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REVIEW

Who benefits? Australian public perceptions of safety and justice in connected and automated vehicles (CAVs)

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Abstract
The integration of connected and automated vehicles (CAVs) into everyday mobility systems raises profound ethical and societal challenges, particularly concerning safety, justice, and the treatment of vulnerable road users (VRUs). This study examines Australian public perceptions of the fairness, safety, and legitimacy of CAV deployment, investigating how exposure to information related to ethics and justice influences acceptance and evaluative perceptions related to trust (including perceived safety, fairness, and institutional confidence). An online survey of 384 respondents (aged 18–82) employed a before-and-after design, in which respondents evaluated CAVs before and after engaging with an infographic outlining key justice and safety dilemmas. Awareness of CAVs was widespread (95.3%), primarily shaped by media narratives rather than direct experience. Whilst over half of respondents expressed optimism about the potential of CAVs to improve safety and fairness, substantial proportions raised concerns about equity, transparency, and procedural justice. Following exposure to the infographic, positive perceptions declined slightly but not significantly, suggesting that attitudes are shaped by deeper moral and institutional expectations rather than informational effects. Open-ended responses revealed recurring anxieties about affordability, infrastructure readiness, technological reliability, and governance accountability, alongside ethical concerns related to VRU prioritisation, liability, privacy, and algorithmic decision-making in critical situations. These findings highlight a cautious public stance towards automation, one that accepts its promise but questions its fairness, underscoring the need for reflexive, transparent, and participatory governance frameworks to ensure that AI-driven mobility evolves in alignment with societal values and distributive justice.

Keywords Connected and automated vehicles (CAVs) · Artificial intelligence (AI) governance · Public trust · Transport policy · Societal readiness · Vulnerable road users (VRUs)

1 Introduction

The rapid advancement of artificial intelligence (AI) has accelerated the development of connected and automated vehicles (CAVs), technologies that are poised to reshape mobility systems and the governance structures that underpin them. Understanding their societal and ethical implications requires addressing a web of interdependent concerns: the evolving capabilities of AI-driven vehicles, how humans can and should interact with them, how communities adapt to their integration into traffic systems, and the broader socio-economic transformations they may trigger (Bonnefon et al. 2016; Stilgoe 2020). Crucially, CAVs are not merely technical artefacts but socio-technical systems that renegotiate the relationships between humans, infrastructure, and institutions. As Wandelt et al. (2025) argue, automation and AI mark not just a technological evolution

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but a paradigm shift in transport policy, one that demands rethinking governance, accountability, and public responsibility. Conventional regulatory models, designed for stable, human-controlled systems, struggle to cope with the distributed agency and ethical ambiguity introduced by intelligent automation. Addressing these challenges requires anticipatory and reflexive governance that integrates insights from behavioural science, ethics, and systems theory to align innovation with societal goals. From this perspective, AI-enabled mobility compels policymakers to balance innovation with precaution, anticipate emergent risks, and design governance mechanisms that are as adaptive and learning-oriented as the technologies they seek to regulate.

The integration of CAVs raises profound ethical questions about safety, accountability, and justice. Imagine standing at a busy intersection where automated shuttles, cyclists, and pedestrians share space: who, or what, truly governs the choreography of risk? Vulnerable road users (VRUs), including pedestrians, cyclists, older adults, and people with disabilities, remain disproportionately exposed to harm, making them central to ongoing debates about fairness, inclusivity, and risk distribution (Martínez-Buelvas et al. 2022). Yet, as Wandelt et al. (2025) remind us, automation also transforms the very meaning of responsibility: when agency is distributed across sensors, algorithms, and institutions, traditional models of accountability falter. The ethical challenge thus extends beyond distributive justice, how benefits and burdens are shared, to encompass procedural justice, questioning who participates in shaping deployment strategies, whose safety is prioritised in algorithmic decision-making, and how legitimacy is constructed in systems where governance itself is partly automated (Stilgoe 2018). These are not merely regulatory or technical questions but moral and epistemic ones that remain unresolved: how much uncertainty can a society accept in exchange for efficiency, and who decides when a technology is ‘safe enough’ to coexist with human life?

Social equity considerations further complicate these debates. Although CAVs have the potential to expand mobility for underserved populations, poorly designed policies may instead exacerbate existing inequalities in access to safe and affordable transport (Martínez-Buelvas et al. 2025a). Ensuring equitable access to CAV technologies, therefore, requires not only inclusive design but also governance arrangements that foster public trust, transparency, and legitimacy. Understanding the perspectives of diverse stakeholders, particularly regarding safety, ethics, and equity, is essential for shaping both technical development and regulatory frameworks (Martínez-Buelvas et al. 2024). Without early and meaningful stakeholder engagement, CAV policy risks overlooking critical social concerns and amplifying resistance, exclusion, and eventual policy failure.

Public perceptions are decisive in shaping the acceptance, legitimacy, and governance of CAVs. From a socio-technical perspective, legitimacy arises not only from regulatory compliance but from public trust in the fairness, transparency, and accountability of the systems that govern emerging technologies (Kelly et al. 2023). Attitudes towards safety, equity, and ethical dilemmas, such as liability in crashes, data privacy, cybersecurity, and life-prioritisation in critical decision-making scenarios, directly influence confidence in both the technology and the institutions that regulate it (Kaye et al. 2022; Afghari et al. 2021). Empirical research shows that trust and perceived behavioural control are critical predictors of behavioural intentions and safety perceptions around automated mobility (Kutela et al. 2024). These findings align with broader insights from AI acceptance research, where perceived usefulness, trust, and social norms consistently explain adoption and use intentions (Kelly et al. 2023). Accordingly, public attitudes towards CAVs should not be viewed as passive reflections of risk perception but as active components of governance systems that can legitimise, or delegitimise, the rollout of automation. Neglecting these social and ethical dimensions risks reinforcing inequities or generating new forms of exclusion and unplanned impacts, whereas inclusive governance strategies that foreground participatory trust-building and transparent communication can enhance both perceived safety and systemic justice (Martínez-Buelvas et al. 2025b).

The growing integration of AI into CAVs is reshaping how mobility systems operate and how safety, accountability, and justice are conceived within transport governance. However, whilst technical research on AI-enabled automation has advanced rapidly, empirical evidence on public perceptions of its ethical and societal implications remains scarce, particularly concerning VRUs who stand to be most affected by algorithmic decision-making in traffic environments. Understanding these perceptions is essential for developing governance frameworks that ensure not only technological safety but also social legitimacy and moral accountability in AI-driven mobility systems. Against this backdrop, the present study examines Australian public perceptions of the safety and justice dimensions of AI-enabled CAVs, with particular attention to human–machine interactions involving VRUs. Using a before-and-after experimental design, it captures perceptions prior to and following exposure to structured information on AI-related justice issues in automated decision-making. This approach enables examination of how ethical framing and awareness of algorithmic responsibility influence perceived safety, trust, and support for regulatory interventions. In this study, trust is conceptualised as a multidimensional construct comprising confidence in technological reliability (i.e. whether CAVs can operate safely and effectively) and confidence in institutional and governance arrangements (i.e. whether authorities and developers deploy them transparently, fairly, and responsibly).

By addressing this gap, this study provides empirical insights into how members of the public evaluate the justice and safety implications of AI-enabled CAVs and how ethical awareness may influence these perceptions. In doing so, it contributes to the emerging literature on AI governance in transport by demonstrating how societal values, concerns about fairness, and expectations of institutional responsibility shape the perceived legitimacy of automated mobility systems. These findings highlight that the successful integration of CAVs depends not only on technological capability but also on societal and ethical readiness, reinforcing the need for governance approaches that incorporate justice, transparency, and public engagement as central components of responsible AI deployment in mobility systems. This study is situated within the Australian context, and findings should be interpreted in the light of national institutional, infrastructural, and governance conditions.

2 Methods

2.1 Participants

A total of 384 participants from across Australia participated in the study, representing all states and a diverse range of demographic backgrounds. Respondents were aged between 18 and 82 years ($M = 42.93$, SD = 15.48), with roughly one-quarter aged 18–30 (24.2%), over one-third between 31 and 45 (38.5%), and 37.2% aged older than 45. In the 2021 Australian Census, the national median age was 38 years, and the population age structure includes a substantial proportion of adults aged 65 years and over. Consistent with patterns commonly observed in voluntary online surveys, our sample slightly over-represents working-age adults (particularly 31–45) and under-represents older adults (65+), which should be considered when interpreting generalisability (Australian Bureau of Statistics 2022a). Slightly more than half identified as male (52.9%), 43.0% identified as female and 3.6% as non-binary, reflecting an inclusive gender composition. Census 2021 data indicate an approximately even sex distribution nationally (49.3% male; 50.7% female), suggesting a modest overrepresentation of male respondents in this sample (Australian Bureau of Statistics 2022a). Notably, nearly one-third (30.2%) of respondents reported living with a disability, most commonly physical (11.7%), hearing (8.3%), vision (4.7%), or intellectual (3.9%) impairments, allowing for critical insight into accessibility perspectives that are often marginalised in technology design. This proportion is higher than the approximately 18% disability prevalence reported in the 2021 Australian Census, which may reflect stronger participation amongst individuals with lived experience of mobility barriers, particularly given the study's focus on safety, justice, and inclusion (Australian Bureau of Statistics 2022b).

Regarding income, the Census 2021 reports a median weekly household income of $1746 nationally (Australian Bureau of Statistics 2022a). The present sample demonstrates substantial spread across income categories, ranging from negative or nil income (5.2%) to high-income brackets exceeding $3500/week (6.3%), with respondents distributed across middle-income ranges (e.g. $1250–$1999/week representing 30.9% combined). This distribution indicates that perspectives were captured across low-, middle-, and high-income groups. However, direct comparison with Census income statistics should be interpreted cautiously because the survey collected self-reported income in ranges and primarily at the individual level, whereas Census benchmarks typically report household income measures.

Patterns of mobility reflected a strong dependence on private vehicles, with a majority (71.9%) reporting car ownership and a further 13.3% having household access. Most held a full driver's licence (68.1%), or possessed learner (8.9%), provisional (5.7%), or international licences (8.1%). Conventional vehicles dominated (61.7%), though hybrid (15.9%) and electric (9.4%) ownership indicated growing technological diversification. Despite high levels of driving, everyday mobility habits were mixed: 22.7% reported driving daily, 17.4% five days per week, and 10.4% did not drive at all. Walking was common (21.2% walked more than 30 min daily), typically for leisure rather than commuting. Public transport use was comparatively low; although 57.3% lived within a 10-min walk of a stop, 19.3% reported never using it, and 15.4% used public transport less than once per week. Most rated accessibility to public transport as easy or very easy (55.5%), but one-quarter (25.8%) reported difficulty.

Collectively, the sample reflects a broad cross section of mobility experiences across urban and regional contexts, enabling analysis of how automation and AI-mediated mobility intersect with everyday patterns of access, inclusion, and technological exposure. Participants were drawn from the general Australian public and are classified here as road users because they interact with transport systems in a variety of ways, including as drivers, passengers, pedestrians, cyclists, people with disabilities, individuals who cannot drive, and public transport users. Although VRUs are central to the analytical focus of this study, the sample was intentionally designed to include diverse road users, as perceptions of safety, justice, and legitimacy surrounding CAV deployment emerge from interactions amongst multiple groups within the transport system. Full demographic details are provided in Appendix 1.

2.2 Survey design

A survey was developed to investigate how members of the public perceive and evaluate the ethical and societal implications of fully CAVs, with a specific focus on issues of safety and justice affecting VRUs. Beyond measuring general attitudes, the survey was designed to examine how exposure to structured information about safety and justice can shape public reflection and trust in emerging mobility technologies.

The first section of the survey gathered demographic and contextual data, including age, gender, disability status, driving licence type, car ownership, travel behaviour, and access to public transport. These variables provided a basis for analysing how social position and mobility experience influence perceptions of automation. Including disability and accessibility measures was particularly important for capturing the perspectives of those most affected by potential changes in transport equity.

To ensure conceptual clarity, all respondents were introduced to CAVs through a standardised definition and accompanying visual explanation. CAVs were defined as *fully connected and automated vehicles* corresponding to Level 5 automation under the Society of Automotive Engineers (2021) classification, that is, vehicles capable of operating under all conditions without human intervention. The explanation emphasised the integration of sensing, navigation, and communication systems that enable interaction with other vehicles, infrastructure, and digital networks to enhance safety and efficiency. Respondents were also asked about their prior awareness of CAVs and the sources of this knowledge (e.g. media, public trials, or personal discussions), providing context for interpreting their initial responses. Respondents were then presented with concise conceptual definitions of *safety* (protection from or minimisation of risk and harm) and *justice* (a condition of fairness in which no group is disproportionately disadvantaged in accessing safe and meaningful mobility). Establishing shared reference points ensured that respondents approached these abstract concepts consistently. Respondents then rated their immediate perceptions of CAVs using 7-point Likert scales, assessing both their overall feelings towards the technology and the acceptability of safety- and justice-related concerns. These indicators were used as indirect evaluative proxies associated with trust in automation research, rather than as direct psychometric measures of trust itself.

A key feature of the design was the informational intervention, which presented respondents with an infographic (refer to Appendix 2) summarising the safety and justice implications of CAVs for VRUs, adapted from the conceptual framework developed by Martínez-Buelvas et al. (2022). This intervention served two purposes: first, it functioned as a *stimulus for ethical reflection*, offering respondents an evidence-based overview of potential societal risks and benefits; second, it provided an *empirical test of informational sensitivity*, allowing the study to assess whether exposure to structured ethical information influences public perceptions, evaluative orientations linked to trust, and policy acceptance. The before-and-after design thereby enabled the identification of perceptual shifts linked to increased awareness, a valuable contribution to understanding how citizens form judgments about emerging technologies.

As shown in Table 1, the survey included items adapted from Vilhunen et al. (2019) to examine justice-related attitudes in greater depth. These items were organised into four domains:

- Distributive justice, assessing whether the benefits and burdens of CAVs (e.g. safety, access, job displacement, and surveillance) would be fairly shared amongst social groups.
- Procedural justice, evaluating the degree of public participation in decision-making, transparency, and legitimacy of deployment processes.
- Informational justice, addressing the quality of communication between communities and authorities, responsiveness to public feedback, and openness in addressing societal concerns.
- Justice in implementation, capturing overall perceptions of fairness in CAV rollout and levels of public support for continued deployment.

Finally, open-ended questions invited respondents to elaborate on safety, justice, and any broader concerns about CAV introduction. These qualitative insights provided context for the quantitative findings and allowed respondents to express reflections and value judgments that might not be captured through structured scales, enriching the analysis of how individuals interpret the ethical and societal dimensions of automated mobility.

2.3 Procedure

The survey instrument was designed and administered through the Qualtrics platform (http://www.qualtrics.com). Recruitment was undertaken via social media channels (e.g. Facebook, X, LinkedIn) and institutional mailing lists, with online distribution serving as the primary strategy to achieve broad geographic coverage across all Australian states and territories. As part of this national recruitment approach, the survey was disseminated through university official social media accounts, the researchers' professional networks, and public community social media groups, ensuring that participation extended beyond the researchers' immediate contacts.

Table 1 Justice-related questions

Dimension	Questions
Distributive justice	*DJ1.* Do you believe that the benefits of fully connected and automated vehicles, such as improved safety and convenience, would be distributed fairly amongst all members of the community?
	DJ2. Do you think that fully connected and automated vehicles will provide equal access to the transport system for people of all income levels?
	DJ3. Do you feel that the implementation of fully connected and automated vehicles takes into account the needs of vulnerable groups, such as the elderly, disabled, and low-income individuals?
	DJ4. Are you confident that all groups will share the benefits equally and fairly from deploying fully connected and automated vehicles?
Procedural justice	*PJ1.* Do you feel that community members have been adequately involved in the decision-making process regarding the deployment of fully connected and automated vehicles?
	PJ2. Have you had opportunities to express your views and concerns about fully connected and automated vehicles to decision-makers?
	PJ3. Do you think that information about the benefits and risks of fully connected and automated vehicles has been communicated transparently and honestly by the authorities and companies involved?
	PJ4. Are the criteria and processes used to determine a fully connected and automated vehicle deployment locations clear and understandable to you?
Informational justice	*IJ1.* Do you believe that there is open and ongoing communication between the community and the entities responsible for fully connected and automated vehicles deployment?
	IJ2. Are you satisfied with the responsiveness of the authorities and companies to community feedback regarding fully connected and automated vehicles?
	IJ3. Do you believe that the authorities and companies are committed to addressing any potential issues arising from the deployment of fully connected and automated vehicles?
Justice in implementation	*JI1.* Overall, do you perceive the implementation of fully connected and automated vehicles in your community to be just and fair?
	JI2. Would you support the continued deployment of fully connected and automated vehicles based on your current perceptions of justice?

Targeted paid advertising on Facebook and X was additionally employed to expand reach outside existing networks and increase visibility amongst groups less likely to encounter the survey organically. Although online dissemination constituted the main recruitment mode, limited supplementary in-person promotion was used to support inclusivity, and snowball sharing was encouraged by inviting participants to circulate the survey amongst other eligible individuals. This multi-channel strategy was adopted to reduce network-based sampling bias and enhance the diversity of respondents rather than concentrate participation within a single social or professional group. Eligibility criteria stipulated that respondents must be at least 18 years of age and residing in Australia at the time of the study. The survey required approximately 45 min to complete, and respondents were advised that their involvement was entirely voluntary. Ethical clearance for the study was obtained from the University Research Ethics Committee of the first author (approval number 7586). Data collection occurred between July 2024 and January 2025. Informed consent was obtained from all respondents prior to undertaking the survey. To promote participation, respondents were offered the opportunity to enter a prize draw for one of ten $100 Australian e-gift cards upon completion, and they could also elect to receive a summary of the study findings.

2.4 Data analysis

Quantitative analyses were conducted using IBM SPSS Statistics (version 29) to examine the respondent demographic profile, levels of awareness of CAVs, and perceptions of safety and justice in their deployment. Descriptive statistics were used to provide an overview of these dimensions, identifying baseline trends in attitudes and awareness. This quantitative component provides a descriptive overview of sample characteristics and aggregate perceptions of safety and justice, complemented by qualitative analysis to illuminate how participants reason about these issues.

To complement this, a qualitative content analysis (Hsieh and Shannon 2005; Neuendorf 2017; Krippendorff 2018) was undertaken to explore the moral reasoning and contextual concerns that underpin public attitudes towards CAVs. Open-ended responses to three guiding questions on safety, justice, and broader concerns about CAV deployment were analysed inductively. The first author systematically reviewed responses, generating preliminary analytical codes to capture recurring ideas and affective framings. A coding framework was then developed in Microsoft Excel, incorporating representative quotations for each theme. Through iterative discussions, the co-authors collaboratively refined the categories to enhance conceptual precision and interpretive coherence. The final framework was validated through a critical review of the coded transcripts by the last author, ensuring that the resulting themes remained grounded in respondents' expressed meanings and reflected a diversity of perspectives. Quotations are identified using pseudonyms that include participants' gender and age (e.g. F, 32), offering demographic context without compromising anonymity.

Together, the quantitative and qualitative research strands provided complementary insights, quantitative data mapping the contours of public opinion, and qualitative analysis illuminating the underlying ethical and societal rationales shaping these views.

3 Results

3.1 CAVs-related knowledge

The findings reveal that awareness of CAVs was almost universal amongst respondents, with 95.3% indicating prior familiarity and only 3.9% reporting no knowledge of such vehicles. The media constituted the predominant source of information, with 317 respondents (86.6%) citing exposure through television, the Internet, and related platforms. Interpersonal networks were the second most frequently mentioned source, with 155 respondents (42.3%) reporting that they had learnt about CAVs from friends, relatives, or colleagues. Other avenues of awareness were less prevalent but included 39 respondents (10.7%) reporting encountering CAVs through public trials, whilst 27 respondents (7.4%) had done so via driving simulators. A small subset of respondents selected "other" specifying more specialised contexts, including professional or academic involvement, personal technological interests, engagement with relevant industries, direct experience with electric or automated vehicles (e.g. Tesla ownership), or employment in the automotive or technology sectors (see Fig. 1).

3.2 Perceptions towards CAVs (before and after)

To examine the impact of safety and justice issues related to CAVs on public perceptions, we conducted a pre–post-presentation assessment. Respondents initially responded to a series of Likert-type questions to measure their perceptions of the safety and justice challenges that CAVs could exacerbate for VRUs. These questions included assessing their immediate feelings about fully connected and automated vehicles, and their views on the acceptability of safety and justice issues related to CAVs. Respondents were then presented with an infographic outlining these issues based on Martínez-Buelvas et al. (2022)'s conceptual framework. The data were analysed using a paired-samples *t*-test to identify any changes in perceptions. A statistical summary of the aggregated response is presented in Table 2.

The analysis of the data reveals differences in respondents' perceptions regarding the safety and justice issues associated with fully connected and automated vehicles before and after being presented with relevant information. The baseline mean scores and standard deviations for each item are reported, with a slight decrease observed in the after-presentation responses for all three questions. However, the paired-samples t-tests indicate that these differences are not statistically significant.

For the question *"Define your immediate feeling about a fully connected and automated vehicle,"* the baseline mean score was 4.39, and the after-presentation mean score was 4.31, indicating a slight decrease in positive feelings following the presentation. The paired-samples *t*-test results ($t(382) = 1.365$, $p = 0.173$) show that this difference is not

Fig. 1 Distribution of responses

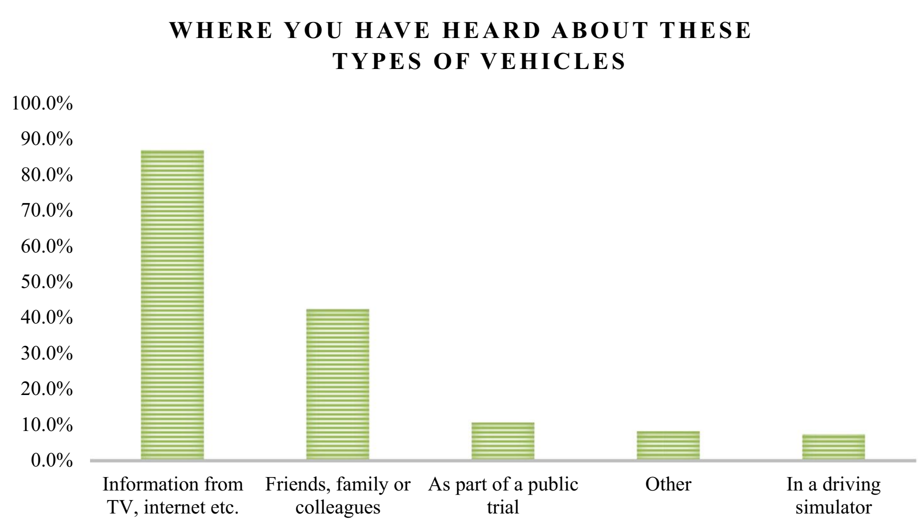


Table 2 Summary of responses: perceptions of CAVs (before and after)

		Mean	SD	SE	95% CI for the mean difference		*t*	df	*one-tailed p*	*two-tailed p*
					Lower bound	Upper bound				
Pair 1	*Define your immediate feeling about a fully connected and automated vehicle*	4.39	1.880	0.096	− 0.034	0.191	1.365	382	0.087	0.173
		4.31	1.932	0.099						
Pair 2	*To what extent are the safety issues associated with using a fully connected and automated vehicle acceptable?*	4.26	1.903	0.097	− 0.053	0.178	1.067	382	0.143	0.287
		4.19	1.948	0.099						
Pair 3	*To what extent are the justice issues associated with using a fully connected and automated vehicle acceptable?*	4.32	1.817	0.093	− 0.059	0.201	1.073	380	0.142	0.284
		4.26	1.924	0.098						

statistically significant, suggesting that exposure to the information did not significantly influence respondents' immediate feelings about CAVs. Regarding the question *"To what extent are the safety issues associated with using a fully connected and automated vehicle acceptable?",* the baseline mean was 4.26, and the post-presentation mean was 4.19, again showing a slight decrease after the presentation. The paired-samples t-test results ($t(382) = 1.067$, $p = 0.287$) indicate no statistically significant difference in perceptions of the acceptability of safety issues. Finally, for the question *"To what extent are the justice issues associated with using a fully connected and automated vehicle acceptable?",* the baseline mean was 4.32, and the post-presentation mean was 4.26, reflecting a similarly small decrease. The paired-samples t-test results ($t(380) = 1.073$, $p = 0.284$) show that this change is also not statistically significant. These findings suggest that the informational intervention did not meaningfully alter respondents' perceptions of safety and justice issues associated with CAVs.

3.3 Perception of justice in CAV deployment

Descriptive statistics reveal neutral to negative perceptions of justice regarding the deployment of CAVs (see Figs. 2, 3, 4, 5). In terms of *distributive justice*, respondents showed moderate agreement that benefits such as safety and convenience would be fairly distributed ($M = 3.63$, SD = 2.022) and that vulnerable groups' needs considered ($M = 3.78$, SD = 2.030). However, perceptions of equal access for people of all income levels ($M = 3.20$, SD = 2.042) and fair benefit-sharing across groups ($M = 3.36$, SD = 2.056) were slightly lower, with over half of respondents expressing some level of disagreement.

For *procedural justice*, the results suggest notable shortcomings in inclusivity and transparency. Respondents gave lower ratings to community involvement in decision-making ($M = 3.37$, SD = 1.886), opportunities to express feedback ($M = 3.23$, SD = 1.923), and transparency in communication ($M = 3.30$, SD = 1.967). Although clarity in deployment criteria scored somewhat higher ($M = 3.54$, SD = 1.948), more than half of respondents disagreed that processes were clear, reinforcing a perception of exclusion from decision-making and limited trust in authorities.

Perceptions of *informational justice* were similarly mixed. Whilst respondents moderately agreed that authorities and companies were committed to addressing issues ($M = 3.70$, SD = 1.998), views on open communication ($M = 3.29$, SD = 1.946) and responsiveness to community feedback ($M = 3.37$, SD = 1.854) were less favourable, with a substantial share indicating dissatisfaction or neutrality.

Despite these challenges, support for *justice in implementation* was comparatively stronger. Respondents agreed more strongly that the implementation of CAVs in

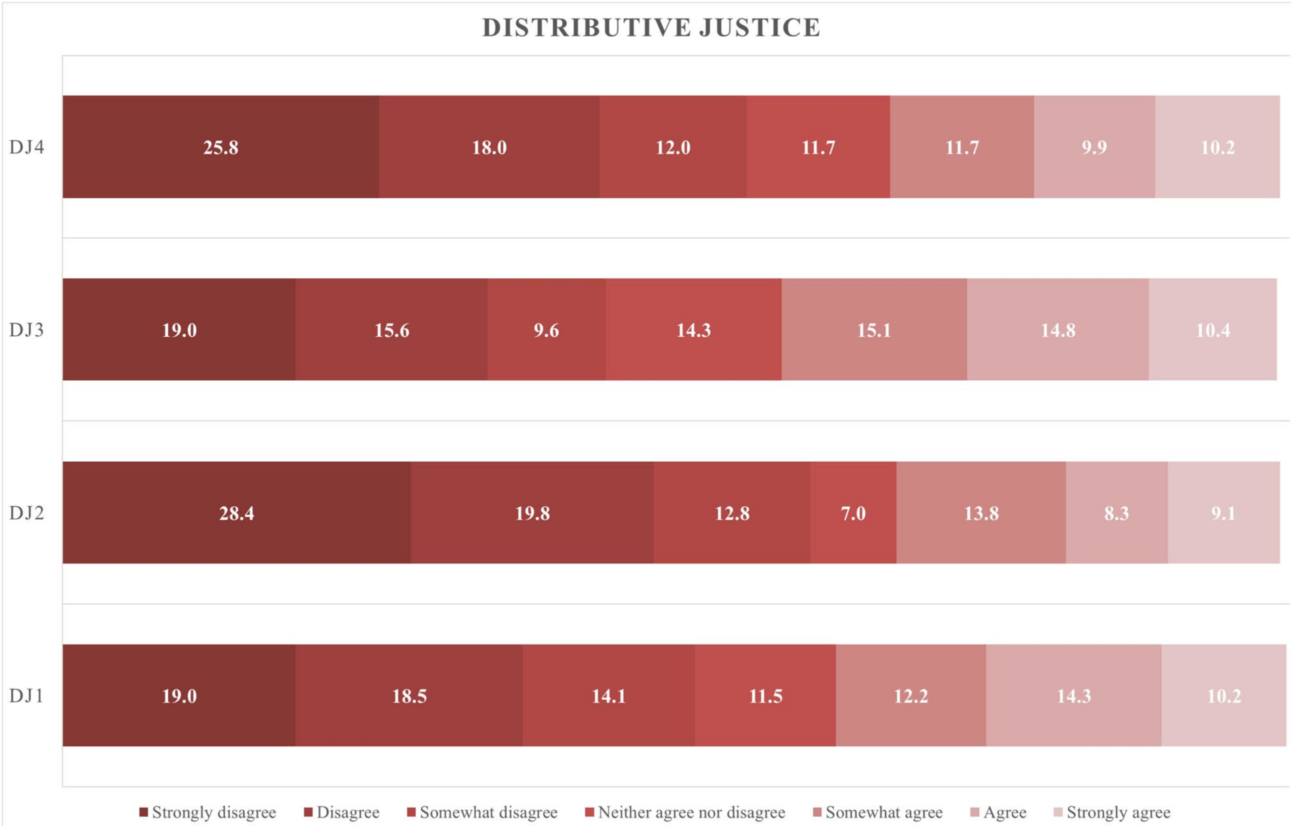


Fig. 2 Distributive justice responses

their community has been just and fair so far ($M = 3.75$, $SD = 1.871$), and many expressed conditional support for continued deployment ($M = 4.05$, $SD = 2.051$).

Interestingly, even though scepticism dominated perceptions of distributive, procedural, and informational justice, nearly half of the respondents indicated willingness to support deployment. This finding suggests cautious acceptance of CAVs in that whilst current practices are seen as limited in fairness, transparency, and inclusivity, there remains openness to adoption provided that justice-related concerns are addressed.

3.4 Broader concerns about CAV safety and justice issues

A content analysis of the open-ended responses was undertaken to identify and categorise the public's broader concerns and thoughts regarding future safety and justice issues associated with CAVs. The data were coded manually. Of the 384 respondents surveyed, most provided valid responses to questions about safety, justice, and other concerns related to the technology. Specifically, 324 respondents addressed safety concerns, with nine stating they had no further input on the topic. Similarly, 304 responded to justice concerns, with 22 reporting no additional issues. For broader concerns, 234 respondents provided feedback, whilst 46 expressed no further concerns.

Table 3 summarises the most frequent concern related to safety and reliability (29.8%). Respondents highlighted risks of malfunctions, hacking, and poor performance in extreme conditions, as well as dangers for VRUs and difficulties in human–machine interaction. Access and social justice (26.6%) was the next most prominent theme, reflecting fears that CAVs could deepen inequities through high costs and unequal access, particularly for disadvantaged and rural communities, whilst also reinforcing car-centric planning and disadvantaging public and active transport. Infrastructure challenges (14.1%) focussed on the quality of Australian roads, connectivity, and system readiness for CAV integration, whilst environmental impacts (10.3%) emphasised concerns about energy use, manufacturing, waste, and the risk of worsening congestion and car dependency. Other issues included job displacement (6.8%), particularly for truck and taxi drivers, and regulatory challenges (6.5%) tied to unclear laws, liability, and oversight. Less frequently mentioned but still significant were moral and ethical implications (3.8%), centring on fairness in AI decision-making, and data privacy and security (2.1%), with concerns about surveillance, data misuse, and unauthorised access. The percentages reported in Table 3 are calculated using the total number of coded responses as the

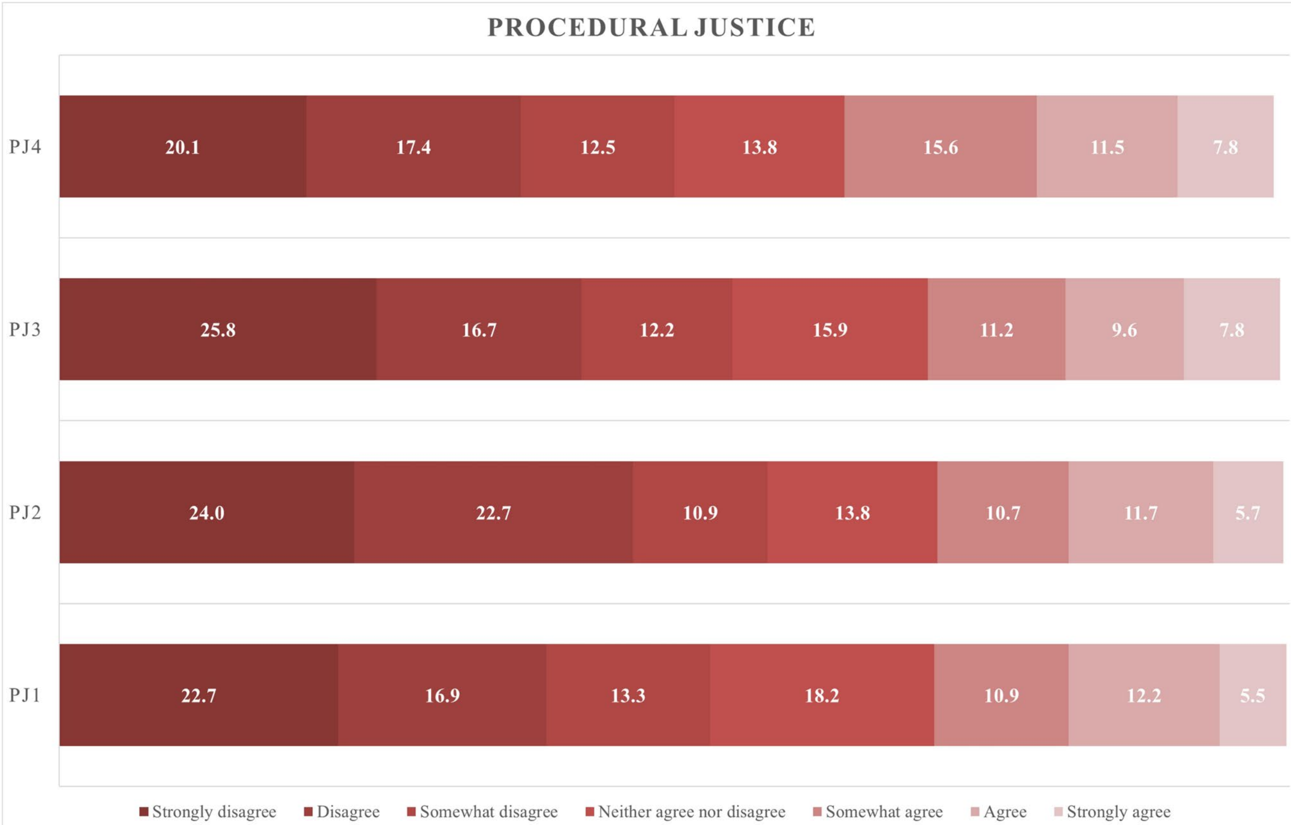


Fig. 3 Procedural justice responses

denominator, with each coded response assigned to one mutually exclusive primary theme.

3.4.1 Safety and reliability concerns

Concerns about technological reliability, safety, and public trust were closely intertwined, with many respondents expressing deep scepticism about whether CAVs could ever operate safely or equitably in real-world environments. Comments were coded for themes such as malfunctions and glitches, performance in unpredictable conditions, human–machine interaction, scepticism, fear of premature adoption, and lack of transparency, reflecting anxieties about both technical failures and the broader legitimacy of CAV deployment. Respondents frequently highlighted risks associated with unauthorised control, data breaches, software errors, sensor failures, and connectivity problems, all of which could compromise safety. These concerns are exemplified in the comments provided by one respondent who noted, *"Trusting computers to always be reliable over humans"* (F, 47).

For some respondents, the fundamental safety of CAVs was called into question, with one respondent stating, *"I don't believe they will ever be safe enough to exist ethically"* (M, 27). Concerns about reliability in unpredictable environments were also common: *"Reliability of operations, dealing with unpredictable situations"* (F, 77). VRUs were seen as especially at risk due to perceptions of CAVs' inability to interpret body language, lack of noise signals, and challenges in responding to dynamic human behaviour. One respondent warned, *"The pedestrians and other road users will have to take extra safety precautions when dealing with these vehicles just in case they fail to get real-time road conditions may be due to connectivity problems"* (M, 34). Others were more direct in their critiques stressing *"Pedestrian safety and technical errors resulting in crashes"* (F, 43) and *"The safety of people not in vehicles, but sharing the roads and crossings, must be a high priority. Pedestrians should not feel any less safe with automated vehicles than they do with drivers"* (F, 43).

These technical anxieties fed into broader distrust. Some respondents connected their lack of trust directly to CAV immaturity and inadequate testing. One respondent explained, *"Australians may be sceptical about the safety and reliability of autonomous vehicles, especially after high-profile accidents involving such technology elsewhere. Public trust will be crucial for their successful integration"* (M, 44). Another emphasised, *"I think that in its current state, technology that drives a car completely on its own is too unreliable… current advanced technology in people-driven vehicles such as lane keep assist and*

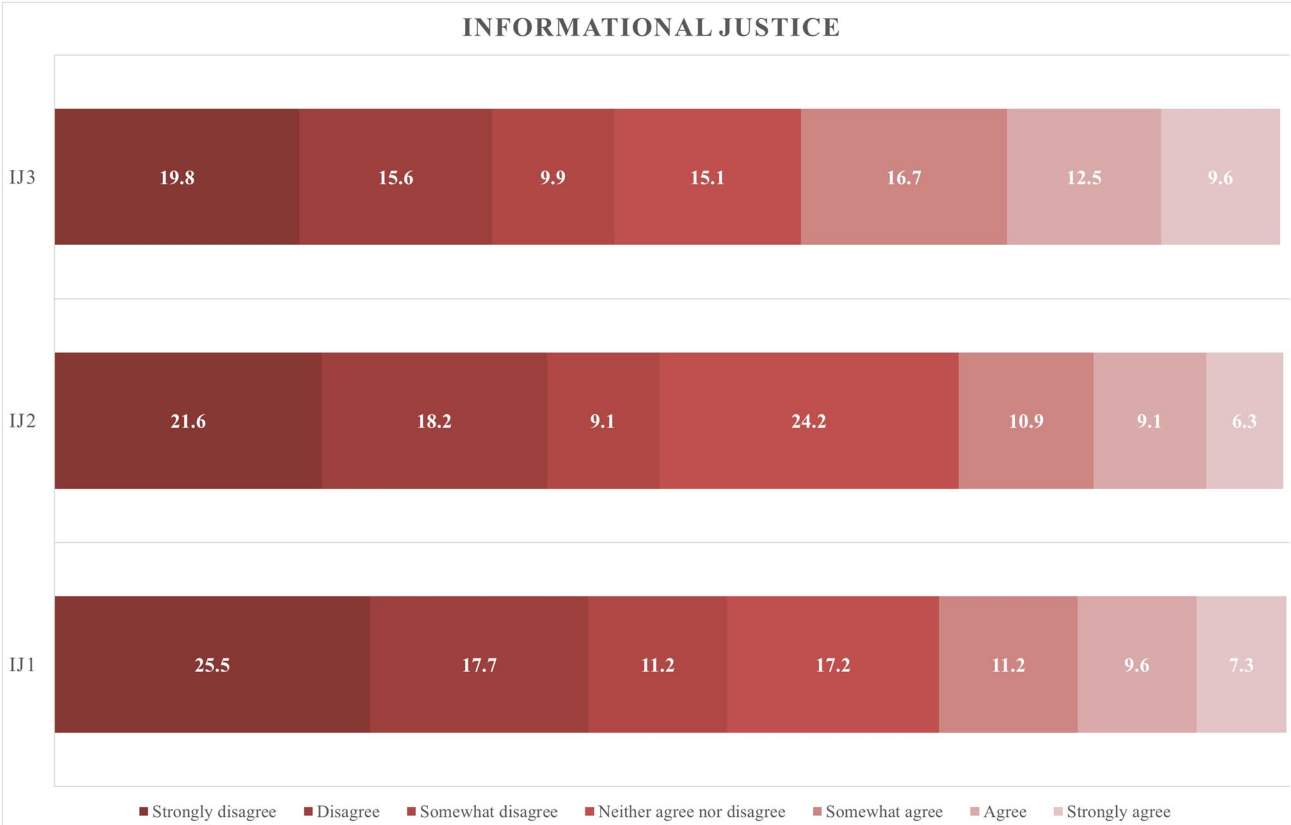


Fig. 4 Informational justice responses

autonomous emergency braking doesn't always work properly. So I can't trust a fully automated car at the moment" (M, 21).

Distrust also extended to industry motives and opaque systems. One respondent expressed scepticism about corporate accountability: *"I would not be able to trust a private company pushing for this simply for their profit and prestige. They are not acting as a public good"* (M, 43). Others emphasised the lack of transparency: *"They don't communicate intent the way you can infer it from a car and driver (eye contact,* etc.*), they don't handle unusual things or road conditions, they're entirely reliant on software that's not open to inspection or review by third parties, and there's no way to prevent 'teaching to the test' for regulatory approval"* (NB, 37). Unease and unfamiliarity were also apparent, with one respondent admitting, *"I am unfamiliar with them and don't trust them"* (F, 64).

Issues of human adaptability and responsibility were also frequently raised. Concerns included over-reliance on automation, diminished human vigilance, and the difficulty of communication between CAVs and other road users. A respondent concerned with interactions noted, *"I am worried about how automated vehicles will interact with human drivers and pedestrians in complex traffic"* (F, 33). Another warned of the risks of premature adoption: *"At this stage of (under)development I can see numerous safety issues without any human interaction within the vehicle"* (M, 53). Liability was also a prominent issue, with one respondent cautioning, *"Collisions will be assumed to be the fault of a pedestrian/cyclist/human driver, because 'machines don't make mistakes,' even as the same companies telling us"* (NB, 37). Similarly, others highlighted how corporate priorities often overlooked human needs, stressing: *"As a pedestrian and cyclist, I don't trust drivers, and I definitely don't trust technology rolled out by big tech. I just want safe and protected bike lanes, safe pedestrian crossings, wider and shaded footpaths and raised crossings at intersections, so cars have to go over the raised area, instead of pedestrians having to go down onto the road"* (M, 36).

Taken together, these responses reveal that distrust in CAVs is deeply tied to technological unreliability, risks to VRUs, and scepticism about industry accountability and transparency. Respondents doubted not only whether the technology could be made safe but also whether its deployment would align with public needs and expectations.

3.4.2 Access and social justice

Affordability and accessibility emerged as one of the most frequent concerns, often intertwined with broader reflections

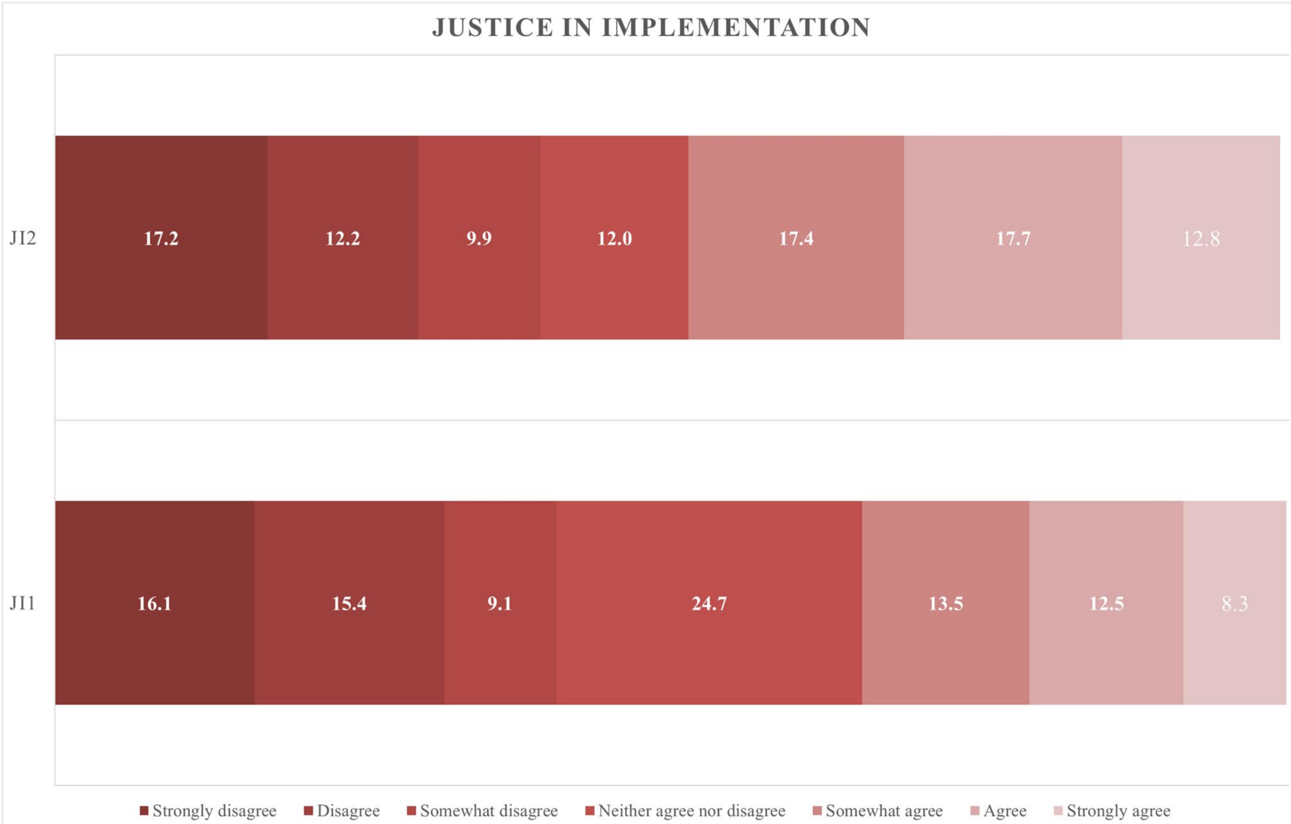


Fig. 5 Justice in implementation responses

Table 3 Themes from open-ended qualitative responses

Theme	Description of the theme	%
Safety and reliability concerns	Concerns about CAV reliability, including risks from malfunctions, hacking, and poor performance in extreme conditions, as well as dangers for VRUs and challenges in human–machine interaction. These technical issues fed into broader distrust, with fears of premature adoption, inadequate testing, and limited transparency	29.8
Access and social justice	Concerns about the high costs and unequal access to CAVs, particularly for disadvantaged and rural communities. They also feared that CAV adoption could reinforce car-centric planning and disadvantage active transport and public transit users, deepening existing inequities	26.6
Infrastructure challenges	Concerns about the quality of Australian roads, connectivity, and infrastructure readiness for CAVs underline incompatibilities with existing systems	14.1
Environmental impact	Concerns about sustainability centre on the environmental impact of manufacturing, energy use, and disposal, along with the potential for increased congestion and car dependency	10.3
Job displacement	Concerns about job losses in transport and related sectors highlight the need for retraining and support for affected workers, including truck and taxi drivers	6.8
Regulatory challenges	Concerns about inadequate laws, unclear liability, and lack of government oversight highlight the need for updated legal frameworks and international standards	6.5
Moral and ethical implications	Concerns about bias in AI decision-making and fairness in ethical scenarios, like prioritising lives during crashes	3.8
Data privacy and security	Concerns over the collection and misuse of personal data from CAVs highlight privacy risks and the need for strong safeguards against surveillance and unauthorised access	2.1

on the social consequences of CAV adoption. Comments were coded for themes such as high purchase cost, ongoing maintenance, inequities, unequal access, car dependency, and public transport prioritisation, highlighting respondents' fears that CAVs could both deepen existing inequities and reinforce unsustainable urban planning practices. Many respondents consistently raised concerns that CAVs would be prohibitively expensive, both in terms of purchase and ongoing maintenance, creating unequal access between higher- and lower-income groups. One respondent cogently expressed these concerns as: *"Affordability – what do low-income earners do/middle class do – besides pay the taxes to implement all the changes to the streets – pave the way for the higher earners to use this novelty?"* (M, 31). Others pointed directly to the risk of reinforcing inequality: *"Inequality of access opportunities. In the future, fully connected and autonomous vehicles may be expensive, making them unaffordable for low-income groups"* (M, 33).

Respondents also emphasised hidden costs, noting that infrastructure and technology expenses would ultimately fall on consumers: *"Cost to deliver and maintain a road, technology and infrastructure network that allows them to operate to their highest standard"* (F, 33). Comparisons with electric vehicles were common, with several respondents suggesting that affordability trends would mirror those of electric vehicles, which remain financially out of reach for many households: *"Advanced technology is expensive, many people will not be able to afford it. Electric cars, which are supposed to be a better option for the ecology are not widely affordable. It is conceivable that automated cars with advanced technology will also not be widely affordable"* (F, 62). Others stressed that affordability was not just an economic issue but a condition for equity and inclusion. For example, one respondent noted: *"For automated vehicles to be seen as an accessibility option for disabled people or people unable to drive, they need to be affordable for those people"* (F, 43). Another warned of broader consequences: *"There could be issues related to access and fairness. If only certain groups have access to these vehicles, it could create an imbalance in society"* (M, 36).

Beyond cost and access, respondents reflected on the wider societal consequences of CAV integration. A recurring concern was that prioritising private automation risked entrenching car dependency whilst neglecting sustainable mobility. One respondent emphasised: *"I think we need to move away from cars. Cars cause congestion whether they are driverless or not. The best way to build a fairer society is one where people can access safe, reliable, speedy, frequent public transport and use active transport"* (M, 50). Others linked these issues to existing inequities in transport planning, arguing: *"Injustice already exists in the transport system. Planners are mostly responsible, as they don't build the right infrastructure to encourage public transport use or active transport. I had a driver deliberately swerve at me as a joke, automated vehicles just won't do those sorts of dangerous behaviours"* (F, 52). Concerns about unequal access to new technologies reinforced these concerns: *"Unequal access to this technology could exacerbate existing social disparities"* (M, 44).

For many respondents, the issue was not only affordability but also misplaced priorities in transport investment. CAVs were seen as diverting resources away from modes that deliver greater social benefit, arguing instead that *"Public transport should be the priority in terms of (social, not just public) investment"* (F, 40). Collectively, these responses reveal a tension between the promise of CAVs and their potential to entrench inequities and car-centric planning, suggesting that without careful policy attention, CAVs could reinforce rather than reduce existing transport injustices.

3.4.3 Infrastructure challenges

Infrastructure readiness was another major concern raised by respondents. Comments were coded for themes, such as road quality, technological compatibility, and urban–rural disparity, reflecting respondents' scepticism about whether existing Australian infrastructure could support the safe and effective operation of CAVs. Many respondents expressed doubts about the quality of current roads and the adequacy of communication systems, emphasising the significant upgrades required for widespread adoption: *"It is important to consider the current infrastructure and traffic system in Australia. Are they ready and convenient enough to accommodate these modern vehicles?"* (F, 40).

Respondents also highlighted the environmental and social consequences of car-centric infrastructure. One respondent noted, *"Car-focused infrastructure already has detrimental effects on the environment, the availability of green space, and access"* (NB, 26). Others stressed the sheer scale of investment that would be needed to prepare Australia's road network: *"Vehicles on the road in Australia have no chance of being safe. The amount of infrastructure needed to be implemented and maintained would be an added cost that would need to be discussed and legislated prior to implementation of any self-driving cars operating on the roads"* (M, 43).

Regional disparities were a recurring issue, with respondents expressing concern that rural and remote areas would be left behind. As one respondent argued, *"Any vehicles that rely on electronic road infrastructure may not be able to operate outside a few metro areas, with the cost of deploying them in country and distant roads possibly proving too expensive"* (M, 82). Others underlined the risks of incompatibilities between CAV requirements and current systems: *"Autonomous vehicles require a certain level* *of infrastructure support, such as smart roads and traffic signals. Incompatibilities or lack of updates to infrastructure could pose safety risks"* (M, 22). Finally, respondents pointed to the scale of the challenge in rural contexts: *"Australia's infrastructure, particularly in remote and rural areas, may need major upgrades to accommodate the needs of autonomous vehicles. This includes improvements in road signs, traffic signals and communications infrastructure to ensure vehicles can operate safely and efficiently"* (F, 35).

Taken together, these responses reveal widespread scepticism about Australia's infrastructure readiness, underscoring fears that without major upgrades, CAV integration may remain limited to urban centres, further entrenching regional inequalities.

3.4.4 Environmental impact

Respondents also raised significant concerns about sustainability. Comments were coded for themes such as manufacturing and disposal, energy use, and congestion and car dependency, reflecting anxieties that CAVs could reproduce or even intensify existing unsustainable patterns. Whilst some respondents acknowledged potential environmental benefits, particularly in reducing emissions through optimised driving, many questioned whether these gains would be offset by broader ecological costs. One respondent stressed the importance of considering the full lifecycle of vehicles: *"Environmental concerns – we talk about their road emissions, but what impact do they have on the environment through their production? What about their lifespan? Technology today seems to have a short life and then we discard – are we going to have obsolete technology, so we end up with discarded vehicles contributing to environmental problems?"* (F, 50). Others linked CAV adoption to patterns of urban development, warning that convenience could drive unsustainable land use: "*The convenience could encourage urban sprawl, as people might be more willing to live further from city centres if commuting becomes easier. This could lead to increased land use and environmental degradation, as well as higher greenhouse gas emissions from longer commutes, undermining Australia's sustainability goals. The environmental impact of producing and disposing their batteries is another concern"* (F, 29).

Concerns were also raised about congestion and energy demand. One respondent cautioned, *"While autonomous vehicles could potentially reduce emissions with optimised driving patterns, their rapid adoption might also increase overall vehicle numbers, particularly in urban areas, leading to more congestion and energy consumption unless carefully managed"* (M, 44). Others framed environmental concerns as intertwined with equity and governance. For instance, *"Carbon emissions/environmentally friendly – our government is still a slave to coal mining. This is a novelty for the rich, and everyone else will pay for it"* (M, 31). Another added, *"We should be investing and discussing more about making the road transport system more efficient, equitable, environmentally friendly and safe for everyone, not just a few. Public transport should be the priority in terms of (social, not just public) investment"* (F, 40). For some, scepticism about the overall sustainability of CAVs was linked to broader concerns about transport policy: *"I doubt they'll be widely accessible and am not convinced that more cars are the solution to congestion and environmental concerns"* (NB, 45).

These responses underline the tension between the promise of emissions reductions and the risk that CAVs could exacerbate unsustainable practices, particularly if they encourage greater car dependency at the expense of public transport and holistic sustainability strategies.

3.4.5 Job displacement

Concerns about employment impacts were frequently raised, particularly for workers in freight, logistics, and passenger transport sectors. Comments were coded for themes such as job losses, displacement, and need for retraining, reflecting respondents' anxieties about the disruptive effects of CAVs on livelihoods. Many respondents feared that automation would displace truck drivers, taxi drivers, and other transport workers, with limited opportunities for equitable transition. As one respondent succinctly explained, *"Shift to automation potentially resulting in job losses for drivers"* (F, 33). Others reinforced this concern with more general statements, such as, *"AVs could potentially lead to significant job loss in sectors such as taxi and truck driving, raising questions about fair labour practices and the ethical treatment of workers displaced by automation"* (M, 25).

Respondents also highlighted the disproportionate effects on those with fewer opportunities to retrain or move into alternative employment. As one explained, *"Automation could lead to significant job losses in sectors like transport, logistics, and vehicle maintenance, disproportionately affecting workers without easy pathways to retraining or new employment opportunities"* (M, 44). Another stressed the need for proactive planning to avoid worsening inequities: *"The transition to autonomous vehicles could lead to job losses in the transportation sector, particularly for truck drivers and taxi drivers. Australia would need to plan for this shift and provide support for retraining or transitioning workers"* (F, 30).

These responses highlight that whilst technological change may bring efficiency gains, it also risks exacerbating social and economic vulnerabilities. Ensuring a just transition was seen as critical to addressing the employment impacts of CAV integration.

3.4.6 Regulatory challenges

Respondents also questioned whether current legal systems are equipped to govern CAVs. Comments were coded for themes including inadequate laws, regulation challenges, and government oversight, reflecting anxieties that existing frameworks may be unable to keep pace with technological change. Respondents expressed concern both about insufficient regulation, leaving gaps in accountability and safety, and about excessive regulation that could stifle innovation. One respondent warned, *"Regulatory challenges: The existing legal framework may struggle to keep pace with rapid advancements in technology, leading to gaps in regulation and oversight"* (M, 28). Others highlighted the dangers of industry capture and weak public accountability. As one respondent explained, "*If the regulatory framework is overly influenced by industry and lacks adequate public input then the costs and burden of the inevitable change will be externalised to the public"* (F, 55). Another stressed the challenge of balancing adaptability and clarity*: "It is essential to establish clear, consistent, and adaptable regulations to keep pace with technological advancements, although doing so is complex"* (M, 38).

Respondents also expressed frustration with government responses, describing them as either ineffective or obstructive. Comments such as *"Government responses and ineffective regulation"* (F, 18) and *"Australia should be leading the world's transition but remains too slow and too bogged down in regulations for innovation"* (M, 59) captured this tension. Others emphasised the gaps between existing traffic laws and the requirements of CAVs, noting, *"Existing traffic regulations and laws may not fully apply to autonomous vehicles. As a result, new laws and regulations may be needed to regulate the use of autonomous vehicles, ensure road safety and resolve potential disputes"* (M, 44).

These responses reflect a dual concern: that weak or outdated legal frameworks could compromise safety and equity, whilst excessive or poorly designed regulation could delay innovation. Together, they highlight the need for regulatory approaches that are clear, adaptive, transparent, and inclusive of public interests.

3.4.7 Moral and ethical implications

The moral and ethical implications of automation were a recurring concern, with respondents questioning how machines could be trusted to make decisions involving human life. Comments were coded for themes including bias in AI decision-making, moral responsibility, life-and-death trade-offs, and the limits of machine judgement, reflecting widespread unease about delegating moral choices to technology. Several respondents highlighted the difficulty of embedding ethical frameworks into autonomous systems. As one explained: *"Autonomous vehicles must be programmed to make ethical decisions in complex scenarios, such as avoiding an accident at the cost of causing another. The development of ethical algorithms is a significant challenge that involves societal values and legal considerations"* (M, 44). Another offered a succinct label: *"Ethical decision-making"* (M, 22). Some respondents connected ethical programming directly to safety, stressing that technical robustness must be accompanied by moral safeguards. One respondent noted: *"A combination of rigorous cybersecurity measures, ethical considerations in AI programming, thorough testing, and careful management of the transition period will be necessary to maximise the safety benefits of CAVs whilst minimising potential risks"* (F, 25).

Respondents often raised concerns about scenarios requiring machines to make decisions between competing harms. For example: *"Ethical decision-making in situations of competing priorities, e.g. the dilemma caused by being presented with the option to crash into a wall injuring the driver or run over a pedestrian. Who is going to make the moral decisions?"* (M, 66). Similarly, others doubted whether machines could ever respond appropriately in moments of crisis: *"The problem with automated vehicles is they can't react to surprise situations and make ethical decisions. It doesn't react like a human does"* (F, 19). Ethical dilemmas were also framed in terms of responsibility and the dehumanisation of decision-making. One respondent reflected: *"The problem is the ethical dilemma of a driverless car causing injury to someone. Asimov's 'A robot may not injure a human being or, through inaction, allow a human being to come to harm' law would prevent the use of widespread car automation. His ideas have been criticised and expanded upon by others, but they're at least a good baseline for how people initially feel about the subject"* (M, 46). Another emphasised the limits of artificial intelligence itself: *"The increasing use of artificial intelligence in CAVs raises concerns about a CAV's ability to make quick and correct decisions and the dehumanisation of the world. Machines can't make ethical and moral decisions"* (F, 69).

Together, these perspectives illustrate deep scepticism about whether CAVs can ever navigate ethical dilemmas in ways that align with human values.

3.4.8 Data privacy and security

Data privacy emerged as a serious concern, with respondents warning about the extensive collection and potential misuse of personal information by CAVs. Comments were coded for themes such as "*surveillance and tracking"*, "*misuse of personal data"*, and "*cybersecurity risks"*, underscoring fears of being constantly monitored and the need for robust safeguards. Many respondents feared that CAVs would enable continuous surveillance. One respondent captured this unease clearly: *"There may also be concerns about data privacy, as these vehicles constantly collect and share user information"* (M, 44). Another expressed it more succinctly: *"Tracking of vehicle movement and other data by the company owners – e.g. privacy issues"* (F, 43).

Respondents also expressed concerns about how the vast amounts of data generated by CAVs would be used and who would control access to it. As one noted: *"Self-driving cars collect vast amounts of data, including personal information, location information, and more. This could lead to legal disputes over privacy and data protection. For example, how to protect the privacy of individuals whilst allowing law enforcement to access this data to investigate criminal activity"* (M, 20). Another emphasised: *"Furthermore, there may be questions about how the data collected by these vehicles is used and who has access to it, which could have implications for privacy and justice. It's crucial to address these potential issues proactively to ensure a just and equitable future with these technologies"* (M, 36).

Cybersecurity concerns frequently overlapped with privacy fears. Respondents warned of risks of hacking, unauthorised access, and malicious exploitation. As one explained: *"Automated vehicles also collect and process large amounts of data, raising concerns about privacy and data protection"* (M, 38). Another posed a broader challenge: *"How will traffic authorities negotiate the exponential accumulation of personal data that this technology will collect with the fundamental rights to privacy residents are entitled to—that does not give license to enforcement of authoritarian-surveillance practices and/or incentivise malicious actors to packet-sniff information on potential targets for scams, fraud, or theft?"* (NB, 29).

Collectively, these concerns reveal that respondents viewed privacy not only as a technical issue but also as a matter of rights, justice, and trust.

4 Discussion

These findings reveal a public that is broadly aware of CAVs but which remains cautious about the societal and ethical implications of their adoption. Whilst respondents demonstrated near-universal familiarity with CAVs, their understanding was largely shaped by media exposure rather than direct experience or structured engagement. This mirrors earlier studies showing that automation discourses are often mediated by external narratives rather than participatory processes (Dubljević et al. 2023; Etminani-Ghasrodashti et al. 2021). Such mediation helps explain the ambivalence observed in this study, where optimism about technological potential coexisted with persistent uncertainty and distrust. Despite the introduction of justice-related information, respondents' attitudes towards CAVs and their perceptions of safety and fairness remained statistically unchanged, suggesting that information exposure alone is insufficient to alter moral or affective orientations to CAVs. This finding supports prior evidence that trust in automation depends less on communication efforts than on the visibility of transparent and contextually grounded governance (Dang and Li 2025). The concerns voiced by respondents, centred on safety, equity, and procedural justice, reflect an enduring moral intuition that persists even in the presence of technical progress, underscoring the need for governance frameworks that recognise automation as a socio-technical transformation shaped by lived experiences, local contexts, and distributive fairness.

Across the justice dimensions, respondents consistently rated distributive, procedural, and informational fairness at or below the midpoint of the scale, indicating uncertainty about whether the benefits of automation would be equitably shared or whether citizens would meaningfully participate in deployment decisions. Procedural justice received the lowest ratings, with 44% of respondents disagreeing that communities were involved in decision-making or that communication was transparent. Informational justice was similarly weak, with respondents expressing frustration over inconsistent or overly technical messaging from authorities and industry actors. These results highlight a persistent governance gap: whilst awareness of CAVs is high, institutional mechanisms to ensure fairness, transparency, and inclusion remain underdeveloped. Comparable concerns have been observed internationally, where early CAV trials have prioritised technological readiness over social inclusion (Dubljević et al. 2023; Kuzio 2019). The Australian context partly illustrates this dynamic. Large-scale government-led pilots, such as the Queensland Cooperative and Automated Vehicle Initiative (Kaye et al. 2019), have enhanced public visibility but offered limited opportunities for citizen deliberation or policy co-creation. This combination of high exposure and low participatory engagement appears to have produced informed yet sceptical publics, who express conditional trust in CAVs and support their deployment only if equity, safety, and accountability are demonstrably addressed.

Qualitative analysis reinforces these quantitative insights. Safety and reliability emerged as the most dominant concerns, reflecting persistent doubts about whether CAVs can operate safely in complex, real-world environments. Respondents questioned both technological readiness and infrastructural adequacy, citing fears of malfunction, hacking, unpredictable conditions, and weak regulation. These concerns echo findings by Kutela et al. (2024), who showed that perceptions of safety and transparency strongly shape willingness to engage with automated shuttles. Similarly, Ferrell et al. (2025) found that public and media discourses on automation are often shaped by sensational portrayals of risk and moral uncertainty, reinforcing the view that trust must be earned through demonstrable reliability and visible accountability. The vulnerability of pedestrians and cyclists was a recurring issue, suggesting that public trust depends not only on occupant safety but on the perceived protection of all road users from adverse impact.

Equally prominent were concerns about fairness and accessibility. Respondents feared that CAVs could evolve into a "luxury innovation" for affluent and urban users whilst excluding disadvantaged or rural populations. This perception aligns with equity critiques in transport planning, where emerging technologies risk deepening, rather than bridging, existing access divides (Kuzio 2019; Robinson-Tay 2024). Many respondents expressed concern that automation might entrench car dependency and divert investment from public and active transport. Collectively, these findings suggest a form of conditional acceptance where public support for CAVs hinges on credible assurances that automation will advance, rather than erode, safety, transparency, and mobility justice.

Other themes, such as infrastructure readiness, environmental sustainability, and employment impacts, illustrate that respondents interpret automation not as an isolated innovation but as part of a systemic transformation embedded within broader patterns of planning, governance, mobility and transport (in)equality. Concerns about road quality, regional exclusion, and environmental burden reflect a public understanding that automation is inseparable from questions of spatial justice and institutional capacity. Similar tensions are noted by Emory et al. (2022), who argue that most AV policies neglect the needs of low-income and rural populations, privileging urban and commercial priorities. Kuzio (2019) further highlights that without early, equity-oriented planning, automation risks reinforcing car dependency and urban sprawl whilst diverting investment away from public transport—an anxiety echoed by respondents in this study. The qualitative findings on job displacement and economic precarity align with Dubljević et al. (2023), who found that professional drivers experience automation as a threat to livelihood and dignity, revealing how AVs are perceived as a moral and socio-economic disruption rather than a purely technical innovation. These results show that public concerns about automation extend beyond vehicles themselves.

These findings are also likely to vary across national contexts, particularly in relation to institutional trust, regulatory maturity, and socio-economic conditions. Comparative evidence suggests that public attitudes towards automated vehicles exhibit both shared patterns and important contextual differences. For example, a multi-country study by Schoettle and Sivak (2014), covering the United States, the United Kingdom, Australia, China, India, and Japan, found consistently high awareness and generally positive expectations of self-driving vehicles across all contexts, alongside persistent concerns about safety, system failure, and lack of control. Notably, respondents in China and India expressed more positive initial attitudes, greater interest in adoption, and a higher willingness to pay for the technology than those in Western countries, whereas respondents in Japan reported more neutral views and lower willingness to pay. Similarly, evidence from the United States further illustrates how acceptance varies within high-income contexts. Bansal and Kockelman (2018), in a large-scale survey of Texas residents, found that willingness to pay for connected and automated vehicle technologies differs significantly across demographic groups, with older and more experienced drivers expressing lower valuations. At the same time, studies based on real-world exposure indicate that direct interaction with automated systems can positively influence acceptance, but also reveals practical limitations. For instance, Nordhoff et al. (2018) found that participants who experienced automated shuttles in Germany reported generally positive attitudes and a willingness to use them, particularly as feeders to public transport. However, concerns about speed, efficiency, and service quality remained, suggesting that acceptance is contingent not only on abstract perceptions but on lived performance and system effectiveness. More broadly, the determinants of public acceptance appear to be shaped by a combination of perceived benefits, risks, and behavioural factors. Acheampong and Cugurullo (2019) demonstrate that attitudes towards automated vehicles are influenced by socio-demographic characteristics as well as latent constructs such as perceived usefulness, trust, subjective norms, and perceived behavioural control. This reinforces the view that acceptance is not solely a function of technological awareness, but emerges from a complex interplay of social, psychological, and contextual factors. Comparatively, the Australian sample in this study reflects elements observed across these contexts: high awareness and recognition of potential benefits coexist with persistent concerns about safety, fairness, and governance. Taken together, international evidence suggests that whilst the specific configuration of concerns varies, a common pattern of conditional acceptance emerges. Across countries, support for automated vehicles is consistently shaped by perceptions of safety, system performance, and trustworthiness, but is also mediated by local socio-economic conditions, user characteristics, and opportunities for direct engagement with the technology.

Taken together, the results paint a picture of conditional legitimacy: the public recognises the potential of AI-enabled mobility but insists that its deployment be governed by fairness, transparency, and accountability. This finding aligns with Kopecky et al. (2023), who demonstrate that public moral preferences towards automation are shaped less by technological performance than by the perceived virtue and social responsibility embedded in design and governance. As Ciriello et al. (2025) note, trust in automation cannot rest on the myth of "autonomous" systems but depends on recognising that agency and responsibility remain fundamentally human and institutional. From this perspective, the acceptance of connected and automated vehicles is not a matter of technological readiness but of moral and institutional readiness—a test of whether societies can design, regulate, and communicate AI in ways that embody the values they claim to uphold (Wandelt et al. 2025). Respondents in this study appear willing to grant trust, but only to systems and authorities that demonstrate they are worthy of it.

This pattern of conditional legitimacy can be further interpreted as a signal of how publics evaluate the governance of technological risk, rather than the technology itself. What is at stake is not only whether CAVs improve safety outcomes, but how acceptable risk, system boundaries, and responsibility are defined and justified. In practice, the deployment of AI-enabled mobility requires setting operational thresholds (e.g.

when systems are considered “safe enough”), allocating liability across actors, and determining how risks are distributed across different road users and contexts. These are not purely technical decisions but governance choices that shape exposure to harm and access to protection. The findings suggest that public scepticism is closely linked to how these choices are structured: concerns about transparency, participation, and fairness reflect unease with decision-making processes that remain largely opaque and expert-driven, whilst conditional support indicates that legitimacy depends on these processes being accountable and inclusive. From this perspective, the challenge is not only to optimise system performance, but to ensure that risk allocation is made visible, contestable, and aligned with societal expectations. Failure to do so risks normalising forms of risk distribution and responsibility allocation that lack public endorsement, even when the technology performs as intended. This also points to emerging challenges in maintaining clear lines of responsibility in increasingly distributed socio-technical systems, reinforcing the need for governance approaches that can anticipate and manage such diffusion.

5 Limitations and future research

Several limitations should be considered when interpreting these findings. First, although the sample captured a wide range of socio-demographic backgrounds and mobility experiences across Australian states and regions, it was not statistically representative of the national adult population (Sousa et al. 2004). Participation was voluntary, and recruitment relied primarily on online dissemination through social media, institutional channels, and professional networks. Whilst this approach enabled broad geographic reach, it may have favoured individuals with reliable internet access, higher digital literacy, or a particular interest in technology-related topics. Consequently, the results should be interpreted as reflecting informed public perspectives rather than population-level estimates. Future research should adopt more inclusive sampling strategies to better capture underrepresented groups, including individuals from rural and remote areas, lower socio-economic backgrounds, and marginalised communities.

Second, this study was conducted exclusively within Australia. Public perceptions of CAVs are shaped by national regulatory frameworks, infrastructure conditions, cultural attitudes towards technology, and levels of institutional trust. These contextual factors vary considerably across countries, limiting direct generalisability to other settings. At the same time, Australia’s distinctive mobility context makes the findings particularly meaningful. Australia is amongst the most car-dependent nations globally, with the majority of households owning at least one vehicle and a substantial proportion commuting primarily by car (Australian Bureau of Statistics 2021; Australian Broadcasting Corporation 2023). Nevertheless, cross-national comparative studies are needed to examine how these attitudes may differ in countries with distinct transport systems and governance traditions.

Third, this study relied on self-reported survey data collected at a single point in time. Responses may have been influenced by cognitive and social biases, including social desirability, confirmation bias, and framing effects. Although the informational intervention allowed examination of short-term perceptual shifts, it cannot capture how attitudes may evolve through sustained engagement or real-world exposure to automated vehicle technologies. Future studies should incorporate longitudinal designs, experimental methods, and qualitative approaches to validate and extend these findings.

Despite these limitations, these findings offer valuable insights into how justice, trust, and governance considerations shape public responses to AI-enabled mobility in a highly car-dependent context. They provide a foundation for future comparative and policy-oriented research.

6 Conclusion

This study explored how public perceptions of safety and justice shape the acceptance and legitimacy of AI-enabled CAVs. The findings reveal widespread awareness of automation but persistent uncertainty about its societal consequences. Public support remains conditional, people are willing to support innovation only when institutions demonstrate fairness, accountability, and transparency in its design and regulation. Low confidence in procedural and informational justice highlights a critical gap between technological progress and the governance structures intended to guide it. These results suggest that ethical and societal considerations are not peripheral to CAV adoption but central determinants of its social legitimacy and long-term success. Ultimately, the transition to automated mobility will be defined not by technical readiness but by societal readiness, the capacity of public authorities, industry, and researchers to align AI innovation with collective values and social justice. Without this alignment, mobility systems risk reproducing the same governance failures seen in other automated technologies, where efficiency and data-driven decision-making have outpaced transparency and inclusion. To ensure that AI genuinely advances public good, mobility governance must evolve towards reflexive, participatory, and ethically grounded approaches that embed justice, equity, and accountability as fundamental design criteria. Only then can CAVs move from being a technological milestone to a socially legitimate transformation in the future of transport.

Appendix 1

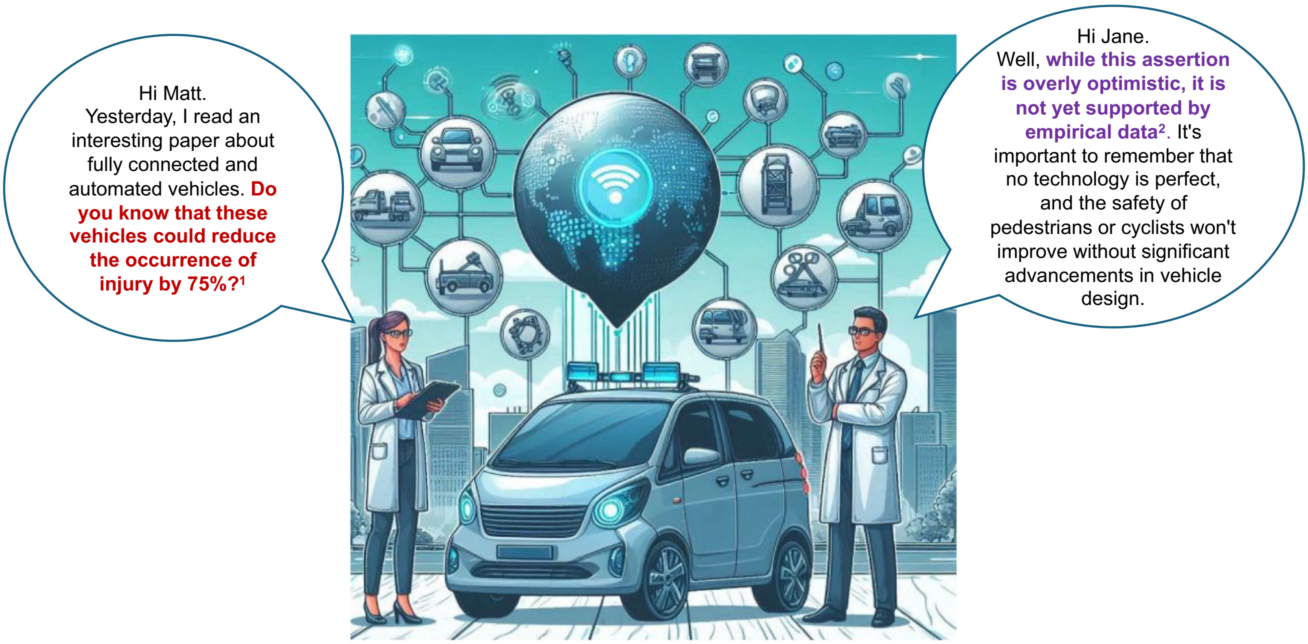
See Table 4.

Table 4 Sample characteristics

Characteristic	Sample %
Age group	
18–30	24.2
31–45	38.5
Above 45	37.2
Gender	
Male	52.9
Female	43.0
Non-binary	3.6
Other	0.5
Disability types	
Hearing impairment	8.3
Physical disability	11.7
Vision impairment	4.7
Intellectual disability	3.9
Car ownership	
I am a car owner	71.9
I only have access to a car in the household	13.3
I rent/hire a car	3.1
I have access to a work vehicle	2.3
I do not have access to a car	9.4
Driver's licence status	
I do not have a driver's licence	6.0
Learner's permit	8.9
Provisional 1/Provisional 2	5.7
Open Australian Licence	68.1
Restricted Australian licence (e.g. for work only)	3.1
International valid in Australia to drive	8.1
Type of vehicle	
Conventional non-electric or non-hybrid vehicle	61.7
Electric vehicle	9.4
Hybrid vehicle	15.9
I do not drive regularly	13.0
Age of the vehicle	
Less than 1 year old	6.3
1–3 years old	24.9
4–6 years old	23.4
7–10 years old	22.8
More than 10 years old	22.8
Vehicle technology	
Little to no technology	3.3
Basic technology	8.7
Somewhat advanced technology	52.4
Advanced technology	32.0
Very advanced technology	3.6
Days per week do you drive	
1 day	2.9
2 days	7.3
3 days	13.0
4 days	10.9
5 days	17.4
6 days	9.6
Everyday	22.7
I use a car less than once a week	5.7
I do not drive a car	10.4
Days per week do you walk 30 min	
1 day	6.3
2 days	11.0
3 days	18.3
4 days	12.8
5 days	11.5
6 days	4.5
Everyday	21.2
I walk less than once a week	10.2
I do not walk	4.2
Use public transport	
1 day	6.8
2 days	11.2
3 days	12.0
4 days	6.0
5 days	8.6
6 days	2.3
Everyday	3.6
I use public transport less than once a week	15.4
I do not use any form of public transport	19.3
I use public transport for certain events	14.8
Access public transport	
Very difficult	11.2
Difficult	14.6
Neutral	18.8
Easy	37.0
Very easy	18.5
Distance public transport from home	
Public transport is less than 10 min away	57.3
Public transport is 10–19 min away	29.1
Public transport is 20–29 min away	7.1
Public transport is more than 30 min away	6.5
Income (AUD) before taxes	
$3500 or more per week ($182,000 or more per year)	6.3
$3000–$3499/week ($156,000–$181,999/year)	5.8
$2000–$2999/week ($104,000–$155,999/year)	11.3
$1750–$1999/week ($91,000–$103,999/year)	7.9
$1500–$1749/week ($78,000–$90,999/year)	12.6
$1250–$1499/week ($65,000–$77,999/year)	10.5
$1000–$1249/week ($52,000–$64,999/year)	7.1
$800–$999/week ($41,600–$51,999/year)	6.5
$650–$799/week ($33,800–$41,599/year)	6.5
$500–$649/week ($26,000–$33,799/year)	6.8
$400–$499/week ($20,800–$25,999/year)	3.7
$300–$399/week ($15,600–$20,799/year)	5.8
$150–$299/week ($7800–$15,599/year)	2.6
$1–$149/week ($1–$7799/year)	1.4
$0 or nil income	4.2
Negative income	1.0

Appendix 2

Infographic on justice-related challenges of fully connected and automated vehicles, adapted from the conceptual framework of Martínez-Buelvas et al. (2022).



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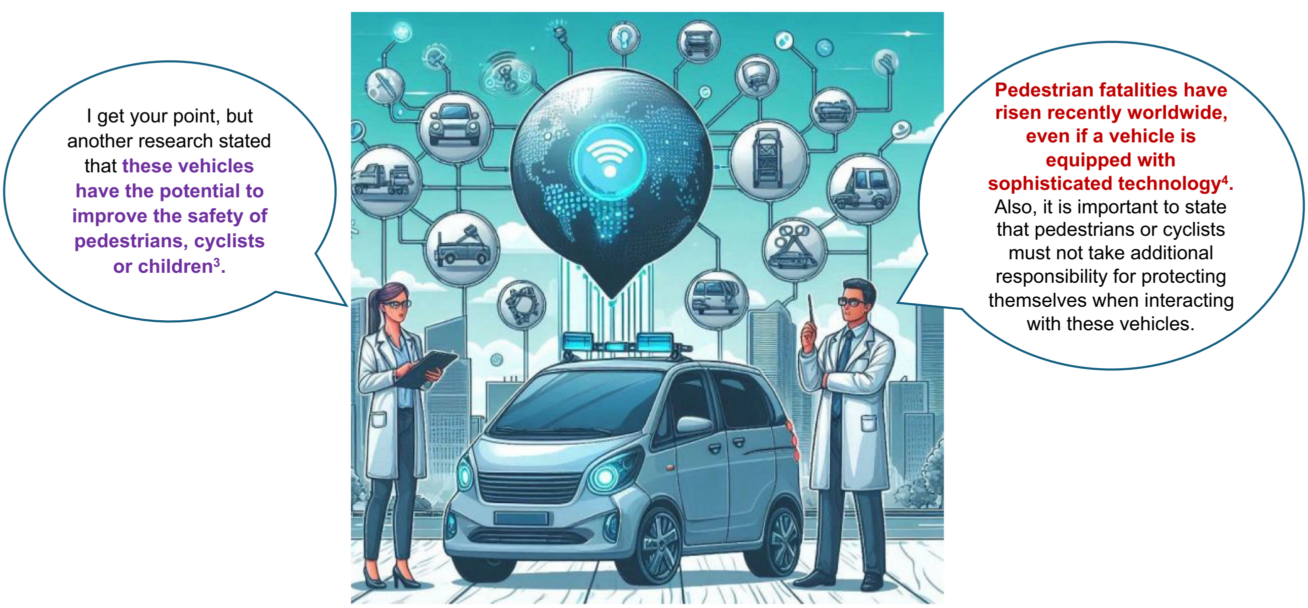

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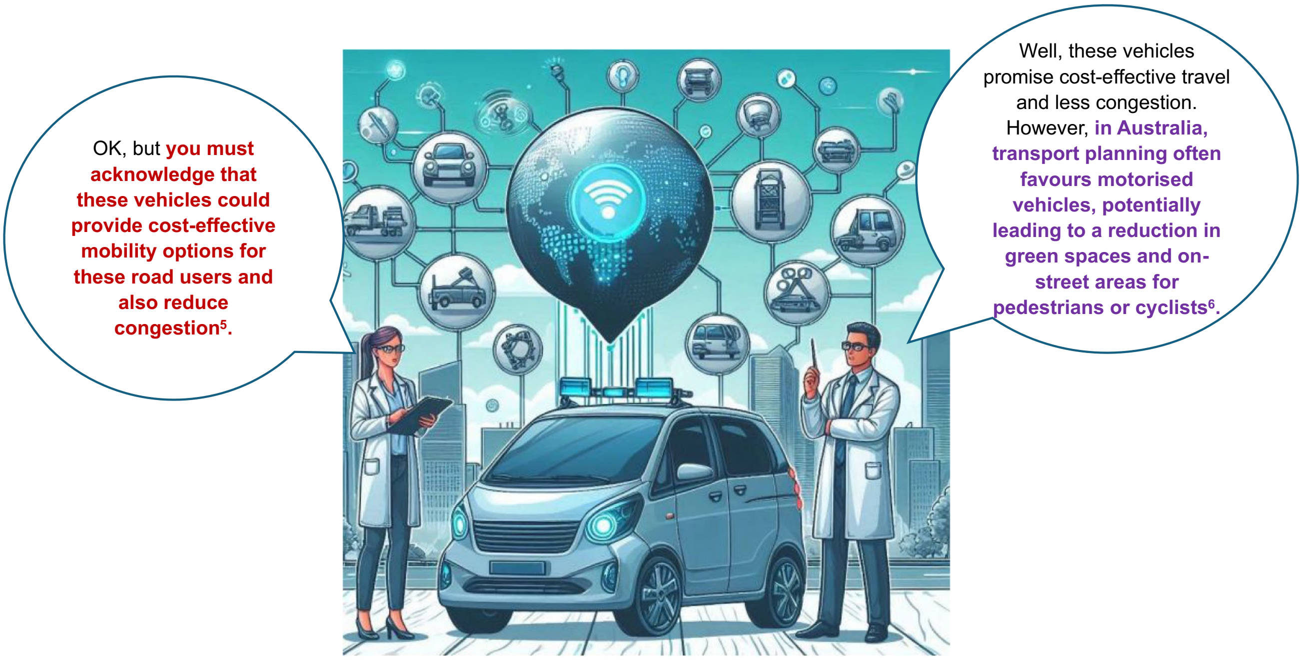

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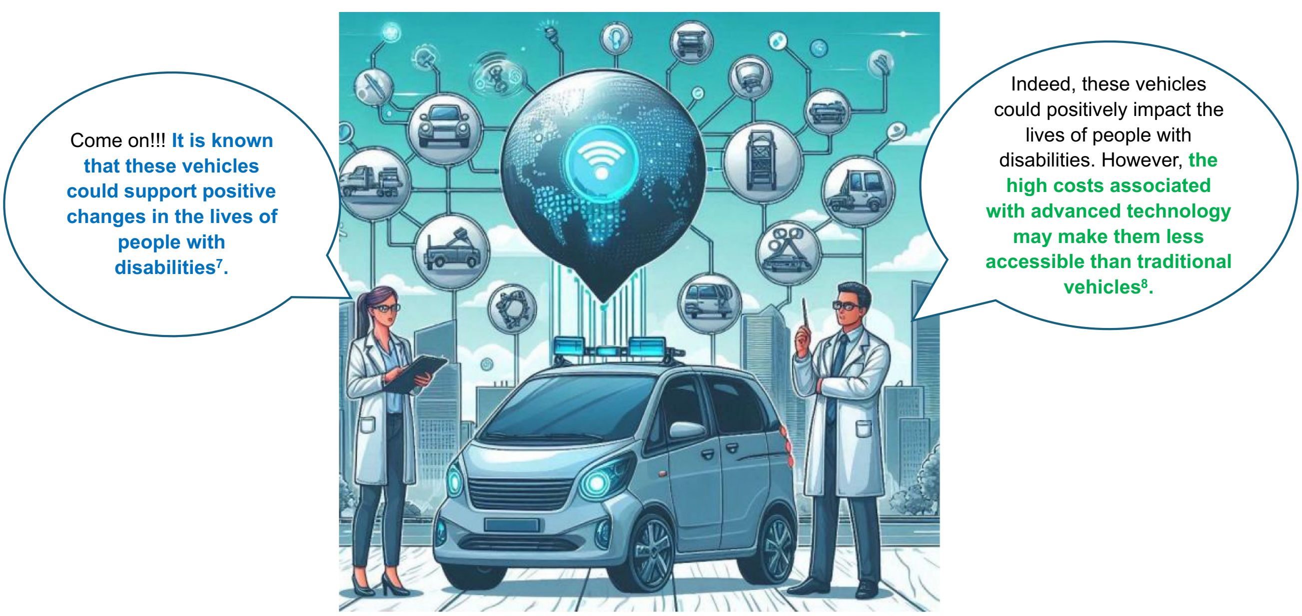

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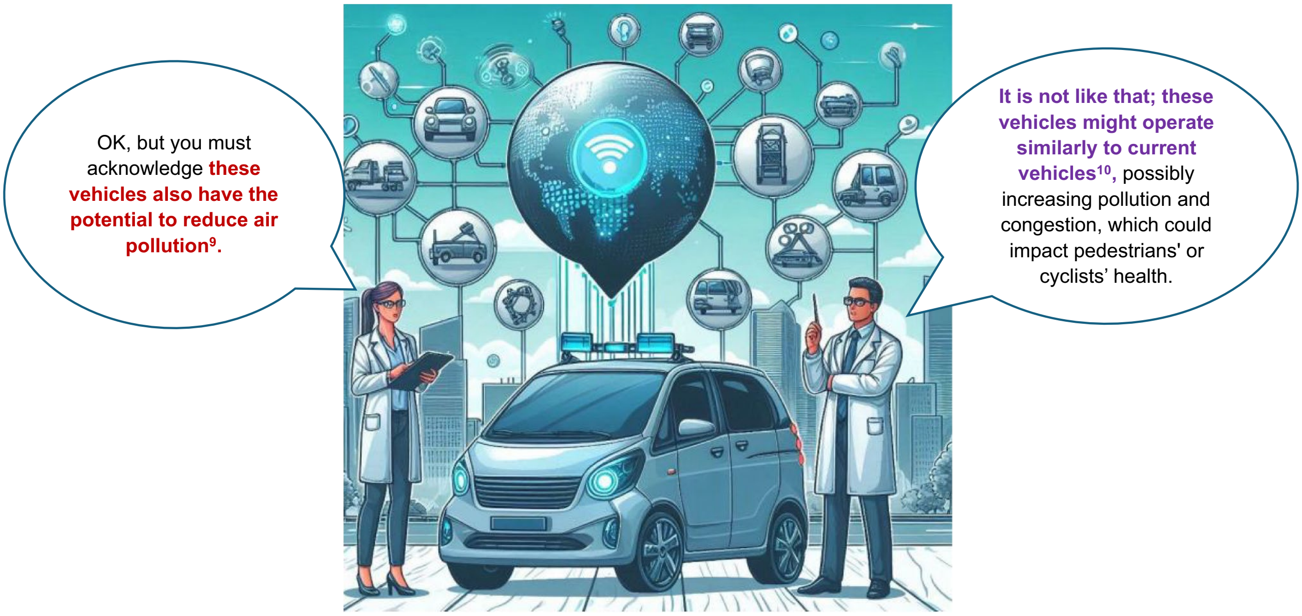

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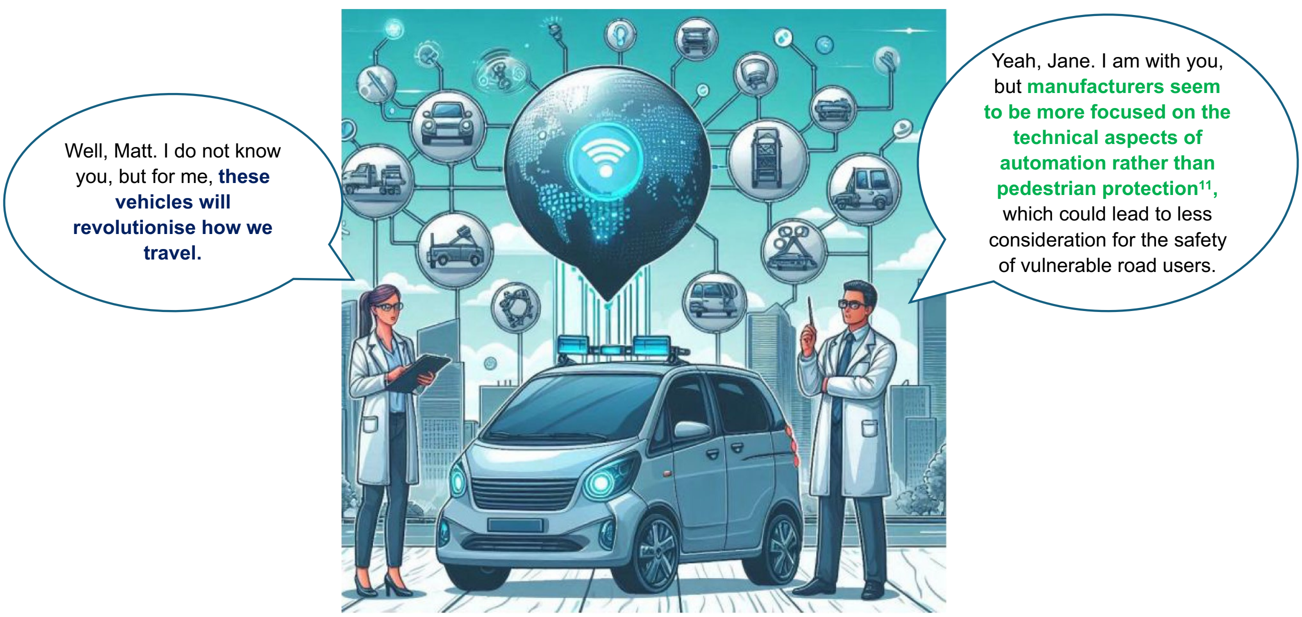

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Data availability All data supporting the findings are presented within the manuscript. Due to the conditions of the ethics approval, the survey dataset cannot be made publicly available at this time.

Declarations

Conflict of interest The authors declare no competing interests.

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