., 2019*).

On the contrary, several respondents favoured AVs adoption over the pleasure of conventional driving as AVs could improve safety:

“If autonomous vehicles are proven to be 1000x safer than a human, and you still choose to drive 'because you enjoy it', then you are putting your personal enjoyment above the lives of others.” (*Participant A.H., 2019*).

This suggests that adopting AVs is worthwhile for many commentators even if comes at the expense of losing driving pleasure.

4.3. Cultural Habits and Practices

This section covers practices, experiences, and cultural habits related to adopting AVs.

4.3.1 Sharing the Road with AVs

Many participants are willing to share the road with AVs. Commentators stated that they would like to share the road with AVs because they are likely to comply with the road code, indicate at roundabouts, and stop at signs, etc.:

“You cannot tell me that truck drivers (generally) are safer drivers. The amount of arrogant, dangerous truck drivers I used to come across when I was doing theatre tours was horrendous. If automation on truck would prevent some of these drivers being in a job that they clearly do not have the skill or patience for, then that is fine by me” (*Participant L.B., 2017*).

Another point raised was whether AVs could deal with the unpredictable behaviour of drivers. While AVs could maintain consistent speed and follow the road code, the human drivers may not necessarily do the same as they may constantly “jump from lane to lane”. At intersections for instance, if the human drivers are intentionally not giving AVs the right of way, AVs may be forced to keep waiting since they are programmed to avoid accidents:

“What is the solution for the mix of driver and driverless cars at intersections? I can see a scenario arising where some drivers won't yield to a driverless car because they know the driverless car will always stop to avoid a collision. The result is some drivers will push the very late orange and red light running - perhaps even more so than if the other car was controlled by a driver.” (*Participant S.M., 2016*).

Initially, society members might need to get exposed to AVs in controlled environments in order to become familiar with the technology. Therefore, some participants suggested that AVs could be used for “airport transfers” while others suggested having “special lanes” would be ideal.

4.3.2 Autonomous Driving Experience and Practices

A new experience that commentators stated is starting the car’s engine. AV users will be able to start the engine as well as “remotely control” their vehicles by “smartphone” instead of putting the keys into ignition and hands on steering wheel. Other participants were excited about AVs because they could “party”, “smoke Cannabis”, and “drink alcohol” in the AV without being worried about driving safely. Overly drunk passengers can also be assured that they “cannot be done for racism or physical assault” if they were unconscious of their actions since AVs have no driver to assault. However, if AVs were used as MaaS, several participants asked how the behaviour of passengers will be monitored and how often the interior of AVs should be cleaned:

“I can imagine booking one and have it turn up full of the previous occupant’s rubbish” (*Participant A.J., 2017*).

AVs could introduce new practices whilst on the move. Participants stated wide-ranging activities that could be undertaken such as eating porridge, doing makeup, and applying eye liner on the way to work. Some participants stated that they would read “The Business Review”, whilst others said that they would not miss watching the “cricket match”. However, others imagined that passengers in shared AVs would just spend more time on their phones “killing conversations even more”.

While AVs might bring added experiences that conventional vehicles cannot, there might be some instances where fully automated AVs pose a limitation. Such instances are when people have no specific destination to go to, but only seeking possible adventures by exploring unplanned routes to enhance their travel experiences and “make memories” with friends or loved ones:

“I'm cool with autonomous cars but [it] still should come with a wheel. What if I don't know where I wanna go and just want to drive and explore? Or how do you navigate temporary parking like in fields and private properties?” (*Participant J.H., 2018*).

4.3.4 Vehicle Ownership

Those who have the habit of, or are more inclined towards, using shared mobility services indicated they would use AVs as MaaS and speculated that AVs could reduce ownership for both autonomous and conventional vehicles:

“I can’t wait for this innovation where I don't need a car any longer and can just buy transportation as I need it as a service. I get my garage back, don't pay for insurance, and no longer have maintenance costs and depreciation” (*Participant C.K., 2016*).

The car culture or driving habit might also influence vehicle ownership. The data analysis revealed that some participants rejected AVs with no explanations except that they have a cultural habit of driving. For instance, some participants stated that “it is not a car if you cannot physically drive it”, and further argued that “the only point of being in a car is to be the driver”, while others stated:

“Millions of car club members and racing drivers are going to say ‘no thanks’ to self-driven cars” (*Participant S.B., 2019*).

“I don't want a self-driving car because I like to go around the roundabout sideways and there's no way the car would know how much smoke I want coming from my rear wheels” (*Participant A.R., 2019*).

5. DISCUSSION AND CONCLUSION

Using the lens of mobilities paradigm was invaluable in generating deeper insights into the complexity of adopting AVs in NZ, and helped explore how adopting AVs is highly influenced by the wide-ranging social meanings, emotions, and cultural habits within the society.

First, social meanings influence vehicle’s adoption (Fitt, 2018). On the one hand, AVs are associated with meanings of improved safety due to eliminating bad and inexperienced drivers’ habits such as texting, tailgating, road rage and drunk driving, etc. Many participants acknowledged that while AVs may not eliminate fatal crashes completely, they may reduce them significantly. Furthermore, AVs were associated with meanings of freedom such as higher degrees of mobility independence and comfort. While driving disabilities may often be perceived as a kind of forced immobility (Goggin, 2016), AVs have a great potential to mobilize a wide range of immobile groups (elderly, legally blind, school children, etc.) and help meet their mobility rights and independency needs, resulting in higher adoption of AVs. On the other hand, the NZ society tends to associate AVs with meanings of potential job losses, especially for drivers (Clements & Kockelman, 2017). This has led truck drivers to negotiate the promotional discourses of the AV industry and challenge the ability of autonomous trucks to “outperform” them particularly around hills and coastal areas, emphasizing the importance of having a human driver to make a case to keep their jobs. More interestingly, even the general society (non-drivers) tended to have a collective responsibility regarding saving jobs, which may hamper mass adoption of AVs. This highlights how different social meanings may influence AVs adoption.

Second, emotions such as the driving pleasure and trust may influence AVs adoption (Bjørner, 2019; Raats et al., 2020). Many participants who expressed their passion for driving tended to see driving as an “event” rather than as simple means of transportation (Pearce, 2017), suggesting the likelihood of accepting AVs with lower automation levels to enjoy driving. While trusting AVs is essential for their mass adoption, the findings showed that trust is a complex feeling as it is embedded in people’s everyday lives, which could be influenced by people’s previous experiences with technologies, pre-existing knowledge about AVs, cultural daily practices, and may evolve after interaction with AVs (Raats et al., 2020). However, our findings also show that trust extends beyond the sole human-machine interaction and perceived use, and could be influenced by ‘external’ factors such as trusting the technology developers and the government. The extent to which technology developers and governments are trusted depend primarily on their reputation and prior achievements. This demonstrates how the structure of trust feeling is complex, multidimensional, and would influence AVs adoption.

Third, AVs could improve travel time productivity by allowing a new wide range of activities while on the move (Jorlöv et al., 2017). The NZ society generally tends to welcome the new practices and experiences AVs might offer, especially when it comes to commuting to work and school as well as weekend practices like drinking and partying. However, having a steering wheel in the AV might be required by some users to enable manual control for unplanned exploratory destinations. Cultural habits such as the car culture may also influence AVs adoption and ownership. For instance, some participants who commented on their habit of drifting felt that drifting is natural to do, leading them to resist adopting AVs although drifting could be associated with road crashes and risking the lives of pedestrians, passengers as well as the driver. This shows that people’s habits (e.g., car culture) is influencing their decisions since habits operate on a non-conscious level (Fitt, 2018). Thus, it is essential to understand how cultural habits – which could be invisible yet feels natural – may influence AVs acceptance and ownership.

Overall, this paper sought to explore the influence of social meanings on adopting automated mobilities in NZ. The findings show that there are wide-ranging meanings and complex perceptions that could influence AVs adoption. For instance, people who tend to have a car culture and seek the driving pleasure (e.g. speed, drift, control the vehicle) as well as having concerns for potential job losses, cybersecurity, and control issues (e.g. surveillance) are less likely to adopt AVs. By contrast, people who tend to follow the road code better, have higher perceptions of AVs safety and freedom, have higher degree of trust, and excited about the new experiences of automated driving are more likely to adopt AVs. While many participants expressed their interest in AVs, the NZ society currently tends to be inclined towards accepting AVs with lower automation levels. In conclusion, the paper demonstrates that the mere deployment of AVs may not be automatically translated into mass social adoption and acceptance. Therefore, understanding how ‘social meanings, emotions, and cultural habits’ could influence AVs adoption is of great importance for governments, particularly when making decisions about AVs policy and infrastructure investment to enable their safe operation on public roads in the future.

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