Public and stakeholder research: Interim Report

Date: May 2018

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Executive summary

FLOURISH is a multi-sector collaboration, helping to advance the successful implementation of Connected and Autonomous Vehicles (CAVs) in the UK. As part of the FLOURISH project, OPM Group ran its second of three waves of fieldwork over December 2017 and January 2018, which was comprised of:

- **Six focus groups** with members of the public (60 participants). Our sampling approach for the groups achieved a mix in terms of driving status, age, gender, geography and socioeconomic background. Our sample also sought the views of those with mobility needs and carers.
- **Four in-depth stakeholder telephone interviews** with backgrounds/expertise in community transport, transporting planning, and road safety.

Groups with the public

Awareness of driverless vehicles and initial reactions

Most participants across all of the groups had heard about driverless vehicles. Many reported that they had seen regular news items about them being trialled, and a few reported seeing documentaries and publicised incidents of crashes. Several participants across all groups (including non-drivers) had an awareness of existing similar technologies such as satnavs, assisted parking and autopilot in planes. Participants often used these to help them make sense of driverless vehicles.

The initial reactions to driverless vehicles across the groups was more often sceptical and dubious than positive, with many asking questions or expressing concerns about their safety and viability. The exception to this was in the group made up of people with mobility issues, who were the most immediately positive about the driverless technology and the opportunities for freedom that it could potentially offer them. These findings are consistent with the Wave 1 public group findings.

While many raised questions and concerns linked to the safety and viability of the technology, when it came to the likelihood of using driverless vehicles (should they be deemed to be safe to use), a majority of participants across the groups said that they would be somewhat or very likely to use them. As in the Wave 1 public groups, participants tended to become more positive and more likely to say they would use driverless vehicles over the course of the sessions. The main reason given why participants would be likely to use them is because they would make travel more easy and convenient. For those with mobility issues and non-drivers driverless vehicles offered a superior alternative to existing modes of transport and participants thought they could give them greater flexibility and independence.

The opportunities, benefits and barrier to using driverless vehicles

Participants were asked to explore how driverless vehicles might benefit them (and others), as well as the key concerns and challenges. Key messages are summarised in the table below.

Benefits	Concerns
✓ The ease and convenience of making trips	x Limited control and access to the vehicle should it be rented
✓ The ability to do other activities while travelling, such as eating, drinking or resting	x Taking away the pleasure of driving
✓ Greater freedom and independence, especially for non-drivers	x More congested roads as greater numbers of people begin to use them
✓ Improved traffic flow and shorter journey times, as the vehicles cooperate more effectively	x Tracking information about your movements being shared with friends, relatives and other third parties
✓ The vehicles monitoring the 'vital signs' of users and raising the alarm where health emergencies took place.	x Loss of certain jobs (e.g. taxi drivers) and government income streams (e.g. parking tickets)

Reflections on design and functionality of the vehicles

Across all the groups, the key messages relating to the vehicle design included:

- As in the first wave of groups, a widespread preference for a voice-controlled vehicle, whilst also offering alternative methods.
- A view that driverless vehicles should come in different sizes and shapes. However, there were mixed views about whether they should mimic current driven vehicles or not.
- The importance of driverless vehicles having accessibility features, so that those with mobility issues could get in and out and travel comfortably.
- A widespread request for entertainment functions in the vehicles e.g. tv, a table for eating/drinking/working, the ability to dock your phone or laptop.
- Participants, especially those in the older age groups, requested that the vehicles should have toilets in them.
- Younger participants suggested that the vehicles could make shopping and restaurant recommendations to users, whilst on route. They also suggested that the vehicles could be linked to other technology and data sources to serve you more effectively e.g. your phone and calendar.

Control over the speed and route of driverless vehicles

While some participants across the groups liked having routes suggested to them by the vehicle, a majority in each wanted to have a choice about the routes taken by the vehicle and wanted to be able to override a decision made by the vehicle.

Participants tended to be comfortable with taking slightly longer and less direct routes if it benefited the wider network. However, across all of the groups, there was a strong feeling that once you have entered your appointment time, the vehicle should prioritise getting you there on time, especially for time critical journeys such as going to the airport.

Participants across the groups were largely comfortable with the principle of the vehicle making ongoing decisions about the best speed to travel at. As with the route taken, many suggested that the vehicle's decision making relating to speed should be primarily about ensuring that it reached the destination at the intended time. The speed of the vehicle should also be dictated by safety considerations and by the need to provide a comfortable journey, which could be particularly important for people with health conditions and mobility issues.

Some participants raised questions about whether the driverless vehicle should allow users to be able to make choices that could place the user and vehicle at risk. In the group attended by young people, several drivers felt that choice should extend to being able to drive the vehicle if you felt like it, while in most of the other groups, participants felt that this element of choice and control should be out of scope, as it undermined the safety benefits of driverless vehicles.

Data sharing and the connected vehicle

The general opinion among most participants was that if data is being shared it is essential that they know with whom, and that the receiver should then ensure that the data is being protected accordingly.

Across the groups, regardless of age, participants were distinctly concerned about the risk of important personal details such as contact details, health and financial records falling into the wrong hands, putting them at risk of fraud or personal harm from criminals. Some participants suggested that a password system, clearly marked signs of how a driverless vehicle was being protected by the government or an independent body, and strictly enforced data protection rules would reassure them and give them more confidence to share their data.

The group attended by younger people was the only one to mention the potential for the vehicles to incorporate tailored recommendations and adverts based on user's preferences/habits. They were also the only group to express how the driverless vehicles could connect with other existing technology, for example expecting the car to have access to an individual's shopping list and other apps.

During the groups, participants were asked to explore their comfort with sharing different types of data with different 'characters' in the driverless vehicle network. Key messages are summarised below.

Other cars: Most participants across the groups agreed that sharing data between cars, such as location on the road and current speed, would be essential for the vehicles to function and operate safely. However, most participants still felt that protecting their privacy and being able to make anonymous journeys was important and they would want the choice of not sharing location or route with other vehicles if this data could be linked back to them as individuals.

Relatives, carers and colleagues: Younger participants tended to not want their colleagues and managers to be able to track their whereabouts. By contrast most participants were positive about the idea of sharing location and estimated time of arrival (ETA) data with friends and relatives. Indeed, younger participants noted that they were already doing so through their phones. However, being in control of your privacy settings, including being able to switch off or limit a friends and family tracking function was emphasised by many as being important.

Insurance providers: Participants were asked how they would feel about data, such as names and contact details, logs of what the vehicle was doing at the time of an accident and road footage, being shared with insurance companies in times of an incident or problem. The responses were mainly positive across groups. It was argued that this information would help to clear up what happened and track down who should be held responsible in the first place. However, a few participants pointed out that they would only be happy to share such data if there was an incident. Some were also especially reluctant to share certain sensitive personal data, such as specific health conditions, with insurance providers and mentioned that there would have to be different rules of what data to share depending on whether the car was private or public.

Driverless vehicle operators: There was a general understanding from across all groups that driverless vehicle operators would need certain types of data, such as speed, location and destination of the vehicle, to manage traffic flows accordingly. A few participants noted that they preferred anonymity and that personal details of passengers in the vehicles should not have to be shared with the operators.

Driverless car companies: Most participants did not see a problem with sharing information about general vehicle performance and regarded it as essential information to driverless car companies if the information was used to improve the system and technology of the cars. Sharing personal information, on the other hand, was looked upon as unnecessary and something that would not be required by driverless car companies.

Emergency services: There was a positive reaction among participants from across the groups when being asked to share key data with emergency services that could help them respond to an accident or health emergency. This is consistent with participants' overall concern with their safety and wellbeing when using the vehicles. Participants in one group attended by non-drivers liked the idea of people with longstanding health conditions adding this information to their CAV profiles, which could then become accessible to emergency services should there be an incident.

Stakeholder interviews

Access, affordability and equity

Stakeholders felt that there would be a clear role for the public sector in ensuring that use of the vehicles was affordable and equitable, and that the different groups who stood to significantly benefit, such as older people who cannot drive and those with mobility needs did not lose out. Here several pointed to the risk that if the development and roll-out of driverless vehicles was entirely market-led this could run the risk of limiting access to the technology and exacerbating existing travel inequalities, for example, between the affluent and less affluent and the rural and urban.

When it came to supporting access and affordability a range of suggestions were made. These included, the role for local authorities in potentially setting price caps on using driverless vehicles, the need to subsidise access for those most in need e.g. through mobility credits. There was also felt to be an opportunity for local authorities to simplify and streamline the number of transport contracts and services in any one area, with an improved approach involving multiple partners in an area buying into a service that would be delivered by a single outsourced provider.

Implications for transport providers and highway authorities

It was suggested that connected driverless vehicles offered the promise of far more accurate and comprehensive data about patterns of travel, which could be used by transport planners and commissioners to plan and commission services. As well as analysing travel data, it was suggested that the vehicles could potentially be monitoring and sharing data about air quality in urban spaces as well as scanning the roads for potholes and other signs of wear.

For these benefits to be achieved, it was felt that transport commissioners and other public bodies will need to ensure that there is the right data sharing legislation and contractual arrangements in place to get the data that they need. They will also need to have the capabilities to handle and make sense of this data.

Potential health and wellbeing impacts

It was suggested that driverless vehicles have enormous potential to deliver more affordable, flexible and accessible transport services, including for those who currently struggle to get around due to poor health, mobility needs and living in areas that are not well served by public transport. This could help to tackle loneliness and isolation and help people to take up employment opportunities that might not have been easily accessible before.

Phasing in the vehicles and public acceptability

Several stakeholders felt that there is likely to be a 'mixed economy' of vehicles on our roads for some time. The technical and legislative demands associated with supporting co-existing systems and infrastructure had the potential to be costly and time consuming to develop.

Several speculated that driverless vehicles may initially be introduced on motorways and on key routes such as between city centres and airports. They might also be designed into new towns and cities.

It was suggested that some large-scale demonstration sites would be needed to raise the public acceptability of the technology and that the vehicles may need to achieve levels of safety and reliability that are associated with air travel to be widely accepted.

1.   Introduction

The FLOURISH project has developed in response to Innovate UK's Connected and Autonomous Vehicles Collaboration Research & Development competition. The three-year project, worth £5.5 million, seeks to develop products and services that maximise the benefits of Connected and Autonomous vehicles for users and transport authorities. By adopting a user-centred approach, FLOURISH aims to achieve a better understanding of consumer demands and expectations, including the implications and challenges of an ageing society.

FLOURISH sets out to identify innovative solutions that address two distinct but related topics within the connected and autonomous vehicle (CAV) market which will help to realise market readiness of CAVs:

- Customer Interaction focusing on the customers' needs and experience when using the technology; and

- Connectivity focusing on effective data analytics and ensuring that the cyber security and wireless connectivity elements of CAVs are safe by design.

The project has the following objectives:

1. Develop an understanding and articulation of user needs and expectations of CAVs to maximise the mobility potential they offer.
2. Develop usable adaptive interfaces, performance certification processes, products and services that enable secure, trustworthy and private technology within CAVs.
3. Capitalise on the large volume of data created by CAVs to develop innovative new tools and products.
4. Leverage existing investment in the Bristol City-Region to expand validation and test capabilities in both urban and interurban networked environments and enhance the commercial opportunities this will deliver.

WP3: Understanding user needs and experience

There are several core strands of research in FLOURISH, each contained in a work package (WP). This report is concerned with WP3 which aims to gain an understanding of customers' needs and experiences when using CAVs.

It is anticipated that older adults with ageing-related impairments will be a particular beneficiary of such technology, allowing them to continue to be active contributors to the economy and society. As a consequence, there is a deliberate focus on the needs of this group, hopefully accelerating their ability to become early adopters of CAVs. Alongside older people, it is anticipated that people with some form of mobility need may also benefit from the use of CAVs. We are defining someone as having a mobility need if they require support to get around,

for example, use of a walking aid, wheelchair or scooter, or if they find that they cannot comfortably walk or stand when they are out and about.

To build an understanding of customers' needs and experiences, in each year of FLOURISH, OPM Group are conducting a wave of research and engagement involving members of the public and stakeholders.

OPM Group's research was designed to complement and inform the simulator and pod trials that are being undertaken by University of the West of England and Designability.

> In the second wave of research OPM Group has completed two strands of activity between December 2017 and January 2018:
>
> - **Focus groups with the public**: A series of six focus groups with members of the public
>
> - **Telephone interview with key stakeholders**: Telephone interviews with four stakeholders with backgrounds/expertise in community transport, transporting planning, and road safety.

Aims of the research

This research had the following aims:

- To understand participants' attitudes towards the concept of CAVs including how likely they would be to use them.
- To understand participant's views on the benefits and opportunities associated with the development of CAVs as well as the concerns and challenges that they have.
- To understand how much choice and control users would expect when using the CAVs, including deciding on the speed and routes taken.
- To understand attitudes towards data sharing between different 'characters' in a CAV network such as insurance providers, traffic management systems and emergency services.

1.1.   Methodology

The six focus groups took place in the Ashford (Kent) and Manchester areas over December 2017 and January 2018. We worked with a recruitment agency to secure participants who were offered a cash incentive to take part. We set quotas, covering participants' age and driving status as well as key demographic characteristics such as gender and socioeconomic group.

Further information about participants' profiles in the six groups is presented in Table 1 in the next section of the report.

1.1.1. Coverage of issues

Focus groups

The focus groups used a structured topic guide and sessions were digitally recorded and transcribed. Over the two-and-a-half-hour session we covered the following topics:

- **Introductions:** participants were asked to say where they were based, how they get around and the first three words that come to mind when they hear "driverless vehicles".
- **Likelihood of using a CAV:** participants were asked to say how likely they would be to use connected driverless vehicles if they had been deemed to be safe to use by the government.
- **The benefits and opportunities associated with CAVs:** Having been provided with information about FLOURISH and having watched a short video demonstrating a CAV in operation, participants were asked to explore the likely journeys that they might make using a CAV, how CAVs might benefit wider society as well as any concerns or risks associated with using them.
- **Who rules the road**: Participants were asked to explore how much choice and control they would expect to have over CAVs during a journey, including deciding on the speed of the vehicle and the route taken.
- **Data sharing and the connected vehicle:** This session began by asking participants to identify the different types of data that they shared on a regular basis (e.g. companies and services) and their general attitudes toward this. Next participants were introduced to the different characters in the CAV network. Participants discussed the acceptability and rationale for the different characters sharing different types of data.
- **Likelihood of using a CAV**: participants were asked to revisit the question about the likelihood of using CAVs following the above discussions to understand whether their position had changed and if yes, the reasons why.

Stakeholder interviews

The stakeholder interviews were conducted by telephone and face-to-face and were guided by the use of a topic guide. Interviews lasted 30-60 minutes. The following topics were explored:

- How driverless vehicles could be successfully rolled out in specific areas
- How different population groups (e.g. older people, those with mobility needs) might respond to the development of CAVs
- Data sharing and the connected vehicle
- Accessibility, ownership and insurance

The stakeholders who we interviewed were:

- A transport advisor at the Local Government Association (LGA)
- A senior transport planner with experience of working with Bristol Council

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- A community transport adviser for Devon County Council

- A road and transport safety specialist with experience of working for Highways England

1.1.2. Reading this report

Terminology: to support accessibility, we tended to use the term 'driverless vehicles' within the public focus groups. Throughout this report, we have used driverless vehicles, CAVs and connected autonomous vehicles interchangeably.

Throughout the report, we state where points were raised by participants in particular groups or whether similar points/views were mentioned across the groups.

1.2. About the participants

The table below provides a summary of the profile of participants across the groups. Their views are represented throughout the report, and participants are quoted throughout. Due to the focus of the Flourish project on older adults, we recruited participants in the target audience age group and those who will be at the target age group once the technology is more widely introduced. We also ran one focus group with younger adults to observe if there were any differences in attitudes, particularly around data sharing.

Table 1 on the next page, provides a summary of who attended the groups.

Table 1. Participant profiles

Group 1 Manchester 10 participants	Group 2 Ashford 10 participants	Group 3 Manchester 10 participants
Mix of suburban and rural participants	Mix of suburban and rural participants	Mix of urban and suburban participants
Mix of 70+ and 80+	Mix of 70+ and 80+	50-75 year olds
Current drivers	Mix of those who have given up driving, those driven by someone else, those who have never driven	Mix of current drivers, those who have given up driving, those who have never driven
Gender split, educational attainment and ethnicity broadly in line with age group in the recruitment area	Gender split, educational attainment and ethnicity broadly in line with age group in the recruitment area	Gender split, educational attainment and ethnicity broadly in line with age group in the recruitment area
Recruited from the Manchester area	Recruited from the Ashford area	Recruited from the Manchester area
Mix of attitudes towards/use of technology e.g. the internet	Mix of attitudes towards/use of technology e.g. the internet	Mix of attitudes towards/use of technology e.g. the internet
Group 4 Manchester 10 participants	**Group 5** Ashford 12 participants	**Group 6** Ashford 8 participants
Mix of urban and suburban participants	Mix of urban and suburban participants	Carers of someone who relies on some form of assistive mobility technology
18-35 year olds	At least half of this group aged under 55	
Mix of current drivers, those who have given up driving, those who have never driven	People who rely on some form of assistive mobility technology (e.g. wheelchair, mobility scooter, community transport), at least half of this group aged 55 or under	
Gender split, educational attainment and ethnicity broadly in line with age group in the recruitment area	Gender split, educational attainment and ethnicity broadly in line with the recruitment area	
Recruited from the Manchester area	Recruited from the Ashford area	
Mix of attitudes towards/use of technology e.g. the internet	Mix of attitudes towards/use of technology e.g. the internet	

2.   Initial reactions

2.1.   Initial reactions to connected driverless vehicles: a three-word warm-up

At the beginning of the workshop participants were asked to share the first three words that came to mind when they heard the words **'driverless vehicle'**. This was to understand their initial top of mind attitudes towards driverless vehicles. The words they chose were used as the basis for a brief discussion. Below we set out a word cloud illustrating the most-used words identified by participants across the groups.

Figure 1: What are the first three words that come to mind when you hear the words 'driverless vehicles'?

In most cases the initial reactions were more sceptical and dubious than they were positive, with many asking questions or expressing concerns about the safety and viability of driverless vehicles. The exception to this was in the case of Group 5 which was made up of people with mobility issues. They were the most immediately positive about the driverless technology and

the opportunities for freedom that it could potentially offer them. Their initial responses included words such as 'wow' 'fantastic' 'really?' 'great invention' 'freedom' 'problemless'.

Across all groups many raised questions and doubts about the reliability of technology and 'computers' over manually operated devices, and questions were raised about how failures in the technology could be mitigated. Most groups were also concerned who would be liable were something to go wrong. This was particularly the focus of discussion in Group 3 which was made up of older people and consisted of a mix of drivers and non-drivers.

Futuristic – not in my lifetime

As can be seen in the word cloud in Figure 1 above, the most common word that people across groups thought of upon hearing the words 'driverless vehicles' was 'futuristic', similarly some said that it was like 'sci-fi' where a couple of participants (across two separate groups) made references to the specific film: 'Total Recall' (set in the future and featuring driverless cars). This sentiment was not dependent on age, and 'futuristic' was also one of the most popular words used in Group 4 which was attended by younger participants.

Generally, participants had the impression that driverless cars were far from being introduced and therefore that the current older population would not see the benefits of the technology, even though they understood that Flourish was aimed at this demographic. Many participants who felt that these vehicles were a faraway reality also felt that driverless vehicles were 'strange' or inconceivable and several commented that they would find it 'weird' to be in a car that was not driven by a human, commenting that it would be 'ghost-like' and could make them feel out of control.

> *"It's obviously for the future, well into the future. How would they roll it out? I think it sounds really impossible." Participant from Group 3*

Several others had the view that driverless vehicles were the inevitable next step in technology and that driverless vehicles would follow in the same way that other new technology that had been introduced and adopted within their lifetimes, such as computers and mobile phones.

> *"Many years ago, the first vehicle on the road was a steam car. The second vehicle was a petrol car. … Think about today; you've got street cars going terribly fast. I think as far as these driverless cars; they are inevitable, they will come in generations to come, and I think it's a good idea that we're thinking about this for our children." Participant from Group 2*

Safety and reliability

There were many participants across all groups who found the idea of driverless vehicles 'dangerous' and 'scary'.

> *"The first thought that came into my head was terrifying. I can't understand the technology of it all." Participant from Group 2*

As in Wave 1, participants were very concerned about the reliability of the technology, in a world where they had to become increasingly reliant on it. This was specifically mentioned in Group 3 with older people and in Group 6 with carers. Participants seemed to be more comfortable relying on human drivers, whose instincts and judgements they felt were more trustworthy. Their concerns included the safety as a passenger, the risk of breakdown and accidents as well as the decisions that the driverless vehicle would make in reaction to obstacles on the road.

"Say you were driving to school and passed a playground with kids playing with balls. You instantly slow down, but you are looking. Something could catch your eye, such as kid with a ball that might come here. You have more consideration. If you have sensors on the car, can it sense that that kid has a ball, the ball is going to go and the kid is going to run into the road?" Participant from Group 6

"My thing is, you can't predict when an accident is going to happen. You can't use a computer to predict when an accident is going to happen." Participant from Group 6.

When discussing reliability issues with the technology, several mentioned that they had read about crashes of driverless vehicles during test trials[1], although some in Group 1 (older drivers) and Group 4 (younger people) felt more confident that by the time the cars would be on the market they would be safe. Participants across most groups commented that driverless vehicles would be safer than human drivers, and some said that this would be safer than relying on taxis.

Participants in Group 4 (with younger participants) were particularly aware of the promise that driverless vehicles were supposed to be safer. Despite this, participants in this group were not initially positive overall about driverless vehicles. Their concerns related less to safety but more about driverless vehicles not being of personal benefit to them. They felt that driverless vehicles would be slower, cause more traffic, or would be too expensive for them to see a benefit from them.

Phasing in driverless vehicles

An initial concern, which remained throughout the workshop across all the groups was about what would happen during the transition period when there were both driverless and non-driverless cars on the road. In most cases this is where participants had the most safety concerns.

"What happens in the transition phase when there are driverless and non-driverless cars on the road. 'the mixture of computers and people making decisions is worrying." Participant from Group 2

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[1] Please note that these focus groups were held before the Uber self-driving car tests fatality

"It's the other idiots that I'm worried about on a motorway." Participant from Group 1

It was also common to raise concerns about the wider infrastructure that would be needed to support driverless vehicle technology and whether this was viable. For example, participants in Group 3 asked about how the cars would navigate themselves on thin, winding country roads and on complex motorways, and some asked how they could be used when driving abroad and whether this might be impacted by Brexit.

"How will it work when you drive outside the boundary of the UK?" Participant from Group 3

Participants in Group 2 queried how the cars would get out of tight parking spots. Other logistical questions raised included whether the cars would be electric, how long they would run for on a single charge, and how they would be charged.

Loss of control

Participants across several groups were worried about how the cars were controlled and who ultimately controlled them. Most groups felt that a driverless car might make people feel like they had experienced a loss of control.

"Computers are our slaves, well they are supposed to be. We're not slaves to them." Participant from Group 2

"I'm not in control, I don't have the break." Participant from Group 6

Who is to blame?

While insurance and liability initially came up in several groups, this was a key focus of discussion for Group 3. This group queried who would be responsible when something went wrong (such as an accident or skidding on ice), for example whether it would be the passenger, the car manufacturer, or (as in the case of ice on the road) the council. They also questioned what decisions the car would be programmed to make in these cases.

"Does it preserve the passenger's life, or does it crash into a queue of schoolchildren?" Participant from Group 3

"People who get in driverless cars but are not driving it themselves, they haven't been on the road, they don't know about cars, they haven't done the hazard [test], so can anyone drive in a car?" Participant from Group 6

Accessibility

Participants in Group 5 and 6 (those with mobility issues and carers respectively) immediately identified the possibilities for increased freedom that the driverless vehicles could offer users, although they did raise concerns about how the car would be designed and wanted to ensure that they would be able to get in and out of the car easily and that there would be space for a wheelchair.

2.1.1.   Levels of awareness and knowledge

Most participants across all the groups had heard about driverless vehicles across different news and media formats. Many had seen new items about driverless vehicles being trialled in other countries or had seen documentaries, and some focussed on publicised incidents of crashes.

Several participants across all groups (including nondrivers) had an awareness of existing technologies that had similar features to driverless vehicles, such as satnavs, autopilot in planes, and traffic and parking sensors, as well as Uber and other taxi services which gave context for how the service might work. In some cases, this reinforced that the driverless vehicles were the likely next step, yet in others it strengthened concerns about the unreliability of technology given their own experiences, for example using unreliable satnavs.

Some felt that driverless vehicles were for a younger age group who were more accustomed to new technologies. As in Wave 1, participants discussed that a level of technological literacy would be needed to operate the vehicles, and so education and training would be needed to teach people how to use them, particularly for those in the older generation.

> *"The comment from my grand-daughter was that eventually her age and her children's age will be brought up with them, whereas we elderly people don't understand. I think children are born with fingers that can touch buttons these days." Participant from Group 2.*

2.2.   Likelihood of using

Having given their initial views on connected driverless vehicles, focus group participants were asked to say how likely or unlikely they would be to use them if they had been deemed safe to use by the government.

To help them to make sense of this question, the facilitator compared driverless vehicles in this hypothetical scenario to products like microwaves and mobile phones, which may have been unfamiliar and novel when they were first introduced to consumers. Views varied, but more people felt that they were unlikely to use a driverless vehicle than those that felt that that were likely to do so. Most participants seemed to be unsure, not deciding strongly one way or the other.

Changes in Likelihood

Where there was sufficient time in the session, participants were asked at the end of the workshop whether they would be likely to use driverless vehicles to see if their opinion had changed after having discussed the topic in greater detail. Participants were asked to share on a scale of 1-10 how likely they would be to use driverless vehicles. All groups that were asked seemed to be more likely to use driverless vehicles than they had been at the start of the session. Results are listed in the table below.

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Table 2. Likelihood of using driverless vehicles

	1 Very unlikely	2	3	4	5 Unsure	6	7	8	9	10 Very likely
Group 1: Manchester, drivers					2			2	3	2
Group 2: Ashford, non-drivers	3	1		1	1	2	1		1	
Group 3: Manchester, older people			2					1	5	
Group 4: Manchester, younger people					1	1	2	3	4	
TOTALS	**3**	**1**	**2**	**1**	**4**	**3**	**3**	**4**	**13**	**2**

2.2.1.   I would be likely to use driverless vehicles

The main reason given why participants would be likely to use driverless vehicles is because they would make travel more easy and convenient. For example, many noted that they would no longer need to park or that they could do other things during the journey. For those with mobility issues (Group 5) and non-drivers (Group 2) driverless vehicles offered a superior alternative to existing methods of transport and could give them greater independence and freedom to make journeys more spontaneously and more often.

"I would definitely use it, I've never driven in my life, and I think I would feel quite safe, providing you had training with an experienced person first." Participant from Group 2

"It's better than coach and rail because of comfort, flexibility and autonomy; you have control over your own journey" Participant from Group 2

The benefits that participants felt that using driverless vehicles could offer them are further discussed in **Section 3.1**

2.2.2. I am unsure as to whether I would use driverless vehicles

Some participants had outstanding questions and concerns which left them feeling unsure about whether they would use a driverless vehicle. Although, some participants felt that, as with lots of technology, they were an inevitability.

Costs

There were a lot of questions across the groups surrounding costs, and a few struggled to answer whether they would be likely to use the driverless vehicles without having more clarity on this. Several suggested that the technology might start out expensive and then get steadily cheaper. Many assumed that the technology would be expensive and a few asked how driverless cars could be made available to older people or those with mobility and health issues and suggested that the NHS could not afford it.

Training

Participants across most groups felt that a high level of computer literacy would be needed to use the driverless vehicles. They felt that there should be formal training and some suggested that this should culminate in a test and a licence. This was raised as a key concern for older people who were less confident with technology and was seen as a possible barrier to adoption by all groups (including the younger participants in Group 4).

> *"TV is supposed to be simple, but I have to put tape on the remote so that my grandma knows what buttons to press." Participant from Group 4*

Others wanted more information surrounding **ownership**. These concerns are discussed in further detail in **Section 3.2**.

2.2.3. I would not use driverless vehicles

Across the groups, three main themes emerged for participants who said that they would be unlikely to use driverless vehicles. These were lack of trust in the technology, their concern about losing control and their doubts that driverless vehicles would provide any added benefit.

Lack of trust in the technology

Those participants who were less likely to use driverless vehicles were often fearful or did not trust the viability of the technology and were concerned that something would go wrong and so wanted to maintain control over the vehicle. A few of the participants in Group 2 attended by older non-drivers had little interest in using driverless vehicles since the concept and technology was so novel and untested at this stage.

> *"At this stage, I just don't think this sort of thing would be for me - it's just too much of a jump. There isn't a lot that would encourage me." Participant Group 2*

"Computers crash in the home, even now. So you are going to be relying on technology that is not reliable. Particularly in a modern car. It goes wrong. So we are going to be depending on that- that scares me." Participant Group 3

As an exception, those participants in Group 4 (with younger participants), who were untrusting of the technology, were only *unsure* about whether they would use driverless vehicles; they did not dismiss using them entirely. This suggests that on the whole the younger demographic was more comfortable adopting new technologies that they may not fully trust, as they believed that to be available on the market, they must be safe to use.

Concern about losing control

"I think everybody who had driven for a number of years would feel that they'd lost that independence of their own control of the vehicle." Participant from Group 2

Some participants across all groups expressed reservations for adopting driverless vehicles as they would still want to be in control of or involved with the driving process, including where they are going and how, as well as the speed and route.

Some said that they would be much more likely to use driverless vehicles if they were able to take control of the vehicle when they wanted.

"I'd like to be involved I think with the driving, rather than switch off completely." Participants from Group 4

Doubts about the added benefit

"It's like a taxi without a driver, it isn't going to make a difference." Participants from Group 4

"It also takes an older person a lot longer to get to grips with new technology, so is it really going to benefit them?" Participants from Group 3

Some participants felt that this technology would not be of additional value to them over existing methods of transport, such as taxis, or mobility scooters. They also felt that this technology may not benefit the older population who would take longer to learn something new than use something existing.

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3. The opportunities, benefits and concerns associated with using connected driverless vehicles

This session began with participants reviewing some further information about the FLOURISH programme and the vision as well as key assumptions and terminology being used, for e.g. the definition of the connected autonomous vehicle and assumptions underlying the conversation (e.g. level 5 autonomy). Next participants watched a short video of a partially sighted man using a driverless vehicle to build their understanding and bring the information to life[2].

Following this, participants were asked to explore how driverless vehicles might benefit them (and others), as well as any remaining concerns.

3.1. Benefits

Overall, participants across all of the groups felt that the main benefit of driverless vehicles was the convenience that they could offer. They liked the idea of being brought to the front door of a building and of not having to think about parking. When it came to parking, many also assumed that they would no longer have to pay for parking. Participants also identified a range of activities that they would wish to be able to do in the car if they did not need to be driving. This included sleeping, eating and drinking, working and watching tv. As mentioned previously, many also emphasised again that driverless vehicles were a superior form of transport compared with other forms of public transport. A more detailed overview of the benefits that participants identified follows below. Themes are set out in order of which were raised most often across the groups.

Convenience

Participants suggested that using driverless vehicles would be more convenient when going to visit friends and family, going shopping, getting to and from the airport or hospital. Many commented that being able to be taken right to the entrance of a building would be particularly beneficial, especially for those with mobility issues. A few participants (all drivers) identified that driverless vehicles could free them up from giving lifts to those that cannot drive including children and those with mobility issues.

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[2] The video can be found here: https://www.waymo.com/

"It can save me dropping off my grandson to work twice a week – he can get one of them!" Participant from Group 1

"It would be worth it for the convenience. Wouldn't have to fill up with petrol." Participant from Group 1

Releasing productive time

Participants in all groups liked that they would be able to do other activities while in the vehicle, and all gave examples of what they would do. This included watching TV, doing makeup, eating, sleeping, reading and doing crosswords. They saw this as a particular benefit for longer journeys, as they could make better use of that longer driving time.

Greater independence

For non-drivers across all groups and those with mobility issues (Group 5), driverless vehicles were seen as an opportunity for greater independence. Those in Group 5 were specifically interested by the fact that the driverless vehicles could allow for them to be mobile without the need to rely on their carers. They mentioned that it would be great to be able to take a day out without their carers and to independently visit their friends. They also mentioned that it would allow them to better support others, such as providing company for ill friends. One participant in Group 5 mentioned that manual driving was physically strenuous for them and that a driverless vehicle would allow them to make longer journeys.

"For me it would give me my independence back because I can't stand getting the bus or Metrolink. For someone used to being independent it is difficult." Participant from Group 3

Many participants who were able to drive and who did not have mobility issues also identified increased independence for those who do not drive as a key benefit.

An alternative to public transport

Some participants in Group 2 (attended by non-drivers), stated that driverless vehicles were an appealing alternative to the public transport options that were currently available to them. This included journeys to get to work or further afield, for example for holidays. In a few groups participants felt that driverless vehicles would be a better form of public transport than a taxi, as they would not rely on a driver who may take indirect routes to make more money. Some also suggested that there were safety risks associated with using taxis, especially when travelling alone. The poor public transport options (e.g. buses with limited timetables and choice of routes) made the driverless vehicles more attractive to this group.

Improved traffic flow and faster journey times

Participants in Groups 2 (non-drivers) and 3 (older people) commented that the use of driverless vehicles would make for a smoother traffic flow, as all cars would be driving at the same speed

and could automatically avoid road traffic accidents and other things that could cause slower journey times. They felt that this would decrease congestion overall and lead to more efficient journey times.

> *"The traffic flows because people are driving at the same speed. It would be the same with driverless cars, they would ensure equal gaps between vehicles." Participant from Group 3*

Participants in Group 4 (younger people), were also supportive of the fact that driverless vehicles would lead to less road traffic accidents.

Monitoring health and wellbeing of users

Participants in most groups thought that it was a benefit that the car could monitor the 'vital signs' of users and raise the alarm when there were health emergencies. For example, participants in Group 4 attended by younger people thought that the car could know when someone was having a heart attack and so could contact the ambulance in such an event and participants in Group 3 attended by older people suggested that there could be CO_2 detectors which could check if the passenger was breathing. Participants in most groups, including Group 4 attended by young people were happy that the car could be linked up with friends or relatives, especially when it came to the most vulnerable passengers, such as children or older people with dementia. They felt reassured that they would be able to keep track of their loved ones during journeys.

Other

Participants in Group 4 attended by young people anticipated that that they would use a driverless car to avoid drink driving and better enable socialising. Additionally, participants in Group 6 attended by carers said that that would use driverless cars to take trips more spontaneously.

3.2.   Concerns

When discussing the benefits of driverless vehicles (as outlined above) many participants also identified concerns which in some cases outweighed the benefits identified, or raised follow up questions. These are described below.

Ownership and shared use of the vehicles

Participants questioned how ownership of a driverless vehicle would work, as this impacted on what they saw as the benefits of driverless vehicles. Many said that they would prefer to own their own car so that it would be available whenever they wanted it and that they could avoid the challenge of entering a vehicle that had been left dirty by the previous user. Some participants, for example in Group 3, wondered if it was shared, who would be responsible for cleaning it or taking it to get fixed.

There was some discussion across groups about the possibility of sharing the vehicles and journeys with others. In some case this was dismissed as something participants would not want. Some specified that it was a key benefit of driverless vehicles to offer them time to be on their own during a commute or other journey, and a few expressed concerns of the safety risks of being in a car with someone that they did not know.

> *"To me, that is an advantage, you don't want to speak to random people." Participant from Group 4*

Some participants were more comfortable with the idea of using driverless cars more flexibly without owning them and compared this to existing services such as bike rental and taxis. They felt that this was more efficient, and they could pay for only what they used. Some also recognised that a shared/ rental model of using the vehicles would lead to less congestion and better utilisation of the fleet of vehicles.

> *"Given the yearly costs of insurance and maintenance [I] only use my car maybe 20% of the time at most. So for 80% of the time it is sitting there being devalued. Whereas, if I didn't own something … you are then cutting down on wasted journeys." Participant from Group 3*

Removing the pleasure of driving

While participants identified that they could make more productive use of their journeys in a driverless vehicle, many participants, particularly in Groups 3 and 4, were initially worried about driverless vehicles removing the pleasure of actively driving. Several participants were concerned that driverless cars would make being in a car boring and lonelier, given the lack of concentration required for driving or the lack of another individual (as in the case of a taxi)

> *"They'll take away the pleasure of driving; the skill, the thinking as you drive." Participant from Group 3*

Increased traffic

Although many felt that driverless cars would improve traffic flow, there was some concern among participants that the introduction of driverless vehicles would lead to more congestion, as participants felt that those who currently don't have cars would start using them.

Privacy

A few participants raised the concern that the cars would always know where they were going and were worried about who this information would be shared with. They said that they would sometimes want the ability to go somewhere without anyone knowing where they were going. It was suggested that if users opted to share their whereabouts with friends and family it could be difficult to then request a phase of travelling anonymity. This will be further discussed in **Section 5.**

Wider concerns

Some participants expressed wider concerns about the use of driverless vehicles. These included a loss of income to the government due to there being no more speeding fines, parking tickets or driving tests. They also identified that there would be a loss of jobs for driving instructors and taxi drivers.

3.3.   Reflections on the design of the vehicles

Participants across all groups gave suggestions about the features that they would like driverless vehicles to have that would be particularly useful to them.

Voice control

As with Wave 1, most groups felt that the cars should be voice activated but a few mentioned that there should be alternatives available to those who have lost their voice or can't speak clearly. A few also felt that voice recognition could be used for identity checking for security purposes.

Sizes and design

Participants felt that the cars should come in different sizes and participants in Groups 5 and 6 (those with mobility issues and carers respectively) wanted to ensure that they could be easily accessible for a wheelchair. They also felt that there should be a mechanism to help people in and out of the vehicle.

There were mixed views about the extent to which driverless vehicles should reflect existing driven vehicles. Some participants in Groups 2 and 4 felt that there should be no steering wheel, as without a driver this was unnecessary and looked strange to them, whereas some participants in Group 4 said that they would want the opportunity to switch to drive manually when they wanted to.

Some participants felt that the car should be able to charge itself, or take itself for repairs when it needed to without human input.

Accessibility

Participants across all groups suggested that the driverless vehicles would need to have accessibility features to ensure that those with mobility issues could easily get in and out of them. Specifically, those in Group 5 felt there was an added benefit that the cars could have greater accessibility as standard, so that people with physical disabilities would not need to pay for more expensive, specially tailored vehicles.

Entertainment options and functionality

Participants wanted driverless vehicles to include entertainment features to amuse them throughout the journey. In many cases they were worried about being bored with the lack of input needed for driving. Suggestions of features included a TV and a table for eating and

drinking, those in Group 4 attended by younger people suggested that there should be a docking station for music. Other features mentioned across groups included a bar and a laptop. It was suggested that the features could be personalised to individuals' requirements.

'If you were on a long journey, you'd get so bored you'd need some sort of interaction"
   Group 2

Participants in Group 4 attended by younger people, were the only group to mention potential advertising opportunities. This group suggested for example that the car give recommendations, telling them which supermarket had the best deals that day (and then taking them to that particular one), or where to go on a day out. They were also the only group to express how the driverless vehicles could connect with other existing technology, for example expecting the car to have access to an individual's shopping list and other apps.

Participants in this group wanted the vehicle to have very accurate information about when it would arrive at the planned destination. This will be discussed in **Section 5**.

Participants, particularly those from the older age groups and the group with mobility needs also mentioned that driverless vehicles should have toilet facilities. It was suggested that this would be particularly useful for longer journeys.

Safety features

Some participants provided suggestions on safety features that should be included within the driverless vehicles. For example, participants in Group 2 felt that there should be visible airbags and those in Group 6 discussed how seat belts should work to ensure that people are wearing them. As in Wave 1, participants again wanted there to be a support line that could be easily called if something went wrong with the vehicle.

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4.　Who rules the road?

Participants were asked to explore how much choice and control they would expect to have over the routes taken by CAVs and the speed at which they travelled at.

4.1.　Vehicle routes

When exploring which routes the vehicle takes, participants were first told by the facilitator that: *Having booked your journey and got into the vehicle, the connected driverless vehicle would draw on available data about things like levels of traffic and road conditions to identify the most appropriate route for you to take.*

Participants were then asked to consider how they felt about the general principle of the vehicle choosing their routes and any circumstances where choice over the route might be more or less important.

Participants across the group liked the idea of the vehicle identifying and selecting the optimum routes to reach a destination in the least possible time. Many participants who were drivers compared this type of functionality to Satnavs, but speculated that driverless vehicles might have even better and more up to date data to draw on when making decisions. It was suggested that driverless vehicles' ability to estimate journey times more accurately could help travellers to avoid miscalculating their journey times and leaving too early for appointments. It would also help to reduce congested roads and traffic jams.

Whilst participants across all the groups liked having suggested routes, a majority in each wanted to have a choice about the routes taken by the vehicle and they wanted to be able to override a decision made by the vehicle. Some felt that this was important because they might have a preferred or more direct route than the one suggested by the driverless vehicle. Other reasons included, wanting to be able to take a more scenic route or to take a route where emergency stops and diversions were easier to accommodate.

> *"I'm not happy for it to choose to start with. Cars aren't right all the time, and I trust my own judgement more. I like to have the destiny in my own hands." Participant from Group 1*

> *"I think you should have some way of choosing the way you want to travel, for instance, if you want to get somewhere very quickly and it's a long journey, you want to go on the motorway, otherwise you might prefer to go along the prettier roads. I certainly think you should be able to choose." Participant from Group 2*

Whilst choice was considered to be important, a few participants suggested that in practice, there would often be circumstances where they would be happy to 'sit back' and defer to the decision-making of the vehicle. In several groups, participants were keen on the idea of being

able to drink alcoholic drinks while using driverless vehicles, and these participants suggested that this was a time when they would be happy to pay less attention to what the vehicle was doing, and allow it to make all of the decisions relating to the journey. Across the groups, participants did not identify any risks or downsides associated with drinking alcohol whilst in a fully autonomous vehicle, although several in Group 3 warned against the risks of overconsuming and making yourself sick.

Participants across Groups 1 and 3 felt that if you paid to use the service, i.e. rent a vehicle, you should not be put at a disadvantage over private owners in terms of the degree of choice and flexibility available to you over route choice and arrival time.

> *"It should be the same benefits whether you rent it, or you own it. Either way, you're paying for service." Participant from Group 3*

By contrast, across the groups there were a few participants who were undecided about the extent to which driverless vehicles should prioritise their occupier's needs over other competing priorities.

Participants were asked whether they would be willing to take a route which benefited lots of users, but which meant that their journey took slightly longer. Overall, participants tended to be comfortable with taking slightly longer and less direct routes, which could lengthen their journey time by around five to ten minutes. However, across all of the groups, participants felt strongly that once you have entered your appointment time, the vehicle should prioritise getting you there on time. Across all of the groups, this was felt to be particularly important for things like health appointments and trips to the airport, where the price of missing the arrival time could be high. When it came to leisure trips and other less urgent appointments, most participants were willing to be more flexible about the route taken and the arrival time.

A few participants across the groups suggested that in cases where the vehicle decided to take a slower and less direct route (which benefited other users/the network as a whole) they would want to have some level of transparency about the decisions made by the vehicle, rather than being kept in the dark about the decisions the vehicle was taking.

> *"I would want to know why the car had slowed down. It could come up on the screen, so you know why it is doing that." Participant from Group 3*

4.2.   Vehicle speeds

When it came to having control over the speed of the vehicle, participants across the groups were largely comfortable with the principle of the vehicle making ongoing decisions about the best speed to travel at. As with the route taken, many suggested that the vehicle's decision making relating to speed should be primarily about ensuring that it reached the destination at the intended time.

Alongside this, another key consideration dictating speed, raised particularly by participants aged 70 and 80+, was about the importance of the driverless vehicle obeying speed limits and reducing their speed when they encountered dangerous driving conditions, or were in an area with lots of pedestrians, or travelling on narrow or dark rural roads. For some of these participants safety was felt to be more important than getting to the destination in the least time possible.

> *"I know of some remote village in Wales, you would want it to slow down, as there would be no street lights." Participants from Group 3*

Reflecting further on this theme, some participants suggested that on motorways, occupied entirely by driverless vehicles, having speed limits would become less relevant, and the vehicles could in theory travel at their maximum speeds.

In Group 3, several drivers in the group felt that conversations about compromising on speed needed to be put into context of the current situation where vehicles, particularly in cities, spend much of the time travelling very slowly because they are caught up in traffic. If driverless vehicles behaved in a more coordinated manner and delivered on their promise of reducing congestion, then everyone would, in theory, be travelling to their destinations more quickly. To make sense of this issue, Group 3 repeatedly used the concept of the "the hive" during their discussions, to describe how connected vehicles might behave as a collective, making more coordinated decisions.

Participants were asked to consider whether they would be willing to sacrifice vehicle speed for benefits such as reduced energy use or greater comfort. As with the route taken, participants tended again to emphasise the importance of the vehicles getting users to their destinations on time and making this their priority.

When it came to reducing energy use, participants tended to assume that the vehicles would have electric power supplies and in Groups 3 and 4, it was suggested that if the vehicle travelled at the optimum speed this could save users money and reduce the amount of time that the vehicle had to spend recharging.

When it came to the comfort of the user as a reason for reducing speed, participants felt that this might be important for someone with a health condition that made bumps and sudden jerks painful. In Group 5 attended by participants with mobility needs, a participant with an ear imbalance said that this would be important for them as the condition made travelling at certain speeds uncomfortable. In Groups 1 and 2, attended by those aged 70 and 80+, participants suggested that it might be reassuring for users to be able to select a slower travel mode, especially if they felt unsafe or lacked confidence about the viability of the technology.

Across several groups, an additional consideration around the speed of the vehicle, was around the potential for having a 'blue light mode', where the vehicle would travel as quickly as possible to a hospital if the user had a health-related emergency. Many participants felt that this would be an important and beneficial feature.

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4.3. Broader reflections on choice and control

Across the groups, participants valued the principle of driverless vehicles giving users a high degree of choice and control over different elements of the journey and the operation of the vehicle, should they want to exercise this. It was noted that some people would want to take an active interest in their journey and in decisions, while others would be happy to sit back and let the vehicle take over.

Some participants raised questions about whether the driverless vehicle should allow users to be able to make choices that could place the user and vehicle at risk. In Group 4 attended by young people, several drivers felt that choice should extend to being able to drive the vehicle if you felt like it, while in most of the other groups, participants felt that this element of choice and control should be out of scope, as it undermined the safety benefits of driverless vehicles. It was also suggested that in a scenario of mixed vehicles, there was a risk that those driving their vehicles might take advantage of the situation by weaving in and out of traffic to get to destinations more quickly, resulting in delays for others, or the potential for accidents.

In Group 3, having reflected on the principle of the vehicle controlling the routes and speed, it was suggested that the introduction of driverless vehicles ran the risk of further creating a population who have become reliant on technology for navigating and getting around. This could result in people becoming increasingly passive, deskilled and disorientated when making journeys.

"Your brain would just disappear with driverless cars. You'd just program your journey, you wouldn't know where you were going. Young people now, using Satnav, they don't know where things are. It's frightening. They don't even know what direction they are going in." Participant from Group 4

"It may sound nuts, but I have a Satnav and even when I am going on a journey when I am not sure where I am going, I do the AA route finder and print it off. Because I love that it gets my brain working. I don't want to lose that, I don't want to rely totally on a machine." Participant from Group 3

Furthermore, if the vehicles were to break down, it was suggested that users may end up feeling more stranded and confused about where they were, compared with today, when we are more engaged with orientating ourselves and route planning.

5. Data sharing and the connected vehicle

5.1. Attitudes and awareness of data sharing

The last session of the workshop focused on attitudes to data sharing in relation to the connected vehicle. To understand general attitudes and awareness of data sharing, both anonymous and personal data, facilitators began the session with asking participants how and when they thought their data might already be shared. Internet banking, store loyalty cards, social media and targeted online advertisements were some of the most commonly mentioned suggestions across all groups of where data might already be shared on a regular basis.

Across the groups, participants were aware that data is being constantly shared between different parties, through different mediums and that much information is accessible. However, some difference in attitudes and what benefits or implications this might have were noticed between groups. Groups with older participants tended to be more concerned about the vulnerability issues that data sharing could potentially contribute to, such as fraud or cyber-crime. There was also a sense of unwillingness and lack of interest in 'going digital' from many of the older participants. For example, some participants in the older age groups had decided that they would not start doing banking online, instead preferring to do their banking face to face or by telephone. Meanwhile, in Group 4, where participants were of a younger age, and in Group 5 where participants relied on some sort of assistive mobility technology the attitude towards data sharing tended to be generally more accepting and relaxed.

Although the benefits of sharing data were mentioned in a few cases, such as health records being available to different GPs if needed or targeted discounts and recommendations, there was general widespread concern across all groups when being asked how they felt about personal and anonymised data being shared. Participants felt uncomfortable about the loss of privacy and personal information, and what safety implications that could have. A lack of trust in data protection laws and disregard of consent were felt to be worrying for many.

"I don't like people knowing too much about me, I tell them what I want them to know." Participant from Group 1

"It only works one way, data protection, and that is for the company that rings you. I ask how they got my number and they say from the database. What database? Your privacy is gone." Participant from Group 3

The general opinion among most participants was that if data is being shared it is essential that they know with whom, and that the receiver should then ensure that the data is being protected accordingly. Many were distinctly concerned about the risk of important personal details such as

contact details, health and financial records falling into the wrong hands, putting them at risk of fraud or personal harm from criminals.

Some participants suggested that a password system, clearly marked signs of how a driverless vehicle was being protected by the government or an independent body, and strictly enforced data protection rules would reassure them and give them more confidence to share their data.

5.2. Exploration of attitudes towards different CAV 'characters' sharing/accessing data

To begin exploring the topic of data sharing in the context of driverless vehicles, participants were shown an infographic (see appendix A) of a driverless car and different characters surrounding it, with which it would potentially have to share certain types of data. The different characters and potential data to be shared were then explored together in the groups. Different groups covered different characters in different depths, dependent upon group interest and preferences.

5.2.1. Other cars

Connected driverless vehicles would need to share information with each other to maintain safe distances and to prevent collision. Participants' attitudes to sharing data such as current location, the speed of the vehicle and the route of the vehicle were explored.

Although concern had been noted among participants when initially asked about data sharing in general, there was still a common understanding and acceptance from across all groups that an autonomous vehicle would need to share data to function effectively, especially with other cars on the road.

> *"If it's a computerised car that we're talking about then any information that is of a respect to help it run more efficiently, then I can't see a problem with that."*
> *Participant from Group 2*

> *"If something happens they're going to have to be talking." Participant from Group 1*

Most participants across the groups agreed that sharing data between vehicles, such as location on the road and current speed, would be necessary and essential for the vehicle to function and operate safely. However, most participants still felt that protecting their privacy and being able to make anonymous journeys was important and they would want the choice of not sharing location or route with other vehicles if this data could be linked back to them as individuals. This was especially important when it came to their end destination and re-occurring journeys to more private destinations, such as the bank.

5.2.2. Relatives, carers or colleagues

People close to you might want to be able to find out about the details of your journey or have the option of contacting you while you are in the vehicle. This might be helpful if you were running late for your appointment or if you changed your plans mid-journey and wanted others to know. Participants were asked how willing they would be to share information such as journey progress, current location and personal details.

When discussing sharing data with relatives, carers and colleagues, participants had differing views about with whom they would want to share certain data with. In the group with younger participants there was instant resistance about sharing their travel data with colleagues. This was unpopular because it could result in employees being excessively micro managed by their managers, discovered going for a job interview or your employer knowing that you were running late. The idea of being more connected with family members or carers was generally positively welcomed among most participants across groups, with several mentioning that they already spent a lot of time updating friends and family on their whereabout already. That someone would be able to track your journey and know where you were located was argued to make, especially elderly, people feel less vulnerable and be reassuring to both the passenger and their family.

"The driverless cars are aimed at older people. People with medical conditions who have been told they can't drive. As a family we can find out where they are, it's a safety issue." Participant from Group 3

"If I was going to visit my friend I'd want my family to know where I was." Participant from Group 1

"I think if you're elderly and living on your own, and somebody at least knows where you are, and if something were to occur, somebody knows you didn't arrive at that time." Participant from Group 2

However, being in control of your privacy settings, including being able to switch off or limit a friends and family tracking function was emphasised by most participants across the groups as being important. A few participants across different groups were sceptical about whether users would really be given a choice about sharing different types of data, such as location and personal details or whether this would be compulsory.

"There are benefits of friends, family, colleagues, being able to see journey, but there must be choice over to what extent they know what you're doing." Participant from Group 2

A few participants in Group 3 attended by older people did not see the need or logic in why information about current location, journey progress and other personal data had to be shared with family members through the vehicle, as they assumed the user would have even more time

and possibilities to inform people about their journey progress and location when not having to concentrate on driving.

In Groups 1 and 5 (older drivers and people with mobility issues respectively) a few participants found the premise of sharing data on their location and journey destinations with friends and family at all times concerning. This was because it could limit their sense of independence and autonomy. It was also suggested that sharing data would reduce the ability to make independent choices, as the car would constantly be making choices on their behalf.

> *"I have nothing to hide, but some people have. It should be choice, and it's really worrying, that, with driverless cars. Initially it was just about transportation, now it's your whole life." Participant from Group 3*

One participant in the group of older drivers (Group 1) also mentioned the worry of people being able to hack into a user's profile and find information about their location, such as burglars being able to tell that they were on holiday or insurance companies finding out that someone was in hospital.

5.2.3. Insurance providers

Insurance providers would be likely to offer a range of different insurance offers. Some might cover the users of the vehicle if they came to harm during a journey. Some might provide compensation for the vehicle owners if it was damaged in a crash and another user was at fault. Examples of data being shared: incident logs, video footage of journey, passenger details.

Participants were asked how they would feel about data, such as logs of what the vehicle/ driver was doing at the time of an accident and road footage, being shared with insurance companies in times of an incident or problem. The responses were mainly positive across groups. It was argued that this information would help to clear up what happened and track down who should be held responsible in the first place. Sharing personal information such as name and contact details was also viewed as a necessity in order to get insurance for anything.

However, a few participants pointed out that they would only be happy to share such data if there was an incident.

> *"The information is only needed should an accident take place." Participant from Group 6*

Participants in Group 3 (older people) also raised questions about who would be held responsible if the car was in a fully automatic mode and expressed unwillingness to pay insurance for incidents that they may have no control over. Others were also especially reluctant to share certain sensitive personal data, such as specific health conditions, with insurance providers and mentioned that there would have to be different rules of what data to share depending on whether the car was private or public.

> *"If you were carrying passengers in your car you wouldn't have any access to their health information normally, would you?" Participant from Group 2*

5.2.4. Driverless vehicle operators

For connected driverless vehicles to function effectively there would need to be systems and organisations in place to oversee and manage the road network (such as Highways England, local authorities and specialist network suppliers) which may affect the routes and the choices made by individual vehicles. Examples of data being shared: current location, speed and destination of vehicle.

There was a general understanding from across all groups that driverless vehicle operators would need certain types of data, such as speed, location and destination of the vehicle, to manage traffic flows accordingly. A few participants noted that they preferred anonymity and that personal details of passengers in the vehicles should not have to be shared with the operators. It was also questioned by some, who the actual vehicle operator would be, i.e. a government body or a private business, and how that would affect their attitude to share certain data. A few participants assumed that government bodies such as local authorities would be involved in operating the system. One participant said they would feel more reassured if the vehicle was marked as protected by a government body. Others did not see the need for any company or authority to be in possession of the shared data and thought more personal information such as destination should just be shared between the user, their vehicle and any Sat Nav component. The risk of personal data being sold was also a reoccurring concern when discussing the question of how and where data was going to be stored.

Moreover, as emphasised by a few of the younger participants (Group 4), they would expect safety and quickest route to their destination to be the priority of the system in return for sharing data with driverless vehicle operators.

5.2.5. Driverless car companies

Driverless car companies will be working to continuously improve the design of the vehicles and the effectiveness of the systems which decide how the cars behave in the network. Examples of data being shared: information about vehicle performance, how the vehicle negotiates through traffic, security incidents.

When discussing the willingness to share data with driverless car companies there was again a clear distinction in attitudes between sharing data about the actual vehicle and sharing personal information. Most participants did not see a problem with sharing information about general vehicle performance and regarded it as essential information to driverless car companies if the information was used to improve the system and technology of the cars. Sharing personal information, on the other hand, was looked upon as unnecessary and something that would not be required by driverless car companies.

"I don't want them knowing my information. Why should we give them that?"
Participant from Group 1

Participants in Group 1 (older drivers) discussed situations of security attacks on the systems, for example if someone would attempt to disable the car or steal personal information. Although participants wanted to be informed if any security threats to the systems were noticed, they still preferred such information to be able to reach the user without having to share any personal details with car companies. One participant suggested a system where alerts of potential security threats to the CAV were sent to the passenger in the driverless vehicle.

5.2.6.   Emergency services

For example, the police, ambulance services or a vehicle repair truck. If someone inside the car has a health emergency or the vehicle itself malfunctions and goes into emergency mode, emergency services and vehicle repairers would value having information so that they could understand the problem and decide how to respond. Examples of data being shared: current location, personal details and health information of passengers, emergency contacts.

There was a positive reaction among participants from across the groups when being asked to share certain data with emergency services. Group 1 (older drivers) discussed the idea of the car notifying changes to the occupant's health status, such as raising blood pressure, temperature and heart rate, and alerting emergency services as an 'amazing' and 'marvellous' safety feature. In another group, a few participants suggested having an option of adding long-withstanding health problems to users' CAV profiles which could then become accessible to emergency services should there be an incident. The generally positive attitude towards sharing data with emergency services in times of an incident is consistent with participants' overall concern with their safety and wellbeing throughout the different sessions.

In the group attended by carers, there was some disagreement between participants on how much the car would need to know about the user: although happy to share certain health information and details of emergency contacts, there was reluctance by some to have too much data on a profile, such as medical records, details of users' GP and other personal contact details.

It was argued by some that, even though extensive information about user health was both being measured and shared by the vehicle, it could still not replace the carer role.

"As your carer, if you are not feeling well, then I am there. You aren't getting in a driverless car - if you need me I am there. Not relying on some computer. If you want some independence, I can take you somewhere, drop you off, and I'll wait. You can go and do whatever you want, but I'll wait for you." Participant from Group 6

Others in the same group instead felt that it could lead to independence and a feeling of security for the passenger.

"They could have peace of mind from using that car, so they could have independence. It would be a benefit if there were sensors that could act in a way that would help them." Participant from Group 6

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6.   Findings from stakeholder interviews

Alongside the six groups held with the public we also conducted four stakeholder interviews. The stakeholders who we interviewed were:

- A transport advisor at the Local Government Association (LGA)

- A senior transport planner with experience of working with Bristol Council

- A community transport adviser for Devon County Council

- A road and transport safety specialist with experience of working for Highways England

The main findings from these interviews are summarised below in the Chatham House style, with quotes not attributed to individuals.

Reflections on access, affordability and equity

Stakeholders felt that there would be a clear role for the public sector in ensuring that use of the vehicles was affordable and equitable, and that the different groups who stood to significantly benefit, such as older people who cannot drive and those with mobility needs did not lose out. Here several pointed to the risk that if the development and roll-out of driverless vehicles was entirely market-led this could run the risk of limiting access to the technology and exacerbating existing travel inequalities, for example, between the affluent and less affluent and the rural and urban.

> *"There's a worry about how it will develop. I think there are two schools of thought – one is that this will enable people that currently have not got their mobility needs met to have them more easily met. The other is that the obvious areas where these will be launched is dense urban markets where there are the most people, most journeys, and most potential for profit."*

A range of other suggestions relating to access and affordability were raised by stakeholders which are summarised below.

- To support affordability of access, as with black cab schemes, local authorities in a city or region could set limits on the prices for renting/accessing driverless vehicles.
- Local authorities could move towards a system where those assessed to be in need could be given "mobility credits" to be used on driverless vehicles and any options that suited their needs. This has the potential to give users greater choice and flexibility, compared with freedom passes, which are often limited to use on bus services.
- When it comes to serving rural areas, it was noted that the upfront investment costs associated with installing the infrastructure and modifying roads would be significant, these need to be factored in by those planning and developing the technology.

- Currently local authorities fund multiple transport schemes in any one area and this is often costly and inefficient. With the introduction of driverless vehicles, it might become possible to simplify and streamline the number of contracts and services. An improved approach might involve multiple partners in an area buying into a service that would be delivered by a single outsourced provider, as seen in the Total Transport pilot being led by the Department for Transport.

"Local authorities and the public sector pay a fortune transporting people and things across their areas every day for lots of different purposes. If you have a budget for school transport, you have generic home to school transport, special needs transport which is usually very costly because you need more supervision and bespoke routes, you'll have social care movements, non-emergency ambulance, older people and their bus passes. All those journeys happen every day, but they're not combined in a smart way."

Implications for transport providers and highway authorities

It was suggested that connected driverless vehicles offered the promise of far more accurate and comprehensive data about patterns of travel, which could be used by transport planners and commissioners to plan and commission services. As well as analysing travel data, it was suggested that the vehicles could potentially be monitoring and sharing data about air quality in urban spaces as well as scanning the roads for potholes and other signs of wear.

For these benefits to be achieved, it was felt that transport commissioners and other public bodies will need to ensure that there are the right data sharing legislation and contractual arrangements in place to get the data that they need. They will also need to have the capabilities to handle and make sense of this data.

"I think that data handling and data analysis will become functions of public sector bodies in a much more identifiable way. If you could get all the NHS' observations about people's health onto some combined format and analyse that, the mind boggles at what you could do with it. The challenge is it's such an enormous amount of data, and getting the analysis done is an interesting challenge that public-sector bodies are going to have to think about, because we want the benefits, but until we get serious about our own data capabilities we won't be able to practice it. I think that will be forced on to the public sector."

As well as making it possible to share and store data between public bodies and companies, it was emphasised that it would be equally important to create systems and safeguards which prevent users' personal data from getting into the wrong hands.

Potential health and wellbeing impacts

All interviewees felt that driverless vehicles had enormous potential to deliver more affordable, flexible and accessible transport services, including for those who currently struggle to get around due to poor health, mobility needs and living in areas that are not well served by public transport.

> *"There is a great potential to help those who suffer from transport severance, what you find is that people in deprived wards tend not to travel out of ward boundaries 90% of the year, in part the reason for that is cost and limited options, driverless vehicles have the potential to open things up."*

This has the potential to lead to significant improvements in physical and mental well-being, as groups of users who were previously isolated and struggling to get around become more active, more independent and connected. Added to this, more affordable transport could also have significant economic benefits, making it possible for people to take up jobs that were previously not viable.

Several interviewees felt that it was crucial that those designing driverless vehicles and wider services aimed at older and mobility impaired people need to ensure that they reinforce and strengthen connections and interactions between people rather than 'designing them out'.

> *"You don't want it to take an old person to a hospital where they pick up their prescription and it dispenses automatically, or they have a tele-consultation with a doctor. Although it's efficient, the evidence is overwhelming that people need care which involves human interaction, it keeps them young longer."*

> *"Driverless vehicles are efficient because you don't have a driver, but that doesn't mean you don't have someone on board who you could have a richer social interaction with. [Driverless vehicles] must not design out connectivity between people, even if it could lead to savings."*

It was suggested that with the introduction of driverless vehicles, volunteers would be freed up from driving and so could potentially offer more dedicated and richer forms of support and social interaction when accompanying vulnerable users on journeys.

Whilst driverless vehicles have enormous potential to increase health and wellbeing, one stakeholder cautioned that they should not be seen as the answer to all problems. In a scenario where driverless vehicles became cheap and convenient for everyone, it is conceivable that they could be overused, which in turn could lead to obesity and other poor health outcomes.

> *"It's important to recognise that driverless vehicles won't be a panacea – we need to stay focused on improving cycling and walking – as that will be what drives real change in cities."*

Reflections on the vehicle design and implementation

Across the discussions, stakeholders made a number of points relating to the design of the vehicles. Many of the points related to the accessibility of the vehicles and around the potential for innovation.

- Several specific design features were identified that were felt to benefit older and mobility impaired users. These included, the ability to make simple accessibility modifications e.g. attachable grab handles, the need to be able to adjust the seating height, the value of having swivelling and or window facing seats, the need for the vehicles to be easily identifiable from those which are semi or not autonomous, and the importance of offering multi-channel booking options.
- It was suggested that driverless vehicle designers could radically depart from the design conventions associated with driven vehicles, experimenting with new seating configurations that made better use of the vehicle's interior.
- It was suggested that it might be helpful to collapse the distinction between buses and cars, and instead experiment with vehicles of varying sizes.
- It was suggested that any investment focused on additional safety features and usability for those who are not confident with technology or vehicle operation, was money well spent, because ultimately this would benefit all users in terms of greater usability and safety.

Phasing in the vehicles and public acceptability

A number of observations and suggestions relating to the public acceptability and phasing in of driverless vehicles were raised during the interviews.

- Several felt that there is likely to be a 'mixed economy' of vehicles on our roads for some time. For this reason, it might be hard to achieve the promised efficiencies that are associated with a scenario when there are only autonomous vehicles on the roads. Furthermore, the technical and legislative demands associated with supporting co-existing systems and infrastructure has the potential to be costly and time consuming to develop.

  "The transition phase might be the most difficult, when you have autonomous vehicles throughout things become simpler. You would have to maintain systems and infrastructure for a minority of non-driverless vehicle users. The driver vehicle will become a small minority of the fleet. But the whole system can't be cut off while they are still around."

- It was suggested that a scenario where there was a mixed economy of autonomous, semi-autonomous and non-autonomous on the road would create significant complexity when it came to providing insurance and understanding who was liable in the event of a crash.
- It was noted that vehicles need to drive reasonably aggressively to make the road network function. Based on current trials of driverless vehicles, it was noted that pedestrians may learn that it is possible to walk-out into the road because driverless vehicles would always stop or slow down. Furthermore, the vehicles might drive excessively cautiously and slowly. These challenges could lead to congested roads and slow journey times.

- Several stakeholders speculated that driverless vehicles may initially be introduced on motorways and on key routes such as between city centres and airports. They might also be designed into new towns and cities.
- It was suggested that some large-scale demonstration sites would be needed to raise the public acceptability of the technology and that the vehicles may need to achieve levels of safety and reliability that are associated with air travel to be widely accepted.

"Developing autonomous vehicles has to address the issue of risk, this would probably involve reducing the level of risk much more than a normal vehicle – it's a bit like flying an aeroplane; it probably needs to be close to zero in terms of level of risk. In fact, even with driven vehicles, a number of leading countries are looking to completely eliminate deaths on roads."

- There was a view that as the sharing economy grows, in the coming decades the public might become more content to rent and share driverless vehicles.

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7. Conclusions

In the second wave of fieldwork we ran six group discussions involving 60 members of the public. Our sampling approach achieved a mix in terms of driving status, age, gender, geography and socioeconomic background. Our sample also sought the views of those with mobility needs and carers. When it came to the stakeholder interviews, we spoke with a transport advisor who represents the interests of local authorities, a senior transport planner, a community transport adviser and a road and transport safety specialist with experience of working for Highways England. The main findings from our fieldwork are set out below.

Thoughts on the concept

- Participants' initial reactions to driverless vehicles across the groups was more often sceptical and dubious than positive, with many asking questions or expressing concerns about their safety and viability. The exception to this was in the group made up of people with mobility issues, who were the most immediately positive about the driverless technology and the opportunities for freedom that it could potentially offer them. These findings mirror the first wave of fieldwork.

- However, having learned a bit more about driverless vehicles through the discussions, when it came to the likelihood of using driverless vehicles (should they be deemed to be safe to use), a majority of participants across the groups said that they would be somewhat or very likely to use them. As in the Wave 1 public groups, participants tended to become more positive and more likely to say they would use driverless vehicles over the course of the sessions. The main reason given why they would be likely to use them is because they have the potential to make travel more easy and convenient. For those with mobility issues and non-drivers driverless vehicles were viewed to offer a superior alternative to existing methods of transport and could give them greater flexibility and independence.

- The main benefits and opportunities associated with driverless vehicles included, greater freedom and independence, the ability to do other activities having been freed up from driving, improved traffic flow and shorter journey times, and the ability for the vehicle to monitor your health status and to call for help in an emergency.

- Alongside the safety and viability of the technology, other concerns associated with driverless vehicles included: having limited control and access to the vehicle should they be rented; taking away the pleasure of driving; congested roads (as increasing numbers of people become regular users); a potential loss of privacy (as friends and family track your movements); and potential job losses (e.g. taxi drivers).

Control over the speed and route of driverless vehicles

- Across the groups, participants valued the principle of driverless vehicles giving users a high degree of choice and control over the speed and route of the journey and the operation of the vehicle, should they want to exercise this. It was noted that some people would want to take an active interest in their journey and in decisions, while others would be happy to sit back and let the vehicle take over.

- Most participants were content to make modest sacrifices when it came to speed and route if this helped to avoid congestion and benefited the wider network. However, the vehicle's commitment to getting you to appointments at the time that was required was seen as of paramount importance, as was the need to operate the vehicle at safe speeds, which would vary depending on driving conditions.

- Some participants raised questions about whether the driverless vehicle should allow users to be able to make choices that could place the user and vehicle at risk. In Group 4 attended by young people, several drivers felt that choice should extend to being able to drive the vehicle if you felt like it, while in most of the other groups, participants felt that this element of choice and control should be out of scope, as it undermined the safety benefits of driverless vehicles.

Data sharing and the connected vehicle

- When participants were asked to consider sharing different types of data with different 'characters' in the driverless vehicle network, participants were very clear that for these vehicles to function, ongoing data sharing was essential. Participants across the groups tended to be comfortable with anonymous non-personalised data being shared with various actors, but were more cautious when it came to sharing personal data such as contact details, locations data and health records.

- The group attended by younger people were the only one to mention the potential for the vehicles to incorporate tailored recommendations and adverts based on users' preferences/habits. They were also the only group to express how the driverless vehicles could connect with other existing technology, for example expecting the car to have access to an individual's shopping list and other apps.

- The general opinion among most participants was that if data is being shared it is essential that they know with whom, and that the receiver should then ensure that the data is being protected accordingly. Many were distinctly concerned about the risk of important personal details such as contact details, health and financial records falling into the wrong hands, putting them at risk of fraud or personal harm from criminals.

- Some participants suggested that a password system, clearly marked signs of how a driverless vehicle was being protected by the government or an independent body, and
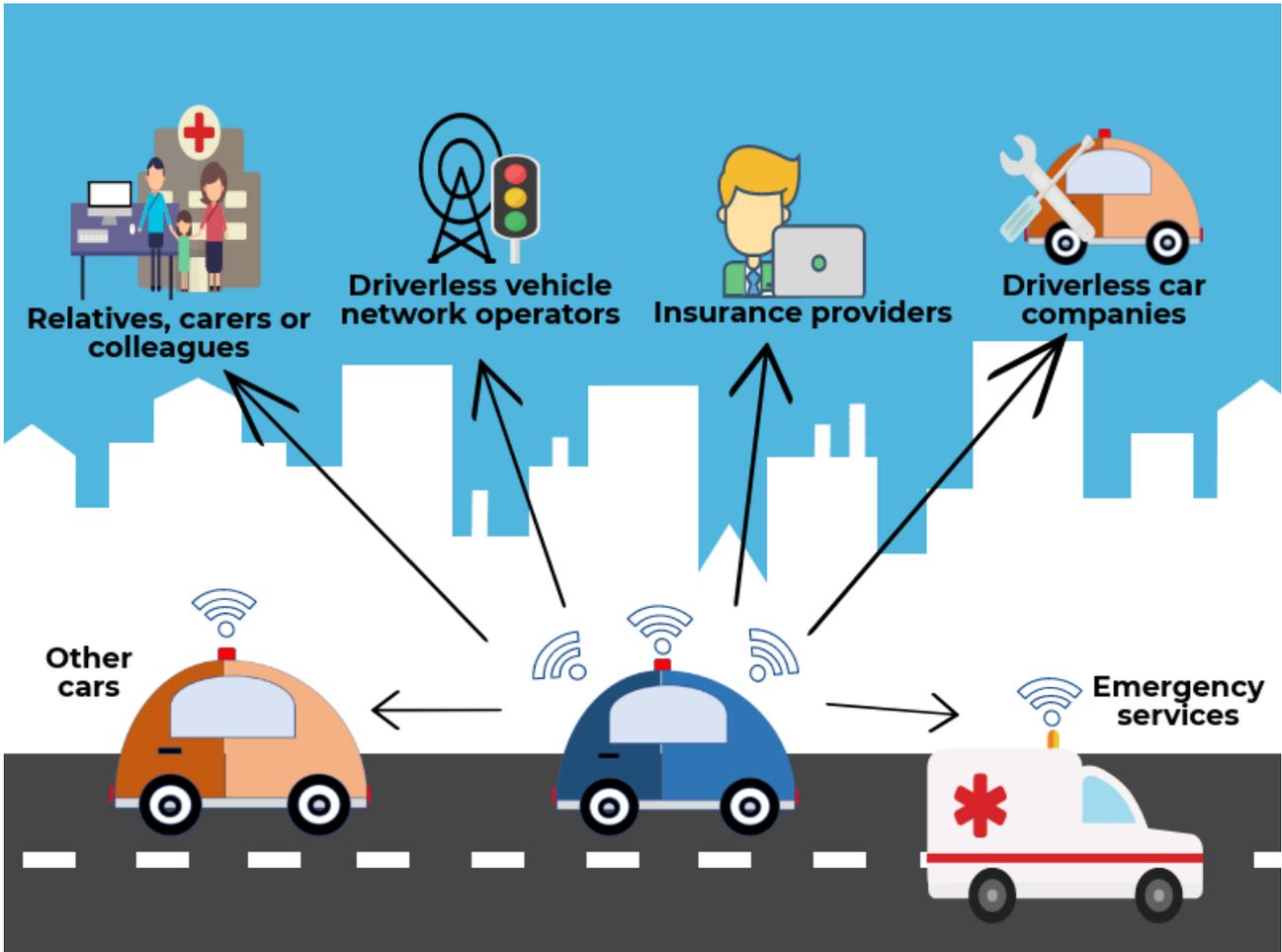
strictly enforced data protection rules would reassure them and give them more confidence to share their data.

Stakeholder interviews

- It was suggested that driverless vehicles had enormous potential to deliver more affordable, flexible and accessible transport services, including for those who currently struggle to get around due to poor health, mobility needs or living in areas that are not well served by public transport.
- However, to achieve such benefits, there would be a clear role for the public sector in ensuring that the use of driverless vehicles was affordable and equitable. It was noted that if the development of driverless vehicles was entirely market-led this could run the risk of limiting access to the technology and exacerbating existing travel inequalities, for example, between the affluent and less affluent and the rural and urban.
- Several felt that connected driverless vehicles offered the promise of far more accurate and comprehensive data about patterns of travel, which could be used by transport planners and commissioners to plan and commission services more effectively and efficiently. The vehicles could also collect other types of data, such as air quality and the condition of roads.
- To grasp the potential of the data being collected by driverless vehicles, transport commissioners and other public bodies will need to ensure that there is the right data sharing legislation and contractual arrangements in place to get the data that they need. They will also need to have the capabilities to handle and make sense of this data.
- It was suggested that driverless vehicles may initially be introduced on motorways and on key routes such as between city centres and airports. They might also be designed into new towns and cities.
- It was suggested that some large-scale demonstration sites would be needed to raise the public acceptability of the technology and that the vehicles may need to achieve levels of safety and reliability that are associated with air travel for the technology to be widely accepted.
- In the initial phase of introducing driverless vehicles, there is likely to be a 'mixed economy' of vehicles on our roads. The technical and legislative demands associated with supporting co-existing systems and infrastructure have the potential to be costly and time consuming to develop.

Appendix A.

Infographic used at data sharing session

EMPOWERMENT THROUGH **TRUSTED** SECURE MOBILITY

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