Driverless Futures?

A survey of US public attitudes

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May 2022

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The survey was part of the *Driverless Futures?* (driverless-futures.com) project (ESRC grant ES/S001832/1).

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We would like to acknowledge the assistance of Miriam Ricci at University of the West of England in developing the survey.

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Executive Summary

1. Introduction

The prospect of self-driving vehicles on our roads has attracted considerable public attention and private investment. As vehicles have started to be tested, it has become clear that their interactions with other road users are complex and potentially controversial. The need for governance is becoming clearer. Questions of how safe the technology needs to be, who should and would benefit and who should be making decisions are becoming ever more important.

This research was conducted as part of *Driverless Futures?* (driverless-futures.com), a project funded by the UK Economic and Social Research Council, with researchers from University College London, UWE Bristol and City, University of London. The main focus of this research was in the UK but we have interviewed experts from around the world, and at the beginning of 2022 we surveyed a sample of 1,890 members of the US public to capture their opinions on self-driving vehicles. The survey questions were derived from a set of more than 50 expert interviews[1] and a programme of public dialogue[2] that identified key issues for governance of the technology. The survey instrument was essentially the same as that deployed at the end of 2021 in the UK (N=4,860) with some amendments to Americanise the terminology.

The total sample of 1,890 respondents comprised a general sample of 1,738 drawn from across the United States, with soft quotas applied to achieve coverage across the nation based upon six regions as detailed in Appendix 1. In addition to this, 152 respondents were drawn specifically from Maricopa County (including the metropolitan area of Phoenix), Arizona, a region that has seen on-street self-driving vehicle trials and deployment for several years.

Most surveys of public attitudes towards self-driving vehicles have addressed respondents as potential users or consumers of the technology. Our survey is different. We address our respondents as citizens, to ask them how they wish to see the future of mobility.

Our respondents all answered a core set of survey questions before being divided into four groups for modules on specific topics relating to self-driving vehicles. On some matters our respondents return a clear consensus; on others, opinions are diverse. The range of sentiments include excitement and scepticism about the benefits, the safety, and the wider impacts of introducing self-driving vehicles.

We have prepared this report on the US results as a standalone document. Many of the results are very similar to those we found in the UK, so, wherever appropriate, the text of the report is similar. Besides the UK, we deployed a shortened version for a convenience sample of 'experts' (N=80)[3]. We comment on some comparisons between our Us results and those from our other two surveys in this summary.

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[1] Tennant, C., & Stilgoe, J. (2021). The attachments of 'autonomous' vehicles. *Social Studies of Science*. doi:10.1177/03063127211038752

[2] Traverse. (2019). *CAV public acceptability dialogue: Engagement Report*. Retrieved from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/837958/cav-public-acceptability-dialogue-engagement-report.pdf

[3] The convenience sample comprised stakeholders known to the researchers or suggested by those contacts as well as some respondents accessed through specialist online forums. Appendix 1 includes brief details on these surveys. Reports on those surveys in similar format to this one can be found at driverless-futures.com.

2. Discomfort with the idea of self-driving

More of our respondents would be uncomfortable using self-driving vehicles (53%) or sharing the road with them (46%) than say they would be comfortable (28% and 29% respectively). Our survey is the third in a series since 2017, and we have found consistent rates of comfort and discomfort across this period. Our 2022 results suggest a very slight reduction in levels of comfort, against a context of increasing investment and publicity surrounding the technology.

3. Scepticism about the benefits of self-driving vehicles

Many are sceptical that the technology would bring widespread benefits. 73% of people agree that the companies developing the technology will be the primary beneficiaries, and only 16% of people agree that poor people will benefit more than the rich. We asked for views on the usefulness of seven different forms of SDV deployment. Respondents tend to think that the technology would make more sense for public transport rather than for private vehicles although this effect is weaker than amongst our UK respondents. Although for six of the seven deployments more people considered them useful than not useful, the difference was modest for self-driving taxis and self-driving car clubs, while a majority considered self-driving trucks not to be useful (52% against 42% useful).

4. Some keen supporters; some ardent opponents

There is plenty of variation in opinions expressed, with some respondents showing keen support, some being ambivalent, and some expressing ardent opposition. Our survey asked for free-text responses, first to the question *'What first comes to mind when you hear the term 'self-driving vehicles'?'*. After providing a short definition of self-driving vehicles, we then asked respondents *'Do you think this technology should be developed?'* followed by *'Why or why not?'* We give examples of the responses throughout the report.

We coded the free-text material according to whether respondents express positive or negative views of the technology, to compare them with people's answers to some of the fixed-response questions (Figure 1.1):

N = 1,890	*Negative %*	*Neutral %*	*Positive %*	*Don't know %*
What first comes to mind? (coded free-text)	49	34	17	
Should this technology be developed?	35	7	58	
Reasons why/why not (coded free-text)	39	23	38	
Comfort with using the roads alongside	46	20	29	5
Comfort with riding in	53	15	28	4

Figure 1.1. Attitudes towards the technology across five different questions

Previous surveys have also found that more general questions, like our question *'Should this technology be developed?'*, tend to elicit more positive responses, whereas more concrete questions, potentially interpreted as readiness to engage with the technology right now, elicit more negative

responses. 25% of our respondents give negative responses to all five questions, with 10% giving positive responses to all. The overall picture is of considerable variation across the sample, but also variation within individuals' answers.

General attitudes towards self-driving vehicles are similar amongst UK and US respondents, although the US respondents are marginally more favourable towards self-driving vehicles. Our 'expert' respondents are much more positive. The table below compares the mean scores in each survey for three of the questions in figure 1.1:

SURVEY QUESTION	***Do you think this technology should be developed?***	***How would you feel about using the roads alongside self-driving vehicles?***	***How would you feel about riding in a self-driving vehicle instead of the existing ways you travel?***
RESPONSE SCALE	from *'definitely no'* (1) to *'definitely yes'* (4)	from *'totally uncomfortable'* (1) to *'totally comfortable'* (5)	from *'totally uncomfortable'* (1) to *'totally comfortable'* (5)
N[4]	*1,762*	*1,799*	*1,804*
US all public respondents	2.74	2.72	2.53
N	*4,421*	*4,642*	*4,632*
UK all public respondents	2.61	2.51	2.37
N	*80*	*77*	*77*
All experts	3.59	3.79	3.84

Figure 1.2. Mean scores of responses to headline questions

As we discuss below, men and those more technologically optimistic show more enthusiasm, on average, than others. Our 'expert' respondents' general views are similar to the most technologically optimistic (those in the top decile) men from the UK and US samples.

5. Roads as social spaces

45% of respondents agreed with the statement that *'On the roads that I use, most drivers drive well'*, with 33% disagreeing, while the free-text responses suggest frustration with others' bad driving. Across a range of scenarios, from passing cyclists to giving way to pedestrians at crosswalks, large majorities of respondents expect the rules to be followed. Respondents also see the road as a social space, with 91% agreeing that *'Being considerate to other road users is as important as following the formal rules of the road'* , and 79% agreeing that *'drivers sometimes have to use common sense instead of just following the State driver's handbook'*.

6. Concerns about mixing humans and self-driving vehicles

[4] N numbers vary since the *'don't know'* responses are excluded when calculating the mean score.

A majority of respondents worry that self-driving vehicles might *'be limited in how well they drive because they lack the common sense of human drivers'* (53% agreeing, 16% disagreeing). One free-text response says:

> *"It is an unbelievably stupid .Cars do not have eyes or common sense. Someone dumb must of been on drugs when they came up with this."*

Respondents tend to say they would be more comfortable interacting with a vehicle driven by a human than a self-driving vehicle. This contrast is strongest for respondents imagining themselves as *'pedestrian, or wheelchair or mobility scooter user, crossing a suburban road with light traffic'* (61% preferring the interaction with a human driven vehicle, 32% with a self-driving vehicle) and weakest for those imagining being a *'cyclist riding on a narrow suburban street'* (55% preferring the interaction with a human driven vehicle, 37% with a self-driving vehicle).

One module asked respondents to consider interactions between pedestrians at a crosswalk and vehicles approaching. 61% agree that self-driving vehicles *'will need to 'understand' the intentions of people at the side of the road when negotiating crosswalks'* and 47% agree that pedestrians will *'want to communicate with the self-driving vehicle just as they do with human drivers'* (26% say that pedestrians would not mind not being able to communicate). But other contexts elicit less negative views. For example, another module asked about interactions involving pedestrians and cyclists. 42% think that self-driving vehicles would be dangerous for pedestrians (31% disagreeing) and 34% think that self-driving vehicles would be safer than human drivers for pedestrians (37% disagreeing).

Although there is considerable uncertainty and variation, more US respondents think that SDVs and human-driven vehicles can share the road than do not: 37% disagree that *'SDVs will never work on public roads'* (29% agreeing, 34% undecided or don't know), with almost exactly the same results for responses to *'Human-driven vehicles and SDVs should not share the same stretch of road'* (36%, 29% and 34% respectively).

US and UK respondents show a similar balance of views on the road as a social space and the challenges of mixing humans and machines. Our expert respondents tend to take a different view on questions that imply limitations in self-driving vehicle performance (e.g. lacking human common sense) or those that suggest restrictions on self-driving vehicle operation. 74% of experts reject the idea that self-driving vehicles and human-driven vehicles should not share the same stretch of road, whereas 29% of public respondents in both the US and UK reject this.

7. Self-driving vehicles expected to follow the rules and to drive cautiously

86% of respondents state that self-driving vehicles *'must follow the same rules as other road users'*, with only 28% agreeing with the idea that self-driving vehicles *'should be allowed to break the formal rules of the road in some situations'* (47% disagreeing). This contrasts with the more fluid approach to human driving, where 47% agree that human drivers sometimes need to break the rules (28% disagreeing). 84% of respondents agree that self-driving vehicles *'should be programmed to drive more cautiously than human drivers'*, and 74% reject the idea that fast-reacting self-driving vehicles should be allowed to drive closer than human drivers.

This is not to say that everyone resists change. A sizeable proportion (48%) agree that *'We should standardise the driving environment internationally, to make it easier for SDVs to work everywhere'* (20% disagreeing), and 56% agree that *'Crosswalks with traffic lights should replace unsignalled crosswalks to help SDVs know when people need to cross the road'* (15% disagreeing). 65% agree that

'If there are enough [self-driving vehicles] sticking by the rules, human drivers should be expected to drive strictly by the rules too' (8% disagreeing).

8. A desire for control and responsibility

People are concerned not only about sharing the road but also about sharing responsibilities with self-driving vehicles. Both drivers (87%) and non-drivers (72%) want someone in the vehicle able to take over the driving, but 64% worry that those riding in the self-driving vehicle might not be able to react fast enough if asked to take control. 72% of respondents reject the suggestion that, after a collision, occupants of a self-driving vehicle *'were not driving and therefore should be free leave the scene'*. A number of the free-text responses express worry over the issue of control and responsibility:

> *"Why on earth would I give up my control of driving to a vehicle with no driver?"*
>
> *"Loss of driver control and dangerous letting on board computer control a vehicle that can potentially kill others. If computer error and someone is killed who is ultimately responsible for the accident if someone has a self drive vehicle. Against it!"*

9. A desire for transparency

Respondents overwhelmingly favour transparency. 89% of respondents agree that *'the companies behind [self-driving vehicles] must be able to explain the actions taken by their vehicles'*. Asked to compare policy approaches, 61% prefer the statement that self-driving vehicles *'should be required to make public the full details of how their AI systems work'* to the suggestion that they should be able to *'keep private the details'* (preferred by 17%). 90% agreed that in the event of a collision *'all data must be made available to investigators'*. Respondents also want self-driving vehicles to be clearly distinguishable: 79% of respondents agree that *'it must be clear when a vehicle is driving itself'*.

US and UK respondents again show a similar balance of views when it comes to following the rules (7, above) and transparency[5] but the expert respondents take a different view on identifiability: 46% agree that *'it must be clear when a vehicle is driving itself'* compared to overwhelming majorities amongst the public respondents. So too with rule following, the experts tend to seek more flexibility where public responses suggest people want to know exactly what they are dealing with.

Our survey suggests that companies will need to start being more transparent if they are to earn public trust. People tend to agree that self-driving vehicles should drive like human vehicles if they are to mix on the road, and tend also to say they would like vehicles to be identifiable, deterministic and fully explainable. There seems to be a desire for self-driving cars to blend in, while also being identifiable as different, so that people know when they are interacting with new types of vehicles on the road.

10. A high bar for safety

31% express safety concerns about their technology in their *'What first comes to mind?'* responses, while 7% see safety benefits as a reason why the technology should be developed:

[5] The question sets were not identical: e.g the US respondents were not asked about zebra crossings, and there were fewer questions on SDV interactions with pedestrians and cyclists.

"Being safe on the road... No drunk drivers... No sleepy drivers.. No stoned drivers... Being safe on the road."

"Not having poor driving. Less deaths. Safer streets."

We asked respondents *'How safe do you think self-driving vehicles should be?'*: 62% set a high bar (either *'Much safer than the safest human driver'*, or *'Never causing a serious collision'*), while 19% set a low bar (either *'As safe as the average human driver'* or *'It doesn't matter'*). It is notable that those expressing positive views of the technology are more likely to demand a high safety bar than others. Of the *'low safety'* bar respondents, 76% are *uncomfortable* with the idea of riding in an SDV, which suggests that there is a group of respondents who might be described as both unengaged and disenchanted. The UK sample also reveals a similar group of the unengaged and disenchanted. Excluding the disenchanted, the other respondents in both the US and UK on average set very high bar for safety, considerably higher than the expert respondents aim for.

11. Demands for regulation, but low confidence in regulators

Our respondents expect self-driving vehicles to be regulated. 68% agree that *'there should be international standards regulating [self-driving vehicle] technology'* (10% disagreeing) while 65% agree that self-driving vehicles *'should be regulated by federal government'*. However, 58% of respondents state they have no or little confidence in national governments to regulate the introduction of self-driving vehicles. 60% say that the technology *'should only be introduced if they have support from a clear majority of the public'*.

60% express *'medium'* or *'high'* confidence in *'the companies developing the technology'* when it comes to making decisions over the introduction of self-driving vehicles. This should be set alongside low trust in those companies (40% agree they do not *'trust the companies developing [self-driving vehicles] to make sure they are safe'*, 28% disagreeing) and the presumption that the technology companies would be the primary beneficiaries (73% agreeing that *'SDV companies will benefit the most'*).

Although the US respondents generally show majority support for regulation, these majorities are noticeably smaller than those in the UK. The experts too support regulation and an overwhelming 77% reject the idea that the tech companies should regulating themselves. But the most striking position taken by the experts is that 61% (77% of those who describe themselves as directly involved in technological development) reject the idea that for SDVs *'it must be clear when a vehicle is driving itself'*.

12. Phoenix

We obtained a sub-sample of 152 respondents from Maricopa County, Arizona, to ask specifically about their experience of self-driving vehicle service deployments in the metropolitan area of Phoenix. Just over half of the respondents were either unaware of these deployments or hadn't seen them: only three respondents had actually used them. On average, the Maricopa respondents expressed slightly more favourable attitudes towards the technology than the rest of our respondents, but also marginally less favourable attitudes than the 206 respondents in the main sample who came from Southwestern states.

13. Expert perspectives and public trust

Companies developing the technology often suggest that public discomfort with self-driving vehicles and problems of public trust will be resolved with greater awareness or information about the technology. Our surveys suggest this won't be the case, and that the issues are more complicated. The concerns, uncertainties and diversity of opinions we reveal here reflect some of the uncertainties around the technology that the experts themselves are currently grappling with, some of which will not be resolved easily in the short term. Indeed, on a number of detailed issues the respondents from our survey of self-driving technology 'experts' showed a wide variety of responses, with similar numbers both for and against various approaches.

Most of our expert interviewees see the technology as intrinsically desirable, whereas our survey respondents express much more hesitation. In interviews, many experts argue for light touch regulation, and some also express impatience with the pace of regulatory developments. Both in interviews and in the survey, experts tend to downplay concerns about humans and self-driving vehicles mixing in shared space and about the importance of transparency and explainability. This creates a potential conflict with the public for whom these concerns are central, and for whom knowing what they are dealing with when interacting with self-driving vehicles on the road is essential.

We mentioned above the challenge of public desires for self-driving vehicles to blend in to the current road system while also being clearly distinguishable from human-driven vehicles. This reflects the developers' promise that self-driving vehicles should be both better than human drivers but capable of fitting in without needing substantial adaptation from them or other road users. Just as when two drivers negotiate who passes first through a narrow space, there needs to be negotiation between human road users, and those responsible for self-driving vehicles, on how the roads and the place of self-driving vehicles on them develops. The developers' tendency to sidestep the idea of public engagement beyond information and exposure exercises falls short of a responsible innovation trajectory.

1. Introduction

1,890 responses were gathered from US participants through the Qualtrics survey platform. Appendix 1 sets out the detailed methodology used in the survey. Of these 1,738 responded to a nationwide survey, and 152 responded to a survey fielded to residents of Maricopa County, Arizona.

After introductory screening questions participants were asked about their attitudes to the road of today before being asked about their general attitudes towards self-driving vehicles (SDVs). These initial questions included two requiring short free-text responses to obtain unprompted answers. The average length of these was 13 words. More detailed questions concerning SDVs followed, before participants were routed through one of four different modules of further detailed questions. This structure was adopted to cover a broader range of topics without making the survey too long for most respondents. Median completion time was 23 minutes.

After completing the questions in the module to which they were allocated, all respondents then answered questions on their attitudes on some general topics beyond SDVs as well as providing socio-demographic information.

2. Participant demographics and survey sampling

2.1 Demographics

We provide detailed demographic information by region, habitat[6], travel habits, education and income in Appendix 2. Participants provided their exact age in years. Figure 2.1 summarises this information:

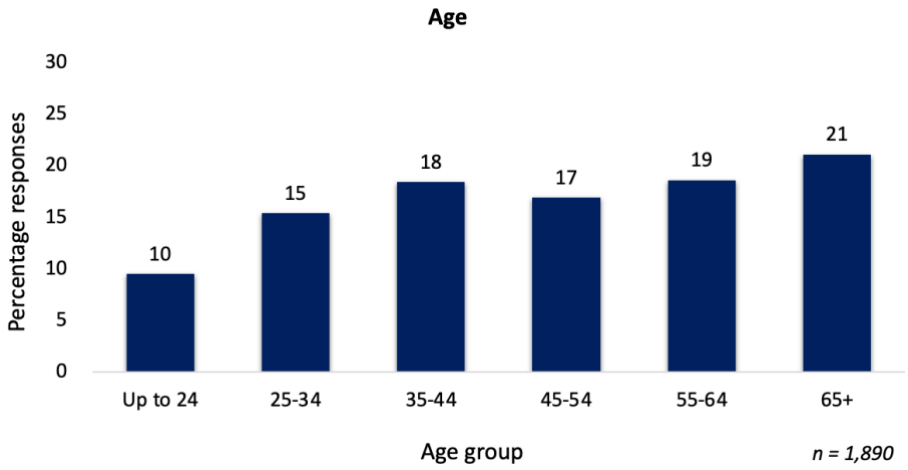

Figure 2.1. Participant demographics - age

Participants were offered three possible responses when asked for their gender: male, female and other. 48% of the sample was male, 51% was female and 1% other.

2.2 Sampling strategy and data weightings

Appendix 1 sets out the detailed methodology adopted in the survey. Since our respondents were recruited from Qualtrics, the sampled population is restricted to the panels used by the company. Although panel providers endeavour to achieve samples that reflect the socio-demographic makeup of the US population, their restricted reach means that we should be cautious about simply generalising our results to the broader UK population.

Subject to this caveat, we have sought to achieve a sample that is reasonably representative of core socio-demographic characteristics of the US population. In the national survey we applied nested hard quotas for age and gender, and separately a quota for region. As data as gathered it became clear that we were recruiting a disproportionate number of lower income respondents so we started to an income quota as well. This did successfully address the skew we were experiencing but eventually it slowed down recruitment and we lifted the restriction in the final days of recruitment. Appendix 1 provides full details of the income distribution of respondents. We reviewed the level of skew for age, gender, region and income. We concluded that we should address the age/gender splits where we recruited too few older men by applying a weighting to the data, but that this would not be appropriate for region and income. Weightings have been applied to the (non-demographic) results as described in Appendix 1. All further results in this report are adjusted by these weights.

[6] Habitat offered descriptions of where respondents lived: city, suburb, town or rural.

3. Road of today

3.1 Introduction

Self-driving vehicles are frequently promoted as offering solutions to a wide range of transportation issues, including improved safety, reduced congestion, reallocation of driving time to other activities, and widened mobility access. We asked respondents about the transportation issues that mattered to them and aspects of the way the road is currently regulated.

3.2 Respondents' preferences on transport policy priorities

Respondents were offered a list of six policy priorities and asked to prioritise two (Figure 3.1):

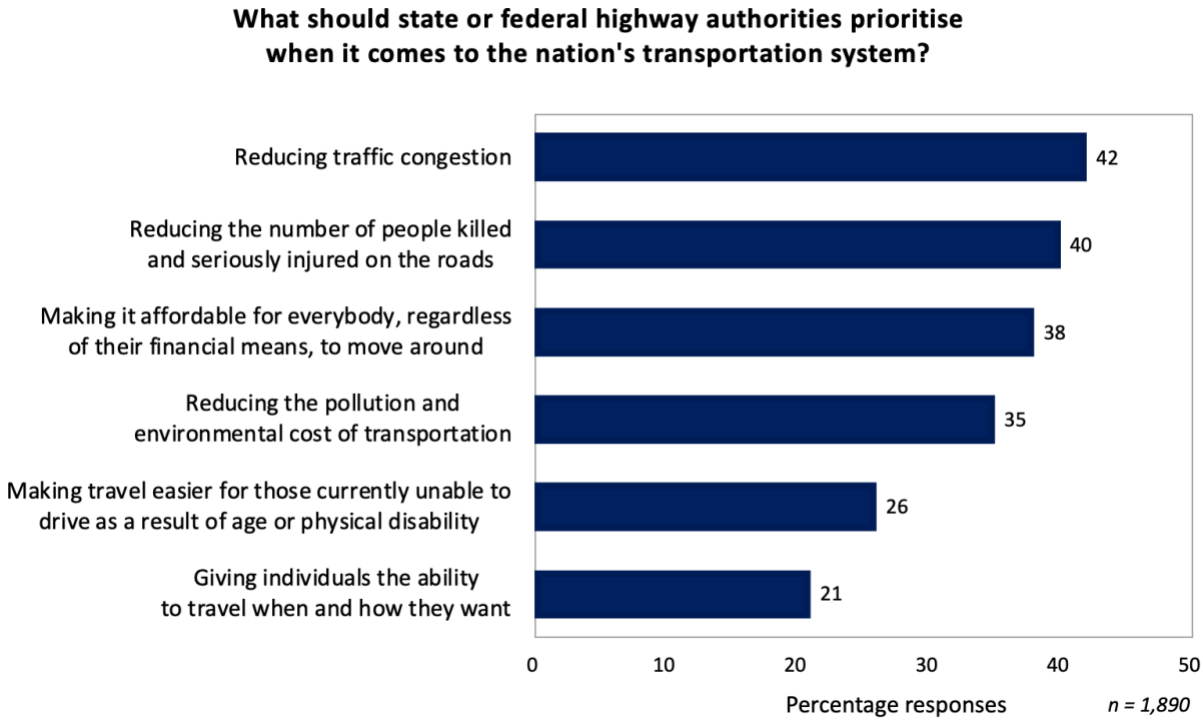

Figure 3.1. Policy priorities

3.3 Regulation of today's roads

Participants were then asked their views on various aspects of the regulation of today's roads. The question asked how much they agree with a list of eight different statements on the subject (Figure 3.2):

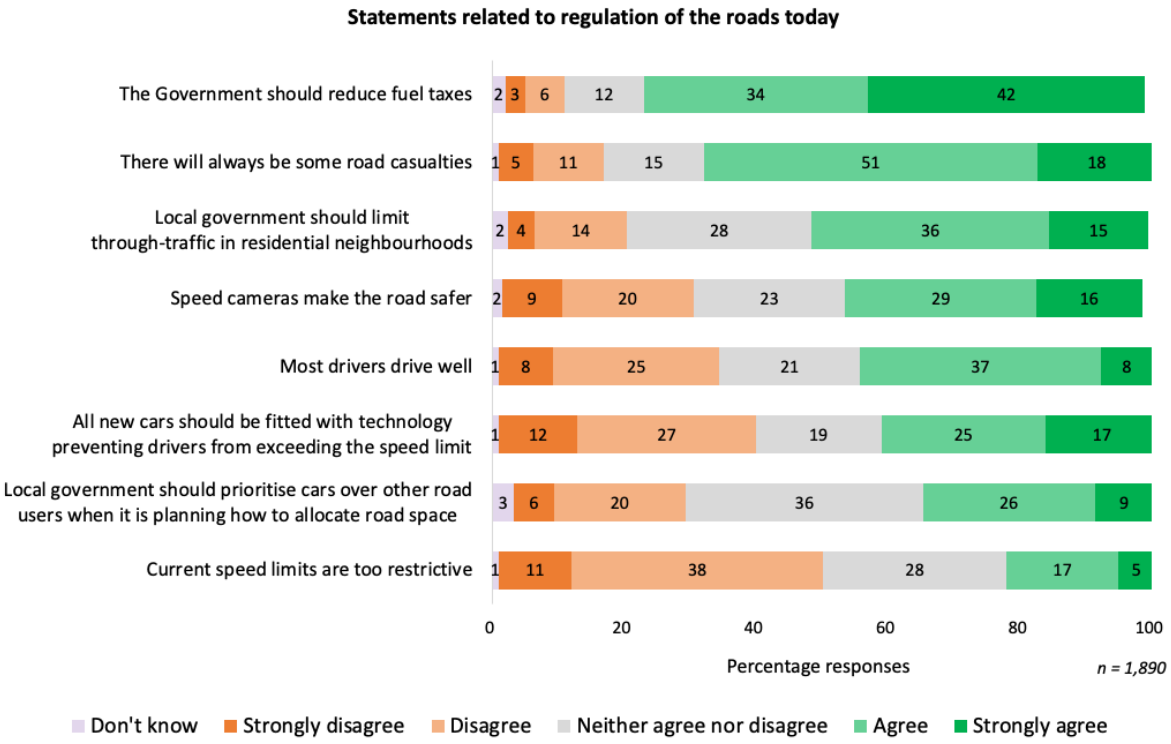

Figure 3.2. Regulation of today's roads

3.4 Preferences for Government funding: private versus public transportation

The next question was in the form of a slider, asking *'When the Government has to decide where to spend money, to improve private motor transport or public transport, how would you like them to allocate funds?'* The two poles of the slider ran from *'More on private'* to *'More on public'* (Figure 3.3):

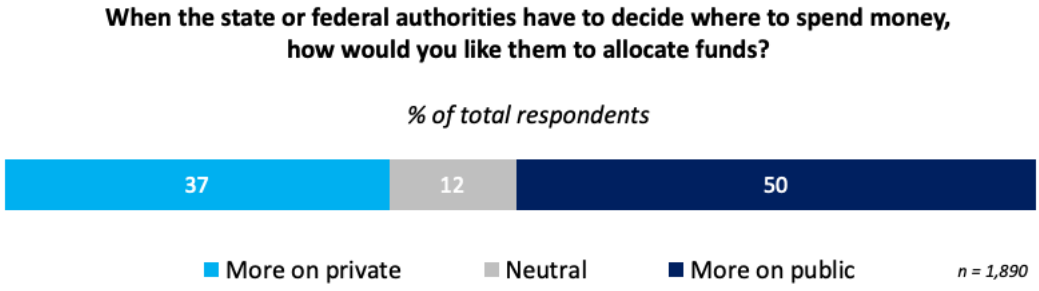

Figure 3.3. Funds allocation: private vs public roads

3.5 Commentary

The case for SDVs typically emphasises the role of human error in road deaths and promises improved safety (U.S. Department of Transportation, 2017) with technology companies often promoting new technology adoption as a moral imperative. It is noticeable that our respondents tend to place safety alongside other priorities rather than making it a stated primary objective (Figure 3.1) and a majority expect that there will always be road casualties. Policy documents (ibid) often show frustration with public tolerance of road casualties, seeking to overturn what the societal choice it implies.

At the same time, respondents are not advocating a low-regulation drivers' paradise: speed limiters, speed cameras, current speed limits and restrictions on traffic in residential neighbourhoods all get more support than opposition from our participants.[7] As our more detailed look at attitudes towards rules of the road in Section 8 will show, our respondents know that the rules are necessary for a workable system. There is a difference between the UK and US respondents on all these measures, with the UK showing stronger support for restrictions on motor transport on all these measures.

There is wide variety in the responses to the proposition that *'On the roads that I use, most drivers drive well'*. However, more agree (43%) with this than disagree (33%): the free-text responses show that some respondents are very critical of other 'idiot' drivers and see them as a serious safety problem. In contrast, others champion the joy of driving and the belief that only human drivers can cope properly with unfolding events on the road.

[7] It is possible that social desirability plays some part in these responses, something continued in the preference for public over private transport investment. However, the level of variation in the responses and, for example, the large majority favouring the reduction in fuel taxes, suggest that it's reasonable to set aside this issue, which cannot easily be mitigated, when analysing the data.

4. General views on self-driving vehicles

4.1 Questions overview

Before posing specific questions about SDVs, our survey first asked a series of questions about their general attitudes towards the technology as well as two questions asking them to express their views in their own words. The topics covered here are:

A. What first comes to mind when asked about SDVs
B. How much they have heard about SDVs
C. Whether they think the technology should be developed,
D. Following the answer to C, why/why not
E. Whether they are comfortable with (a) the idea of sharing the roads with SDVs and (b) riding in an SDV
F. How safe, relative to human driving, SDVs need to be

A and D required free-text responses from participants, who were asked to reply in their *'own words'* and told *'your responses can be very short (minimum 7 characters) or longer (maximum 250 characters)'*. These parameters applied to both questions.

We have coded these free-text responses first either overall positive, neutral or negative for the attitude expressed towards the technology and second for the topics referenced. The preamble to the free-text questions was framed in neutral terms to describe the core idea of a vehicle that drove itself without driver intervention (see Figures 4.1 and 4.2 below). The participants' evaluations of the technology and their introduction of issues such as safety, control, reliability, or usefulness in their answers can therefore be treated as unprompted[8].

The detail of the coding frame was developed by two of the authors. The frame identifies eight main topics and four minor ones. Full details of the coding process, the coding frame, and the inter-coder reliability checks carried out, are included in Appendix 3.

4.2 What first comes to mind when respondents hear the term 'self-driving vehicles'

The first question was posed as follows: *'In recent years, there has been talk in the media about self-driving vehicles, sometimes also called driverless vehicles or autonomous vehicles. What first comes to mind when you hear the term 'self-driving vehicles'?'*

Almost three times as many respondents expressed negative as positive sentiments (Figure 4.1):

[8] The preambles used were discussed with an expert advisory panel as part of the steps taken to achieve as neutral a description as possible, and to avoid the descriptions introducing the evaluative dimensions mentioned above.

	Frequency	%
Negative	922	**48.8**
Neutral	648	**34.3**
Positive	320	**16.9**
Total	*1,890*	

Figure 4.1. Coded tone – free-text answers to "What first comes to mind when you hear the term 'self-driving vehicles?"

Responses range from the brief (e.g. *"dangerous"*, or *"I want one now"*) to lengthy, with an average length of 13 words. To give a negative and a positive example:

> *"Self driving cars doesn't sound like a safe alternative. I feel the reaction time might not be adequate to prevent accidents. I also think a glitch with the technology or a computer hack could make self driving vehicles less safe"*
>
> *"I think these cars are a good idea. I think it would cut down a lot on accidents and help control traffic. I think people could be more productive without the worry of driving. I think people that enjoy driving would have a hard time adjusting to thi[s]."*

The most frequent issue or topic raised is **safety**, with responses expressing that the technology is not safe, safe or safer than human driving, or sometimes raising the topic more neutrally, asking whether SDVs would be safe. Some express an emotive reaction rather than a judgement, using words like *'terror'* or *'scary'*.

We found that 14.7% of respondents express their views in ways that suggest their broader attitudes towards technology: again, in some cases this is brief, along the lines of *"omg technology is amazing"* or *"too reliant on technology"* whilst in others it is more developed. Two examples:

> *"Why bother driving at all. It seems people are getting lazier and lazier and using technology for everything so they don't have to think anymore."*
>
> *"I think about the advancement in technology in the recent world. And I think about how easy it is to drive around without doing much stress".*

We coded these as expressing a **'technological vision'**.

In addition to these two, the other topics we coded for were:

1. **Control**: concerns about the need for human control, worries over who was responsible, but some comments about eliminating human driver error. We coded for the presence of the topic, and for the tone of the view expressed.
2. **Reliability and trust**: reliability is usually expressed in terms of machines going wrong, failing or malfunctioning. Trust is expressed in terms of trusting or having confidence in the technology, or not. We coded for the topics of reliability and trust separately, but combined the coding for the tone of the view expressed to cover both together.
3. **Usefulness**: respondents with positive evaluations often cite some of the benefits listed in Section 3.1 above - convenience, reduced congestion and environmental improvements. Respondents with negative evaluations of *'usefulness'* are more general, saying things like '*dumb*' or '*not necessary*'.
4. **Mixing humans and machines**: some respondents worry that humans and machines could not share the same roads, or that the technology would not work without all vehicles being driverless.

5. **More research needed**, or '**not yet**': some participants emphasise the need for much more research or state that the technology is not ready or a long way off. This view sometimes conditions otherwise positive attitudes.
6. Four further 'minor' topics also covered are:
    - the issue of how people in SDVs behave or interact with the vehicle;
    - the possibility of job losses,
    - references to science fiction, usually films, and
    - concerns over cost or affordability.

Figure 4.2 shows an analysis of the topics present in the responses to the question, and the tone (negative, positive or neutral) of the text given by respondents:

Topic coding for answers to free-text question *"What first comes to mind when you hear the term 'self-driving vehicles'?"*				
Percentage of respondents *N = 1,890*	**Topic present (%)**	**Topic tone[9] (%)**		
		Negative	**Neutral**	**Positive**
Safety topic	51.5			
Safety judgement	44.9	33.2	5.4	6.2
Safety emotion	8.6	8.4	0.2	0
Control	5.7	4.6	0.5	0.6
Reliability and/or Trust	14.6	11.3	3.0	0.3
Reliability	10.6			
Trust	4.4			
Technological vision	14.4	6.6	1.7	6.1
Not useful / useful	11.5	3.0	0.5	8.0
Mixing humans and machines	3.8	3.1	0.3	0.3
Not yet / More research needed	4.8			
More tests needed	1.3			
In SDV behaviour	2.7	1.3	0.4	1.0
Job losses	0.6	0.6	0	0.1
Affordability	1.2			
Sci-fi	2.5			

Figure 4.2. Topic coding for answers to free-text question "What first comes to mind when you hear the term 'self-driving vehicles'?"

On balance sentiments expressed tended to be negative, especially for safety, control, reliability, and trust. When assessing the less frequently mentioned topics we emphasise that the question asked what first comes to mind: many answers only cover one or two topics while others simply describe SDVs and are not coded for any of these identified topics. The presence of a topic is an indicator of its relative importance to the respondent, but we cannot infer that absent topics would be unimportant to them.

[9] Where topics typically had statements that not clearly negative or positive, we have only coded for the topic's presence but not for the tone of the respondents' comments.

4.3 Respondents' knowledge about and engagement with the topic of SDVs

Having asked what first comes to mind, but before asking any more detailed questions or providing a definition of SDVs, we asked respondents to assess their knowledge of the topic and to respond to measures of their engagement with the topic.

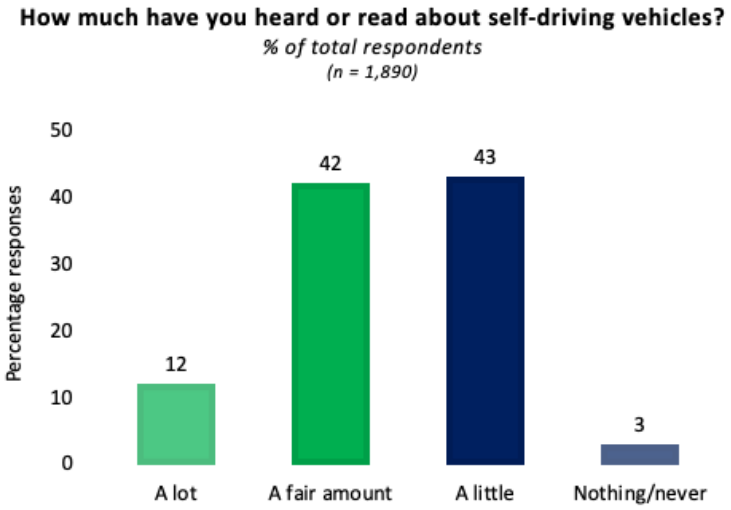

Figure 4.3. How much have you heard or read about SDVs?

For all those who did not answer *'nothing/never'* to this first question, we followed up with measures of more active engagement:

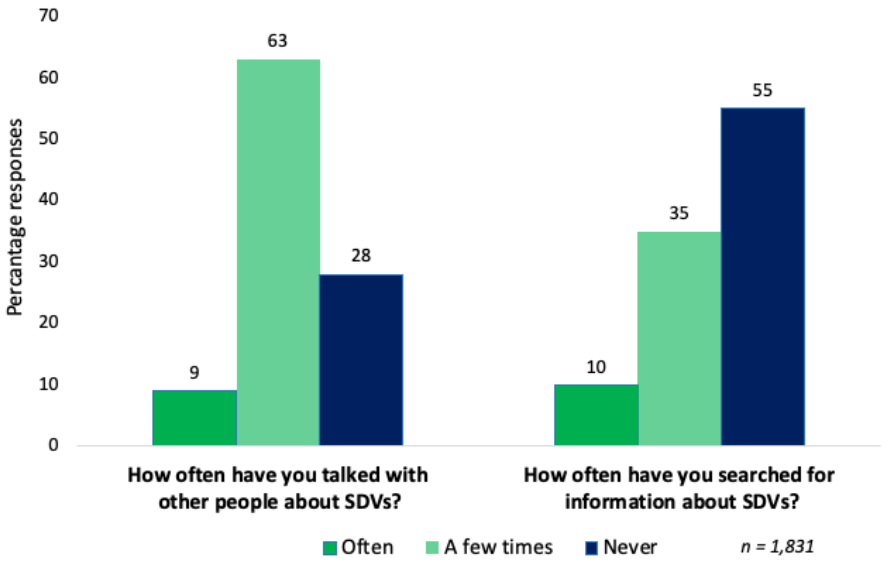

Figure 4.4. How often have you talked with others about SDVs and how often have you searched for information about SDVs?

4.4 Do respondents think SDV technology should be developed?

The question *'Do you think this technology should be developed?'* was posed after providing a definition of SDVs.[10] We offered four response options plus a 'not sure' option. Figure 4.5 provides the results:

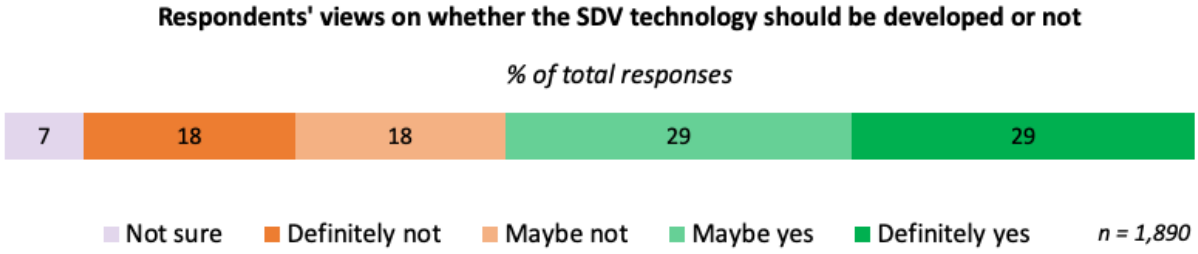

Figure 4.5. Respondents' views on whether the SDV technology should be developed or not

Despite the many negative evaluations reported above, 58% of participants are in favour of SDV development. Selected socio-demographic patterns in the responses merit reporting here, and are detailed in Appendix 4. As in previous surveys, younger people are more in favour than older, men more than women, and urban more than rural inhabitants. However, demographic factors only explain a modest amount of the variation in this measure of attitudes towards SDVs: other attitudinal measures, such as a respondents' general technological optimism, have much greater explanatory power. We discuss these associations, and provide references from the literature, in Section 14.

4.5 Respondents' reasons for why SDV technology should or should not be developed

We followed this question with the second free-text question, asking participants to explain the reason for their response to whether the technology should be developed. We applied the same coding frame developed for the first free-text question to these answers.

The highlighted results in Figure 4.6 below provide the percentages of responses coded negative, positive, or neutral. We have also shown how the free-text responses compared to those given to the preceding multiple choice of whether the technology should be developed:

[10] The definition was as follows: *'In this survey, we refer to self-driving vehicles (sometimes known as driverless or autonomous vehicles), often using the abbreviation "SDV". SDVs are being designed to drive themselves on some or all of the conventional road network without the need for a human operator. These could be privately owned cars, or taxis, trucks, buses, or low-speed delivery vans and pods, or passenger shuttles. Some vehicles might be capable of self-driving some of the time while requiring, or permitting, a human driver at other times. Some vehicles might be exclusively self-driving.'*

N = 1,890 *"Do you think this technology should be developed?" (Q4.7)*	**Coded tone of free-text question on why SDVs should/shouldn't be developed** %			Total %
	Negative	*Neutral*	*Positive*	
Definitely not	16.9	0.8	0	17.7
Maybe not	14.5	3.1	0.1	17.7
Maybe yes	4.3	11.7	13.1	29.1
Definitely yes	0.3	4.0	24.5	28.8
Not sure	2.8	3.8	0.2	6.7
Total (%)	**38.8**	**23.4**	**37.9**	

Figure 4.6. Responses to the question of whether SDV technology should be developed, with coded tone of subsequent free-text question requesting reasons for that answer

The way in which the question is posed seems to influence how negative or positive respondents appear to be, as shown in a comparison of these three question responses in Figure 4.7. Here, for ease of comparison we have combined the percentages for *'definitely'* and *'maybe'* in the multiple-choice question.

N = 1,890 ***Question***	%		
	Negative	*Neutral*	*Positive*
"… What first comes to mind when you hear the term 'self-driving vehicles'?" (free-text)	48.8	34.3	16.9
"Do you think this technology should be developed?"	34.8	6.7	57.9
"Why or why not?" (free-text)	38.8	23.4	37.8

Figure 4.7. Distribution of positive, neutral and negative responses to questions on what first comes to mind when thinking of SDVs, whether they should be developed, and why or why not

The free-text allows for more nuance and more of the responses are neutral than the defined choice response[11]. Participants frequently ask or imply questions (e.g. *"Will they be safe enough?"*) or make ambivalent assessments (e.g. *"It would be helpful but also arises some scary thoughts on safety"* or say something that doesn't allow a definitive coding (e.g. *"We got to be careful"*). There is some variation in how individuals respond to the two free-text questions. Of the 981 respondents who give negative responses to the first, 36% give either neutral or positive responses to the second: a few go the other way, but with only 320 answering the first question positively the 22% of those who move to neutral or negative in the subsequent free-text question is a comparatively small number.

Later on in this report we will show that many of the responses to more detailed questions suggest that for some respondents attitudes are uncomplicated: those who are positive towards the technology generally tend to be positive about most aspects of the technology. But the variation prompted by the different framing in these three opening questions presents a more complicated

[11] The defined choice has a *'don't know'* equivalent (*'not sure'*) but is a 4-point response scale without a middle *'neither/nor'* option. This also suppresses neutral responses. The effect of a middle response in a 5-point response scale can be seen in section 4.6 below.

picture, with more nuanced and conditional attitudes. Figure 4.8 analyses the responses to the 'reasons' free-text question in the same way as Figure 4.2 above:

Topic coding for answers to free-text question asking for reasons why SDV technology should or should not be developed				
Percentage of respondents *N = 1,890*	**Topic present (%)**	**Topic tone[12] (%)**		
		Negative	**Neutral**	**Positive**
Safety topic	44.7			
Safety judgement	42.9	21.3	7.2	14.4
Safety emotion	2.1	2.1	0	0
Control	10.7	6.5	1.6	2.6
Reliability and/or Trust	10.3	8.2	1.7	0.4
Reliability	12.6			
Trust	3.5			
Technological vision	17.2	8.2	1.7	7.3
Not useful / useful	26.7	3.4	1.4	21.9
Mixing humans and machines	2.9	2.1	0.5	0.3
Not yet / More research needed	3.9			
More tests needed	1.0			
In SDV behaviour	2.7	1.3	0.4	1.0
Job losses	2.9	2.3	0	0.5
Affordability	0.9			
Sci-fi	0.2			

Figure 4.8. Topic coding for answers to free-text question asking for reasons why SDV technology should or should not be developed

Following the question *'Should the technology be developed?'* many more respondents give positive safety or positive usefulness evaluations than for the first free-text question. The *'usefulness'* category captures all the possible benefits suggested by developers, including improved accessibility for elderly or disabled, reduced congestion, reduced environmental impact. Some examples of such responses are:

> *"For elderly people, this would be great so that they can travel safely. It would also be great for other people that are not able to drive either due to no license, or physically unable to drive themselves to grocery stores, or doctor's appointments."*
>
> *"For the reduction of emissions and convenience."*
>
> *"It will keep the cost of freight down reducing prices for all. there is also a lack of truck drivers now."*

Worries about safety continue: 15% of all respondents give negative safety evaluations to both questions. But for the second, some are readier to anticipate longer term safety benefits. For reliability and trust issues, there is less overlap between responses. But there are still 11% in the first and 12% in the second free-text question arguing either that the technology cannot be relied upon or cannot be trusted.

[12] Where topics typically had statements that not clearly negative or positive, we have only coded for the topic's presence but not for the tone of the respondents' comments.

4.6 How comfortable would respondents be riding in or alongside SDVs?

Following measures used by some of the authors in earlier surveys, we adapted a standard format applied in Eurobarometer surveys (European Commission, 2015, 2017) to then ask participants:

> *'How would you feel about using the roads alongside self-driving vehicles?', and*
>
> *'How would you feel about riding in a self-driving vehicle instead of the existing ways you travel?'*

The first of these questions addresses the importance of non-users, broadening the scope compared to the narrower focus on users in surveys seeking predictors of technology acceptance (see Tennant, Stares, & Howard, 2019). Figure 4.9 shows the results:

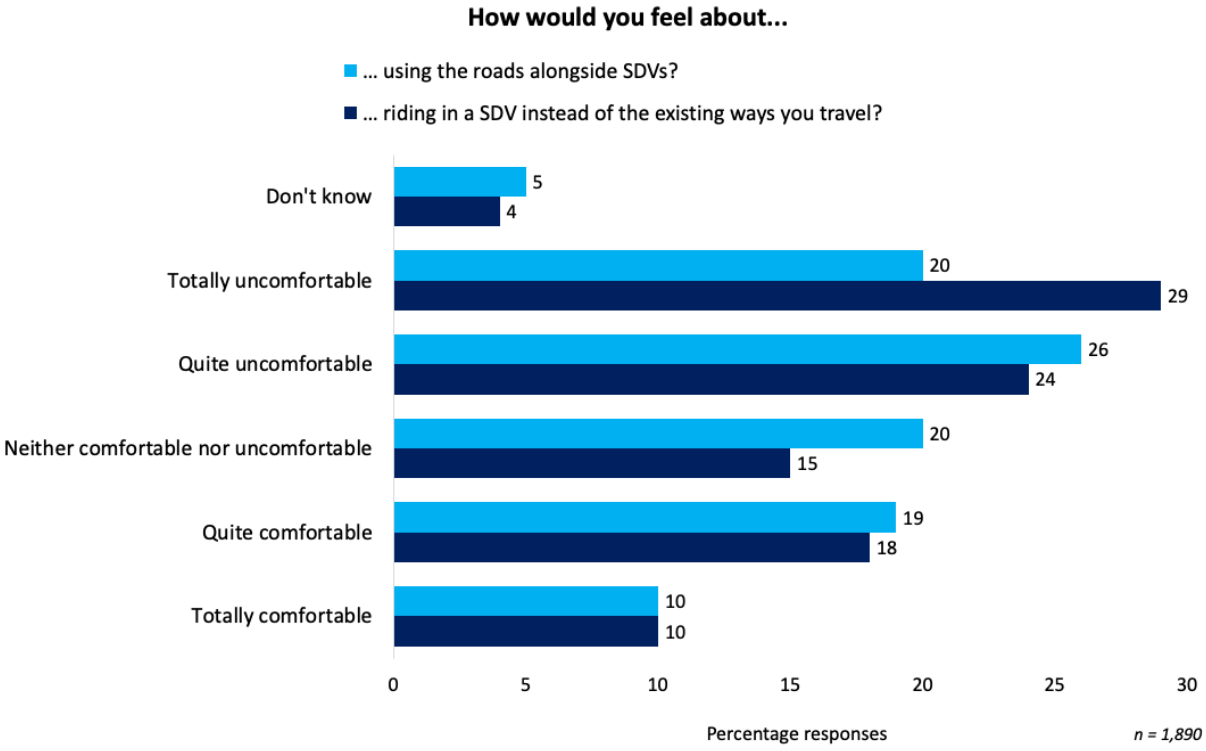

Figure 4.9. Responses to questions how you would feel about using the roads alongside SDVs and riding in a SDV instead of the existing ways you travel

These results are very similar to the results of our two earlier surveys[13] (Figures 4.10 and 4.11):

[13] The exact wording in the series provided in Figure 4.10 varies but the core questions are the same. Further details on this material in Appendix 5.

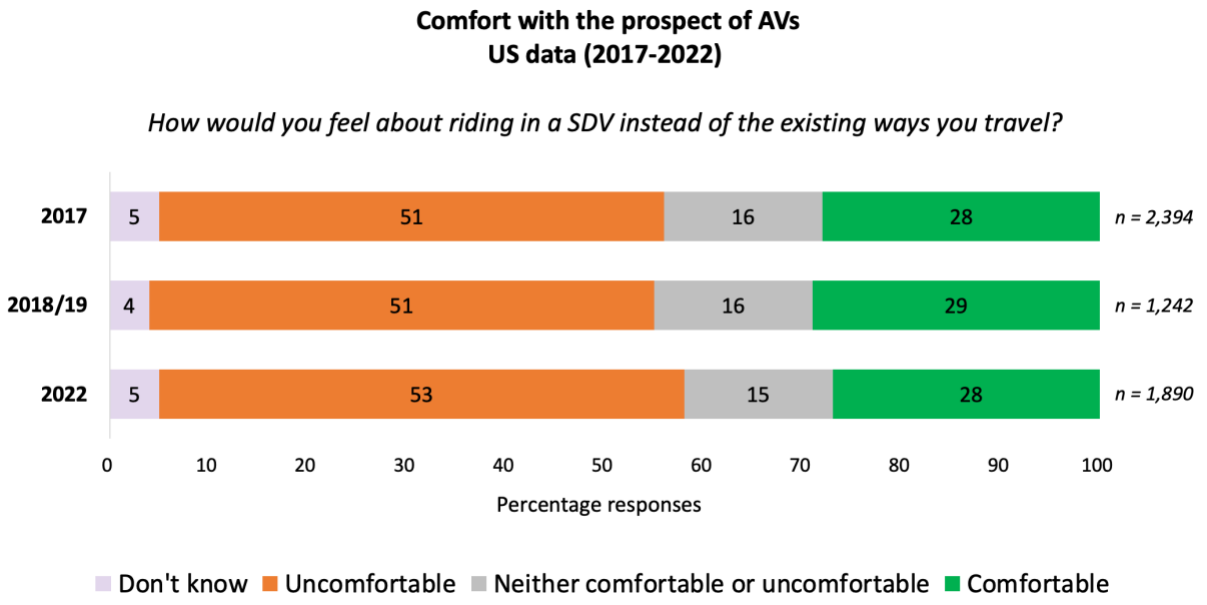

Figure 4.10. Responses to question how you would feel about using the roads alongside SDVs, comparison between 2015 and 2021, US

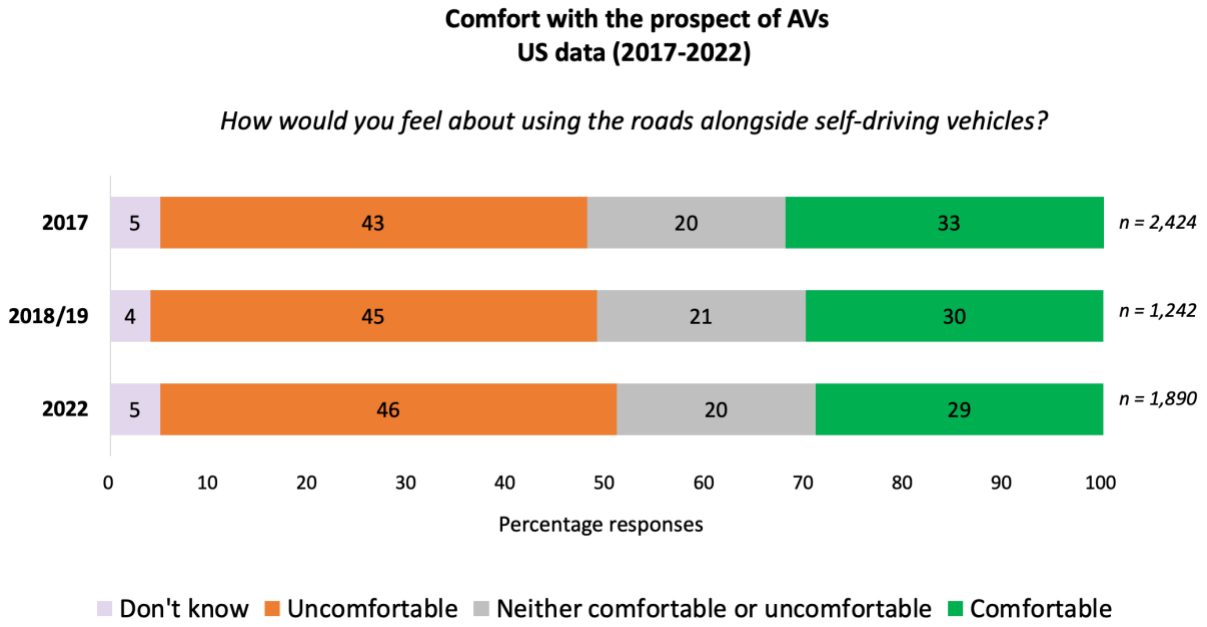

Figure 4.11. Responses to question how you would feel about riding in a SDV instead of the existing ways you travel, comparison between 2015 and 2021, US

Participants' answers to these two questions express unfavourable attitudes towards SDVs, with close to twice as many (in 2022) saying they are uncomfortable with the prospect or riding in an SDV than say they are comfortable. These more concrete questions elicit more negative responses than seen for the more general question as to whether the technology should be developed.

Other surveys have also reported more negative responses to questions asking if the respondent would feel comfortable using the technology (e.g. European Commission, 2015, 2017). By contrast, some revealed more positive responses to general questions about the desirability of the technology, (e.g. König & Neumayr, 2017; Liljamo, Liimatainen, & Pöllänen, 2018). A possible explanation for this

contrast is that questions asking if the respondent would be comfortable using the technology make the issue more immediate, tantamount to asking would you be happy to use the technology now. General questions may be construed as referring to a further future and may feel less personally salient to the respondent.

4.7 Summarising responses to different types of general questions on SDV attitudes

The general questions with which we started the survey are asking about different aspects of the technology, and asking respondents to take different perspectives: it is therefore a simplification to collapse the results into *'negative'* or *'positive'* attitudes towards the technology. Nevertheless, the table below (same as Figure 1.1) provides a snapshot summary of these five different questions:

N = 1,890	*Negative %*	*Neutral %*	*Positive %*	*Don't know %*
What first comes to mind? (coded free-text)	49	34	17	
Should this technology be developed? Reasons why/why not (coded free-text)	35 39	7 23	58 38	
Comfort with using the roads alongside Comfort with riding in	46 53	20 15	29 28	5 4

25% of respondents give negative responses to all five questions, with 10% giving positive responses to all. The overall picture then is of considerable variation across the sample, but also variation within individuals' answers.

4.8 How safe do respondents think self-driving vehicles should be?

The last of our general questions asked how safe SDVs need to be (Figure 4.12):

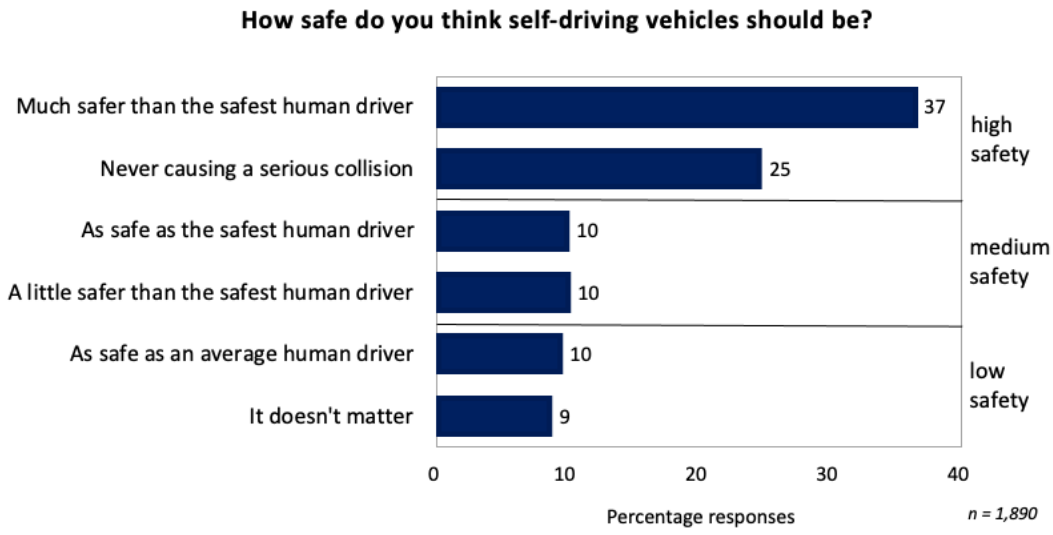

Figure 4.12. Responses related to how safe SDVs should be

We can classify these six answer options into three levels of desired safety, as indicated in Figure 4.12. It is first of all notable that over one and a half times as many respondents choose the *'high safety'* conditions as the medium or low safety options. Looking more closely at the 347 respondents who choose one of the two *'low safety'* answers, 72% of these stated in a previous question that they were uncomfortable with the idea of riding in an SDV (49% totally uncomfortable): this suggests there is a group of respondents whose hostility encourages disengagement. A few of the free-text responses to the *'What first comes to mind'* question from some of these *'low safety bar'* respondents give the flavour:

> *"Very scary..they don't react as we do. Computers do mess up."*
>
> *"MORE DEATHS MORE HURT CANT FEEL SAFE WITH THEM ON THE ROAD."*
>
> *"Dumb, laziness, careless."*
>
> *"Disaster and stupid. Are we so lazy?"*
>
> *"I think it is the most ridiculous idea I have ever heard. It is a waste of time and money. Why is the government actually funding this when there are people starving and fighting to pay their bills."*

The sentiments expressed in the first free-text question are not reflected in the level of safety demanded. 68% of those asking for a low safety bar express negative sentiments in their answers to the first free-text question, and 43% give negative safety evaluations there too. 61% of all respondents demand a high safety bar, but of these, only 46% express negative safety sentiments in that question (barely more than the 42% of those asking for a low or medium safety bar). Although we separated comments on safety into beliefs and emotions, it appears that many of these responses are instinctive: these respondents seem not to want the technology and refuse to engage with a future they do not want to see.

Those expressing the most positive views across all the measures in Section 4.7 are more likely to demand a higher safety bar than others (of the 411 most positive, 72% demand a higher safety bar, compared to 58% amongst the rest).

5. Views on modes of SDV deployment and who might benefit and lose out from the technology

5.1 Introduction

Potential deployments of self-driving technologies will affect others, not just those using them. This section addresses participants' views on these impacts. First, we asked them which deployments they would consider to be useful *'for society in general'*. Next, we asked respondents to think about who would benefit from the deployment of self-driving vehicles and who might lose out.

5.2 Which deployments would be useful?

Participants were asked: *'For society in general, which of the following developments do you think would be useful? Place the slider to indicate your view'*. The slider ran from 'not useful' to 'useful' and could be placed in one of nine possible positions (i.e. from -4 through 0 to plus 4). The table below summarises the results: greater detail is provided in Appendix 6.

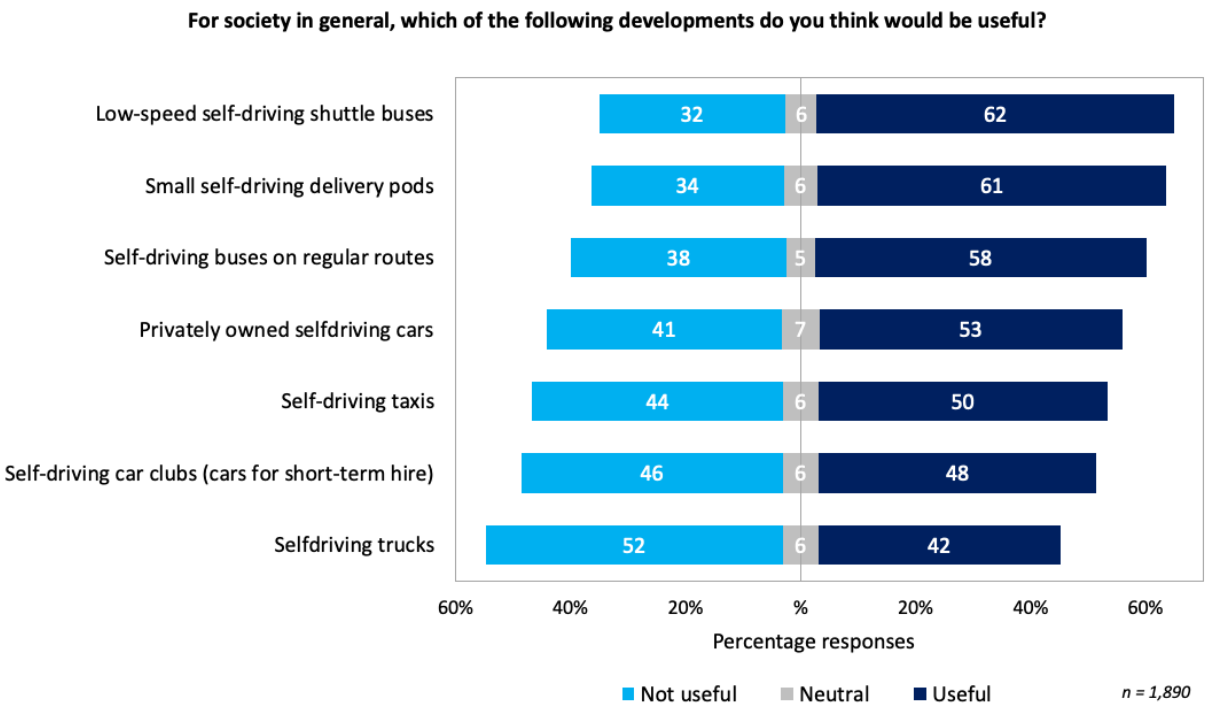

Figure 5.1. Responses related to usefulness of developments for society in general

Each respondent's average usefulness score across all seven modes correlates strongly with how they answered the question of whether the technology should be developed (correlation[14] coefficient of +0.769). Whilst there is clear variation regarding how warmly participants feel towards different deployments, their overall view of the concept of self-driving technology appears to be an important component of their assessment of each different mode. Those who worry about safety in their free-text earlier in the survey give much lower *'usefulness'* scores on average than those who didn't.

[14] Further details on the calculation of the correlation coefficients in this report are given in Appendix 1.'

For some respondents the preference for public transport deployments echoes the preference for Government investment in public over private transport (3.4 above). One free-text response (to Q4.8) states this clearly: *"because if we had this, we might eliminate privately owned cars altogether, and allow people to avail themselves of public transport whenever needed."* Only some of the free-text responses discuss different modes, and although others also call for public transport SDVs, when public transport is mentioned it is as likely to be an argument against SDVs in favour of investing in existing public transport (e.g. *"I think it is unsafe and I'm not comfortable with the idea. I really think they should prioritize public transportation instead."*) or an argument *for* SDVs (e.g. *"Coming from Texas, public transportation is a huge issue. I hope that SDVs are a cost effective solution for a rising need"*).

5.3 Who do respondents think will lose out or benefit from the introduction of SDVs?

We asked participants who they thought would '*lose out or benefit from the introduction of self-driving vehicles'*. Figure 5.2 presents the results:

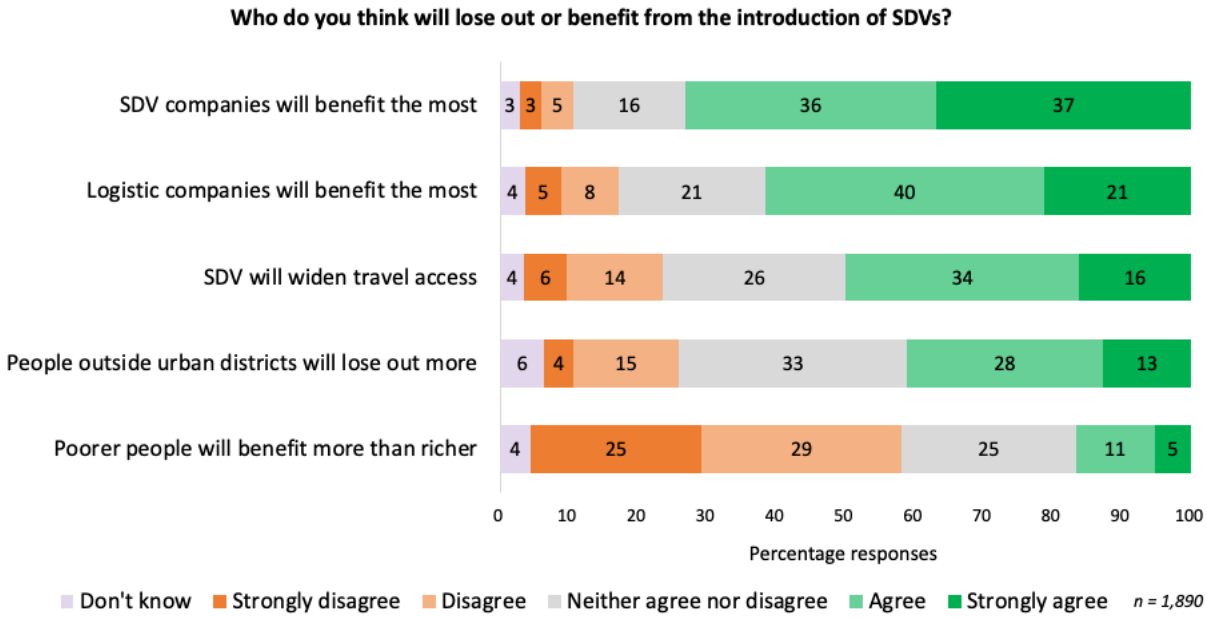

Figure 5.2. Views on who will lose out or benefit from the introduction of SDVs

50% agree that SDVs will widen travel access compared to 20% disagreeing, but 42% of respondents think those outside urban districts will lose out, and 54% disagree that poorer people will get more than richer people from the technology. The results also indicate a level of cynicism in the strong expectation that SDV companies will be the principal beneficiaries[15] and the strength of belief that the poor will lose out. As with the results in Section 5.2, those who are more confident that SDVs will widen travel access, or who believe that the less well-off will benefit from the technology, tend to hold more enthusiastic views as to whether the technology should be developed.

There is wide variety in the responses. Other than in the first and last statements, respondents tend to avoid strong agreement or disagreement, and plenty provide neutral responses, with an average of

[15] One respondent expressed this vigorously: *"Technology is flawed there's always a back door into software and if there is an accident who's gonna be accountable the big corporations who invented them? Or the people who die since they are already dead might as well blame them right."*

28% giving *'neither agree nor disagree'* or *'don't know'* responses across the five questions. This may reflect greater uncertainty when asked for predictions.

Taken together, the results in Sections 5.2 and 5.3 show that respondents tend to be less enthusiastic when it comes to the deployment of SDV technology in private transportation and unconvinced that the technology will achieve some of the societal goals promoters claim it will address.

6. How should SDVs share the road with other road users?

6.1 General views on how SDVs might share the road with other road users

We first asked about respondents' general expectations of a world in which SDVs share the road with others. Figure 6.1 shows the results:

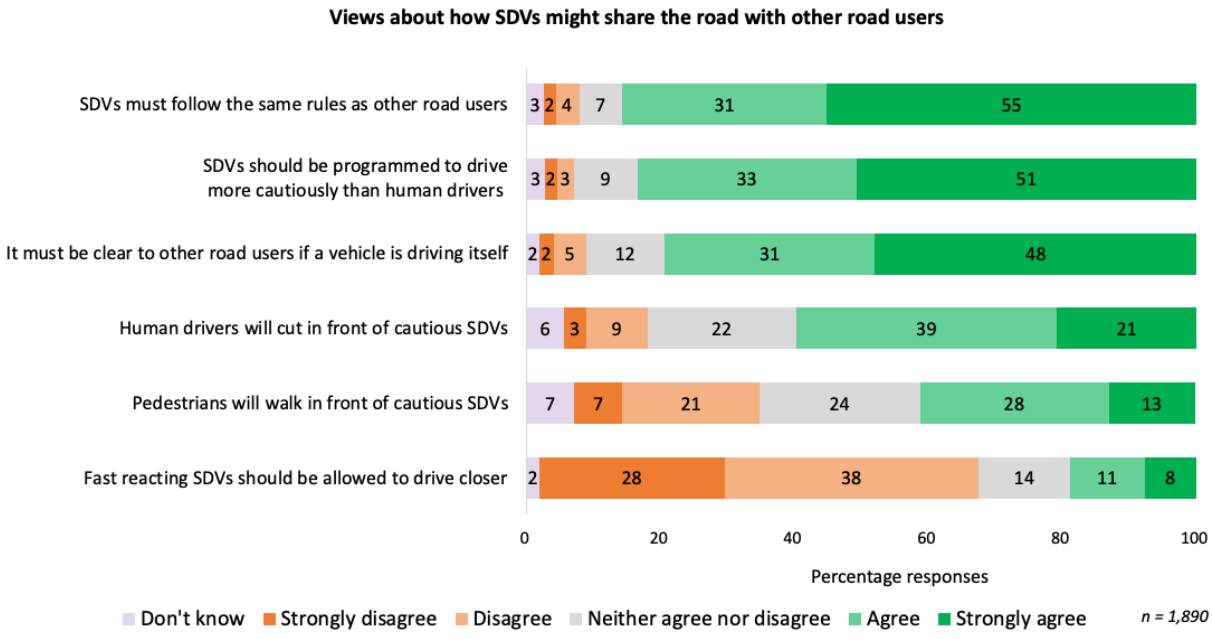

Figure 6.1. Views on how SDVs might share the road with other road users

The strength of agreement for the first three propositions is notable[16]. Most participants want SDVs to behave similarly to human driven vehicles (following the same rules; not being allowed to reduce following distances based on faster reaction times), but at the same time they expect them to be different: clearly identifiable, and likely to be taken advantage of by human drivers and to a lesser extent pedestrians. Those in favour of developing the technology are less likely to object to the idea that *'If SDVs are able to react more quickly than human drivers, they should be allowed to drive much closer to other vehicles'*[17].

6.2 Drivers' and non-drivers' views on how SDVs might be controlled when driving

'Should occupants of an SDV be able to take control of the vehicle?' Wwe asked questions on this topic in two different contexts, one version for those who reported themselves to be drivers (1,652 respondents) and one for those who stated they were non-drivers (238). The results are shown in Figures 6.2 and 6.3 respectively:

[16] As in the results for Section 5.2, the two statements framed as predictions (people will take advantage of cautious SDVs) elicit a higher proportion of *'neither agree nor disagree'* responses. The other four are normative statements about how the world should be and there is less uncertainty with these.
[17] The positive correlation coefficient between the two statements is 0.385.

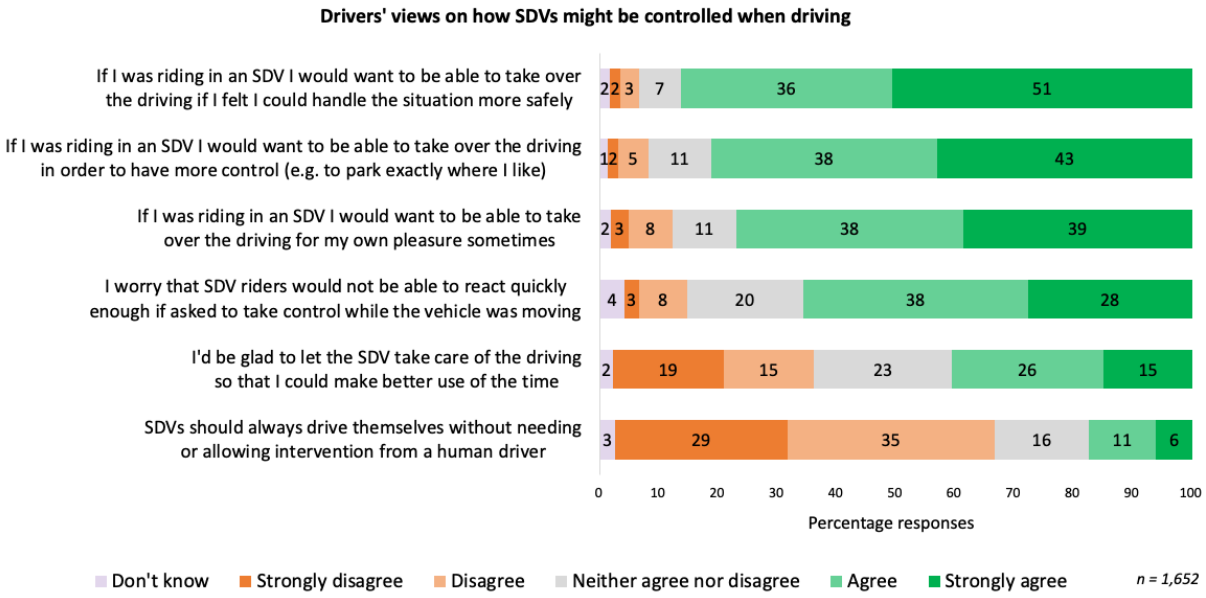

Figure 6.2. Drivers' views on how SDVs might be controlled when driving

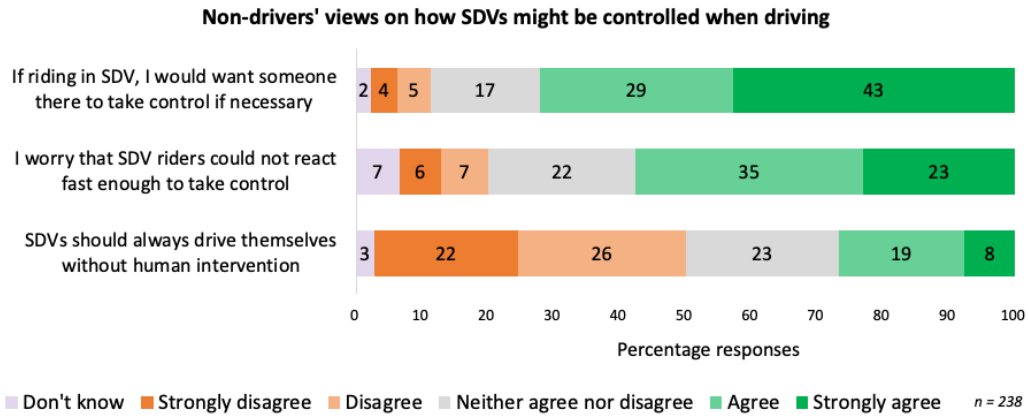

Figure 6.3. Non-drivers' views on how SDVs might be controlled when driving

The consensus of responses to the first and the last statements is striking, albeit weaker amongst non-drivers: a large majority of respondents agree that humans should be able to take control of an SDV, even though they express concern that SDV riders might not be able to react quickly enough. The alternative proposition, that SDVs should drive with no intervention, is rejected by the majority. Belief that the technology should be developed correlates with greater confidence in the SDV being in control[18].

6.3 Anticipated levels of comfort while interacting with SDVs and HDVs as other road users

We next asked respondents how they felt about the prospect of interacting with SDVs as fellow road users as compared to interacting with human driven vehicles. The question format was a slider for

[18] Combining the responses of non-drivers and drivers, 353 agreed that *'SDVs should always drive themselves without needing or allowing intervention from a human driver'* and of these, 294 (83%) think the technology should be developed.

each scenario, running from *'more comfortable with SDVs'* to *'more comfortable with human-driven vehicles'*. It could be placed in nine possible positions (i.e. from -4 through 0 to plus 4). Questions relating to sharing the road as a driver or as a cyclist were put to drivers and cyclists only. The combined results are shown below (Figure 6.4):

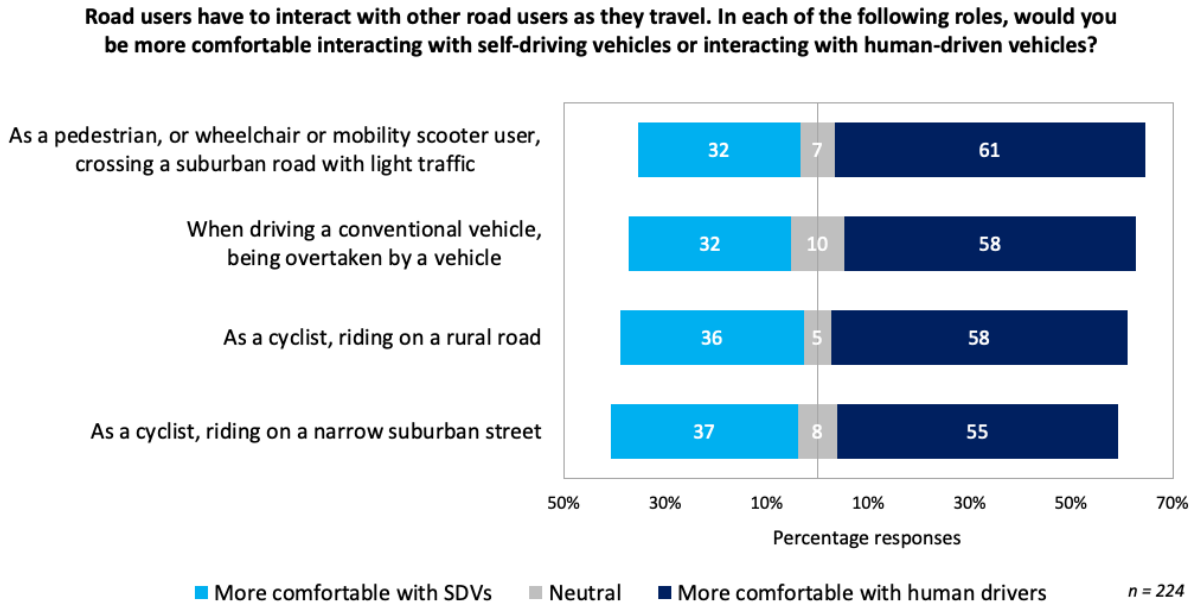

Figure 6.4. Combined answers about comfort while interacting with SDVs and HDVs

Across the different scenarios, more respondents state that they are more comfortable with the idea of interacting with human drivers than with SDVs. However, it is noticeable that the gap between the two narrows modestly for cyclists in an urban setting when compared to the more widespread preference for interacting with human-driven vehicles expressed as a pedestrian. The need for pedestrians to communicate with vehicle drivers is explored further in Section 9, and the views of cyclists on sharing the road with SDVs is further explored in Section 10. Some cyclists have a strong preference for the idea of interacting with SDVS: 10% give the maximum ('-4') score to state they are much more comfortable with the idea of interacting with SDVs in the urban setting (9% in the rural), although it is not possible to determine whether this expresses the strong feelings against human drivers felt by some cyclists or positive feelings towards SDVs.

In the free-text answers, participants typically engage with the issue of sharing the road with SDVs in general terms: e.g. *"Chaos, I don't know if people are ready to drive with driverless vehicles on the road"* or *"I believe that this could be a great boon to safety on the road, but only when they are the only type of vehicle, as I don't think they will mix well with human drivers"*, or they express a sense that some environments are just too complex: *"Safety issues especially in a rural area with rugged terrain, hills, and in cities with congestion, bicycles, people walking everywhere."*

7. Views on the introduction of SDVs to the road and their regulation

7.1 Views on the conditions under which SDVs might be introduced

The purpose of this section was to ask participants how the introduction of AVs should be governed. First, we asked whether SDVs will or should be introduced, and Figure 7.1 presents the answers:

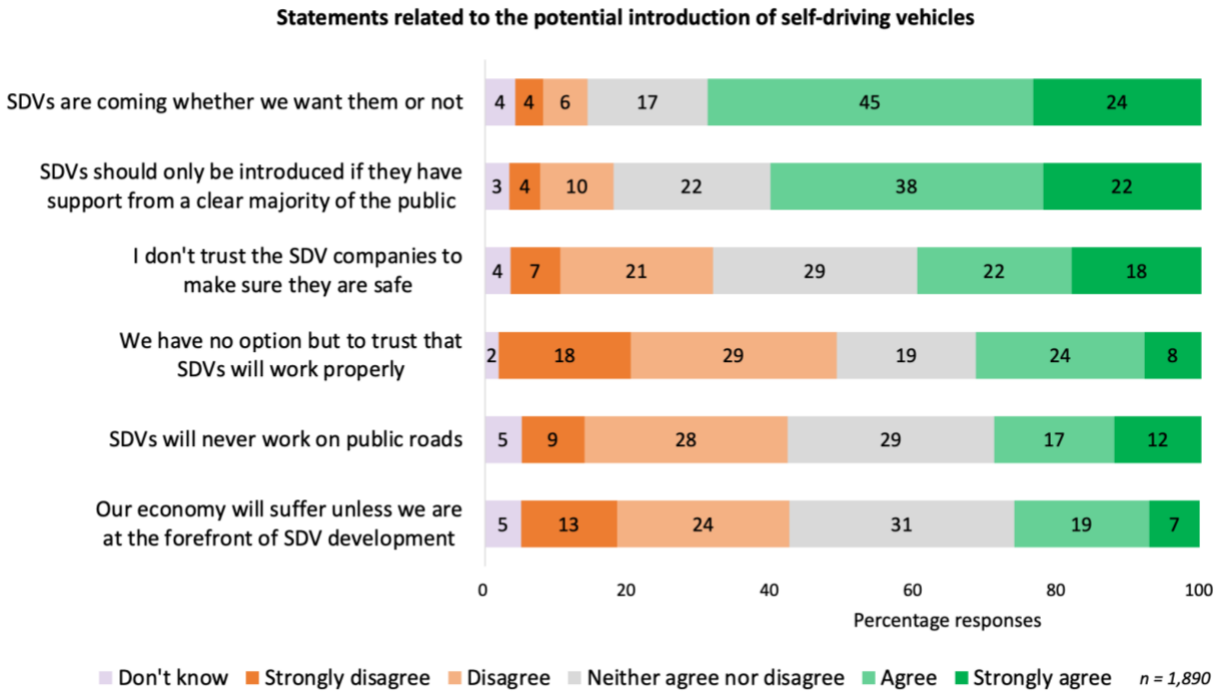

Figure 7.1. Statements related to the potential introduction of self-driving vehicles

Although 60% of respondents assert that SDV introductions must have majority public support, even more (69%) expect that the technology is coming with or without that support. More people (40%) say they don't trust SDV companies than those disagreeing with this (28%), but similar numbers agree (39%) as disagree (37%) that SDVs will never work on public roads; but there are sizeable numbers saying they don't know or that they neither agree nor disagree with these statements (33% and 34% respectively).

Positive general attitudes towards SDVs (belief they should be developed, comfort with the prospect of riding in an SDV) associate with the expectation that SDVs are coming whether we want them or not, and with the statement that we have no option to trust they will work. On the other side, negative general attitudes associate with the assertion that they must have public support, lack of trust in SDV companies and the belief that they will never work on public roads[19]. These views warrant further research since they might imply a degree of passivity in some of the support for the technology, alongside a degree of active hostility in some of the scepticism towards it.

[19] Belief that SDVs should be developed correlates positively with agreement that *'SDVs are coming whether we want them or not'* (correlation coefficient +0.295), that *'Our economy will suffer if we are not at the forefront of SDV development'* (+0.394) and that *'We have no option but to trust that SDVs will work properly'* (+0.364); it correlates negatively with *'SDVs should only be introduced if they have support from a clear majority of the public'* (-0.070), with *'I don't trust the companies developing SDVs to make sure they are safe'* (-0.520) and with *'SDVs will never really work on public roads'* (-0.579).

7.2 What should be the rules of the road for SDVs, and the rules governing how human drivers and SDVs share the road?

Next, we asked how the rules for SDVs should be made and who should be making them. Figure 7.2 presents the results:

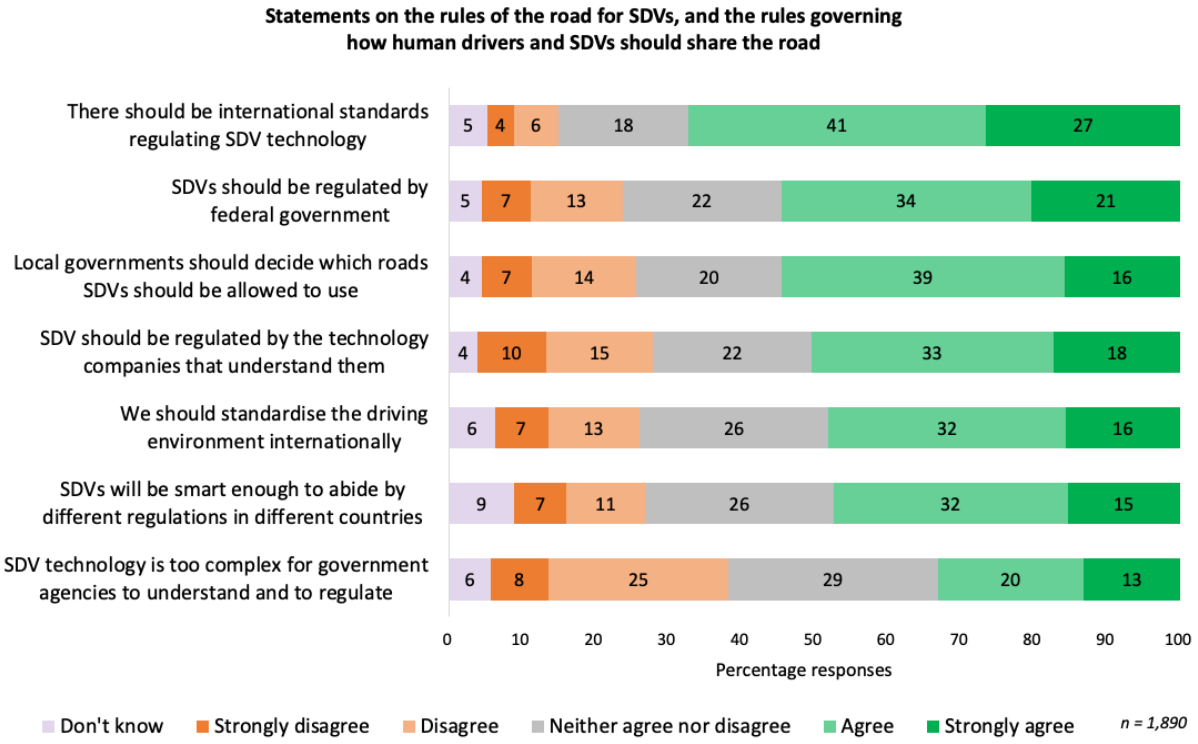

Figure 7.2. Statements on the rules of the road for SDVs, and the rules governing how human drivers and SDVs should share the road

Although for all of the first five statements considerably more respondents agree with the need for the proposed type of regulation than disagree, the numbers in favour are not overwhelming, with a slim majority (55% on average). There is some uncertainty on the topic, an average 30% neither agreeing or disagreeing (or saying don't know) to all but the first of the statements.

51% agree that SDVs should be regulated by the technology companies that understand them, against 25% disagreeing. This latter statement does not appear to be an assertion that the tech companies should be exclusively self-regulating. Of those people who agree with the involvement of the SDV companies in regulation, 55% also agree that national governments have a role and 79% agree that there should be international standards.

7.3 Who should be making the decisions over the introduction and regulation of SDVs?

The final question in this section continued to probe the issue of who should be making the decisions over the introduction and regulation of SDVs. We asked how much confidence participants had in a range of possible stakeholders making the decisions. Figure 7.3 provides the results:

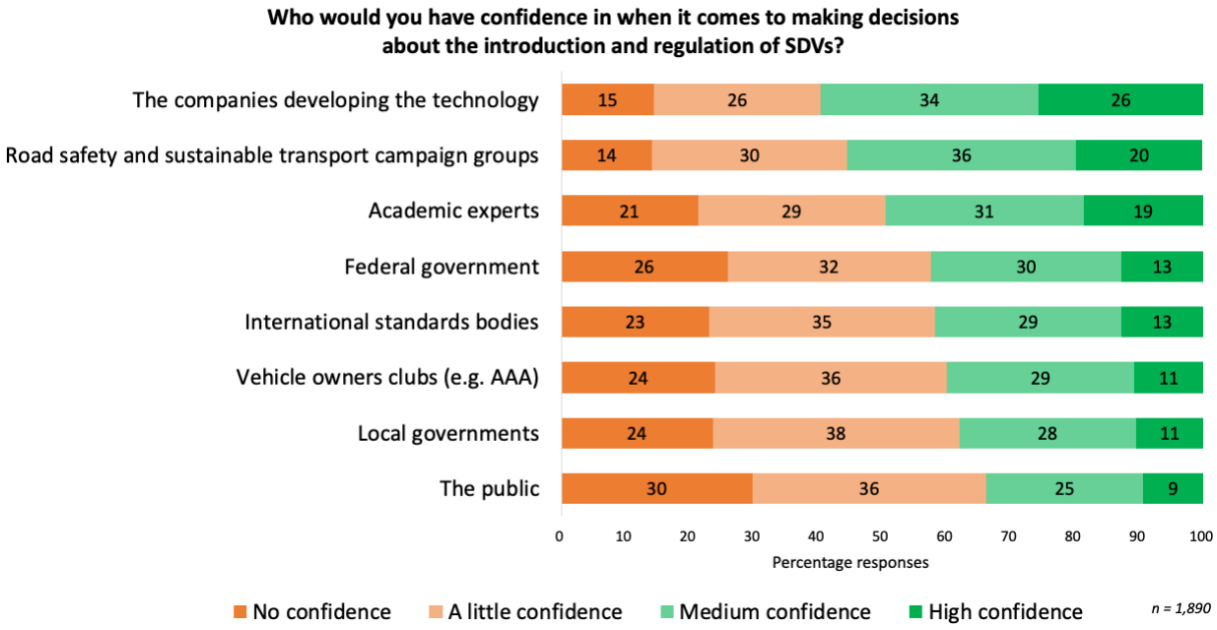

Figure 7.3. Statements on who should be making the decisions over the introduction and regulation of SDVs

As with previous questions, positive general attitudes towards the technology associate with higher confidence in all of the above decision makers: a score averaging the levels of confidence across all eight correlates with belief that the technology should be developed (correlation coefficient +0.520) and with comfort with the idea of riding in an SDV (+0.522).

Most noteworthy is that although only 20% of respondents disagree with the involvement of federal government in SDV regulation (Section 7.2 above), 58% express only low or no confidence in them. Similarly, although 60% agreed that SDV introduction needed majority public support (Section 7.1 above), only 34% of respondents have confidence in the public's role in decision making. There is a surprising level of confidence in the companies developing the technology (60% medium or high) given that trust in them (Section 5.3 above) is weak. As might be expected, that lack of trust is associated with low confidence in SDV companies (correlation coefficient -0.403).

In the free-text responses, there is almost no discussion of regulation, but some anticipate SDVs bringing about a more regulated road environment without human drivers breaking the rules.

8. Perceptions of the rules of the road, and opinions on SDV roles and responsibilities in the event of collisions

8.1 Introduction

This is the first of the four modules each shown to approximately 20% of the respondents. 485 participants completed this module. It combines two topics asking participants to think in more detail about how a world with SDVs in it might work.

Developers are keen to keep proprietary systems private, but the public may want SDVs to be able to account for their actions (see Stilgoe, 2018; Winfield et al., 2020). Human road users have a fluid rather than rigid approach to road rule compliance, but will this suit SDVs, and who gets to set the new rules for a road to be shared with new types of agent (Tennant, Neels, et al., 2021)? How do members of the public want these agents to behave in shared space?

The first set of questions consider what should happen after a collision involving an SDV. The second considers the nature of the rules of the road today before the third set addresses how the rules might apply to SDVs.

8.2 What should happen after a SDV is involved in a collision?

This question was framed as follows: '*If a self-driving vehicle is involved in a collision, what should happen next? Currently, the State driver's handbooks expect that if you are involved in a collision you should provide your name and address and registration number to others involved.'* Figure 8.1 presents the results:

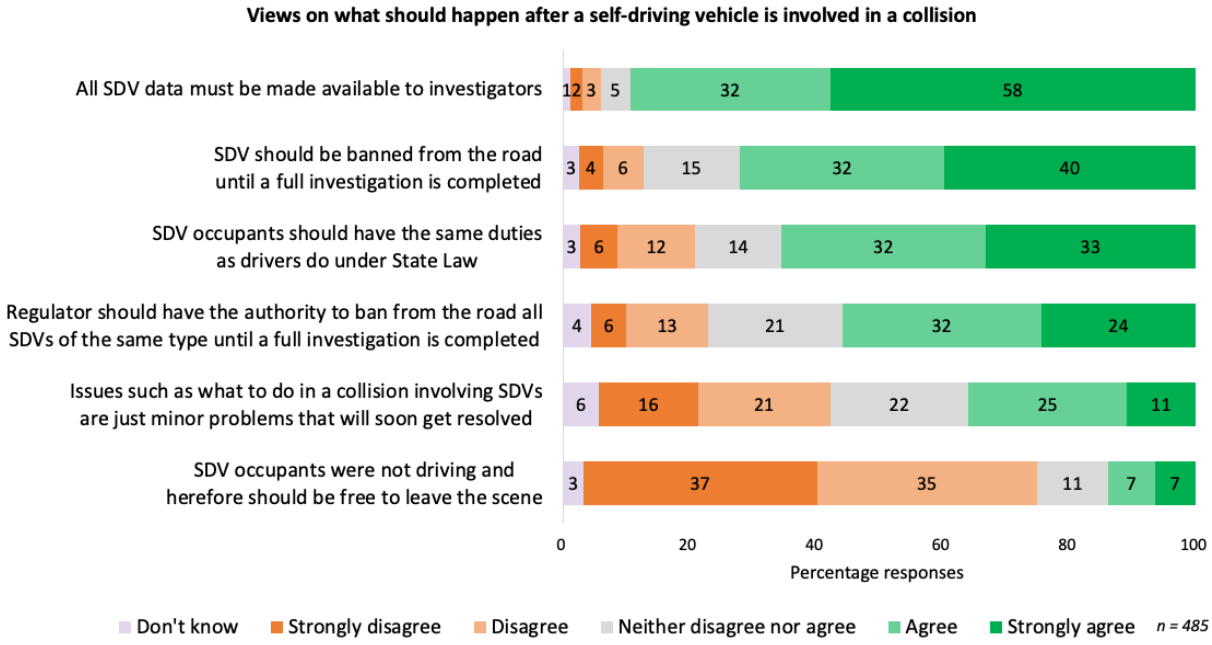

Figure 8.1. Views on what should happen after a SDV is involved in a collision

These responses suggest that participants want SDVs to demonstrate they are good citizens: as newcomers they are not given the benefit of the doubt. Although the question wording does not make any suggestion of responsibility, the strong agreement that the SDV involved should be banned until an investigation is completed (72% agreeing) suggests that respondents have assumed that the SDV might be at fault while the view that all SDV data must be handed over (90% agreeing) suggests a desire to ensure accountability. 56% of participants agree with the more draconian proposal that *'An independent regulator should have the authority to ban from the road all SDVs of the same type until a full investigation has been completed'* (19% disagreeing). So too the idea that passengers in the SDV might be allowed to leave is roundly rejected (72% disagreeing with the suggestion). If the passengers were in a truly self-driving vehicle, they could be argued not have had a role in the collision and might be impatient to be on their way. The impression is one of a technology on trial, where any misstep requires a full rethink. More research, exploring different scenarios with, for example, varying levels of seriousness for the incident, would be needed to understand what responsibilities respondents are attributing to users and operators of SDVs in such situations.

The statement expressing a prediction, that these issues will soon be resolved, provokes greater variation, and perhaps a degree of hesitation, amongst respondents, with a more even distribution across all six possible answers.

A number of responses to the earlier free-text questions worry over the issue of responsibility too, e.g.:

"If there's an accident who's responsible if there's not a driver in the other car"

The ambivalence our respondents feel over control (Section 6.2) and responsibility reflects the current debates over the boundaries between advanced driver assistance systems and more comprehensive automation (Stayton & Stilgoe, 2020). Yet these debates themselves reflect long standing issues with automated systems, in which easy tasks are automated and more complex situations remain the responsibility of the human operator (Bainbridge, 1983; Leveson, 2011). The existence of the boundary between human and machine agency necessarily introduces new uncertainties.

8.3 Perceptions of current rules of the road

The following questions addressed the rules of the road today, and how strictly they must be adhered to, in order to provide context for people's views on future rules for SDVs. Figure 8.2 presents the results:

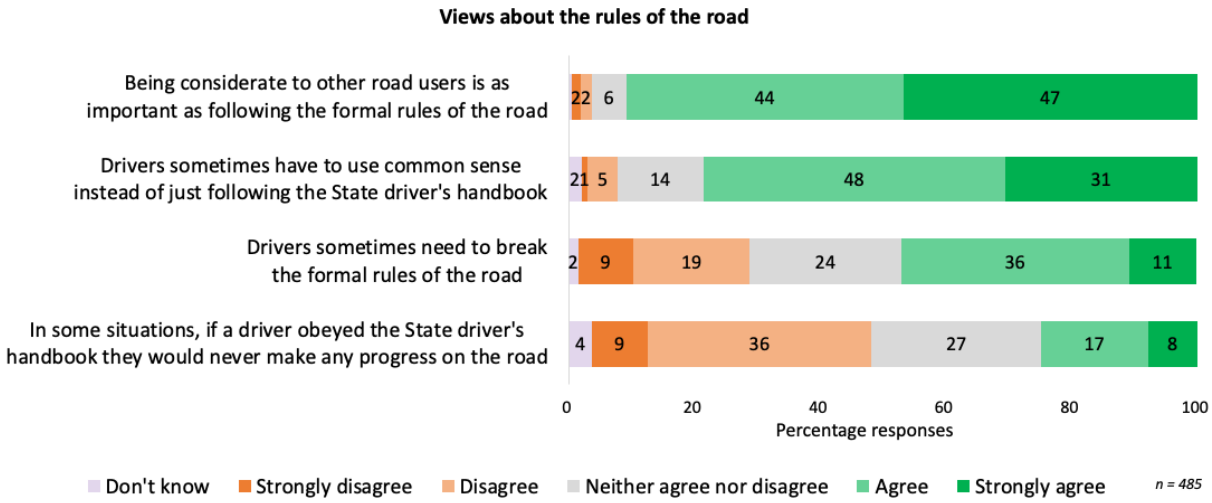

Figure 8.2. Views about the rules of the road

Participants agree (at a rate of 91%) that driving involves being considerate to others and that drivers sometimes need to use their common sense as much as following a rule book (79% agreeing, 6% disagreeing), but there is more variation when it comes to the idea that the rules have to be broken sometimes (47% agreeing, 28% disagreeing), and little support (25%) for the idea that breaking the rules of the State driver's handbook is sometimes necessary for making progress on one's journey. While there is some desire for fluidity rather than rigidity over the rules, the overall message is one of consensus on the importance of keeping to the rules while applying consideration and common sense.

8.4 Views about what rules that might be needed for SDVs

Having established people's views on how human drivers should apply the rules of the road, we sought to understand how they thought SDVs should integrate in that system. Figure 8.3 summarises these results:

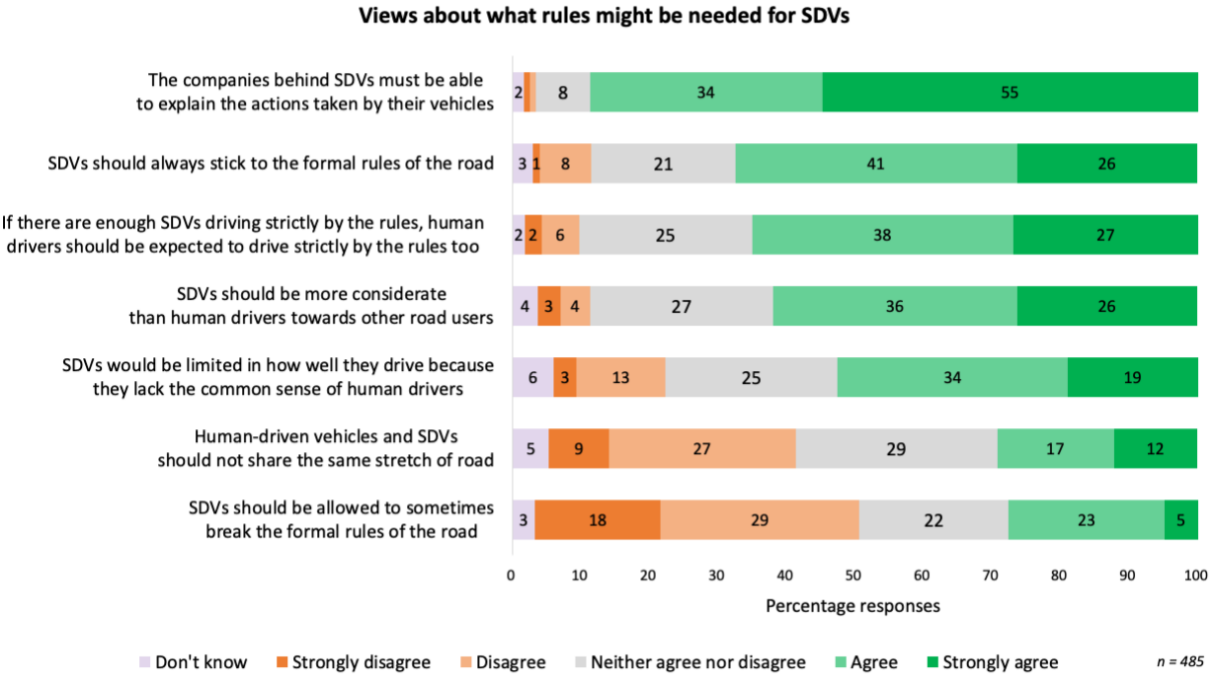

Figure 8.3. Views about what rules might be needed for SDVs

These answers present a complex picture: respondents accept that human drivers will use other guidelines besides the rules when driving, such as consideration for others and common sense. But they expect SDVs to always stick to the rules (89% agreeing) despite worrying that not following the guidelines of common sense would limit the quality of driving SDVs could achieve.

Looking at how human drivers and SDVs might share the road, 29% of respondents agree that the two should not share the same stretch of road but 36% disagree while 34% are unsure. A clear majority endorses the idea that with enough SDVs driving strictly by the rules, human drivers should follow suit.[20] More research will be needed to understand how people relate the rules of the road to the idea that drivers apply common sense: these should not be imagined as alternatives, since common sense is what tells one when to apply which of the rules.

Noteworthy too is the strong consensus on transparency and interpretability: 90% agreeing that all data must be available after a collision (Section 8.2 above) and 89% agreeing that SDV companies must be able to explain their vehicles' behaviour.

[20] 65% agree that *'If there are enough SDVs driving strictly by the rules, human drivers should be expected to drive strictly by the rules too'* while 8% disagree. We should caution against over-interpretation here: respondents express frustration with other drivers driving badly, especially in some of the comments in the responses to the earlier free-text questions. With *'double-barrelled'* statements such as this that include two linked propositions it may be the case that respondents are agreeing with just one of them, the proposition that human drivers should be sticking to the rules, irrespective of the introduction of SDVs.

9. Interactions between SDVs and pedestrians at crosswalks and cyclists

9.1 Introduction

The next module addresses how SDVs might interact with pedestrians at crosswalks. 474 respondents answered these questions. In particular, we asked what participants felt about interactions at unsignalled crosswalks, since this is a situation in which human interactants need to show consideration towards each other and they are more likely to be guided by common sense than in more rigidly regulated settings.

9.2 Should SDVs share the road with pedestrians and cyclists?

The first question asked all participants in the module general questions about the relative safety of SDVs and these other road users, and whether they should be kept apart (Figure 9.1):

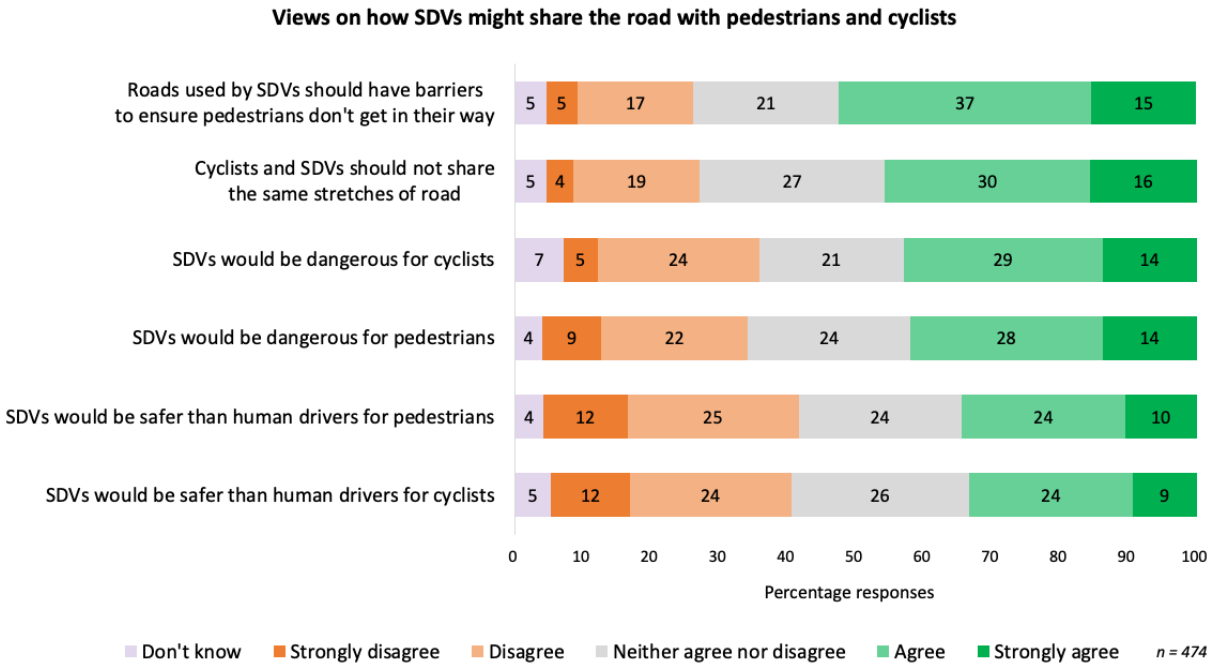

Figure 9.1. Views on how SDVs might share the road with pedestrians and cyclists

Superficially, it looks as if respondents are giving very similar answers to all questions, but it is different respondents agreeing or disagreeing with different questions: thus responses to statement 4, stating that SDVs would be dangerous for pedestrians, correlate negatively with responses to statement 5, that SDVs would be safer for pedestrians (correlation coefficient -0.589). Respondents who previously gave positive answers to whether the technology should be developed or whether they would be comfortable sharing the road with SDVs are more likely to say that SDVs will be safer for pedestrians and cyclists, and to disagree that they would be dangerous. For cyclists, they also tend to disagree with the idea that they need to use separate roads.[21] The suggestion of barriers between pedestrians

[21] For example, comfort with the prospect of using the road alongside SDVs correlates positively with the view that SDVs will be safer for pedestrians (+0.590), and negatively with the view that they will be dangerous for pedestrians (-0.609). Belief that the technology should be developed correlates negatively with the view that cyclists and SDVs should use separate road (-0.319).

and SDVs is framed in a way that makes the proposal for the benefit of SDVs, which might elicit agreement from those feeling positive about and wanting to enable SDVs as well as those feeling negative about SDVs and wanting to protect pedestrians: there are only weak associations between answers to this question and general views on SDVs.

9.3 Views on interactions between pedestrians and human drivers at crosswalks

We asked first about current interactions at crosswalks. Figure 9.2 shows the results:

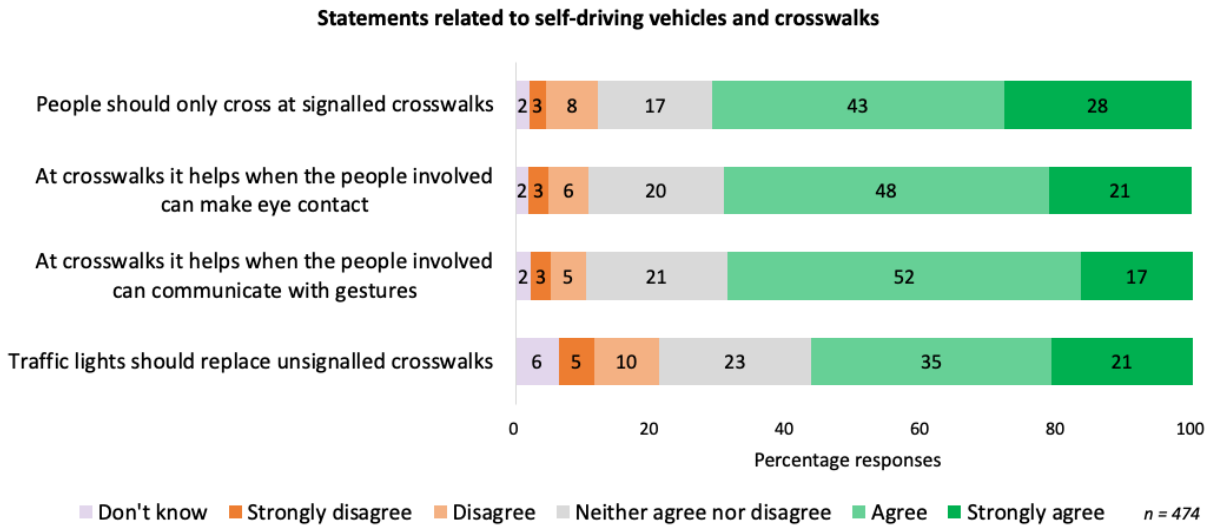

Figure 9.2. Statements related to self-driving vehicles and crosswalks

Most participants agree on the need for communication between vehicles and pedestrians, with eye contact only marginally preferred to gestures. 56% of respondents agree with the idea that *"Crosswalks with traffic lights should replace unsignalled crosswalks to help SDVs know when people need to cross the road"*, but this may simply be an endorsement of the first statement that *"It would be better if people only crossed at fully signalled crosswalks"*.

9.4 SDVs at crosswalks

Next we posed five questions in the form of semantic differentials: participants were asked which of a pair of statements was closest to their view, using a five-point scale. The results are shown below (Figure 9.3):

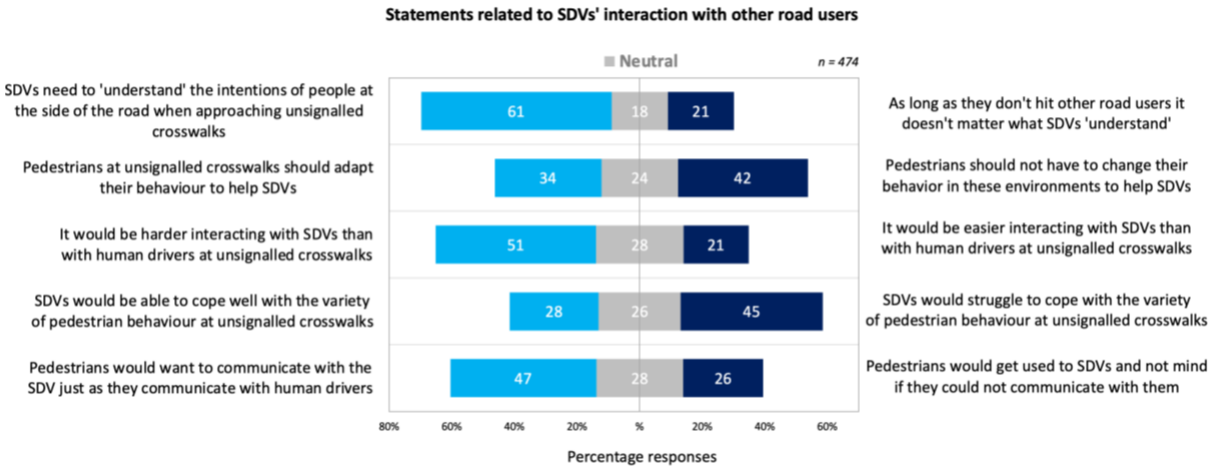

Figure 9.3. Statements related to SDV's interaction with other road users

61% of respondents opt for *'SDVs need to 'understand' the intentions of people at the side of the road when negotiating crosswalks* over *'As long as they don't hit other road users it doesn't matter what SDVs 'understand"* (21%). The results show some concern over how well SDVs will manage in these more fluid social situations. Fitting in to this environment requires that SDVs perform like a typical party to a social interaction: open to communication and capable of understanding others' intentions. Continuing the view that an SDV's lack of human common sense might be a limitation, respondents express doubt that SDVs might handle the sort of social interaction typically navigated by common sense (47% favouring the view that they *'would struggle to cope'* over 26% opting for *'would be able to cope'*).

10. Views on the use of data and surveillance on the roads

10.1 Introduction

SDVs will gather large amounts of data while perceiving the road around them, and as with other digital technologies this will include a lot of data about people. Do our participants have strong views about how this data should be used?

We opened this module (answered by 454 participants) with a series of questions about the use of telematic devices to monitor driving behaviour: the purpose of these questions is to test whether views about hypothetical gathering of data by SDVs match views about the use data in a related technology that already exists. Appendix 7 provides the results of these questions, but we have not conducted the comparative analysis for this report.

We then asked three sets of questions: first, whether other road users should assist SDVs by carrying radio frequency identification devices (RFIDs) to allow them to be detected more easily; second to consider how the data picked up by the SDVs cameras might be used; and lastly, whether respondents as passengers in an SDV would be happy to share information about themselves.

10.2 Who should be required to carry radio-frequency identification devices (RFIDs)?

Figure 10.1 below presents the views on RFIDs:

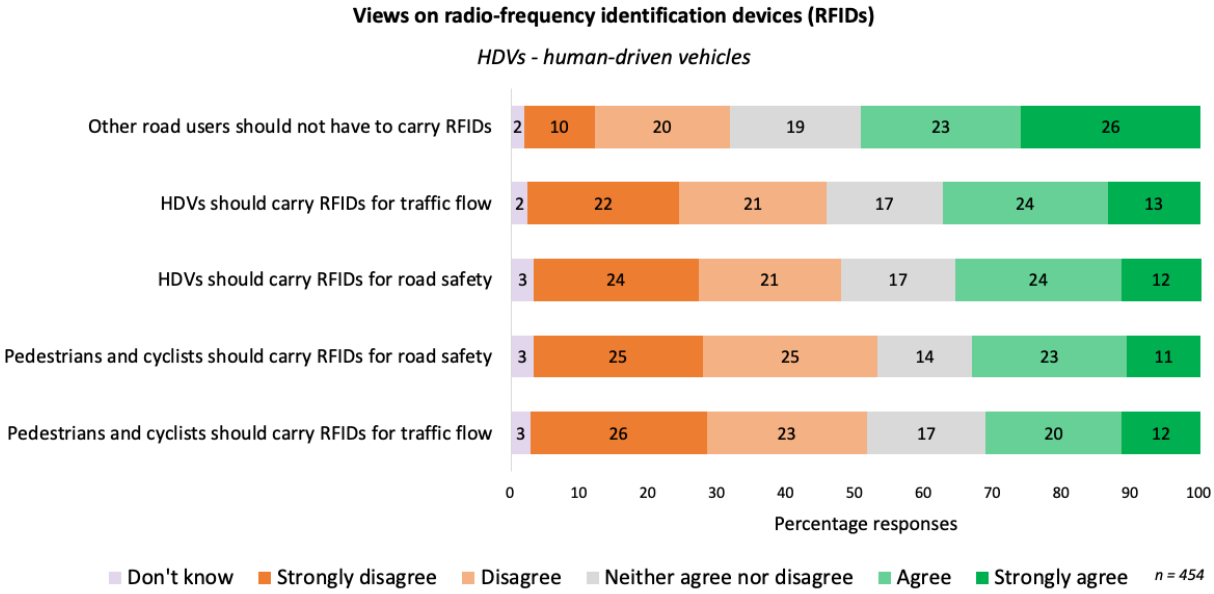

Figure 10.1. Views on radio-frequency identification devices (RFIDs)

The rejection of the idea that others should carry RFIDs is clear even if not overwhelming. 49% agree (30% disagreeing) that others should not have to carry RFID, while for the two cases of human-driven vehicles carrying RFIDs an average 44% disagree (36% agreeing), and for pedestrians and cyclists 50% disagree (33% agreeing).

10.3 Views on the use of sensors and cameras in today's new vehicles and on any future SDVs

Questions regarding the use of camera sensor data asked whether respondents were for or against various uses. Figure 10.2 summarises the results:

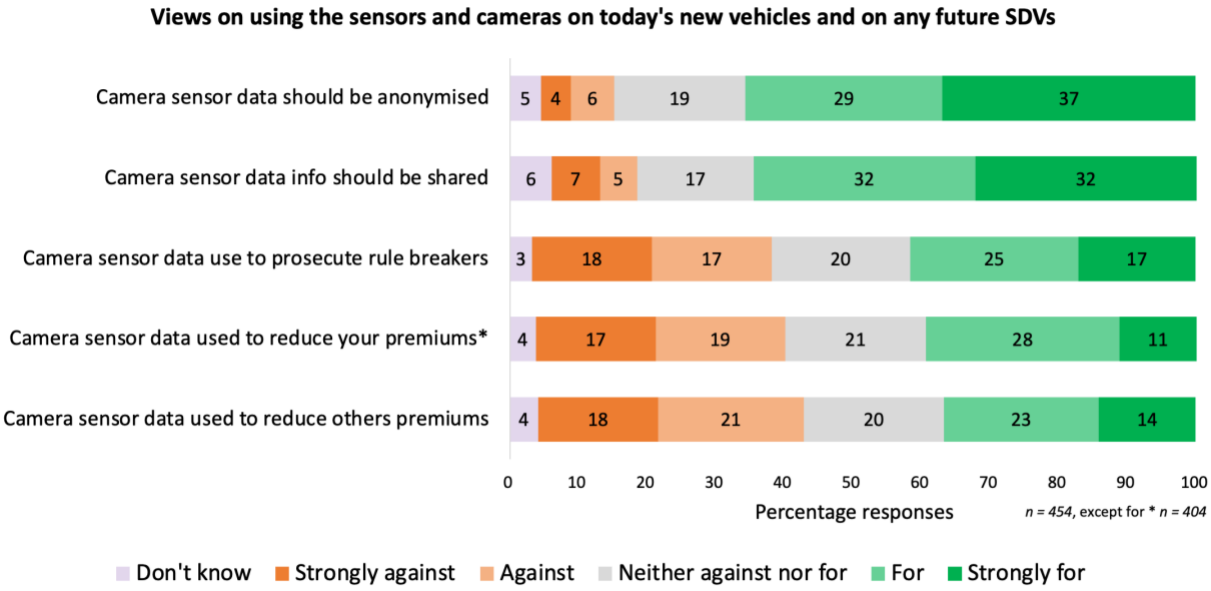

Figure 10.2. Views on using the sensors and cameras on today's new vehicles and on any future SDVs

There are clear majorities in favour of the propositions that *'All such data should be anonymised so that it does not identify other road users'* and *'When an SDV generates new data, such as map updates or detection of new hazards, this information should be shared between SDV companies and not kept private'*. This latter point echoes expectations of transparency expressed in the first module (Section 8.3).

Ostensibly the desire for anonymisation is inconsistent with proposing the use of such data for purposes such as reducing observed drivers' insurance premiums or prosecuting rule breakers, but there is no association (negative or positive) between respondents' answers on anonymisation (where 68% supporting) and answers to the final three questions (averaging 39% supporting). But there is clearly a hope that good use can be made of the data, with 64% supporting *'When an SDV generates new data, such as map updates or detection of new hazards, this information should be shared between SDV companies and not kept private'*; and although the average 39% support for the three uses that would require the data to identify drivers is modest, the average 37% against those uses does not amount to a forceful rejection by our sample.

10.4 Comparing views on two potential types of service for SDV riders when using their data

We presented two possibilities for the use of rider data:

1. *'Imagine you are riding in a self-driving vehicle on a long journey. If you share your health data, the vehicle could report if you fall sick, and maybe even drive you to hospital.'*
2. *'While riding in a self-driving vehicle, the vehicle operator could show advertisements to you to reduce the cost of your trip. To do this effectively, operators might want your web browsing history and other personal data.'*

Both were followed by the question *'Would you be against or for sharing this with the vehicle operator in this situation?'*. Figure 10.3 shows the responses:

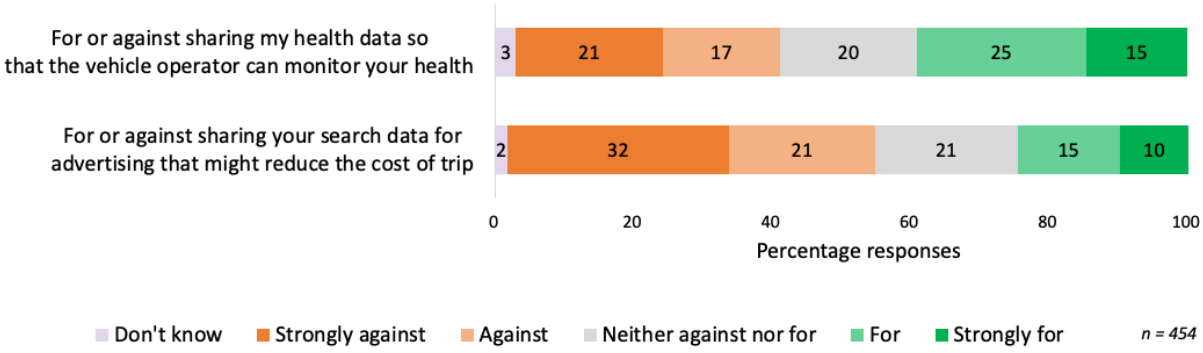

Figure 10.3. Views on provision of services to SDV riders by using their data

The responses suggest a contrasting evaluation of the two data uses, with slightly more (40%) for sharing their health data than against (38%), whereas a majority (53%) reject the idea of reduced trip costs if they are shown tailored advertising with only 25% for this.

11. Views on robots, SDVs as robots, and Artificial Intelligence (AI)

11.1 Introduction

This module (completed by 477 respondents) is designed to explore general attitudes towards robots and AI. Later in the survey we ask a series of questions about participants' general attitudes towards technology with which to measure their *'technological optimism'*. The purpose of this module is to explore whether attitudes to robots and AI might play a different role to general technological optimism within respondents' views about SDVs. A number of the questions repeat formulations used within Eurobarometer 427 (European Commission, 2015). We do not report on this analysis in this report. However, for the sake of completeness, and because the module includes some further questions regarding SDVs, we include the results here.

11.2 Respondents' general view on robots and some specific applications

We began by asking about people's views on robots in general, then about specific applications of robots. Figures 11.1 and 11.2 present the results:

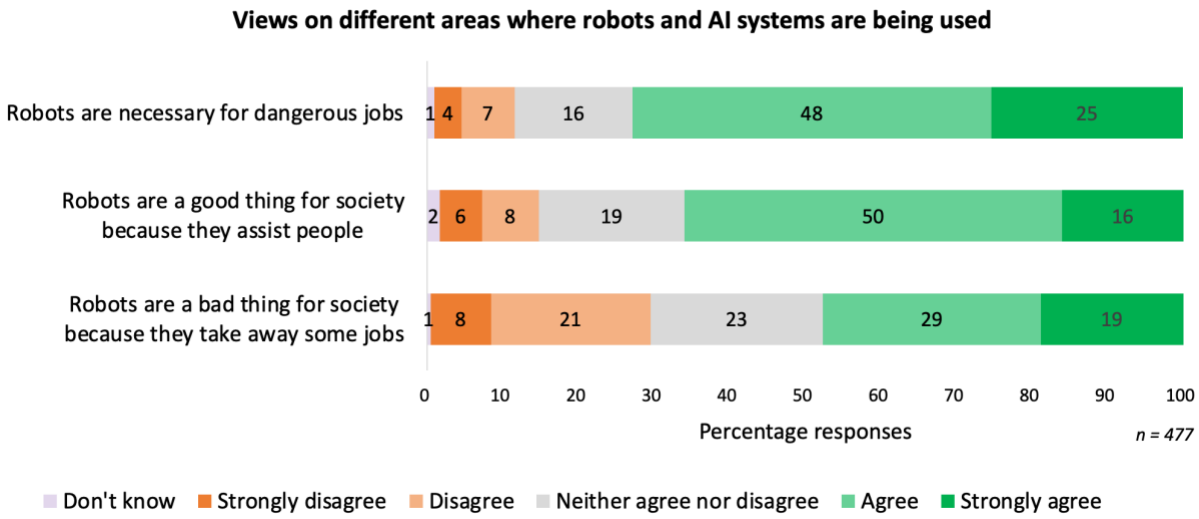

Figure 11.1. Views on different areas where robots and AI systems are being used

The following questions about specific applications ask '*How uncomfortable, or comfortable, are you with the idea of a robot doing the following jobs?'*:

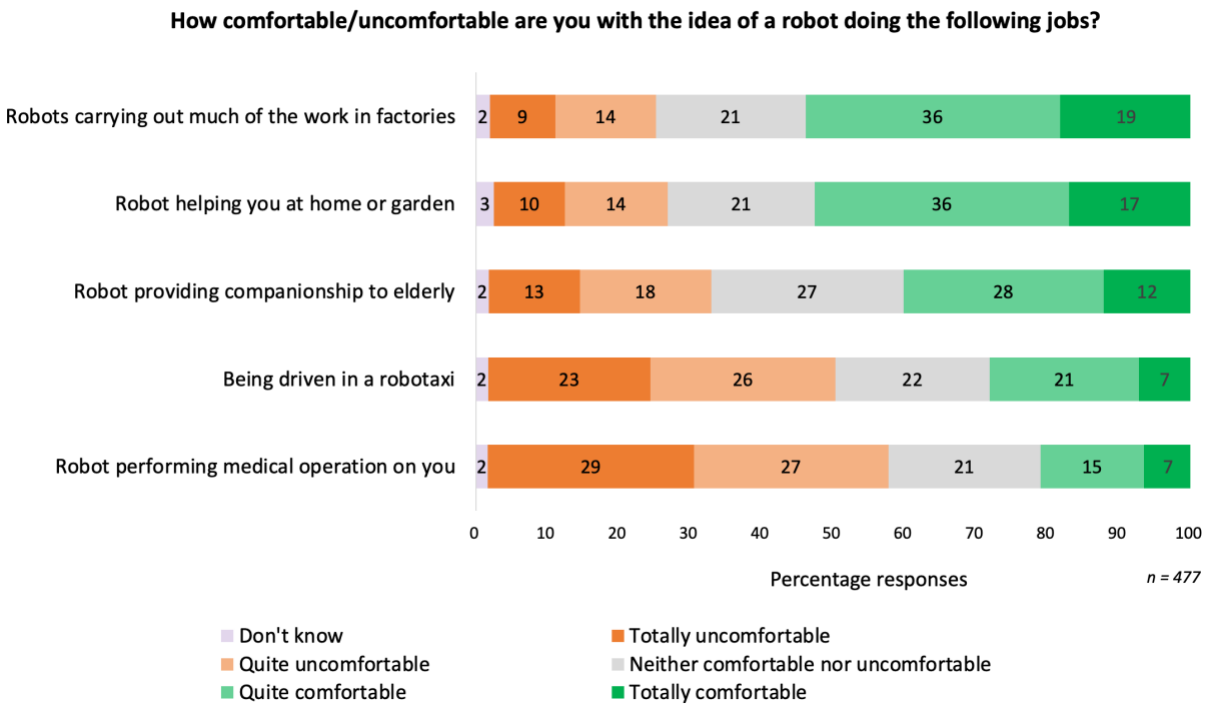

Figure 11.2. Views on the idea of a robot doing different jobs

Most noteworthy within these responses is the level of aversion to *'being driven in a robotaxi'* and *'having a robot perform a medical operation on you'*. These responses are quite closely correlated (correlation coefficient +0.501) and suggest that some respondents consider that entrusting their wellbeing to a robot crosses some sort of boundary of acceptability.

The free-text responses revealed some respondents having a strong aversion to robots, and in particular the feeling that 'we' are being overrun:

> *"Robots taking over the world."*
>
> *"Human interaction is always going to be needed when using a a vehicle and no robot will ever place that of having a soul and knowing when to stop or pull over.."*

But others express more positive associations:

> *" Robots make less mistakes than humans"*
>
> *"Robots and cool let's relax instead of having road rage"*

11.3 Respondents' views on specific applications of AI

We then asked a similar set of questions about specific applications of AI. Figure 11.3 presents the results:

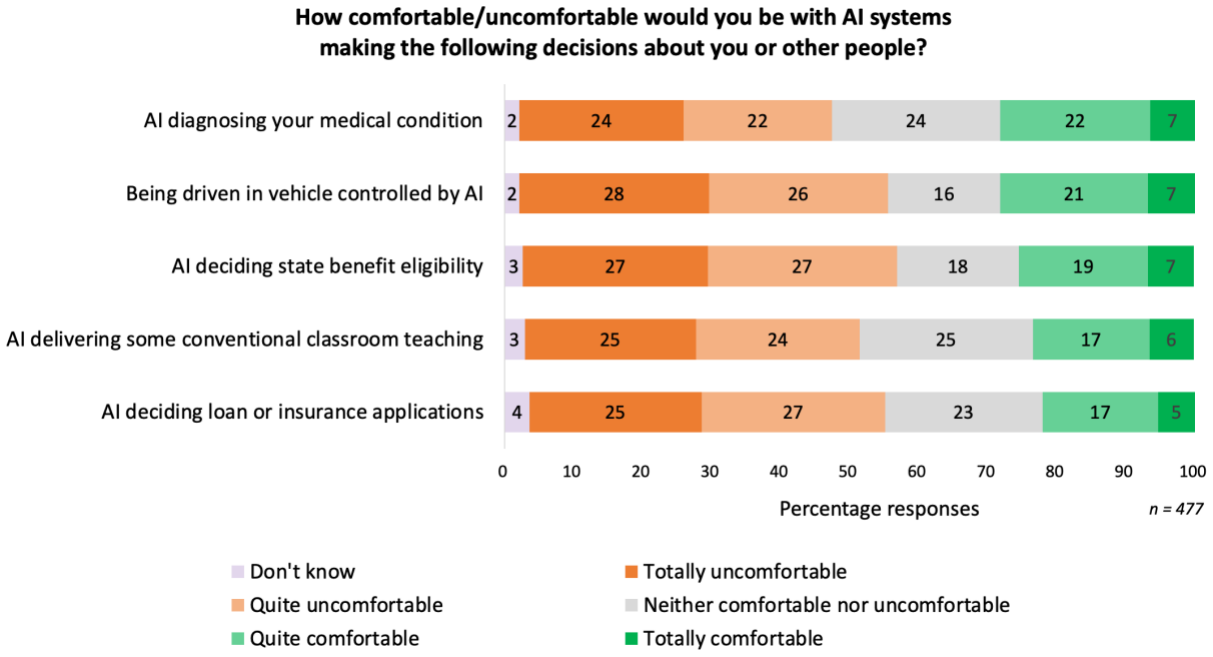

Figure 11.3. Views on the idea of a robot making decisions about you or other people

There is a broader resistance to these AI applications when compared to the more discriminating views about robots. However, the highest level of discomfort is seen with the prospect of being driven in a vehicle controlled by AI, with 55% stating they would be uncomfortable with this. It is noteworthy that the correlation between those uncomfortable with an AI controlled car and those uncomfortable with the idea of a robotaxi is very high (correlation coefficient +0.795). This suggests that respondents make little or no distinction between AI systems and robots in terms of their willingness to place their safety in their hands.

11.4 Views on the use of AI systems in SDVs

Lastly, we presented three questions framed as semantic differentials (see 9.4 above). Figure 11.4 presents the results:

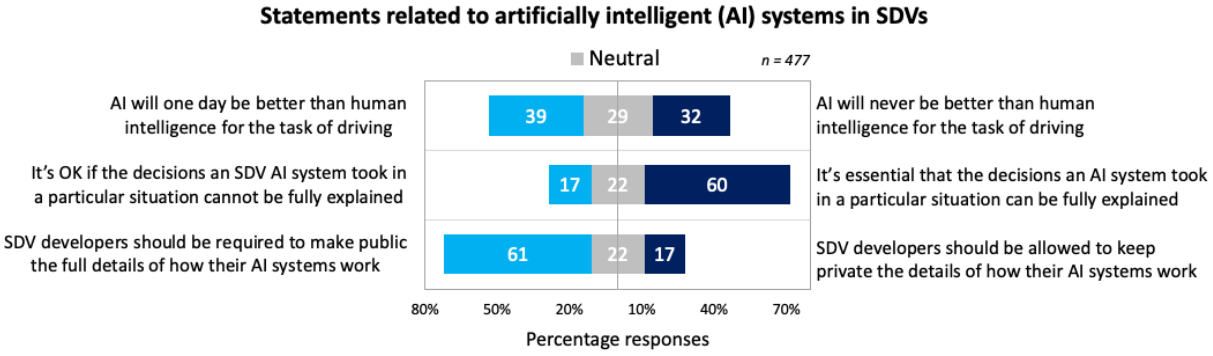

Figure 11.4. Statements related to AI systems in SDVs

These results are quite striking. First, in spite of the majority aversion to the idea of riding in an AI-controlled vehicle, more respondents expect that *'AI will one day be better than human intelligence for the task of driving'* than the opposite[22].

Second, as with earlier modules, respondents are decisive in their view of the need for transparency and interpretability of SDV AI systems. Yet these demands are challenging for self-driving vehicles if they are to be able to cope with more fluid, less controlled environments, or what Suchman and Weber (2016) described as the *'open horizon of potentially relevant circumstances'*. By their very nature such environments, and the behaviours that results from interacting with them, are not fully determined. The desire for transparency presents a challenge. We have seen earlier that people agree that self-driving vehicles need to drive like human vehicles if they are to mix on the road, coping with unfolding circumstances. But they would also like vehicles to be deterministic and fully explainable. The concerns, uncertainties and diversity of opinions we reveal in relation to SDVs are not a function of ignorance but a reflection of uncertainties around the technology that the experts themselves are currently grappling with, some of which will not be easily resolved in the short term.

[22] This does not represent a contradiction. Discomfort with the prospect of riding in an AI-controlled vehicle correlates negatively, -0.390, with belief that SDVs will one day be better than humans at driving. But of those respondents who said they were uncomfortable with the prospect of riding in one (something that could be construed as referring to the present) 26% are amongst those who agree that AI will one day be better, and another 29% of those uncomfortable are undecided on the question about SDVs eventually being better. The shift from present to future may tip the balance, as discussed in Section 4.

12. Phoenix

12.1 Introduction

152 of our respondents were drawn from Maricopa County, Arizona. This area includes most of the metropolitan area of Phoenix, where Waymo have both tested extensively and now deployed SDVs as a ride hail service.

The Maricopa sample is skewed by gender, with only 56 males amongst the 152 respondents. In some of the data below we provide the raw data and also adjusted figures. In the adjusted figures we apply the gender distribution of the main US sample to the Maricopa data.

12.2 Awareness of SDVs

We asked the Maricopa participants about their level of exposure to SDVs. The exposure is fairly modest but it should be remembered that the Waymo vehicles only service a small part of the county[23]:

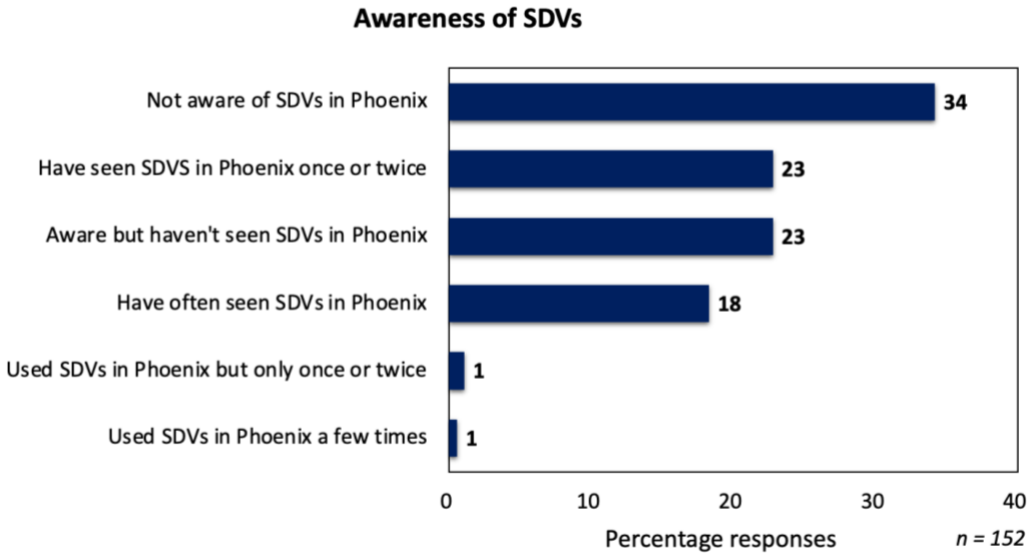

Figure 12.1. Awareness of SDVs

12.3 Attitude towards SDVs

We asked the 100 respondents who were aware of the SDVs in Phoenix *"What do you think of the self-driving car services now operating in parts of Phoenix?"* The table below shows the answers:

[23] The service area is centred on, the city of Chandler, part of the metropolitan are of Phoenix. Chandler comprises less than 1% of the area of Maricopa County and c 6% of the population.

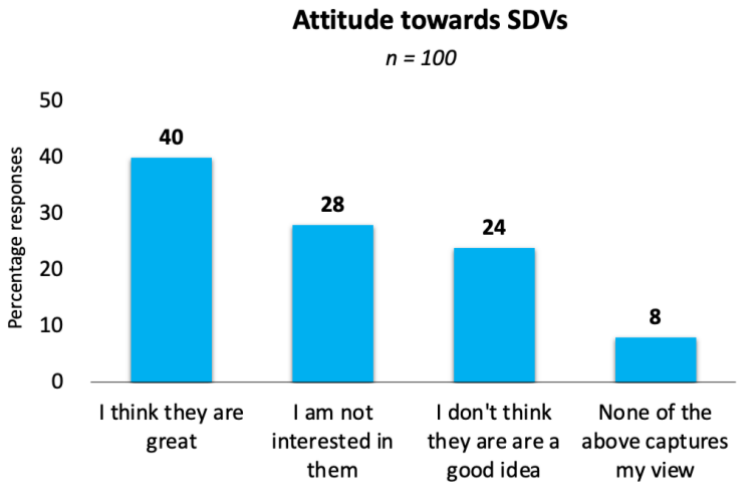

Figure 12.2. Attitude towards SDVs

With respect to our more general measures of attitudes towards SDVs set out in section 4, and the *'knowledge and engagement score'* set out in Appendix 11, we can compare the attitudes of the Maricopa respondents to the main US sample. The table below provides the mean scores for these measures:

General attitude measures	Scale	US excluding Phoenix		Phoenix 'unadjusted'		Phoenix 'adjusted'	Rest of South West	
		N	Mean	N	Mean	Mean	N	Mean
Knowledge engagement score	1 to 7*	1,738	2.93	152	3.10	3.21	206	3.08
Do you think this technology should be developed?	1 to 4	1,618	2.73	144	2.83	2.89	189	2.83
How would you feel about using the roads alongside self-driving vehicles?	1 to 5	1,655	2.71	144	2.82	2.91	188	2.89
How would you feel about riding in a self-driving vehicle instead of the existing ways you travel?	1 to 5	1,661	2.53	143	2.56	2.65	195	2.76
Average usefulness of 7 SDV modes	-4 to +4	1,738	0.16	152	0.35	0.44	206	0.43
Techoptimism scale	1 to 5	1,738	2.74	152	2.62	2.65	206	2.77

*Knowledge engagement score is not strictly linear, see Appendix 11.
Number of respondents varies due to exclusion of don't know responses

Figure 12.3. Attitude towards SDVs – mean scores

The adjusted figures suggest that the Phoenix, or Maricopa County, sample has slightly more positive attitudes[24] towards SDVs that the rest of the country. But it is also worth making the same comparison to the other respondents from the Southwestern states excluding the Phoenix sample. These show very similar mean scores towards SDVs as the Phoenix sample. However, technological optimism in

[24] The differences are not great. On the comfort measures for riding in or driving alongside SDVs, the mean differences for the adjusted Phoenix sample are less than 0.15 x the standard deviation.

the Southwest is almost the same as in the rest of the US, and very slightly less in our Phoenix sample. Given that residents of these states do not appear to be, in prinicple, more receptive of new technology, slightly more positive attitudes towards SDV technology specifically may suggest that greater discussion of SDVs in the South Western states may have had some slight impact. With such modest differences more research would be needed before speculating further.

13. Socio-demographic measures, and other attitudes of our respondents

13.1 Introduction

Literature reviews have identified a wide range of variables associated with attitudes towards SDV (Becker & Axhausen, 2017; Gkartzonikas & Gkritza, 2019; Tennant et al., 2019). These include:

- Core socio-demographic variables
- Age and gender,
- Income, education and occupation
- Measures of other attitudes
- Attitudes towards technology
- Ideology
- Attitudes towards driving and modes of transportation
- Behavioural measures
- Existing travel choices

Typically, these measures are used as independent variables predicting SDV technology acceptance in a variety of models. Some of the measures in this survey can serve as measures of SDV technology acceptance. However, our main objective is not to create another model to predict factors enabling or preventing acceptance by individual users, but to explore public attitudes towards SDV technology and its integration on the roads.

With this objective in mind and constrained by the need to manage the length of the survey, we included measures of those variables from the user acceptance literature that we considered also to have a bearing on our broader research agenda.

13.2 Measures in this survey - attitudes

The road of today
Section 3 documents the measures we used to assess respondents' policy priorities with respect to transportation. We also measured levels of preference for provision of public transportation, attitudes to speed limits and fuel taxes, and towards the relative prioritisation of cars over other road users.

Technological optimism
Appendix 8 shows the results for nine items measuring more general attitudes towards technology. We have used these in the past to build useful scale measures of technological optimism *(Tennant, Howard, Franks, Bauer, & Stares, 2016; Tennant et al., 2019*).

Socio-political attitudes
Appendix 9 shows the results for three different measures of socio-political attitudes. Some recent studies (Mack et al., 2021; Mohammadzadeh, 2021) have explored associations between political ideology and user attitudes to acceptance. Socio-political attitudes also play a role in views on regulation and the role of private enterprise in introducing new technologies. Our first measure asks respondents to place themselves on a sliding scale from left to right in terms of political orientation. The second is a ten-item battery, nine of which are commonly used in the UK[25]: we used informal pilot testing to confirm that these items would be meaningful to US citizens. The third asks respondents to state how they voted in 2020 US Presidential election.

[25] https://www.britishelectionstudy.com/wp-content/uploads/2019/06/Bes_wave15Documentation_V2.pdf

Attitudes towards driving and car ownership

We asked the 1,716 drivers amongst our respondents seven questions about their attitudes towards driving and car ownership. These were in the form of semantic differentials on a five-point scale (as described in section 9.3): respondents were asked, *'Please read the following pairs of statements. For each pair, please select a point on the scale to show how much closer your view is to one of them than the other. If you agree/disagree with both equally strongly, please select the middle point.'* For example, one pair contrasted *'I find driving easy'* with *'I find driving difficult'*. Appendix 10 provides the results.

13.3 Measures in this survey - socio-demographics

We obtained socio-demographic measures and information on travel behaviour:

- US State, summarised into 6 regions.
- 'Habitat', using descriptions of where respondents lived: city, suburb, town or rural travel habitats
- Travel behaviour, based on behaviour prior to the pandemic. This was measure by a matrix which offered seven different modes of travel and five different frequencies from *'Never'* to *'Once or more times a day'*.
- Disabilities: respondents were asked if they had *"any disabilities or any other issues affecting your mobility that prevent or hinder you from travelling by any of the following modes"* followed by a list comprising walking, cycling, driving myself, public transport and *'Yes, but not covered by the above'*, as well as the answer option *'No, none'*. The 432 respondents who said they had a mobility issue were given the option of providing further details in free-text.
- Education using a standard set eight steps used on the Qualtrics platform
- Occupation using a standard set of nine options on the Qualtrics platform
- Household income: as described in section 2.2 we had to adjust the measure used during sampling. Details are provided in Appendix 1.

Results for the above are shown in Appendix 2.

14. Further research with this dataset

Throughout the report we have indicated some of the associations between the different items covered by the survey. We will be conducting further research to analyse these associations systematically. These associations tend to be used to generate market profiles for potential users of the technology. By contrast our research will be focused on developing a better understanding of the responses that cluster together, and of the characteristics of the different groups with such clustered responses to the societal impact of this technology. The objective is to understand citizens as partners in the future as opposed to the barriers to acceptance they are often theorised to be (e.g. König & Neumayr, 2017; Raj, Kumar, & Bansal, 2020).

We can provide a snapshot of the way that different participants respond to SDV technology in general terms. Figure 1.1, repeated below, sets out five measures which we compressed to *'negative'*, *'neutral'* or *'positive'* towards the technology:

N = 1,890	*Negative %*	*Neutral %*	*Positive %*	*Don't know %*
What first comes to mind? (coded free-text)	49	34	17	
Should this technology be developed?	35	7	58	
Reasons why/why not (coded free-text)	39	23	38	
Comfort with using the roads alongside	46	20	29	5
Comfort with riding in	53	15	28	4

For the 'comfort with' questions the compression combines the *'Don't Know'* answers with the *'Neither comfortable nor uncomfortable'* answers. Similarly for the question *'Should this technology be developed?'* we have treated the *'Not sure'* answers as neutral. This reduction necessarily loses nuance but is appropriate for the summary picture we present below.

Cross-tabulations of these five general measures of enthusiasm for SDVs against some of the socio-demographic and attitudinal variables associated with attitudes towards self-driving vehicles provides an effective snapshot[26]. Appendix 11 schedules this analysis which we summarise:

- Men tend to be more positive about self-driving vehicles than women are (Becker & Axhausen, 2017)
- Younger people tend to be more positive than older people (Becker & Axhausen, 2017)
- Those more optimistic about technology generally tend to be more positive about self-driving vehicles than the less optimistic are (Tennant et al., 2019)
- Urban dwellers tend to be more positive those from rural locations (Becker & Axhausen, 2017)
- Those claiming greater knowledge and engagement with the topic tend to be more positive (Sanbonmatsu, Strayer, Yu, Biondi, & Cooper, 2018)

[26] Cross-tabulations are simple associations between two variables, and we can assess the strength of the associations with a range of statistical tests. Multi-variable analyses such as regression models, using all the variables and other relevant measures such as socio-demographic characteristics, would provide a clearer picture of how the variables are related to each other. Provisional analyses of this kind, not reported here, indicate that all of the associations mentioned are statistically significant (at the conventional 5% level) even when controlling for the remaining variables in the list above.

These results concord with the literature as indicated by the references and the literature reviews already mentioned above.

15. Conclusion

Companies developing the technology often suggest that problems of public trust will be resolved with greater awareness or information about the technology. Our surveys suggest this won't be the case. The concerns, uncertainties and diversity of opinions we reveal here reflect some of the uncertainties around the technology that the experts themselves are currently grappling with, some of which will not be easily resolved in the short term. Indeed, on a number of detailed issues the expert respondents showed a wide variety of responses with similar numbers both for and against various approaches.

Most of our expert interviewees see the technology as intrinsically desirable. In interviews, many experts argue for light touch regulation, and some also expressed impatience that the new rules of the road needed to be sorted out soon. Both in interview and in the survey experts tend to downplay concerns about humans and self-driving vehicles mixing in shared space and about the importance of transparency and explainability. This creates a potential conflict with the public for whom these concerns are central and for whom knowing what they are dealing with when interacting with SDVs on the road is essential.

We mentioned above the challenge of public desires for self-driving vehicles both to blend in and to be distinguishable: but this simply reflects the developer's promise that self-driving vehicles should be both better than human drivers but capable of fitting in without demanding any adaptation from them or other road users. Fitting in requires interacting with others in ways they are familiar with. Just as when two drivers negotiate who passes first through a narrow space, human drivers as a group, and those responsible for self-driving vehicles, will have to negotiate how to share the road. The developers' tendency to reject the role of the public in this negotiation is unlikely to resolve the issues satisfactorily.

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Appendices

Appendix 1 – Sampling methodology

Respondents to the survey were recruited via Qualtrics, the same company that hosts the web platform in which we set up the questionnaire. Qualtrics provides respondents through a selection of industry partners who curate survey panels. Such panels comprise members of the public who have signed up to take part in surveys, usually in exchange for modest compensation in the form of vouchers that can be redeemed for cash or in high street or online shops. These companies go to considerable lengths to maximise the numbers of people they have on their panels, and their diversity in terms of socio-demographic and consumption characteristics. While any resulting sample from their database cannot be thought of as a strict probability sample of the general public, the efforts at maximising variability (known in survey research as *'indirect approximation'*) go some way towards addressing worries about biases that may be present in the sample as a result of the way people are recruited.

During the sampling process, nested hard quotas were applied to try to ensure that we obtained a roughly even split of males and females within each age bracket, and a distribution of age that reflects that of the US population. There were some imbalances in the gender splits across age bands in the sample: fewer younger men than women, and more older men than women. We calculated a weight to adjust these proportions to more closely match their population counterparts, and applied it to all of the results reported in this document, apart from the demographic variables documented in this section. Population statistics for gender are not available for the 'other' category, so in our weighting variable we assigned those cases a weight of 1, and adjusted the proportions of males and females accordingly. The mean weighting value was 1.0327, median 0.9107, minimum 0, maximum 2.4116.

In addition to the quotas for age and gender we applied a soft quota for the six regions. Further, during data collection it became apparent that there was a disproportionate number of lower income respondents, so that approximately half the data was collected while applying a hard quota between four income quartiles as drawn from US governmental data. Towards the end of data collection this hard quota was proving too constraining and we relaxed it. Appendix 2 shows that the income distribution of the respondents in our four bands was 31%, 29%, 22%, 18%, compared to approximate national quartiles of 25% each. Including estimated weights for income does not appear to make substantial differences to our analyses and given the difficulties with sourcing applicable household income by age by gender information for the population we have not sought to address this bias in the dataset. Since we had to adjust the income bands to apply the quota, the consolidated income bands for all respondents include estimations to allocate respondents to the bands.

Participants were assigned to the different modules in a quasi-random way, employing a least fill strategy to try to ensure that each module contained respondents with a range of socio-demographic characteristics.

Data Cleaning

Online survey participants are adept at completing surveys rapidly. After early pilots we agreed with Qualtrics to apply a threshold completion time of 15 minutes.

Qualtrics apply their own data scrubbing to the data. We then applied quality controls to the data and excluded responses with:

- Nonsense responses to the free-text questions

- Excessive straightlining (i.e giving exactly the same answer to each question) on the larger batteries
- Consistently speeding on a selection of the survey pages - this was measured by identifying respondents in the lowest deciles for time taken on each of four different pages
- Implausible travel modes: respondents who say they used all of the travel modes (see Appendix 2 below) more than once a week.

We excluded 282 respondents (13% of the original sample) through these procedures.

Analysis

The majority of analyses reported here are simple univariate statistics displayed in bar charts, showing the percentages of respondents who gave particular answers. In some places we make reference to correlation statistics to illustrate how answers to pairs of questions are (or are not) related. Those reported in the main text are Pearson correlation coefficients, which are well-known and easily understood: they have a possible range of -1 (indicting a perfect negative linear association – such as would be illustrated with points lying directly on a straight line of best fit in a scatterplot) through 0 (indicating no linear association) to +1 (a perfect positive linear association). For these calculations we exclude 'don't know' responses and treat the question response options as representing continuous, interval-level scales. In a strict sense, the answer options form only ordinal scales, so we would caution against interpreting the Pearson statistics as representing the associations very precisely – they nevertheless provide an accessible indication of how respondents' answers do (or don't) vary systematically. In Appendix 11 we substitute for Pearson correlation statistics an alternative (gamma), which is defined specifically for items with ordinal response scales.

Comparative UK and 'Expert' surveys

UK survey

A similar survey was conducted in the USA with data collection in Octoer and November 2021. Suvey text was essentially the same with the following exceptions:

- Where appropriate, language in the US survey was amended to use standard American English terminology: for example, the references to zebra crossings in the UK survey were replaced by 'unsignalled crosswalks'
- The UK survey includes five modules rather than four, including a module using pictures of typical UK street scenes with pedestrians and a cyclist which would not have translated to a US survey.

Full results from the UK survey are available in a separate report, arranged like this one to enable easy comparisons.

'Expert' Survey

We invited developers, other stakeholders and interested observers to complete a shortened version of the survey, also on the Qualtrics platform. Respondents were invited either by direct email contact or by an invitation posted on two different Reddit chat groups. In this report we refer to our respondents as 'experts', reflecting the fact that most have had much more involvement in the technology than our public respondents (see Appendix 12 for details on how this was measured).

Although 113 people started the survey, a number exited the survey before completing it. The survey was explicitly divided into a short survey of core questions, followed by an invitation to continue to supplementary questions. As shown below, 80 people completed the short survey and 73 people responded to all questions on self-driving vehicles. The 80 respondents who answered the short survey were asked to describe their role, and were offered six different descriptions from which they could choose any that applied:

Self-descriptions (n = 80)	Yes	No
Interested Observer	35	45
Tech commercial	29	51
Tech non-commercial	11	69
Social scientist	16	64
Regulation specialist	21	29
Other	13	67
Total	**125**	**325**

Figure 15.1. Occupational self-descriptions of survey respondents

Of the 80 respondents, 37 described themselves as involved in self-driving technology development. The sample was fairly evenly split between North American and European respondents, with less than 10% from other continents. Over 90% of respondents are male.

Full results from this survey are available in a separate report.

Appendix 2 – Survey demographics (unweighted)

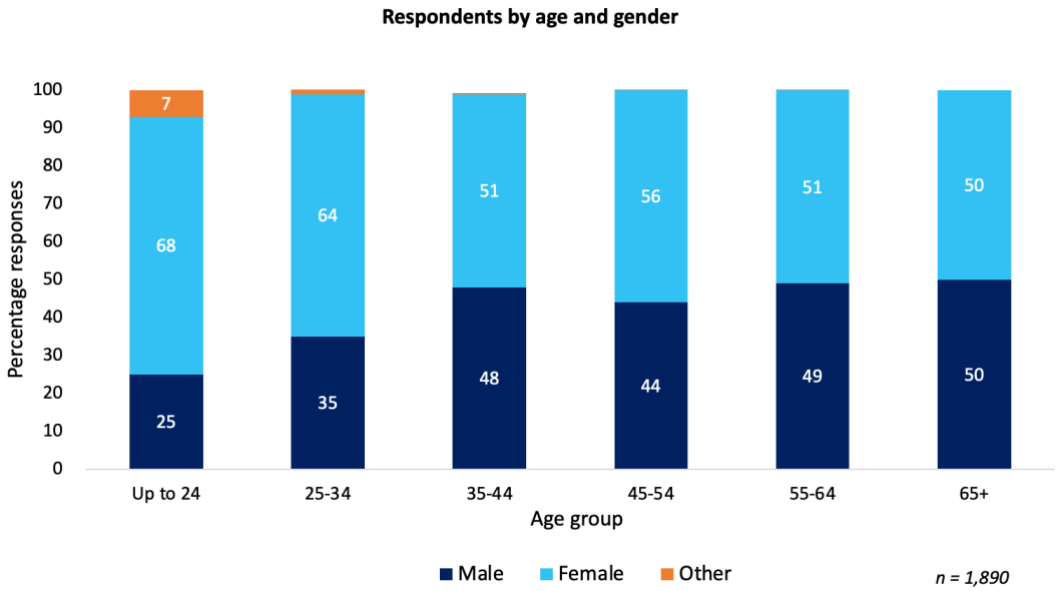
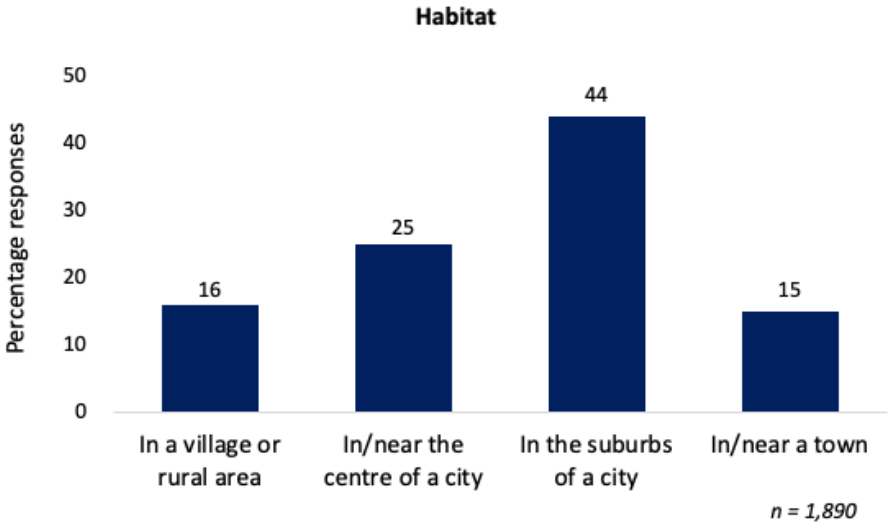


Table below compares survey participants' home region with the population distribution:

United States *by region*	population[27] %	survey respondents %
Pacific	16.3	11.0
'Rocky Mountain'	4.8	3.9
Southwest	13.1	18.8
Midwest	20.7	21.1
Southeast	26.0	26.3
Northeast	19.2	18.8

Figure below shows how respondents categorised where they lived out of four options:



[27] https://worldpopulationreview.com/states

Respondents' mobility difficulties

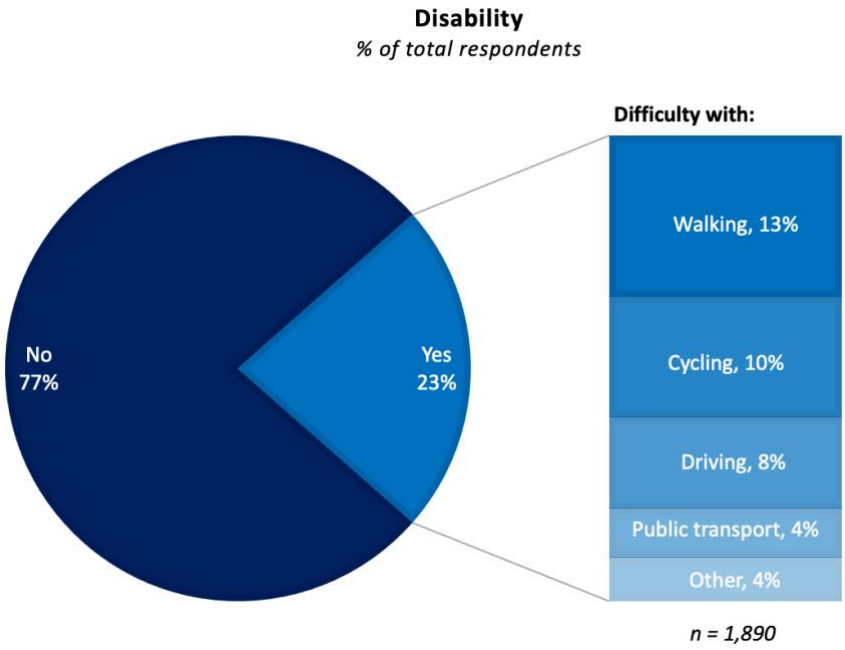
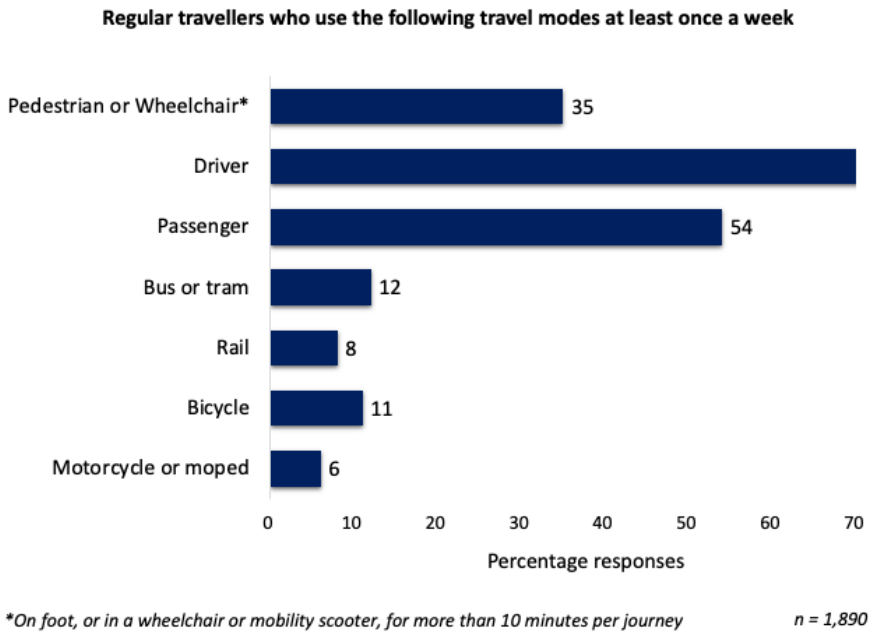
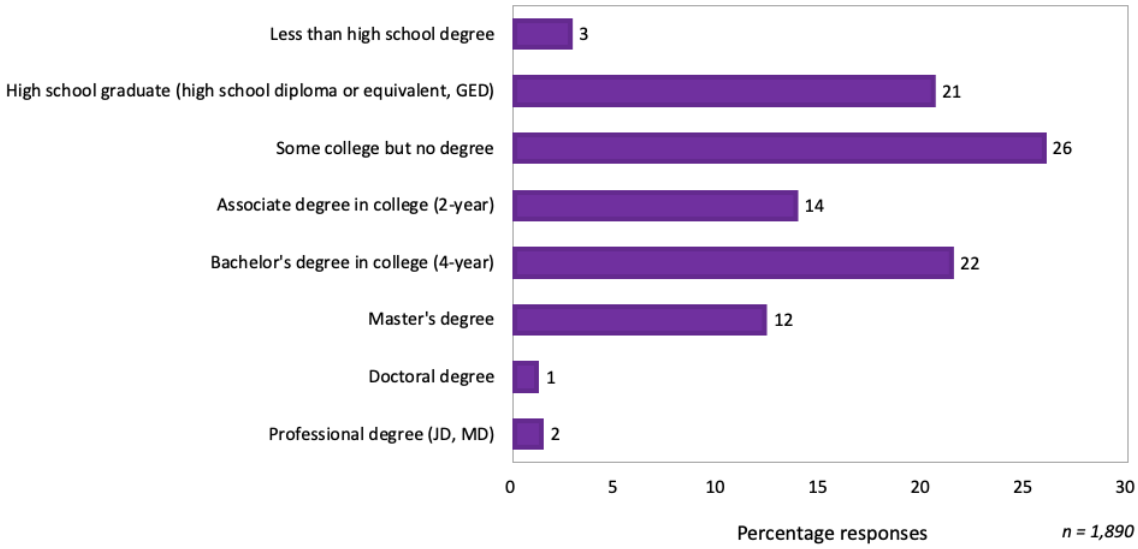


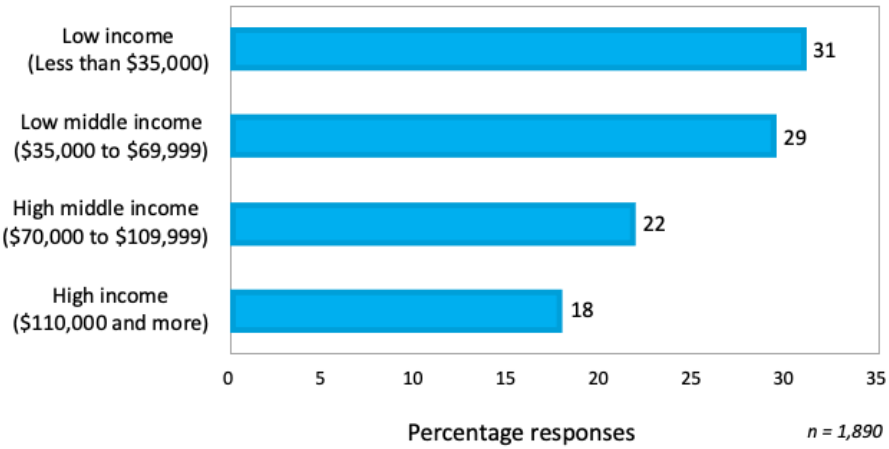
Figure below shows the percentages of respondents who reported using each mode at least once a week:



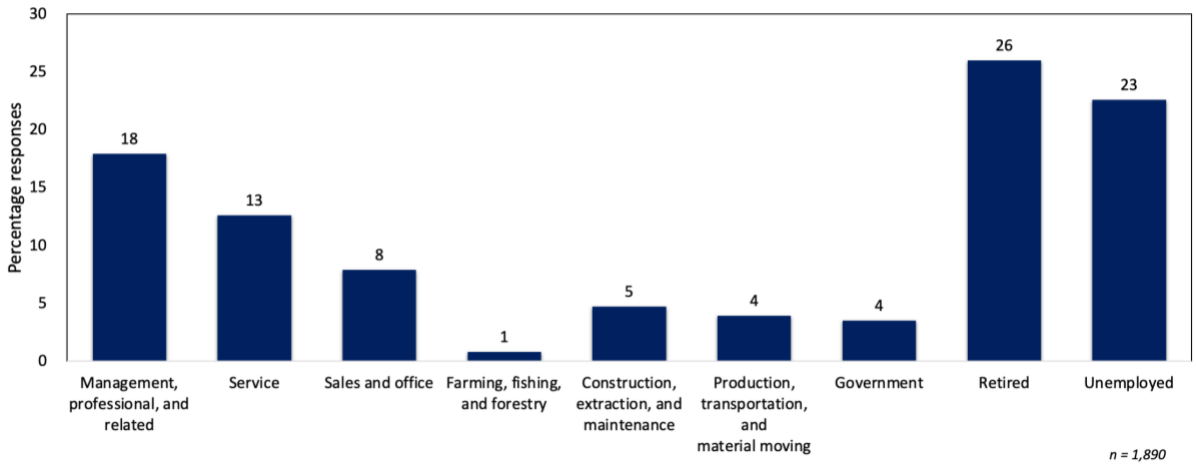
Highest level of education completed



Income



Occupation



Appendix 3 – Free-text coding and reliability checks (Q4.1 and Q4.8)

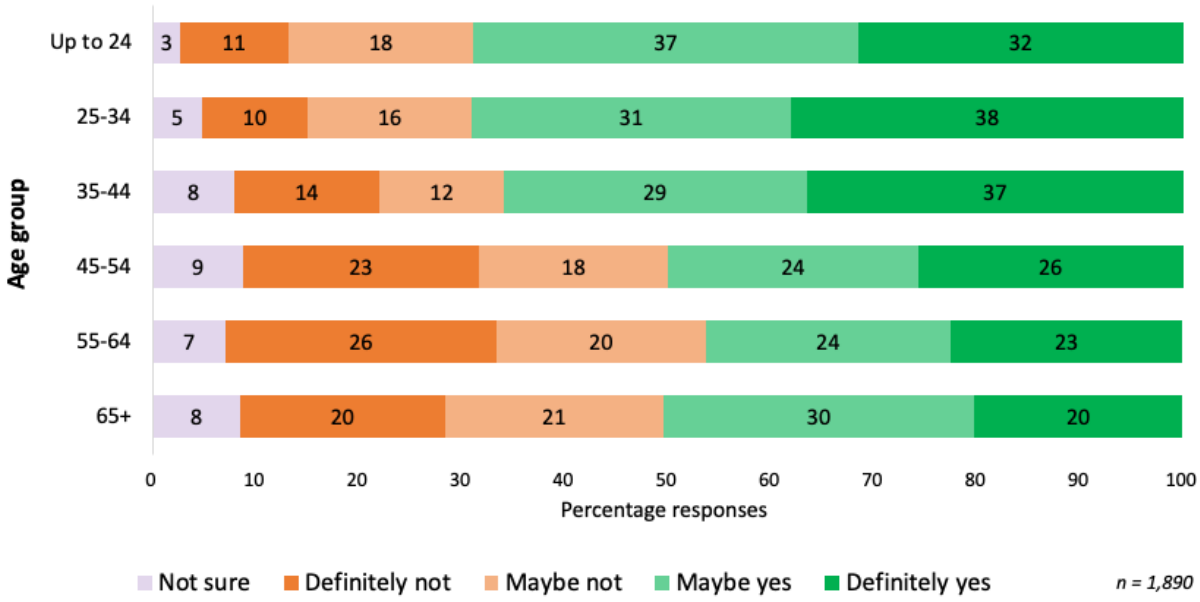
The coding of the free text responses to Questions 4.1 and 4.8 was carried out by two of the authors. Both coders started by coding small numbers of responses independently and then comparing notes to progressively develop a coding frame. This was refined by both subsequently coding a small number of the same responses and comparing.

The final coding frame is shown in Section 4.5 of the report. Coding reliability was confirmed originally for the UK survey by comparing results for 50 respondents on the free text answers in Q4.1 and Q4.8. To reconfirm coding reliability for the US survey, both coders coded Q4.1 and Q4.8 for sets of 25 respondents, i.e. 50 free-text responses in each set. With 13 codes for each set this represents 650 possible codes for each response. The two different sets of 25 were coded early and late in the coding exercise.

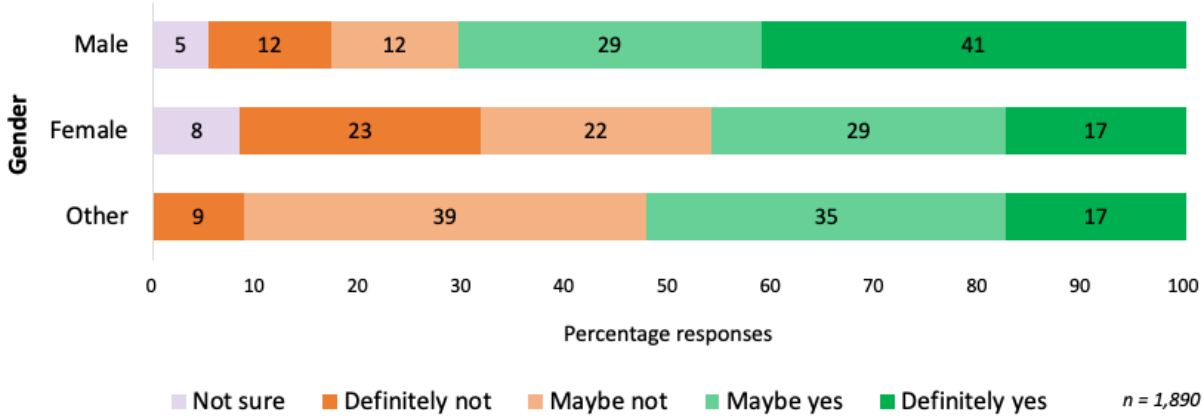
The measurement of reliability repeats the approach adopted by some of the authors in previous studies (Tennant, Howard, & Stares, 2021). Cohen's Kappa co-efficient was 0.70. Cohen's Kappa is considered to correct too strongly for chance agreement (Gwet, 2008; Wongpakaran, Wongpakaran, Wedding, & Gwet, 2013) in analyses such as ours, where most of the sampled units were not marked by either coder as having most of the codes present - in 79% of cases both coders deemed the code to be absent. Gwet's AC1 coefficient (Riffe, Lacy, Fico, & Watson, 2019) aims to correct for this and was calculated as 0.90. These steps taken to achieve a reliable coding scheme were necessary to enable us to make claims about the nature of the content in the corpus such as relative prevalence and co-occurrence of themes (Krippendorff, 2004).

Appendix 4 – Should SDV technology be developed? Answers by age, gender, and habitat

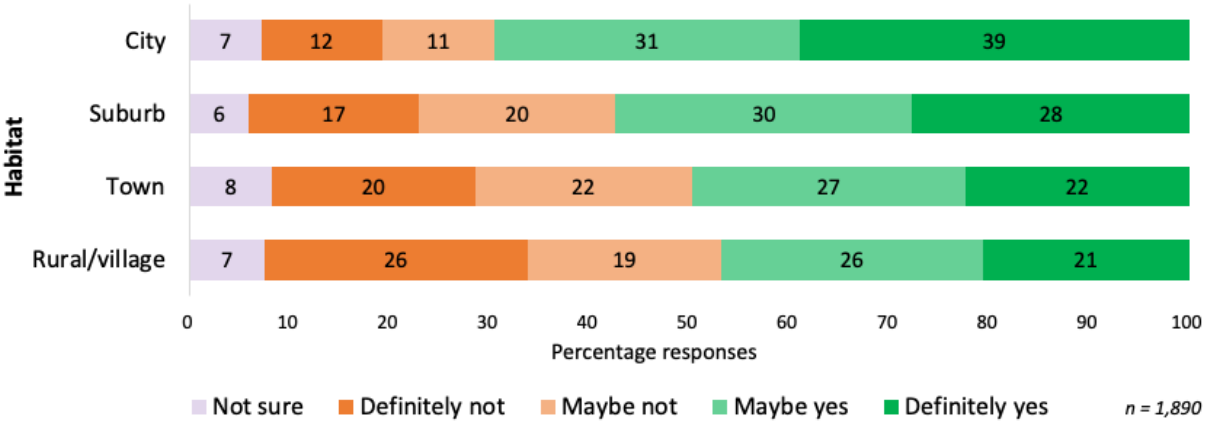
Respondents' views on whether the SDV technology should be developed or not, by age



Respondents views on whether the SDV technology should be developed or not by gender



Respondents' views on whether the SDV technology should be developed or not, by habitat



Appendix 5 – Sources of data for survey series

In Section 4.6 we present results from a series of surveys conducted by two of the authors. All of these surveys have asked two questions relating to comfort with SDV technology, one addressing the prospect of using the roads alongside them, the other that of riding in them. the wording of these questions has been varied, as has the order in which they have been asked. The authors have previously carried out experimental variations within individual surveys to assess whether the term used to describe the SDV (e.g. autonomous vehicle, driverless car etc) and the order in which the two scenarios (using the roads alongside versus riding in) affects the results.

Many of the questions were developed during the fielding of surveys in European countries in both 2015 and 2016. Data collection for these surveys was funded by Goodyear Tyre and Rubber Company (Tennant et al., 2019; Tennant et al., 2015). We used many of these questions in surveys deployed in 2017 and 2018/19 in the UK and US.

2017: data collection funded by departmental funds from London School of Economics and City, University of London.

In this survey we used the following introduction of the topic before asking the comfort question about driving alongside and using autonomous cars: but we conducted an experiment to see if the order mattered. The results in section 4.6 combine both conditions.

> *Now we'd like to ask you next for your opinion on autonomous cars, sometimes also called driverless cars. Autonomous cars are cars which drive themselves with little or no intervention by the human user. Already, many cars have advanced driver assistance systems such as lane departure warning intended to increase safety and to make driving easier. Now, making the car fully autonomous could be the next step.*
>
> *How would you feel about **driving on roads alongside** autonomous (driverless) cars?*

Answer options a 7 point scale: Totally / very / quite - comfortable; neither comfortable nor uncomfortable; quite, very, totally uncomfortable 'Don't Know' option.

> *How would you feel about using an autonomous (driverless) car instead of driving a traditional car? Same answer options.*

2018: data collection funded by departmental funds from London School of Economics and City, University of London

In this survey we conducted and experiment by varying the attitude referent: with the following conditions: autonomous (driverless) car, autonomous car, autonomous vehicle, driverless vehicle, self-driving vehicle, driverless car, connected and autonomous vehicle. The results in section 4.6 combined all conditions.

> *Now we'd like to ask you next for your opinion on autonomous vehicles. Autonomous vehicles are vehicles which drive themselves with little or no intervention by the human user. Already, many vehicles have advanced driver*

assistance systems such as lane departure warning intended to increase safety and to make driving easier. Now, making vehicles fully autonomous could be the next step.

*How would you feel about **driving on roads alongside** autonomous vehicles?*

Answer options a 7 point scale: Totally / very / quite - comfortable; neither comfortable nor uncomfortable; quite, very, totally uncomfortable 'Don't Know' option.

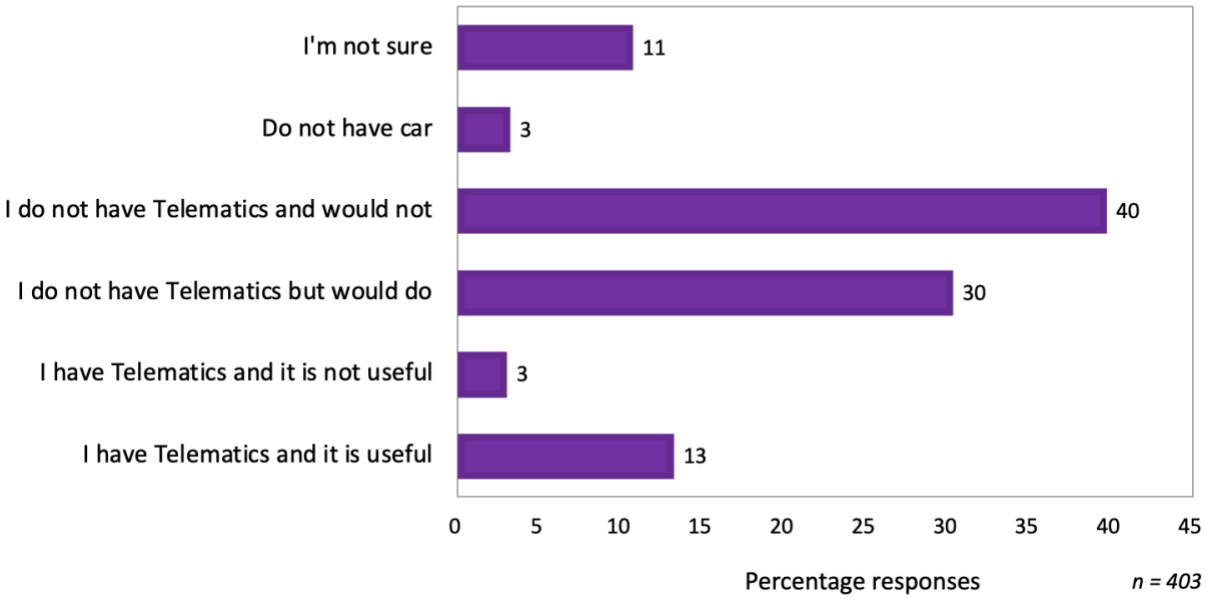
*How would you feel about **using an autonomous vehicle** instead of driving a traditional vehicle?*

Appendix 6 – Usefulness of different deployments for society in general

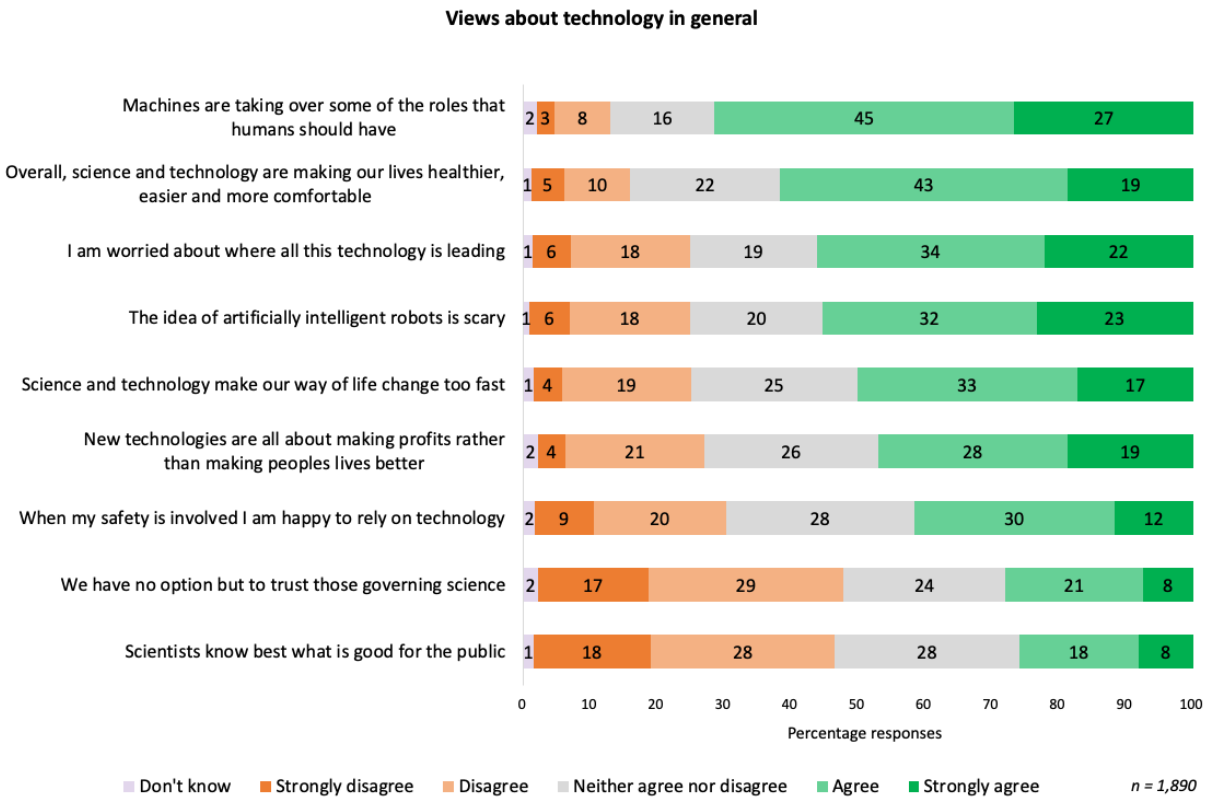
% of respondents *(n = 1,890)*	Not useful -4	-3	-2	-1	Neither 0	1	2	3	Useful 4
Low-speed self-driving shuttle buses	12.0	5.1	7.7	7.6	5.5	14.8	20.0	13.5	14.0
Small self-driving delivery pods	13.9	5.5	6.8	7.2	5.9	16.4	18.8	11.3	14.0
Self-driving buses on regular routes uses	14.5	5.4	9.1	8.5	5.0	14.6	17.1	11.4	14.5
Self-driving taxis	17.3	6.4	9.8	10.2	6.1	13.6	14.7	10.6	11.3
Privately owned self-driving cars	16.4	7.2	8.6	8.8	6.6	13.3	13.9	10.4	14.9
Self-driving car clubs (cars for short-term hire)	16.2	7.6	9.5	12.2	6.2	15.2	15.7	8.5	8.9
Self-driving trucks	22.1	8.2	11.0	10.3	6.1	11.7	11.7	7.7	11.3

Appendix 7 – Answers on data and surveillance questions

Some insurance companies offer reduced premiums if drivers install and use telematic devices or programmes on their smart phones that track the driver's behavior on the road. Which of the following best fits your view?



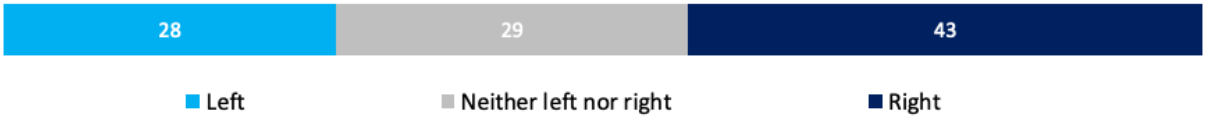
Appendix 8 – Attitudes towards technology in general



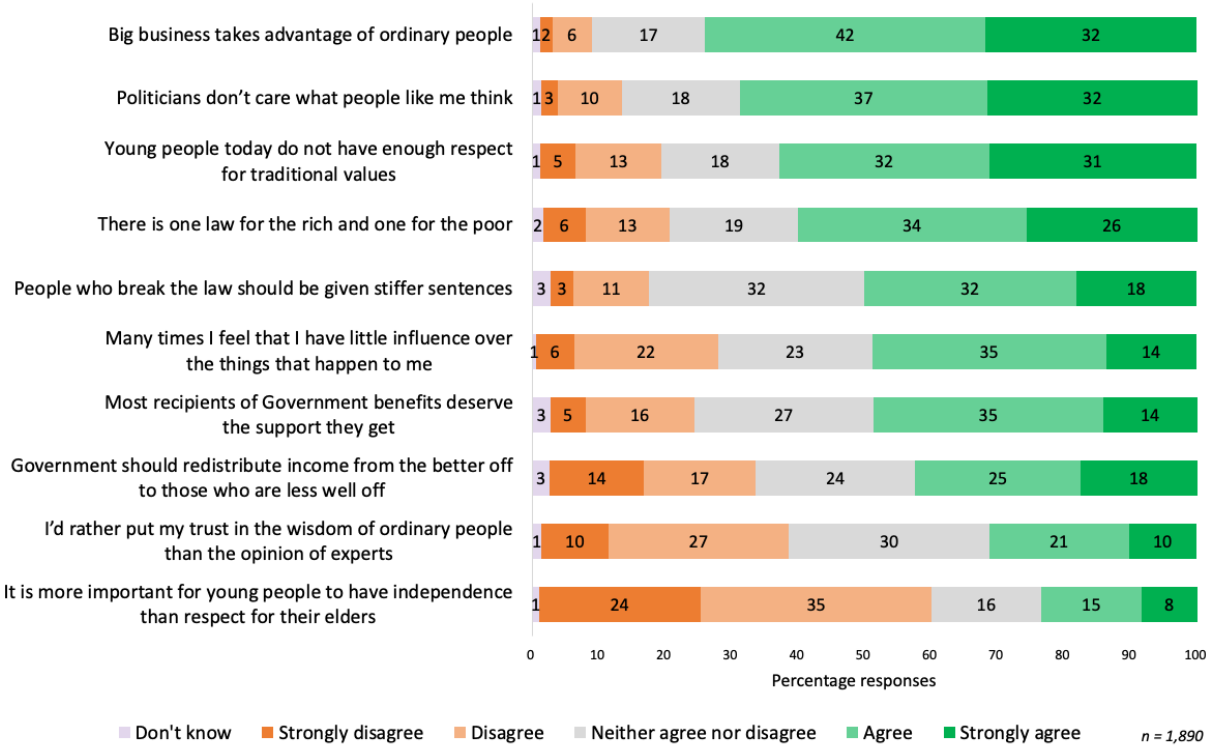
Appendix 9 – Socio-political attitudes

**In politics people sometimes talk of 'left' and 'right'.
Where would you place yourself on this scale?**

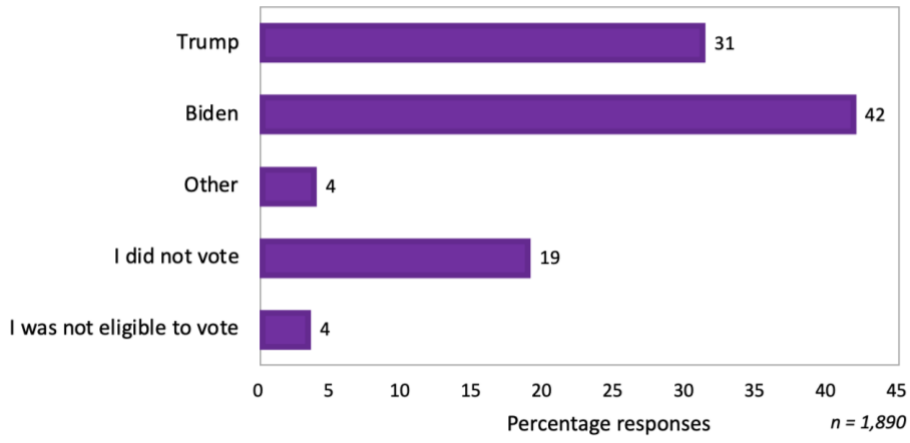
% of total respondents
(n = 1,890)



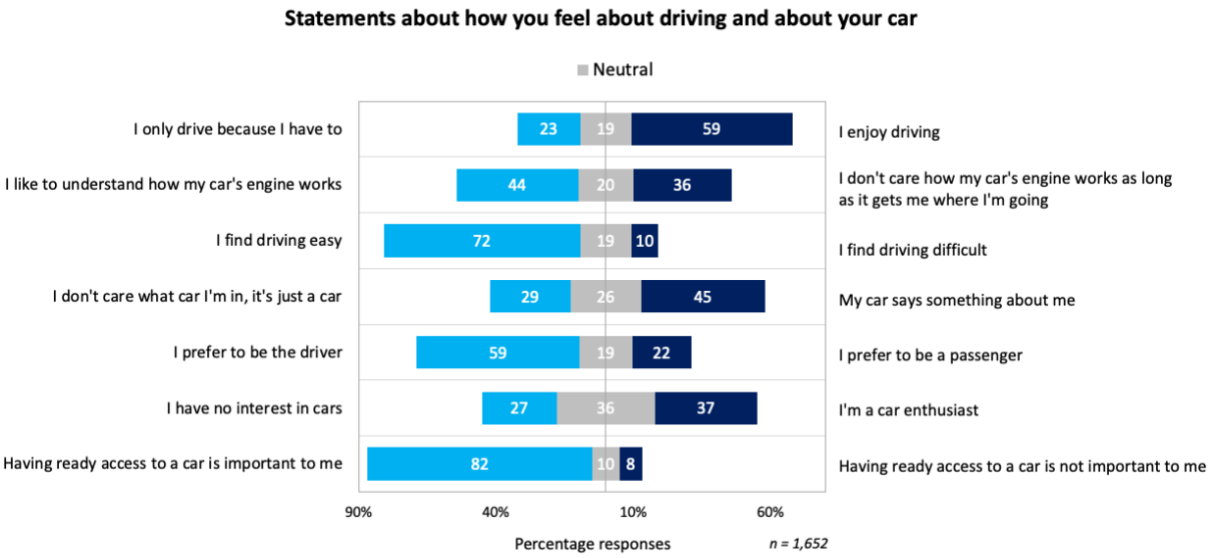
**There are many different views as to what makes a society fair or unfair, and what societies should do with respect to such matters.
How much do you disagree or agree with the following statements?**



How did you vote in the 2020 presidential election?



Appendix 10 – Attitudes towards driving and car ownership



Appendix 11 – Associations between general measures of enthusiasm for self-driving vehicles and socio-demographic and attitudinal variables

For the purposes of this report we have conducted a simple analysis to show some of the associations between our general measures of enthusiasm for SDVs and some of the "independent" variables used within the literature as predictors of attitudes towards SDVs. Cross tabulations show clearly how levels of enthusiasm change across different values for the independent variable. These independent variables are not normally distributed so that we treat the cross tabulations as ordinal and calculate a gamma statistic, which is similar to the level of correlation between the variables. The measure ranges from -1 to +1, so that higher values represent a stronger positive association.

The first table below shows the gamma statistic for the five different general measures of enthusiasm we showed in Figure 1.1, compared to five different independent variables. Negative values for the statistic show the following:

- Younger people tend to be more positive than older people
- Urban dwellers tend to be more positive than those from rural locations
- Men tend to be more positive about self-driving vehicles than women are

Positive values of the statistic show that:

- Those more optimistic about technology generally tend to be more positive about self-driving vehicles than the less optimistic are
- Those claiming greater knowledge and engagement with the topic tend to be more positive

"Independent" variable (higher values = categories indicated)	**Measures of Enthusiasm for SDVs (higher values = more positive about SDVs)**				
Table showing Gamma statistic for the 25 cross-tabulations	Coded tone for what first comes to mind	Coded tone for why/why not develop	Compressed comfort with using roads alongside SDVs	Compressed comfort with riding in SDV	Compressed response to should SDVs be developed
Gender (female[28])	-0.325	-0.382	-0.416	-0.426	-0.404
Age group (older)	-0.182	-0.150	-0.231	-0.256	-0.160
Habitat (more rural)	-0.230	-0.211	-0.228	-0.232	-0.226
Technological Optimism (more optimistic)	0.562	0.610	0.622	0.619	0.663
Knowledge and Engagement score (more engaged)	0.260	0.322	0.371	0.397	0.360
	Crosstabulations included in this appendix				

[28] Gender is not an ordinal variable (the categories of gender cannot be put in any meaningful order) but for ease of presentation we include a gamma measure involving just the male and female categories. The coding of gender (where the lower numerical code = male and the higher code = female) leads to the interpretation of negative gamma statistics that female respondents tend to be less enthusiastic about SDVs than male respondents do.

We show below the cross-tabulations for the five associations highlighted in the table above. In the table below increasing age associates with reduced comfort with riding in an SDV, hence the negative statistic:

Crosstabulation for Age and compressed measure for 'Comfort with riding in SDV'					
Age group		**Negative**	**Neutral**	**Positive**	**Total**
	Up to 24	*38%*	*29%*	*33%*	*180*
	25-34	*44%*	*22%*	*34%*	*292*
	35-44	*45%*	*17%*	*38%*	*348*
	45-54	*60%*	*17%*	*23%*	*319*
	55-64	*68%*	*17%*	*15%*	*352*
	65+	*66%*	*18%*	*16%*	*399*
Total					
	% in each 'comfort' group	***55%***	***19%***	***25%***	***1,890***
Gamma = -0.256					

In the table below, increasingly rural habitat (decreasingly urban) associates with decreasing comfort with using the roads alongside SDVs, hence the negative statistic.

Crosstabulation for Habitat and compressed measure for 'Comfort with using roads alongside SDVs'				
Habitat	**Negative**	**Neutral**	**Positive**	**Total**
In or near the centre of a city	*37%*	*26%*	*37%*	*477*
In the suburbs of a city	*50%*	*24%*	*26%*	*820*
In or near a town	*52%*	*29%*	*19%*	*284*
In a village or rural area	*61%*	*22%*	*17%*	*309*
Total				
% in each 'comfort' group	***49%***	***25%***	***26%***	***1,890***
Gamma = -0.228				

In the table below, the layout of the table results in a negative gamma statistic as fewer women say that SDVs should be developed: the gamma statistic applies to the Male and Female responses only.

Crosstabulation for Gender and compressed measure for 'Should develops SDVs'				
Gender	**Negative**	**Neutral**	**Positive**	**Total**
Male	*26%*	*6%*	*68%*	*826*
Female	*46%*	*8%*	*46%*	*1,044*
Other	*50%*	*0%*	*50%*	*20*
Total				
% in each attitude group	***37%***	***7%***	***56%***	***1,890***
Gamma = -0.404				

We have created a measure of technological optimism using the nine items in Appendix 8. Respondents' scores on this scale have been allocated to quintiles for easy of analysis. Increasing levels of technological optimism associate with more positive free-text answers to the question "why or why not?' asked about whether SDVs should be developed.

Crosstabulation for Technological optimism and coded tone of answers to "why or why not' the SDVs should be developed					
Quintiles for scale of technological optimism *(9 items, higher scores equal more optimistic)*		**Negative**	**Neutral**	**Positive**	**Total**
1	*% within Quintile*	*77%*	*16%*	*7%*	*335*
2	*% within Quintile*	*56%*	*23%*	*21%*	*488*
3	*% within Quintile*	*39%*	*29%*	*32%*	*344*
4	*% within Quintile*	*17%*	*33%*	*50%*	*339*
5	*% within Quintile*	*10%*	*18%*	*72%*	*384*
Total	***% in each 'tone' group***	***40%***	***24%***	***36%***	***1890***
Gamma = 0.610					

We created a measure of self-declared knowledge of and engagement with SDV technology. We allocated values to the questions described in Section 4.3 as shown in the table below:

Knowledge & Engagement	**Score**
Heard about	
Never	0
A little	1
A fair amount	2
A great deal	3
Add talked about	
Never	0
A few times	1
Often	2
Add searched about	
Never	0
A few times	1
Often	2
If 'never' talked about deemed never talked or searched also	

Thus the maximum score is 7 (3+2+2) for heard 'a great deal' and talked 'often' and searched 'often' about SDVs. 60% of respondents have an engagement score of 2 or less. The cross-tabulation below shows that increasing knowledge and engagement associates with increasingly positive free-text responses to the question "what first comes to mind?"

Crosstabulation for Knowledge & Engagement Score and coded tone of answers to "what first comes to mind"				
Knowledge and Engagement Score	**Negative**	**Neutral**	**Positive**	**Total**
0	*53%*	*44%*	*3%*	*59*
1	*61%*	*30%*	*9%*	*332*
2	*56%*	*30%*	*14%*	*474*
3	*56%*	*31%*	*13%*	*428*
4	*45%*	*35%*	*20%*	*344*
5	*31%*	*36%*	*33%*	*117*
6	*27%*	*35%*	*38%*	*79*
7	*14%*	*49%*	*37%*	*57*
Total ***% in each 'tone' group***	***51%***	***33%***	***16%***	***1,890***
Gamma = 0.260				

Appendix 12 – Survey Questionnaire

Note: *This is the version answered by residents of Maricopa County, Arizona. In the main survey Q132 was replaced by a question asking which state the respondent was from, and Q118-122 were omitted.*

Start of Block: Intro and consent

Q1.1 We would like to invite you to participate in this survey on attitudes towards the future of road transport. We are interested in your opinions: this is not a test of your knowledge. It is for a study conducted by a team of British researchers at the University College London and the University of the West of England. In order to participate, you must be over 18.

In participating you agree that you understand that you are free to withdraw from the survey at any point if you so wish, and the responses you give will be used for the purposes of this study only. You understand that your responses will be anonymous, and your data will be handled in accordance with the UK's Data Protection Act 2018. University College London will be the data controller. Where questions ask for you to answer in your own words we may use quotations (still anonymous) from those responses in our reports. To find out more about our research, and how we protect your data, you can access the Participant information sheet. Do you agree to participate in this survey?

- ○ Yes (1)
- ○ No (2)

Start of Block: Travel mode screen

Q2.1 How old are you?

_____

Q2.2 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Other (3)

Q14.4 In which state do you currently reside?

▼ Alabama (1) ... I do not reside in the United States (53)

Q2.3 Do you drive, or ride, for a living (other than commuting/travelling to work)?
(You can tick more than one of the 'yes' answers)

- ☐ No, I do not drive or ride for a living (1)
- ☐ Yes, I drive a truck or van (2)
- ☐ Yes, I drive a bus (3)
- ☐ Yes, I drive a cab (4)
- ☐ Yes, I ride a motorcycle for a living (5)
- ☐ Yes, I ride a bicycle for a living (6)
- ☐ Yes, I drive, or ride, another type of vehicle for a living (7)

Q2.4 Do you have a current, valid driver's license?

- ○ Yes (1)
- ○ No (2)

Q2.5 For this question, think about how you used to travel before the pandemic, in 2019. How often did you travel on average by each of the following modes?

- By personally driving a car, van or truck (1)
- As a passenger in a car, van or truck (5)
- Travelling by bus (2)
- By bicycle (3)
- By motorbike (4)
- Using the train or subway (6)
- On foot, or in a wheelchair, for more than 10 minutes per journey (7)

Answers (one per each statement):

- Never (2)
- Less than once a week (3)
- Once or twice a week (4)
- A few times a week (5)
- Once or more times a day (6)

Q126 It would be helpful to know your approximate household income. Please indicate the answer that includes your entire household income last year before taxes.

- Less than $20,000 (1)
- $20,000 to $34,999 (3)
- $35,000 to $49,999 (5)
- $50,000 to £70,000 (7)
- $70,000 to $94,999 (9)
- $95,000 to $110,000 (11)
- $110,000 to $149,999 (12)
- $150,000 or more (13)

Start of Block: Road of today

Q3.1 Now we are going to ask what you would like state or federal highway authorities to prioritize when it comes to the nation's transportation system. Please choose the **two** from this list which you would consider to be the highest priority:

- Making it affordable for everybody, regardless of their financial means, to move around (1)
- Giving individuals the ability to travel when and how they want (4)
- Reducing the number of people killed and seriously injured on the roads (2)
- Reducing traffic congestion (3)
- Making travel easier for those currently unable to drive as a result of age or physical disability (5)
- Reducing the pollution and environmental cost of transportation (6)

Q3.3 How much do you disagree or agree with the following statements about what happens on the roads and how they are regulated?

- On the roads that I use, most drivers drive well (11)
- Current speed limits are too restrictive (2)
- We have to accept that there will always be some road casualties (1)
- All new cars should be fitted with technology (currently used in trucks and buses) preventing drivers from exceeding the speed limit (3)
- The Government should reduce fuel taxes (5)
- Speed cameras make the road safer (6)
- Local governments should prioritize cars over other road users when they are planning how to allocate road space (7)
- Local governments should limit through-traffic in residential neighbourhoods (8)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q3.4 When the state or federal authorities have to decide where to spend money, to improve private motor transportation or public transportation, how would you like them to allocate funds?

	More on private transportation	More on public transportation
()		

Q3.5 When the state or federal authorities have to decide where to spend money, to improve public transportation or private motor transportation, how would you like them to allocate funds?

	More on public transportation	More on private transportation
()		

Start of Block: Roads of the future part 1

Q4.1 Next, we are asking you to think about the future. In two of the questions we ask you to give a response in your own words: your responses can be very short (minimum 7 characters) or longer (maximum 250 characters). In recent years, there has been talk in the media about self-driving vehicles, sometimes also called driverless vehicles or autonomous vehicles. What first comes to mind when you hear the term 'self-driving vehicles'?

_____

_____

Q4.3 How much have you heard or read about self-driving vehicles?

- ○ A lot (1)
- ○ A fair amount (3)
- ○ A little (4)
- ○ Nothing/never (5)

Q4.4 How often have you talked with other people about self-driving vehicles?

- ○ Often (1)
- ○ A few times (2)
- ○ Never (3)

Q4.5 How often have you searched for information about self-driving vehicles?

- ○ Often (1)
- ○ A few times (2)
- ○ Never (3)

Q4.7 In this survey, we refer to self-driving vehicles (sometimes known as driverless or autonomous vehicles), often using the abbreviation "SDV". SDVs are being designed to drive themselves on some or all of the conventional road network without the need for a human operator. These could be privately owned cars, or cabs, trucks, buses, or low-speed delivery vans and pods, or passenger shuttles. Some vehicles might be capable of self-driving some of the time while requiring, or permitting, a human driver at other times. Some vehicles might be exclusively self-driving.

Do you think this technology should be developed?

- ○ Definitely yes (1)
- ○ Maybe yes (2)
- ○ Maybe not (3)
- ○ Definitely not (4)
- ○ Not sure (5)

Q4.8 Why or why not? (Minimum 7 characters, maximum 250 characters.)

_____
_____

Q4.10 How would you feel about using the roads alongside self-driving vehicles?

- ○ Totally comfortable (1)
- ○ Quite comfortable (3)
- ○ Neither comfortable nor uncomfortable (4)
- ○ Quite uncomfortable (5)
- ○ Totally uncomfortable (7)
- ○ Don't know (8)

Q4.11 How would you feel about riding in a self-driving vehicle instead of the existing ways you travel?

- ○ Totally comfortable (1)
- ○ Quite comfortable (3)
- ○ Neither comfortable nor uncomfortable (4)
- ○ Quite uncomfortable (5)
- ○ Totally uncomfortable (7)
- ○ Don't know (8)

Q4.12 How safe do you think self-driving vehicles should be?

- ○ Never causing a serious collision (1)
- ○ Much safer than the safest human driver (2)
- ○ A little safer than the safest human driver (3)
- ○ As safe as the safest human driver (4)
- ○ As safe as an average human driver (5)
- ○ It doesn't matter (7)

Start of Block: Modes plus winners and losers

Q5.1 For society in general, which of the following developments do you think would be useful? Place the slider to indicate your view.

	Not useful / Neither / Useful / I'm not sure -4 -3 -2 -1 0 1 2 3 4
Low-speed self-driving shuttle buses ()	
Self-driving buses on regular routes ()	
Self-driving taxis ()	
Self-driving car clubs (cars for short-term hire) ()	
Privately owned self-driving cars ()	
Small self-driving delivery pods ()	
Self-driving lorries ()	

Q5.3 Who do you think will lose out or benefit from the introduction of self-driving vehicles? How much do you disagree or agree with the following statements?

- – Companies that make and operate SDVs will benefit the most (1)
- – SDVs will give easy access to transport for people who cannot access it now (2)
- – Compared to today, poorer people will benefit more than richer people (5)
- – Compared to today, people living outside cities and towns will lose out more than people living in cities and towns (6)
- – Companies that move goods and materials around will benefit the most (3)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Start of Block: Aspects of SDVs

Q6.1 We are interested in your views about how self-driving vehicles might share the road with other road users. How much do you disagree or agree with the following statements?

- It must be clear to other road users if a vehicle is driving itself (1)
- SDVs should follow exactly the same rules of the road as other road users (2)
- If SDVs are programmed to drive cautiously pedestrians will walk in front of them (3)
- If SDVs are programmed to drive cautiously human drivers will cut in front of them (9)
- If SDVs are able to react more quickly than human drivers, they should be allowed to drive much closer to other vehicles (6)
- SDVs should be programmed to drive more cautiously than human drivers (7)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q6.3 We are interested in your views on how self-driving vehicles might be controlled when driving. How much do you disagree or agree with the following statements?

- SDVs should always drive themselves without needing or allowing intervention from a human driver (6)
- If I was riding in an SDV I would want to be able to take over the driving if I felt I could handle the situation more safely (9)
- If I was riding in an SDV I would want to be able to take over the driving for my own pleasure sometimes (10)
- If I was riding in an SDV I would want to be able to take over the driving in order to have more control (e.g. to park exactly where I like) (11)
- I worry that SDV riders would not be able to react quickly enough if asked to take control while the vehicle was moving (8)
- I'd be glad to let the SDV take care of the driving so that I could make better use of the time (12)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q6.5 We are interested in your views on how self-driving vehicles might be controlled when driving. How much do you disagree or agree with the following statements?

- SDVs should always drive themselves without needing or allowing intervention from a human driver (5)
- If I was riding in an SDV I would want there to be a human driver capable of taking control if it was necessary (2)
- I worry that SDV riders would not be able to react quickly enough if asked to take control when moving (3)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q6.6 Road users have to interact with other road users as they travel. In each of the following roles, would you be more comfortable interacting with self-driving vehicles or interacting with human-driven vehicles? Please use the slider to position yourself on the scale.

	More comfortable with SDVs	More comfortable with human-driven vehicles
As a pedestrian, or wheelchair user, crossing a suburban road with light traffic ()		
As a cyclist, riding on a rural road ()		
As a cyclist, riding on a narrow suburban street ()		
When driving a conventional vehicle, being overtaken by a vehicle ()		

Q6.7 Road users have to interact with other road users as they travel. In each of the following roles, would you be more comfortable interacting with human-driven vehicles or interacting with self-driving vehicles? Please use the slider to position yourself on the scale.

	More comfortable with human-driven vehicles	More comfortable with SDVs
As a pedestrian, or wheelchair user, crossing a suburban road with light traffic ()		
As a cyclist, riding on a rural road ()		
As a cyclist, riding on a narrow suburban street ()		
When driving a conventional vehicle, being overtaken by a vehicle ()		

Q6.8 Road users have to interact with other road users as they travel. In each of the following roles, would you be more comfortable interacting with self-driving vehicles or interacting with human drivers? Please use the slider to position yourself on the scale.

	More comfortable with SDVs	More comfortable with human-driven vehicles
As a pedestrian, or wheelchair user, crossing a suburban road with light traffic ()		
As a cyclist, riding on a rural road ()		
As a cyclist, riding on a narrow suburban street ()		

Q6.9 Road users have to interact with other road users as they travel. In each of the following roles, would you be more comfortable interacting with self-driving vehicles or interacting with human drivers? Please use the slider to position yourself on the scale.

	More comfortable with SDVs	More comfortable with human-driven vehicles
As a pedestrian, or wheelchair user, crossing a suburban road with light traffic ()		
When driving a conventional vehicle, being overtaken by a vehicle ()		

Q6.10 Road users have to interact with other road users as they travel. If you were a pedestrian, or wheelchair user, would you be more comfortable interacting with self-driving vehicles or interacting with human drivers when crossing a suburban road amidst light traffic?

	More comfortable with SDVs	More comfortable with human-driven vehicles
Please use the slider to position yourself on the scale. ()		

Start of Block: Governance

Q7.1 Now we would like to ask what you feel about the potential introduction of self-driving vehicles. How much do you disagree or agree with the following statements?

- SDVs will never really work on public roads (11)
- SDVs are coming whether we want them or not (2)
- I don't trust the companies developing SDVs to make sure they are safe (3)
- Our economy will suffer unless we are at the forefront of SDV development (10)
- We have no option but to trust that SDVs will work properly (7)
- SDVs should only be introduced if they have support from a clear majority of the public (12)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q7.2 Who should decide on the rules of the road for self-driving vehicles, and the rules governing how human drivers and self-driving vehicles should share the road? How much do you disagree or agree with the following statements?

- Local governments should make the decisions about which roads SDVs should be allowed to use (4)
- SDVs should be regulated by the federal government (1)
- Self-driving technology is too complex for government agencies to understand and to regulate (2)
- SDVs should be regulated by the technology companies that understand them (3)
- There should be international standards regulating self-driving technology (5)
- SDVs will be smart enough to abide by different regulations in different countries (6)
- We should standardize the driving environment internationally, to make it easier for SDVs to work everywhere (11)

Answers (one per each statement):
(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q7.3 Who would you have confidence in when it comes to making decisions about the introduction and regulation of SDVs?

- The companies developing the technology (1)
- Academic experts (2)
- Federal government (3)
- International standards bodies (4)
- Local governments (5)
- The public (7)
- Road safety and sustainable transport campaign groups (8)
- Vehicle owners clubs (e.g. AAA) (9)

Answers (one per each statement):
(1) No confidence
(2) A little confidence
(3) Medium confidence
(4) High confidence

Start of Block: Collisions and rules module

Q8.1 If a self-driving vehicle is involved in a collision, what should happen next? Currently, the State driver's handbooks expect that if you are involved in a collision you should provide your name and address and registration number to others involved.

- Occupants of the SDV were not driving and so should be free to leave the scene (10)
- Any occupants of the SDV should have the same duties as drivers do under State law (9)
- All of the data stored by the SDV and its operator must be made available to accident investigators (4)
- The SDV should be banned from the road until after a full investigation has been completed (1)
- An independent regulator should have the authority to ban from the road all SDVs of the same type until a full investigation has been completed (3)
- Issues such as what to do in a collision involving SDVs are just minor problems that will soon get resolved (11)

Answers (one per each statement):
(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q8.2 We are interested in your views about the rules of the road. How much do you disagree or agree with the following statements?

- To drive well, drivers sometimes have to use common sense instead of just following the State driver's handbook (17)
- In some situations, if a driver obeyed the State driver's handbook they would never make any progress on the road (16)
- Being considerate to other road users is as important as following the formal rules of the road (21)
- Drivers need to break the formal rules of the road in some situations (22)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q8.3 We are interested in your views about what rules might be needed for self-driving vehicles. How much do you disagree or agree with the following statements?

- SDVs should stick to the formal rules of the road in all situations (3)
- SDVs would be limited in how well they drive because they lack the common sense of human drivers (6)
- SDVs should be allowed to break the formal rules of the road in some situations (4)
- The companies behind SDVs must always be able to explain the actions taken by their vehicles (14)
- SDVs should be more considerate than human drivers towards other road users (15)
- If there are enough SDVs driving strictly by the rules, human drivers should be expected to drive strictly by the rules too (19)
- Human-driven vehicles and SDVs should not share the same stretch of road (20)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Start of Block: Interactions using unsignalled crosswalks module

Q303 We are interested in your views on how SDVs might share the road with pedestrians and cyclists. How much do you disagree or agree with the following statements?

- SDVs would be dangerous for pedestrians (6)
- SDVs would be safer than human drivers for pedestrians (7)
- Roads used by SDVs should have barriers to ensure pedestrians don't get in their way (8)
- SDVs would be dangerous for cyclists (1)
- SDVs would be safer than human drivers for cyclists (2)
- Cyclists and SDVs should not share the same stretches of road (3)

Answers (one per each statement):
(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q305 In many cities and towns pedestrians can use unsignalled crosswalks: that is, crosswalks without traffic signals to stop vehicles for them. Regulations vary in different states, but vehicle drivers are expected to slow down or stop to let people cross. How much do you agree or disagree with the following statements?

- It helps when the people involved can communicate with gestures in these sorts of situations (5)
- It helps when the people involved can make eye contact in these sorts of situations (3)
- It would be better if people only crossed at fully signalled crosswalks (6)
- Crosswalks with traffic lights should replace unsignalled crosswalks to help SDVs know when people need to cross the road (1)

Answers (one per each statement):
(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q306 Continuing to think about how SDVs might interact with other road users in situations like unsignalled crosswalks. Please read the following pairs of statements. For each pair, please select a point on the scale to show how much closer your view is to one of them than the other. If you agree/disagree with both equally strongly, please select the middle point.

	1	2	3	4	5	
SDVs need to 'understand' the intentions of people at the side of the road when approaching unsignalled crosswalks	o	o	o	o	o	As long as they don't hit other road users it doesn't matter what SDVs 'understand'
Pedestrians at unsignalled crosswalks should adapt their behavior to help SDVs	o	o	o	o	o	Pedestrians should not have to change their behavior in these environments to help SDVs
It would be harder interacting with SDVs than with human drivers at unsignalled crosswalks	o	o	o	o	o	It would be easier interacting with SDVs than with human drivers at unsignalled crosswalks
SDVs would be able to cope well with the variety of pedestrian behavior at unsignalled crosswalks	o	o	o	o	o	SDVs would struggle to cope with the variety of pedestrian behavior at unsignalled crosswalks
Pedestrians would want to communicate with SDVs just as they communicate with human drivers	o	o	o	o	o	Pedestrians would get used to SDVs and not mind if they could not communicate with them

Start of Block: Data and surveillance module

Q11.1 Some insurance companies offer reduced premiums if drivers install and use telematic devices or programmes on their smart phones that track the driver's behavior on the road. Which of the following best fits your view?

- I have a telematic tracker and find it useful (1)
- I have a telematic tracker but don't find it useful (2)
- I don't have a telematic tracker but would do if offered (3)
- I don't have a telematic tracker and would not take one up if offered (4)
- I don't have a car (9)
- I'm not sure (10)

Q11.3 Self-driving vehicles could navigate the road better if they know who else is on or near the road, like cyclists or pedestrians, as well as human-driven vehicles. This might need those others to carry sensors, or their phones, so that they can be detected and tracked. How much do you disagree or agree with the following statements?

- Human-driven vehicles should be required to share their location data to help the traffic flow (1)
- Pedestrians and cyclists should be required to share their location data to help the traffic flow (6)
- Other road users should not have to share their location data to help SDVs (10)
- Human-driven vehicles should be required to share their location data to help improve road safety (7)
- Pedestrians and cyclists should be required to share their location data to help improve road safety (8)
-

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q11.4 The sensors and cameras on today's new vehicles, and on any future self-driving vehicles, will generate a lot of data. Would you be against or for the following ways of using such data?

- All such data should be anonymised so that it does not identify other road users (3)
- This data should be used like speed cameras as evidence to prosecute other road users who break the rules (2)
- This data should be used to provide ratings of other drivers which would increase or decrease their insurance premiums (4)

Answers (one per each statement):

(1) Strongly against
(2) Against
(3) Neither against nor for
(4) For
(5) Strongly for
(6) Don't know

- This data should be used to provide ratings of your driving, which could be used to decrease (or increase) your insurance premiums (5)
- When an SDV generates new data, such as map updates or detection of new hazards, this information should be shared between SDV companies and not kept private (15)

Answers (one per each statement):
(1) Strongly against
(2) Against
(3) Neither against nor for
(4) For
(5) Strongly for
(6) Don't know

Q11.6 Continuing to think about the data that might be used by self-driving systems, imagine you are riding in a self-driving vehicle on a long journey. If you share your health data, the vehicle could report if you fall sick, and maybe even drive you to hospital. Would you be against or for sharing this data with the vehicle operator in this situation?

- Sharing your health data so that the vehicle operator can monitor your health (1)

Answers:
(1) Strongly against
(2) Against
(3) Neither against nor for
(4) For
(5) Strongly for
(6) Don't know

Q11.7 Continuing to think about the data that might be used by self-driving systems: while riding in a self-driving vehicle, the vehicle operator could show advertisements to you to reduce the cost of your trip. To do this effectively, operators might want your web browsing history and other personal data. Would you be against or for sharing this with the vehicle operator in this situation?

- Sharing data to enable targeted advertising that might reduce the cost of your trip (6)

Answers:
(1) Strongly against
(2) Against
(3) Neither against nor for
(4) For
(5) Strongly for
(6) Don't know

Start of Block: Other robots module

Q12.1 Self-driving vehicles use artificial intelligence to perceive and operate within the world around them, as robots do too. We are interested in your views on different areas where robots and artificial intelligence systems are being used. To what extent do you disagree or agree with the following statements?

- Robots are necessary as they can do jobs that are too hard or too dangerous for people (2)
- Robots are a good thing for society because they assist people (3)
- Robots are a bad thing for society because they take away some people's jobs (4)

Answers (one per each statement):
(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q12.2 How uncomfortable, or comfortable, are you with the idea of a robot doing the following jobs?

- Having a robot providing services and companionship to elderly or infirm people (3)
- Having a medical operation performed on you by a robot (4)
- Having a robot help you with jobs in your home or garden (12)
- Being driven as a passenger in a self-driving cab (or so-called 'robo-taxi') (13)
- Robots carrying out much of the work in factories (14)

Answers (one per each statement):

(1) Totally uncomfortable
(2) Quite uncomfortable
(3) Neither uncomfortable nor comfortable
(4) Quite comfortable
(5) Totally comfortable
(6) Don't know

Q12.4 Artificially intelligent (AI) systems are increasingly used to interpret large amounts of information and make decisions based on that information. How uncomfortable, or comfortable, would you be with AI systems making these decisions about you or other people?

- Having your medical conditions diagnosed by an AI system Having your medical conditions diagnosed by an AI system analysing your scans (9)
- Having a decision on people's loan or insurance applications made by an AI system (10)
- Replacing some conventional classroom teaching by having AI systems managing online learning for children (2)
- AI systems deciding whether applicants are eligible for government benefits (11)
- Being driven as a passenger in a vehicle entirely controlled by an AI self-driving system (14)

Answers (one per each statement):

(1) Totally uncomfortable
(2) Quite uncomfortable
(3) Neither uncomfortable nor comfortable
(4) Quite comfortable
(5) Totally comfortable
(6) Don't know

Q12.6 Focusing on artificially intelligent (AI) systems in self-driving vehicles: please read the following pairs of statements. For each pair, please select a point on the scale to show how much closer your view is to one of them than the other. If you agree/disagree with both equally strongly, please select the middle point.

	1	2	3	4	5	
AI will one day be better than human intelligence for the task of driving	o	o	o	o	o	AI will never be better than human intelligence for the task of driving
It's OK if the decisions an SDV AI system took in a particular situation cannot be fully explained	o	o	o	o	o	It's essential that the decisions an AI system took in a particular situation can be fully explained
SDV developers should be required to make public the full details of how their AI systems work	o	o	o	o	o	SDV developers should be allowed to keep private the details of how their AI systems work

Start of Block: Attitude correlates

Q13.1 Next, we are asking for your opinions about technology in general. To what extent do you disagree or agree with the following statements about technology?

- Science and technology make our way of life change too fast (1)
- We have no option but to trust those governing science (2)
- Overall, science and technology are making our lives healthier, easier and more comfortable (3)
- The idea of artificially intelligent robots is scary (4)
- New technologies are all about making profits rather than making people's lives better (5)
- I am worried about where all this technology is leading (6)
- Machines are taking over some of the roles that humans should have (7)
- When my safety is involved I'm happy to rely on technology (8)
- Scientists know best what is good for the public (9)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q13.3 Now we'd like to ask about how you feel about driving and about your car. Please read the following pairs of statements. For each pair, please select a point on the scale to show how much closer your view is to one of them than the other. If you agree/disagree with both equally strongly, please select the middle point.

	1	2	3	4	5	
I only drive because I have to	o	o	o	o	o	I enjoy driving
I like to understand how my car's engine works	o	o	o	o	o	I don't care how my car's engine works as long as it gets me where I'm going
I find driving easy	o	o	o	o	o	I find driving difficult
I don't care what car I'm in, it's just a car	o	o	o	o	o	My car says something about me
I prefer to be the driver	o	o	o	o	o	I prefer to be a passenger
I have no interest in cars	o	o	o	o	o	I'm a car enthusiast
Having ready access to a car is important to me	o	o	o	o	o	Having ready access to a car is not important to me

Q13.5 Next, we would like to ask you for your opinions about society in general. In politics people sometimes talk of 'left' and 'right'. Where would you place yourself on this scale?

	Left	Neither left nor right	Right
Please place yourself on the scale ()			

Q13.6 There are many different views as to what makes a society fair or unfair, and what societies should do with respect to such matters. How much do you disagree or agree with the following statements?

- Big business takes advantage of ordinary people (4)
- Politicians don't care what people like me think (6)
- People who break the law should be given stiffer sentences (7)
- There is one law for the rich and one for the poor (8)
- Young people today do not have enough respect for traditional American values (9)
- It is more important for young people to have independence than respect for their elders (10)
- Government should redistribute income from the better off to those who are less well off (11)
- I'd rather put my trust in the wisdom of ordinary people than the opinions of experts (13)
- Many times I feel that I have little influence over the things that happen to me (14)
- Most recipients of Government benefits deserve the support they get (15)

Answers (one per each statement):

(1) Strongly disagree
(2) Disagree
(3) Neither disagree nor agree
(4) Agree
(5) Strongly agree
(6) Don't know

Q13.8 How did you vote in the 2020 presidential election?

- ○ I did not vote (4)
- ○ Trump (2)
- ○ Biden (3)
- ○ Other (5)
- ○ I was not eligible to vote (1)

Start of Block: Back end socio-demographics

Q14.1 Finally we have a few factual questions about you.Do you have any disabilities or any other issues affecting your mobility that prevent or hinder you from travelling by any of the following modes? Please tick all that apply.

- ☐ No, none (5)
- ☐ Walking (1)
- ☐ Cycling (2)
- ☐ Driving myself (3)
- ☐ Public transport (4)
- ☐ Yes, but not covered by the above (6)

Q14.2 Please describe your disability or mobility issue.

_____

Q14.5 Which of the following options best describes where you live?

- ○ In/near the centre of a city (1)
- ○ In the suburbs of a city (2)
- ○ In/near a town (4)
- ○ In a village or rural area (3)

Q14.7 What is the highest level of school you have completed or the highest degree you have received?

- ○ Less than high school degree (1)
- ○ High school graduate (high school diploma or equivalent including GED) (2)
- ○ Some college but no degree (3)
- ○ Associate degree in college (2-year) (4)
- ○ Bachelor's degree in college (4-year) (5)
- ○ Master's degree (6)
- ○ Doctoral degree (7)
- ○ Professional degree (JD, MD) (8)

Q14.8 Please indicate your occupation.

- ○ Management, professional, and related (1)
- ○ Service (2)
- ○ Sales and office (3)
- ○ Farming, fishing, and forestry (4)
- ○ Construction, extraction, and maintenance (5)
- ○ Production, transportation, and material moving (6)
- ○ Government (7)
- ○ Retired (8)
- ○ Unemployed (9)