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Dimensions of attitudes to autonomous vehicles

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ABSTRACT

For the benefits of autonomous vehicles (AVs) to be optimized, the fleet conversion process needs to be efficient and timely. This study explored public attitudes to AVs to inform strategies to increase receptivity to the wide-scale use of AVs. A national online survey was administered to a sample of 1,624 Australians aged 16+ years. The survey featured open-ended questions that scoped respondents' perceptions of AVs. A grounded, thematic analysis identified two primary dimensions in the data: response valence (how positive or negative the comments were about the advent of AVs) and response type (the extent to which the comments reflected a cognitive or emotional response). This resulted in a dimensional analysis featuring four guadrants that captured the topics that were most frequently raised spontaneously by respondents. The quadrant characterized by comments that were positive/neutral and cognitive in nature was the most substantial, indicating general acceptance. Where concerns were expressed, they typically related to perceived safety, trust, and control issues, and tended to be more emotional in nature. The results highlight the importance of providing the public with concrete information about AVs to address fear levels and to resolve trust and control issues.

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Introduction

The advent of autonomous vehicles (AVs) is predicted to usher in an era of improved well-being across multiple domains. In the first instance, it is anticipated that the wide-scale use of AVs will greatly reduce the number of traffic accidents and prevent most of the death and disability currently attributed to crashes (Fagnant & Kockelman, 2015). Second, substantial reductions in emissions are expected due to improved traffic flows and the use of electric batteries to run the vehicles, especially where AVs are used as shared vehicles (Bajpai, 2016; Fagnant & Kockelman, 2014; Greenblatt & Saxena, 2015). Third, the improved mobility afforded the elderly and disabled will enable them to better access medical services and to achieve higher levels of social integration (Pettigrew, Cronin, & Norman, 2018a; Yang & Coughlin, 2014). Finally, AVs provide enhanced opportunities for active transport because of increased safety for pedestrians and cyclists (Millard-Ball, 2018). For these benefits to be optimized, it is important for the conversion process to be efficient and timely (Pettigrew, 2017). It is argued that public sentiment towards AVs will be critical in determining how quickly they are adopted and hence the timeframe in which the anticipated benefits can be achieved (Hohenberger, Spörrle, & Welpe, 2016; Menon, Pinjari, Zhang, & Zou, 2016; Pettigrew, Talati, & Norman, 2018b).

The small but growing body of work examining public attitudes to AVs has tended to focus on a range of predictor variables including demographic characteristics, specific psychographic attributes (e.g. sensation seeking and risk taking), and the outcome variables of intentions to use AVs and willingness to pay additional amounts for AV technology. This work has primarily involved quantitative surveys, although notable methodological exceptions include studies using online content from Twitter feeds and blog posts on the topic of vehicle automation (Kohl, Mostafa, Böhm, & Krcmar, 2017; Ro & Ha, 2017).

The results of these prior studies consistently suggest that (i) there is considerable positive interest in AVs in the community (Bansal, Kockelman, & Singh, 2016; Menon et al., 2016; Payre, Cestac, & Delhomme, 2014; Schoettle & Sivak, 2014); (ii) males, younger people, and those with higher levels of education are likely to express greater interest in using AVs (Dong, DiScenna, & Guerra, 2017; Hohenberger et al., 2016; König & Neumayr, 2017; Lavieri et al., 2017; Menon, Barbour, Zhang, Pinjari, & Mannering, 2018; Nielsen & Haustein, 2018; Payre et al., 2014; Regan et al., 2017; Schoettle & Sivak, 2014); and (iii) there are substantial sections of the population that would not be prepared to pay any extra for full vehicle automation (Daziano, Sarrias, & Leard, 2017; Kyriakidis, Happee, & de Winter, 2015; Regan et al., 2017; Schoettle & Sivak, 2014). The main perceived advantages of AVs appear to be accident reduction, increased mobility for vulnerable people, and greater leisure time, while the primary anticipated problems relate to equipment failure and safety issues, followed by hacking and liability issues (Bansal et al., 2016; König & Neumayr, 2017; Kyriakidis et al., 2015; Menon et al., 2016; Regan et al., 2017).

Conceptual work in this field has focused on topics such as data privacy (Schoonmaker, 2016), liability and insurance (Collingwood, 2017; Schellekens, 2015; Taeihagh & Lim, 2018), regulatory impediments (Hanna & Kimmel, 2017), and ethical aspects of the role of AVs in society and the prioritization of human life in various crash scenarios (Goodall, 2017; Sparrow & Howard, 2017). These conceptual analyses highlight the need for numerous complex issues to be resolved to ensure that a migration to an autonomous fleet will bring substantially more advantages than disadvantages. Some survey research has indicated that these issues are also of concern to members of the general public (Kyriakidis et al., 2015; Regan et al., 2017; Schoettle & Sivak, 2014), however it is not clear whether this is only the case once the issues are made salient to respondents through participation in the research process.

Given the amount of attention the AV phenomenon is currently attracting in the mass media, public attitudes on the topic are likely to be in a state of flux. Monitoring attitudes over time is important to assist in the development of strategies to inform the public about the nature and imminence of AV technology. Commercial entities developing AVs and government agencies responsible for ensuring appropriate physical and social infrastructures are in place are likely to be interested in the extent to which the general public is aware and supportive

of the impending roll-out of these vehicles (Kelley, 2017; Smith, 2017). In particular, identifying the strongest concerns relating to AVs can assist in the planning of proactive efforts to address these issues while building on any perceived positive attributes (Bansal et al., 2016).

The reliance to date on quantitative research methods in most previous public opinion research suggests that the application of a more exploratory approach could complement existing work. Such an approach has the potential to provide new insights for government departments, transport agencies, and AV developers into how the general public feels about AVs. These organizations are likely to be interested in the barriers that would need to be addressed to facilitate wide-scale adoption of the technology and the positive expectancies that could form the basis of future communications designed to enhance overall receptivity. In particular, it is important to understand the extent to which specific issues are salient and important to individuals. To achieve this, the data collection process needs to allow study participants to spontaneously raise issues rather than being prompted to consider aspects of AV introduction that they may not have otherwise considered.

Exploratory work is especially important in locations where AVs will be soon introduced because public sentiment will influence adoption rates and will therefore need to be factored into communication strategies designed to increase acceptance and willingness to experience these vehicles. In Australia, the context of the present study, trials of autonomous buses have commenced and a trial ride-sharing service is scheduled to be launched in 2019. Australians are recognized as being rapid adopters of digital technologies (Telefonica, 2016), indicating that AVs could be expected to achieve relatively high levels of market share. The aim of the present study was thus to explore Australians' knowledge of and attitudes to AVs to provide policy makers with the information needed to develop appropriate public education strategies designed to increase receptivity. Such strategies could assist in realizing the potential of AVs to achieve large-scale societal benefits.

Material and methods

The project received ethics clearance from a University Human Research Ethics Committee. As part of a larger study (Pettigrew et al., 2018, 2018a, 2018b), a national online survey was administered by an ISO-accredited web panel provider (PureProfile) to a sample of 1,624 Australians aged 16 years and older (16 years is the age at which Australians can commence learning to drive on public roads). To achieve broad population coverage, quotas were applied to recruit a sample with an even split across gender and age groups (16-30 years, 31-50 years, and 51+ years). Respondents were recruited by the web panel provider in two ways: (i) invitation emails sent to panel members meeting the age eligibility criterion and (ii) the listing of the survey on the PureProfile website to enable selection by panel members.

The sample profile is shown in Table 1. Although quotas were not specified for education level and driver status, the relevant proportions in the sample are consistent with national figures (Australian Bureau of Statistics (ACS), 2017; Charting Transport, 2015). The primary focus of the present study is on the qualitative data collected as part of the broader project on driving-related beliefs and behaviors and attitudes to autonomous vehicles.

Table 1. Sample profile (n = 1,624).

Characteristic	n	%
Gender*		
Male	810	50
Female	811	50
Age		
16–30 years	531	33
31–50 years	544	33
51+ years	549	34
Mean age	43 years $(SD = 17.5)$	
Education		
Primary school	20	1
High school	551	34
Technical/trade certificate	467	29
Undergraduate degree	402	25
Postgraduate degree	184	11
Driving status		
Driver	1565	96
Non-driver	59	4

^{*} n = 3 missing values

To capture qualitative data relating to Australians' perceptions of AVs and their attitudes towards them, three open-ended items were included in the larger survey. To prevent priming, definitions of vehicle autonomy were not provided, and instead the first qualitative item was designed to elicit existing perceptions of AVs: 'What is the first thing that comes to mind when you hear the terms 'autonomous vehicle' or 'driverless car'?'. This forced response qualitative item was followed by a quantitative item asking 'How much do you know about fully autonomous vehicles?' (four response options: (1) 'Nothing at all' to (4) 'A large amount'). Those who selected a response other than 'Nothing at all' were asked a second forced response qualitative item: 'What, if anything, do you know about autonomous vehicles?'. The third qualitative item was optional for all respondents: Is there anything else you would like to tell us about autonomous vehicles in general?

Given the potential for respondents to provide brief and truncated responses to openended questions in online surveys, the questionnaire was designed to provide respondents with multiple opportunities to provide comment. As such, rather than assessing different aspects of attitudes to AVs, the three open-ended questions were very similar to each other to encourage expansive discussions of respondents' thoughts and feelings about the introduction of AVs. The unit of analysis was therefore comments rather than respondents because individual respondents could make multiple comments. This approach was also appropriate because some respondents gave brief responses while others provided detailed accounts that could be coded to multiple conceptual categories.

Analysis

All of the responses to the open-ended items were imported into NVivo 11 qualitative data management software (QSR International) for coding and analysis. A grounded, thematic approach was used whereby a single coder (the first author) undertook the coding process and built the coding hierarchy progressively as new topics emerged (Glaser & Strauss, 1967). The entire dataset was coded by line unit to ensure all relevant concepts were captured. NVivo's text and matrix search functions were used to refine the analysis and explore any trends by age and gender. Responses to the quantitative items were imported into SPSS, and t-tests and ANOVAs were used to test for significant differences between demographic groups.

Results

When asked to self-report their knowledge about autonomous vehicles, the majority (57%) indicated that they knew 'Very little', around a quarter (23%) considered that they knew 'A moderate amount', and 1.5% reported knowing 'A large amount'. One in five (19%) selected the 'Nothing at all' option. Males (Mean (M) = 2.20) and those with a university qualification (M = 2.22) were more likely to report higher levels of knowledge than their female (M = 1.93; p < .001) and less-educated counterparts (M = 1.98; p < .001). No differences were observed by age.

Including all responses to the three qualitative questions, 3,642 comments were analyzed. Once 'no comment' (n = 442) and 'don't know' (n = 38) type responses and those relating to the nature of the survey itself (e.g. 'Great Survey'; n = 18) were excluded, the resulting sample comprised 3,144 comments.

The topics raised by the respondents in their answers to the open-ended questions were wide-ranging and covered a vast array of issues. Each issue was assigned to a separate NVivo node, with all comments relating to the specific issue assigned to the node during the coding process. Many issues received a very small number of mentions. For example, only five of the 3,144 comments related to the benefits of AVs for older people and seven related to positive environmental outcomes. To select the topics to be included in the thematic analysis, a threshold of 36 comments (i.e. at least 1% of analyzed comments) was applied. Interrogation of the NVivo nodes meeting this threshold indicated that there were two primary dimensions represented in these data: response valence (how positive or negative the comments were about the advent of AVs) and response type (the extent to which the comments reflected a cognitive or emotional response). This resulted in a dimensional analysis featuring four quadrants that captured the most substantial topics raised by respondents (see Figure 1). In total, 1,945 comments from the total dataset were represented in the dimensional analysis. The remaining comments related to issues raised by only a small number of respondents and hence were not analyzed beyond the initial coding process.

Quadrant 1 (assigned the title 'AVs = progress') encompassed responses from those exhibiting more accepting and positive attitudes to AVs and citing concrete or tangible aspects of this technological advancement. Quadrant 2 ('AVs are not good for us') reflected a negative attitude to AVs based on specific physical and/or social concerns. Comments allocated to Quadrant 3 ('Bring it on!') lacked specificity but clearly indicated positive anticipation. Quadrant 4 ('Too scary') comprised negative emotional reactions that were general in nature and did not appear to have specific origins. The most substantive issues raised in the responses assigned to each of the quadrants are outlined below, with example quotes provided for illustration.

Q1: AVs = pro (54%, n= 104	0		Q2: AVs are not good for us (14%, n = 281 comments)	
	Positive/Neutral		Negative	
Cognitive	Companies Imminent arrival Increased safety Parking Electric	(n=782) (n=120) (n=60) (n=45) (n=39)	Decreased safety	(n=281)
Emotional	General +ve	(n=303)	General -ve Fear Trust and control issues	(n=140) (n=96) (n=79)
Q3: Bring it on (16%, n = 303 comments)			(16%, 1	Q4: Too scary n = 315 comments)

Figure 1. Dimensional analysis of qualitative responses relating to the perceived nature of AVs.

Quadrant 1: 'AVs = progress'

This quadrant accounted for the largest proportion of responses included in the dimensional analysis. Half (54%) of the comments were allocated to this quadrant, with these responses often referring to specific companies that are at the forefront of AV development. In order of mentions, the three most frequently cited companies were Google (n = 408), Tesla (n = 232), and Uber (n = 71). The male respondents were especially likely to make reference to specific companies that are active in the AV field.

Expected to be on the roads in the next few years, most major car manufacturers are looking into their own models. Google has some exciting technology in this field (male, 26 years).

They are driverless cars from brands such as Google and now Apple. Pods to get you from A to B without you needing to do much more than tell the vehicle where you want to go (male, 34 years).

Wow. Now a car will move on its own - no driver required. My husband told me last month about this and that Uber may be starting autonomous vehicles (female, 29 years).

Those with more positive attitudes to AVs sometimes referred to the imminent timing of the release of these vehicles. Males in particular referred to current testing programs in place around the world and the likelihood that AVs would soon be available for public use.

They are testing them in England on the road under normal circumstances (male, 65 years).

They are already being made and made better and it is not a distant future idea (female, 32 years).

Many manufacturers are beginning to introduce autonomous vehicles, it is increasing in trend rapidly at the moment. They are cars that can drive themselves, park themselves, and can brake all of a sudden on their own (male, 44 years).

Some respondents reported that they expected the roads to be safer once AVs are in use. Once again, males were more likely than females to refer to this outcome of AV implementation, and younger respondents were also more convinced of the superior safety represented by vehicle automation.

They are many times safer than human drivers, and could help reduce energy consumption as well as congestion (male, 24 years).

They can sense their position on the road, any nearby other vehicles, and respond promptly to any danger of a collision, all with the aid of sensors, or some form of radar (male, 75 years).

There will be less car accidents and more people can be on the road and more mobile (female, 34 years).

The ability of AVs to self-park was described as being an advantage of these vehicles, especially among the female respondents.

You are not required to do anything while parking, it parks itself (female, 17 years).

The final category of responses within Quadrant 1 related to respondents' discussions about the projected likelihood of AVs being powered by electricity. This issue was more often raised by older respondents.

I am excited by the prospect of autonomous vehicles especially if they are powered by electricity that has been generated by solar or wind (male, 70 years).

Quadrant 2: 'AVs are not good for us'

This quadrant, which comprised 14% of the comments included in the dimensional analysis, was dominated by concerns about the safety of AVs, specifically assumptions that the new technology would increase accident rates and cost more lives. These concerns were often related to perceptions of the unreliability of computer systems and the inability of automated vehicles to anticipate and respond to the large variety of situations encountered on the road. Male respondents were more likely to express such concerns.

Dangerous - computers crash all the time and the consequences could be catastrophic (female, 52 years).

They would be extremely dangerous because they would be unable to interpret many situations (male, 51 years).

On country roads, how will they know when to stop for a kangaroo jumping in front of the car or driving through a mob of cattle or sheep? I fear that driverless cars will not be safe (male, 72 years).

Quadrant 3: bring it on!

The comments allocated to this quadrant (16%) typically did not refer to any specific or concrete factors associated with AVs. Instead they were more emotional reactions indicating excitement and enthusiasm for a world in which vehicles are automated. Of note is that



these comments were expressed by respondents regardless of age, with both younger and older respondents being equally represented in this quadrant.

Can't wait for it (male, 69 years).

That sounds great; I don't enjoy driving (female, 52 years).

I want one (female, 64 years and male, 19 years).

Technology at its finest (female, 69 years).

Best idea ever (female, 31 years).

Bring them on! (female, 41 years).

Future, exciting, inevitable, Uber (male, 28 years).

Looking forward to their arrival on Australian roads (male, 76 years).

Quadrant 4: too scary

This quadrant also accounted for 16% of the comments and was characterized by more emotive responses, this time with a negative valence. A cluster of comments was classified as 'general negative' reflecting their lack of specificity accompanied by a clear aversion to AVs. These kinds of comments were more commonly expressed by older respondents.

They would be crap (male, 61 years).

I don't believe it. It's weird (female, 55 years).

Glad that I will be NOT around when they are fully used (female, 90 years).

Silly waste of money! (female, 72 years).

Sheer madness (male, 47 years).

The end of the world (male, 20 years).

Very bad idea! (female, 37 years).

How far are we taking this craziness? (male, 57 years).

I don't like the idea of them, too many things are automated these days (male, 36 years).

Females in particular occasionally expressed a personal fear of vehicle automation. Rather than the societal-level safety issues that dominated comments allocated to Quadrant 2, these concerns were much more personally oriented and the first person was often invoked in the explanation.

I would feel distressed not being in control or seeing no one in control (not that there are always sane people in control of driving). What happens if it breaks down in the middle of the road? Technology gone mad - scary (female, 72 years).

The idea of AI driven cars with limited personal accountabilities makes me nervous and anxious (female, 37 years).

Scares the crap out of me not being in control of a vehicle (male, 35 years).

The ramifications of relying on technology for something so potentially dangerous frightens me (male, 41 years).

The idea scares me (female, 25 years).



Others expressed emotional concerns that were articulated in terms of an inability to trust vehicles that are not being controlled by humans. In some cases this was extended to conspiracy theories about plans to remove control from individuals and place it in the hands of centralized agencies.

I don't EVER want to use one. I don't trust AI one jot! (female, 46 years).

Would not trust them and would not drive them (male, 54 years).

I would not trust one in a pink fit (male, 56 years).

I don't like the idea of technology being in control (female, 31 years).

Purpose seems to be to control transportation by police state operatives (male, 64 years).

Discussion

Using an exploratory approach, the present study identified issues relating to AVs that are most salient to the Australian public. The results indicate that there may be a substantial level of acceptance of AVs from which to base efforts to encourage the large-scale use of these vehicles once they are widely available. The two quadrants of the dimensional analysis (Quadrants 1 and 3) representing neutral to positive reactions accounted for the majority of classified comments (70%), which is similar to proportions identified in previous quantitative research conducted in various countries (Haboucha, Ishaq, & Shiftan, 2017; Payre et al., 2014; Regan et al., 2017).

The results suggest various strategies that could be used to increase receptiveness to AVs (see Table 2). Many of the comments reflecting neutral or positive attitudes related to more concrete elements (Quadrant 1), such as specific companies that are investing in AV technology and particular characteristics and capabilities of AVs (e.g. electric powered and ability to self-park). Consistent with previous research, positive views were more common among male respondents (Regan et al., 2017). By comparison, negative comments (which were more common among females and older respondents) were as likely to be emotional in nature (Quadrant 4) as they were to be based on more tangible issues (Quadrant 2). This indicates that an effective strategy for improving receptivity is to provide concrete information that can be used to structure thoughts and feelings about AVs. Examples of such information may include statistics on numbers of road miles travelled (both real and simulated) by test vehicles and the large projected reductions in car accidents.

Little previous research has identified the emotional-cognitive continuum as being especially relevant to attitudes to AVs. An exception is Hohenberger et al.'s (2016, 2017)

Table 2. Potential communication strategies to increase public acceptance of autonomous vehicles.

General approach to communications

- Ongoing and balanced communications to off-set sensationalized coverage of occasional accidents
- Focus on identified issues of concern rather than non-salient issues

Specific topics to be included in communications

- Road miles travelled (real and simulated)
- Rigorous testing in progress
- Extent and results of AV trials being conducted around the world
- Estimated reductions in crashes and injuries
- Autonomous technology being incrementally installed in new vehicles

work on the effect of positive and negative emotional responses on usage intentions. Their findings support those of the present study in suggesting that increasing public receptivity to AVs will involve allaying negative emotional responses and encouraging individuals to focus on tangible positive outcomes of using AVs. Such strategies may be most needed for females, who were found in the present study and previous research to be more likely to express negative reactions to the prospect of using AVs (Hohenberger et al., 2016; König & Neumayr, 2017; Kyriakidis et al., 2015; Regan et al., 2017; Schoettle & Sivak, 2014).

Consistent with previous research, a major impediment to adoption appears to be the safety concerns that featured in both Quadrants 2 and 4 and the trust issues noted in Quadrant 4 (Bansal et al., 2016; Choi & Ji, 2015; Kohl et al., 2017; König & Neumayr, 2017; Kyriakidis et al., 2015; Menon et al., 2016; Ro & Ha, 2017; Schoettle & Sivak, 2014). Communications specifically addressing this topic are therefore likely to be important elements of any public education strategies that aim to increase receptivity. This focus on safety also highlights the need for AVs to be thoroughly tested and trafficready prior to implementation because any problems occurring in the early stages of roll-out are likely to consolidate existing fears (Kohl et al., 2017). This is apparent in the widespread media attention dedicated to the small number of AV-related accidents that have occurred elsewhere in the world, with news articles typically including immediate reporting of the party at fault in these accidents (e.g. Hinchliffe, 2017; Titcomb, 2017).

Of note are the issues identified in previous studies that did not feature to any meaningful extent in the respondents' spontaneous mentions of the factors they associate with AVs. In particular, despite a substantial amount of attention given in the literature to ethical, liability, and hacking concerns (Collingwood, 2017; Goodall, 2017; König & Neumayr, 2017; Kyriakidis et al., 2015; Ro & Ha, 2017; Schellekens, 2015; Schoonmaker, 2016; Sparrow & Howard, 2017), these aspects received minimal attention in the data. This suggests that previous quantitative surveys that have listed these issues and asked respondents to report whether they find them to be of concern may only reflect prompted concerns and not salient issues. Drawing the public's attention to these issues may cause individuals to assume they could constitute potential problems, while in fact they may have little bearing on decisions to purchase or use AVs. A strategy to increase receptiveness to AVs may therefore be to focus communications on those aspects of AV implementation that are of higher perceived relevance to consumers to ameliorate existing concerns rather than attempting to address issues that have low salience.

Rather than converting directly to fully autonomous vehicles, consumers are being incrementally exposed to autonomous driving technologies within their existing cars in the form of various features including adaptive cruise control, lane keeping systems, automatic braking while skidding, parking assistance, and blind spot and collision warning systems (Eby et al., 2016; Payre et al., 2014; Richards & Stedmon, 2016). Drivers exhibit varying levels of awareness and use of these in-car technologies (Abraham et al., 2017), suggesting that it is important to also educate consumers about the benefits of these autonomous functions to increase their acceptance and use and provide opportunities for trial (Höltl & Trommer, 2013; Koo et al., 2015; Lee, Mehler, Reimer, & Coughlin, 2015; McDonald et al., 2016). Higher levels of use of partial vehicle automation functions have been found to be associated with more

positive reactions to fully automated vehicles (Kyriakidis et al., 2015), illustrating the value of promoting these features due to their positive impact on road safety in their own right as well as their ability to increase receptiveness to fully autonomous vehicles. The results of the present study may have relevance for efforts to increase receptiveness to these autonomous features by identifying specific target groups (especially females) and specific issues (e.g. safety fears and aversion to loss of control) that may be most important to consider when developing public communication strategies about both partial and full autonomy.

This study has several limitations, some of which could be addressed in future research. In particular, relying on a web panel for respondent recruitment may have resulted in a sample that is somewhat more technology-savvy than the general population, indicating the need to replicate the study with samples recruited via other means. In addition, the confinement of the study to a single country could be addressed through the use of international samples, although this can be problematic for exploratory studies that generate large amounts of qualitative data that need to be interpreted by a single coder due to the use of an emergent coding approach. To overcome this constraint, it may be necessary in international studies to adopt a content analysis approach that involves the application of a pre-specified coding hierarchy that attempts to cover all possible responses (Kassarjian, 1977), thereby permitting different researchers to perform the coding task for responses provided in different languages. Relatedly, the final study limitation pertains to the use of a dimensional analysis approach that resulted in a conceptual interpretation that was based on those themes for which there were a critical mass of responses (n \geq 37). Despite the inevitable loss of content, this approach is consistent with thematic analyses of qualitative data that focus on the main themes in the data to develop a parsimonious interpretation rather than attempting to account for all possible variations and outliers (Vaismoradi, Turunen, & Bondas, 2013). Future research could assess the relationships identified in the present study via the use of quantitative items designed to examine the relative strength of these relationships, and could also assess the role of potential predictors such as extent of knowledge of AVs, other demographic factors (e.g. education and income), and psychological factors (e.g. sensation-seeking and risk-taking tendencies).

The primary strength of this study was the very large sample for a primarily qualitative study and the resulting ability to identify emergent issues rather than priming respondents by mentioning specific potential benefits and problems associated with AVs and then gauging respondents' reactions. This approach facilitated the identification of issues that are most important to consumers and provided insights into the lack of concern over other implementation challenges that are well-covered in the literature but apparently are not salient to the Australian public.

Conclusions

Migration to an AV vehicle fleet will provide substantial benefits at the societal level, resulting in the need to ensure the community is aware of and receptive to this technological change to enhance the likelihood of timely adoption. The results of the present study indicate that only a minority of Australians has negative attitudes to AVs, and that these negative attitudes may be derived from a combination of cognitive and emotional factors. This highlights the importance of providing people with concrete information to minimize fear levels and resolve trust and control issues. This may involve, for example, developing proactive communication campaigns that use cognitive approaches to (i) provide mental anchors in the form of crash statistics, (ii) draw attention to the many autonomous features that are currently available in new cars, and (iii) keep the public informed of the outcomes of the numerous AV trials that have already taken place around the world. By allowing respondents to nominate the issues of importance to them, it was possible to ascertain that key concerns highlighted in literature may not be salient to many people, and as such it may not be necessary to develop strategies to overcome assumed concerns relating to ethics, hacking, and liability.

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