Behaviour & Information Technology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tbit20

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To cite this article: Veljko Dubljević, Sean Douglas, Jovan Milojevich, Nirav Ajmeri, William A. Bauer, George List & Munindar P. Singh (2023) Moral and social ramifications of autonomous vehicles: a qualitative study of the perceptions of professional drivers, Behaviour & Information Technology, 42:9, 1271-1278, DOI: 10.1080/0144929X.2022.2070078

To link to this article: https://doi.org/10.1080/0144929X.2022.2070078

Published online: 14 May 2022.

BEHAVIOUR & INFORMATION TECHNOLOGY
2023, VOL. 42, NO. 9, 1271–1278
https://doi.org/10.1080/0144929X.2022.2070078

Moral and social ramifications of autonomous vehicles: a qualitative study of the perceptions of professional drivers

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ABSTRACT

Artificial intelligence raises important social and ethical concerns, especially about accountability, autonomy, dignity, and justice. We focus on the specific concerns arising from how the emerging autonomous vehicle (AV) technology will affect professional drivers. We posit that we must engage with stakeholders to understand the implications of a technology that will affect the stakeholders' lives, livelihoods, or wellbeing. We conducted nine in-depth interviews with professional drivers, with at least two years of driving experience, to understand the ethical and societal challenges from the drivers' perspective during the predicted widespread implementation of AVs. Safety was the most commonly discussed issue, which was mentioned by all drivers (17 times by truck drivers and 18 times by Uber/Lyft drivers). We find that although drivers agree that AVs will significantly impact future transportation systems, they are apprehensive about the prospects of reskilling for other jobs and want their employers to be straightforward in how the introduction of AVs will affect them. Additionally, drivers dismiss the suggestions that driving jobs are unsatisfying and potentially unhealthy and thus should be eliminated. These findings should be considered seriously in decision-making about questions of socioeconomic justice, and could be useful to policymakers as they shape relevant regulations.

ARTICLE HISTORY
Received 16 June 2021
Accepted 19 April 2022

KEYWORDS
Autonomous vehicles; interviews; drivers; artificial intelligence; socioeconomic justice

1. Introduction

Recently, in Texas, a woman climbed into a tractor truck fitted with autonomous vehicle (AV) technology, took the front seat, and monitored the vehicle's progress en route to California without touching the steering wheel (Davies 2017). In Las Vegas, the owner of a Lyft vehicle simply monitored the road as he picked up and dropped off passengers in his self-driving car (Korosec 2020). In North Carolina, a driverless shuttle, CASSI, transported students around the campus of North Carolina State University (see https://transportation.ncsu.edu/cassi/). On board, a person served as an 'ambassador', but not a driver. In other locations around the U.S., other vehicles are completing their tasks without a human supervisor being on board. These stories are not from the future, but the present. They are harbingers of the autonomous vehicle (AV) world that is emerging.

As these rapid changes in AV technology occur, urgent moral questions press researchers and policymakers alike to develop a comprehensive approach to the study of ethics in artificial intelligence (AI) systems, including AVs (Taddeo and Floridi 2018; Winfield and Jirotka 2018). AI systems—including AVs, medical bots, and automated trading systems—shape socioeconomic structures and affect the lives of many citizens (Ford 2015; Frank et al. 2019; Lyons et al. 2021). These AIs influence public safety, particularly with AVs and automated mass transportation systems, as illustrated by the automation problems created by the Boeing 737 Max aeroplane that caused crashes in 2018 and 2019 (Gelles 2019). Although AI systems have the potential to save lives, they also raise important new safety and ethical concerns, including the way AI systems deal with (human) autonomy and dignity, justice and equity, and data protection and privacy, among other issues (EGE 2018).

Since they involve both people and machines, AI and AV deployments should be viewed as sociotechnical systems (Chopra and Singh 2018). Previous work on such systems has focused on representation and reasoning to provide a computational basis for user

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/0144929X.2022.2070078.

requirements. In contrast, here we tackle the problem of understanding the stakeholder perceptions that underlie any such requirements. Our approach thus exemplifies 'social-systems analysis' as an interdisciplinary assessment of the human impact of AI that 'thinks through all the possible effects of AI systems on all parties' (Crawford and Calo 2016, 313).

Previous work (Pettigrew, Fritschi, and Norman 2018; Dubljević et al. 2021) has largely considered the opinions of 'high-level experts' (whether technologists, decision-makers, or ethicists) rather than users, who we consider 'ground-level experts'. However, we take the stance that to develop a suitable foundation for an ethical response, it is important to understand the concerns of stakeholders who are most likely affected by the introduction of AVs.

Accordingly, we have studied the perceptions and concerns of professional drivers, perceiving them to be a source of valuable information about the potential harms and benefits of AVs. We aim to use their perceptions and concerns to provide guidance and advice to the people who are developing such systems and determining when and how they should be employed. It is not that these people will speak with one voice; rather they will express a pluralism in which 'every one of us has different life experiences that inform our values' (Himmelreich 2020, 35).

Summary of research methodology and findings. To elicit and understand the perceptions and values of these stakeholders we conducted in-depth structured interviews. We found that driver perceptions of the ethical and political ramifications of deploying AVs differ significantly from those of experts. This leads us to conclude that drivers' perceptions should be part of the epistemic basis for decision-makers when formulating policies to govern AV deployments. That is, the input of ground-level experts (professional drivers) should inform transportation experts, AI researchers, ethicists, and other relevant experts making policy decisions. We do not contend that drivers should have the final word, only that high-level experts must give their perspective serious consideration in the policy-making process.

Organisation. The remainder of the paper proceeds as follows. Section 2 explains how we approached the social ramifications of AVs. Section 3 explains our study design and research methodology. Section 4 presents and analyses the results of our study. Section 5 presents concluding remarks.

2. Justice and social ramifications

We distinguish between micro-ethics and macro-ethics, reflecting a distinction made by Chopra and Singh (2018), relating to AIs and similar technologies. Micro-ethics concerns the moral interactions between a relatively small number of individuals, as represented by classic ethical theories such as deontology (Kant 1785), utilitarianism (Mill 1863), and virtue ethics (Aristotle. 350 BCE). Macro-ethics, conversely, concern systems of entities. Although there is no sharp distinction between the two, clear examples of both exist.

Much of AI research has focused on micro-ethics. The classic trolley problem (Philippa Foot 1967) exemplifies what Dubljević and Bauer (2022) call the 'ethics on the road'. Bergmann et al. (2018) used the trolley problem to conduct a virtual reality study about how people react to a variety of vehicular dilemmas, balancing concerns for their own safety against the safety of others.

Macro-ethics (Chopra and Singh 2018) focuses on higher level issues like distributive justice (Rawls 1999; Wells 1921). That is, how should we structure the basic institutions of society, as well as distribute goods, and opportunities, risks, and harms so that ethical behaviour occurs? What kinds of economic incentives will improve society?

Focusing on the macro issues—the socioeconomic impact of AVs—we posit that fairness requires decision-makers and relevant leaders to account for stakeholder perspectives in designing policies to mitigate the negative impacts and enhance the positive impacts of AV technology.

Rawls (1999) presents an influential theoretical model for analysing the fairness of socioeconomic institutions and outcomes. His 'original position' thought experiment provides an objective and illuminating way to think about the basic structure of society and what members of society owe each other. In the original position—conceptualised as a hypothetical device and not an actual historical condition or 'state of nature'—people are behind a 'veil of ignorance' about their individual characteristics; thus, they do not know who they are. As in a sporting match, the rules of the game are set in advance, before it is known which side is advantaged and which disadvantaged.

Parties in the original position employ *reflective equilibrium* (Rawls 1999), a prominent method to test the normative and empirical adequacy of ethical principles. It implies there is a coherent procedure for applying general principles from theories to specific moral intuitions or considered moral judgments of stakeholders. Specifically, self-interested interlocutors propose principles of justice and test them against considered judgments on particular examples.

We see two reasons to adopt a Rawlsian perspective. First, 'justice as fairness' highlights the value of equity when talking about the basic structure of society and,

we presume, the public shares a significant interest in creating fair results for drivers as AVs become more integrated into our transportation systems. Second, the original position engages all relevant stakeholders; policies are chosen fairly. Specifically, in the later stages of the original position, stakeholders transform abstract principles into concrete policies based on relevant new socio-political data.

3. Study design and research methodology

In developing policies concerning the deployment of AVs, decision-makers might consider accepting that drivers need protection from emerging technological advances or that they should participate in finding solutions that ensure AVs are deployed fairly and responsibly. In any event, from our perspective, public policies should be informed by the experiences and perspectives of drivers since they are stakeholders who would be directly affected by the deployment of AVs.

3.1. Method

We applied a qualitative research method to interpret the inputs from the drivers. Qualitative research techniques are commonly applied in the social sciences to analyse non-numeric, value-laden data. Although qualitative research is not typically applied in domains like computer science and information technology, it is a useful way to address the ethical and social implications of technology.

In this study, the basis for our qualitative research is the inputs from the semi-structured interviews. This method is well suited to exploratory studies and helps gather rich and meaningful data that (1) future research can build on, and (2) decision-makers can use to develop a broader understanding of the phenomena under investigation as they make decisions that will affect stakeholders (Given 2008).

This qualitative method enabled the interviewers to focus on key research questions while facilitating a free exchange between the interviewer and interviewee. Interviewers follow a script to guide the conversation but vary the conversation as needed. This enables the interviewer to ask relevant follow-up questions; and the interviewee feels free to expound on anything they feel is important for the interviewer to know, producing as much information as possible from the drivers within a restricted time. We endeavoured to leave the interviewees naïve about the full purpose of the study and noted that the interview is 'about how people make moral judgments while driving'. Questions were open-ended and started with 'a reflection of a personal experience of a split-second decision that prevented something bad from happening' and included questions about length and evaluation of their work, prior knowledge of AI and AV technology, what benefits ('public good') the technology might provide to society, how soon they think it will be implemented and their views of the fairness of such implementation.

Our strategy employed five analytic stages: (1) familiarisation with the data by reading the transcripts; (2) identification of a thematic framework that reflected the ideas discussed; (3) indexing the data, i.e. identifying patterns across the transcripts; (4) charting the data, i.e. comparing data across identified patterns; and (5) mapping and interpreting the data, i.e. making sense of the data holistically (Ritchie and Spencer 2002).

We conducted data analysis concurrently with the structured interviews to enable the integration of information from each step of the process. We coded the responses following an iterative process where one coder (SD) developed the initial codes and another (VD) checked whether there was an alternative interpretation (intercoder reliability was 95.45%). We developed the codes using abductive analysis, a form of qualitative content analysis that combines elements of both induction and deduction (Sen 2009), which we successfully used in prior work (Racine et al. 2017).

3.2. Drivers as stakeholders

By engaging with the drivers, we aimed to ensure that the opinions of this important group of stakeholders are heard during agenda setting as well as research on AV deployment, consistent with the expectations of social justice. Recognising how these stakeholders are affected and probing their concerns is an important component of any 'power analysis' (Sandler 2014, 19) of technological changes in society (i.e. recognising who is empowered and disempowered by such changes).

We interviewed drivers who had at least two years of paid driving experience. We conducted nine interviews in total among truck drivers and Uber or Lyft drivers. We identified and analysed perceptions among these stakeholders concerning the relevant challenges of deploying AVs. We considered these professional drivers to be important stakeholders in virtue of their considerable 'roadside' experience, especially in challenging urban environments (Morton et al. 2019). Namely, the truck drivers travelled around 100,000 km per year, while the Uber/Lyft drivers drove up to 80,000 km per year, mostly in urban settings. Compared with regular vehicle drivers who cover approximately 12,500 km per year, the truck and Uber/Lyft drivers have much more relevant experience.

3.3. Implications of AVs

Previous studies on the implications of AVs are sparse, geographically limited to Europe and Australia, and largely focused on the opinions of institutional experts. For instance, Pettigrew, Fritschi, and Norman (2018) investigated the societal implications of AVs by conducting interviews of representatives from government (at multiple levels), trade unions, law, technology firms, AV manufacturers, academia, and other professional groups. Thus, although they interviewed stakeholders in the AV deployment process, they did not query the professional and semi-professional drivers whose livelihoods would be radically affected. In contrast, Morton et al. (2019) did interview eight professional drivers in the United Kingdom and assessed their views on advanced driver assistance systems.

Following the tactic of Morton et al., we investigated the potential implications of AVs on drivers and their expectations of community impacts. We focused on the claims shown in Table 1. Though these claims are based on previous findings (Pettigrew, Fritschi, and Norman 2018, 4–7), we approached them from the ground-level perspective of drivers in the US.

3.4. Study logistics

We obtained approval from the Institutional Review Board of the authors' institution (IRB approval no. 20276) to conduct the interviews. No personal information was collected during the interviews. Any names that appear later are fictitious. Participants were recruited via flyers. The interviewees indicated their willingness to participate at the start of the audio recording. Each interviewee received a $60 gift card as compensation for their time.

Similar to Morton et al. (2019), we found that finding willing volunteers was challenging. In total, we conducted nine interviews: four with truck drivers (identified as TR in the quotes below), one female and three males, and five with Uber or Lyft drivers (all-male, identified as UL in the quotes below). The TR drivers were typically older than the UL drivers. The interviews were conducted from December 2019 through March 2020 by the corresponding author or by undergraduate research assistants trained by the corresponding author. The undergraduate research assistants received an orientation to the study protocol, as well as training in ethics, qualitative research methods, and interview administration.

The number of interviews we conducted is sufficient, as six interviews are generally recognised in the qualitative research literature as leading to 80% of thematic saturation (Guest, Bunce, and Johnson 2006; Mill 1863). Interviews varied in length from 30 to 70 min and were all digitally recorded. We transcribed them and applied the method detailed in Section 3.1.

Since professional driving was previously described by experts as 'unsatisfying and potentially unhealthy' (Pettigrew, Fritschi, and Norman 2018, 5), and by drivers in the UK as 'boring, deskilled, undervalued and unappreciated' (Morton et al. 2019, 2066), we asked drivers to elaborate on their feelings about the driving job, whether they felt meaningfully connected to others socially, and whether they perceived professional driving as overall a positive or negative experience.

Table 1. Claims about social aspects of AVs that we evaluate.

Transportation industry	AVs' significant impact on transportation is inevitable
Drivers' expectations	Employers should be straightforward about changes and options toward the potentially affected stakeholders
Reskilling	Reskilling is manageable due to the decade-plus lead time (this, we note, is generous as technological changes sometimes occur more quickly than expected)
Responsibility to respond	Responsibility for dealing with these issues falls across all elements of society (government, business, drivers)
Driving as a profession	To the extent that driving jobs are 'unsatisfying and potentially unhealthy', their elimination could be a positive development so long as other opportunities are available

4. Results and discussion

Our findings not only speak to the perceptions of these US drivers about their jobs but also how AVs might impact their livelihoods and society at large. Overall, the drivers expressed ethical concerns about the effects AVs might have on society, specifically on non-professional drivers and passengers. Safety was the most commonly discussed issue, which was mentioned by all drivers (17 times by TR drivers and 18 times by UL drivers). The UL drivers lamented automation's weakness in human interaction (see Table S2 in the Supplemental Information Appendix). They frequently mentioned *conversation*, *human intuition*, and *human knowledge* as benefits from interacting with human drivers that society would lose with AVs. The TR drivers were generally more concerned about the *welfare* of the truck-driving community and the *potential harm* AVs could have on their livelihoods. In addition, the TR drivers expressed concern about the *decision-making process of AVs, especially during adverse weather conditions* (TR drivers mentioned weather 7 times as compared to UL drivers only mentioning it once). Nevertheless, there was some variation in TR driver responses. For instance, some stated that automation

could be integrated into the industry with drivers learning to adapt to the new technology, whereas others stated that automation involved too many risks—to both drivers and society—and that, as a result, it would be morally wrong to introduce it further (see TR-3).

Some researchers have asserted that driving is an unsatisfactory, boring, and unhealthy (Pettigrew, Fritschi, and Norman 2018; Korosec 2020; Morton et al. 2019) job. However, our interviewees painted a different picture. They emphasised the 'joy of driving'. The UL drivers focused on the value of the income. Altogether, the respondents viewed their job as a net positive for themselves and society. Many were opposed to full automation. Some were opposed even to partial automation (see TR-3). Many of the respondents realised that automation was likely to increase. However, almost all thought it was at least 10 years away. None had given serious thought to changing their careers, should automation come sooner than they anticipated.

Table S3 presents a selection of personal or group-related ethical concerns stated by each respondent, which can be read as concerns regarding automation or AVs. Notable examples are *loss of jobs* and *loss of safety* for passengers, as the driver is able to intervene or call the authorities if one passenger seems to be threatened by another passenger.

In contrast, Table S3 presents general-level concerns that were expressed by the interviewees. These concerns include impacts to society or some larger community. This was done to see not just to what extent these issues were a concern, but also to express the range of concerns.

4.1. Micro-ethics: safety for or from others

Note that Table S4 is a gauge for the level of awareness of each respondent, not a qualitative difference in the definition of problems with AV technology. Concerning micro-ethics, and specifically safety concerns, we present summaries of responses in Table S4, citing safety concerns regarding AVs, especially about 'technical bugs' or 'growing pains'. We also show that the interviewees are generally aware of a variety of important social and ethical issues regarding the deployment of AV technology.

4.2. Macro-ethics: society and workforce

The UL drivers perceived that AV technology would be deployed in 10 years, and they had concerns regarding safety, social, and ethical issues. Besides job loss, they were concerned that early deployment could create many other problems. The respondents pointed out that some new technologies might work in experiments with controlled environments, but the results could be considerably different outside those limits. Pedestrians, for instance, were seen as being negatively affected by automation; drivers stated that human intuitions were better suited to pedestrian interactions than AVs. As one of the UL drivers stated, 'People have run in front of my car while I'm having a conversation and it's hard to balance that. […] They might not really take that [a car is autonomous] into account and that could lead to accidents' (UL-1). This driver raised his concerns regarding pedestrians and industry overreach emphatically: 'There's no coincidence that Google Waymo is testing their technology in Scottsdale. The city planning there is very grid-like and it's also very hot, during the day, which is the only time that Google Waymo is active, so there's less pedestrians, and less bicyclists out there which is another danger, so in places that have a grid plan, [it is easier to implement] […], but places like Boston it'll be [difficult]. Because there's a lot of city streets and curves and stuff like that […]. But, that doesn't mean companies won't try it' (UL-1).

The intuition to protect others and react instinctively to avoid accidents is not the only human characteristic that UL drivers felt automation could not replicate. They believed social practices would also be affected. Another UL driver noted that 'most people do want to talk [… even] with a random stranger […]. For them [the passengers] it's definitely probably going to be a little more soul-crushing to get into the car and see a box making the moves instead of you, or someone who can at least try to put on a friendly face' (UL-3). Other social changes include a lack of agency. As noted by this UL driver, 'I think we're going to get into a generation where … it makes us lazy and … dependent' (UL-4). Semi-professional drivers felt that the *dehumanisation of driving* (or lack of human interaction opportunities while riding in an automated taxi) would be a loss caused by AV technology.

The TR drivers expressed much greater scepticism about AVs. They perceived that AVs may be deployed in 10–20 years and identified a range of concerns. Some of these concerns were similar to those of the UL drivers, yet their concerns were often more nuanced. As one TR driver stated, 'I don't know as if the driver will ever be fully replaced. […] I think for interstate travel where it's highways and open roads, that's gonna happen first but when you're in the city and suburbs and there's more variability […] on an interstate highway you don't have pedestrians that you have to worry about' (TR-1).

Some of the TR drivers were vehemently opposed to AV technology. TR driver Christina was highly critical,

declaring that 'I think it [AV Tech] would be wrong, and it would put a lot of people in danger' (TR-3). There is some reluctance among TR drivers critical toward AVs to even estimate when the technology might be widely adopted. In her words, 'I hope never. I don't know if it will be. I hope not soon' (TR-3). Her criticism of automation is specific and based on concrete experiences with automation technology: 'The robots load you. The robots put the things in your trailer. Everything was done by robots. Until delivery when you find out they didn't put the slab right or they forgot something else. […] before you used to be able to go inside and look through the load to have it how you like it to be loaded, now the machine goes in and loads you' (TR-3). The drivers seem to base their negative opinion of AV technology on personal experiences with automation and highly publicised tragedies involving self-driving technology: 'What is going to happen when […] you let that computer drive you? […] A Tesla was in an accident and the car completely shut down; you couldn't open the window. […] He burned completely. The car was on fire and the fire department couldn't take him out, because it was all electrical and it all shut down. So, I think that is completely wrong' (TR-3).

Other drivers offered a more mixed assessment with detailed or nuanced estimates. TR driver Bill estimated that 'the first 10 years are gonna be driver and technology both together … then I'm sure at one point we will see it to where it will completely take over trucking' (TR-2). Some drivers even provided state-specific estimates: 'I'd say 10–15 years maybe, in the right places, in the right states. Like I'd see them driving around in Texas or Nebraska, but Colorado or Wyoming where there's whiteout conditions? I don't see them dealing with that' (TR-4).

An overarching concern was that *their voices would not be heard at any stage of public policy deployment*. As one TR driver noted, 'When you have people sitting there making rules like that, who have never been in the truck—it's just mind-boggling how they get away with this' (TR-4).

4.3. Evaluating the initial claims

The results of our interviews help assess the claims introduced in Section 3.3 (and presented in Table 1). Does our interview data confirm, disconfirm, or neither confirm nor disconfirm the relevant claim? In sum, the claims about the *transportation industry* and *drivers' expectations* are confirmed; the claims about *reskilling* and *responsibility to respond* are neither confirmed nor disconfirmed; the claim about *driving as a profession* is disconfirmed.

Transportation industry: *AVs significant impact on transportation is inevitable: Confirmed*. For TR respondents, this is confirmed by all except Christina (TR-3), who hopes it does not ever come. UL respondents agree wholeheartedly that AVs will inevitably impact the way in which the transportation system is managed.

Drivers' expectations: *Employers should be straightforward about changes and options toward the potentially affected stakeholders: Confirmed*. For TR respondents, this is the case across the board. They referenced the electronic logbook regulations that had recently been instituted, with which they were frustrated, and they all spoke of the importance of communication about changes in the industry and associated regulations. UL drivers unanimously agreed as well, although it was less of a concern for them than for TR drivers. Two UL drivers were interested in the recent California law that established 'gig-economy workers' as employees, rather than as contractors. Two respondents, UL-1 and UL-4, had opposite opinions regarding the law, but both agreed that greater consideration for workers was necessary. UL-4 expressed outright distaste for the communication (or lack thereof) received from Uber about new changes its to Uber's policy. UL-1 expressed contempt for Uber and Lyft, calling them both 'slimy' companies. The other UL drivers all anticipated changes coming and expressed their approval for better communication with drivers.

Reskilling: *Reskilling is manageable due to the decade-plus lead time: Neither*. The opinions here were mixed. Half of the TR respondents agreed with this claim, whereas two others (TR-3 and TR-4) were either dismissive of all automation or frustrated that so many jobs would be lost, respectively. The UL drivers viewed the advancement of AVs more positively and were less likely to care about reskilling, as they used the income merely to supplement their livelihood. To the UL drivers, it was seen mostly as a necessary, but unfortunate, step into the future.

Responsibility to respond: *Responsibility for dealing with these issues falls across all elements of society (government, business, drivers): Neither*. The discussion of responsibility varied across respondents, and no clear trend was observed.

Driving as a profession: *To the extent that driving jobs are 'unsatisfying and potentially unhealthy' their elimination could be a positive development so long as other opportunities are available: Disconfirmed*. Not one driver from either category said this was the case. Each said that driving for them was a net positive and that they enjoyed what they did. Some interesting caveats were brought forth by UL-1. This respondent

gives stipulations, such as being young and comfortable defending themselves, but says that driving for Uber as a full-time job and the only source of income at an older age would be an 'unimaginable hell.' However, every truck driver found their job to be positive, despite the challenges, even going as far to say that technology and the elimination of their jobs would, in fact, be negative. Overall, our interviewee data disconfirms the idea that drivers found their jobs unsatisfying or unhealthy.

5. Conclusions and directions

Wells (1921, 1100) declared that 'Human history becomes more and more a race between education and catastrophe'. Although Wells was not talking about AVs, he was talking about economic disasters, and AVs are a prime example of a potential 'disaster' that poses significant risks to society and the economy. AVs have much to offer but they could also precipitate catastrophes by affecting the lives, livelihoods, and well-being of humans. In our study, we focused on the important ethical concerns of human autonomy and dignity, justice, and equity (EGE 2018) concerning AVs, especially as these concerns relate to the frontline stakeholders: the drivers.

The main contributions of this paper are the following. First, we posit that stakeholders' perspectives constitute important data in a full assessment of the social and ethical impact of AVs. Second, toward that end, we engaged with drivers using a semi-structured interview methodology. These drivers are aware of and concerned with both micro and macro-ethical issues in relation to AVs, both of which motivate this investigation and which society should actively address. Third, we show that incorporating stakeholders' perspectives would produce conclusions that are different from those from experts: specifically, we obtained results that disconfirm some of the findings of studies of experts.

We view the interviewee responses as informing the thought process of parties in Rawls' original position, particularly in later stages as specific social and economic policies are developed. The perspectives and opinions of drivers (and stakeholders in other relevant fields impacted by AI) are clearly relevant morally to the kinds of principles that should be devised in the original position. To be clear, we are not suggesting that our drivers were, or should be, placed behind a veil of ignorance during interviews or in real life. We are also not suggesting that drivers should determine AV policy.

Instead, we suggest that drivers' lived experience and perspectives should be *part* of the epistemic basis, or general basis of knowledge, concerning the effects of AVs on transportation and the economy because this better informs the design of principles and policies to govern deployments of AV technology. On the most practical level, decision-makers must pay close attention to these perspectives and representatives of relevant stakeholders should be included in the policy development process. A reasonable principle of fairness requires it.

Although professional drivers are not policy experts, they are experts in their lane, so to speak. Their perspectives on driving are not mere opinions but informed opinions based on their lived experience. Just as political leaders should conduct town halls with ordinary citizens to understand consequences of laws and budget decisions, AV policy experts (and other high-level experts) should seek information from drivers (ground-level experts) about the consequences of their policy proposals.

Additional studies that focus on diverse stakeholder groups, such as pedestrians, public transport users, and people with mobility limitations, are necessary to align AV technology's deployment with the values of the public at large. Doing so can improve the ethical standing of our policies and increase public confidence that the values of the relevant stakeholders are being respected.

Our findings raise interesting challenges for further investigation. Along the theoretical dimension is advancing theories of justice and fairness considering the permeation of AI into society. Along the practical dimension are identifying the elements of work processes that would be lost due to automation. The future is promising for AI and for deeper analysis of the ethics of AI from the perspectives of Science and Technology Studies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Kenan Institute for Engineering, Technology and Science.

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