Public engagement research: Round 3

Date: May 2019

Notice

This document and its contents have been prepared and are intended solely for Innovate UK and the FLOURISH consortium's information and use in relation to FLOURISH Project.

Traverse assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 39 pages including the cover.

Document history

Work Package: 3			Document ref: Public engagement research: Round 3			
Document Lead Organisation: Traverse			Document Lead Name: Fanny Goterfelt			
Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	Draft for comments	FG	FG	HA	HA	15/04/19
Rev 2.0	Final	FG	TV	HA	HA	03/05/19

Table of contents

Tables

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, Traverse ran its final round of fieldwork over February and March 2019, which was comprised of:

- Four focus groups with 42 older members of the public.
- A video diary project with younger people with mobility issues: 7 young people (18 – 26 year olds) with different mobility issues participated in a video diary project, recording their reflections on four different journeys.

The purpose of the research was to explore the development of driverless vehicle technology for older people and those with mobility issues.

Focus group findings:

Acceptability of the technology

Across the focus groups views were varied, including initial positive reactions and concerns around safety and unreliability of the technology.

Participants who said they would be likely to use a driverless vehicle if they were to become available in their area, and had been deemed safe to use, did so because:

- They thought it would be a safe mode of transport;
- They thought it would feel more normal to use driverless vehicles in the future;
- They like to try new things; and
- They believe driverless vehicles will make it easier to get around as they get older.

Participants who were unsure about using driverless vehicles emphasised that they wanted to be reassured the technology was reliable first, and were generally unsure if the logistics surrounding the technology would develop in a reliable way over time.

Participants who said they were very unlikely to use driverless vehicles emphasised that they did not trust the safety of the technology.

These findings are covered in more detail in section 2.

Comparing to rounds 1 and 2

In order to test out the assumption that awareness of driverless technology would increase over the lifespan of the FLOURISH project, and to explore any resulting changes in attitudes towards the technology, we repeatedly asked participants about their initial reactions, level of awareness of driverless technology, and likelihood of using driverless vehicles in all three rounds of research.

Initial reactions were varied throughout the project, with some commonly occurring themes, such as safety concerns and questions around reliability of the technology. Most participants across all rounds of engagement had heard about driverless vehicles. However, there was a notable shift after round 1, when participants more frequently began to mention news coverage of accidents related to driverless vehicles. This also made some participants question the safety of the technology more than previously.

These findings are covered in more detail in section 2.

What do older adults expect from driverless vehicles and how might they want to use them?

Most participants envisioned how driverless vehicles could relieve the stress and anxiety of making journeys that they find difficult, both local and longer distances. However, it is important for older adults that the vehicles are designed in an easy-to-use way. Participants had several views on how different features of the vehicles could ensure maximised support when making journeys, especially around:

- Booking a journey;
- Support arrangements;
- Safety arrangements;
- Communication arrangements; and
- Payment methods.

These findings are covered in more detail in section 3.

How do users want to interact with the vehicles and the network?

Participants looked at different displays from the Human Machine Interface (HMI) developed elsewhere in the Flourish project. The purpose of this exercise was to enable us to obtain accurate reflections on the different functions of the HMI

- Facial recognition: While some participants could see the benefits of the vehicle being able to recognise the user and their preferred settings when entering the vehicle, others had concerns about the effectiveness of facial recognition technology and wondered whether this opened up opportunities for people to hijack the vehicles
- Voice or touch: The majority of participants preferred to communicate with the vehicle using the voice option, but still emphasised the importance of having both voice and touch options available.
- Journey summary: Participants were initially confused about the journey summary display and found the map somewhat difficult to read.
- While on your way: Most participants liked the idea of a map showing their exact location while on a journey.They emphasised knowing the exact location of the vehicle would make them trust the technology more.
- Journey notifications: The majority of participants emphasised updates on journey duration and traffic events along the way were essential, and that they want to be able to decide the frequency and type of updates provided by the vehicle depending on the context
- Vehicle health: Participants became nervous about having sight of a vehicle health display, this is because they expect the vehicles to be reliable and they don't want to be in doubt about whether it will meet their transport needsThese findings are covered in more detail in section 4.

Video diaries findings:

Seven young people (18 – 26 year olds) with different mobility issues participated in a video diary project as part of this round of engagement. Participants were asked to take four different journeys

and reflect on current travel difficulties and how a driverless vehicle could ease their mobility needs: Key messages from the video diaries included:

- Regular travel often means relying on friends and family;
- Travel by public transport often means relying on staff and strangers;
- Regular travel can be too restrictive and being in the same position for a long time can be difficult;
- Travel by public transport can mean having to prove your mobility needs;
- Parts of public transport can be inaccessible; and
- Parking can be difficult.

Participants felt that having access to a driverless vehicle to get around would relive a lot of stress and anxiety, and make them feel more independent.

These findings are covered in more detail in section 4 and in a summary video which can be found at www.flourishmobility.com.

1.   Introduction

The FLOURISH project was developed in response to Innovate UK's Connected and Autonomous Vehicles Collaboration Research and 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, Traverse (formerly OPM Group) are conducting a round of research and engagement involving members of the public.

> In the third round of research Traverse has completed two strands of activity in spring 2019:
>
> - **Focus groups with the public** – a series of four focus groups with older members of the public.
> - **Video diary project with younger people with mobility issues:** 7 young people (18 – 26 year olds) with different mobility issues participated in a video diary project, recording reflections on four different journeys.
>
> The findings are reported on separately in this report.

1.1.   Aims of the research

This research had the following aims:

- To complement and inform the research being undertaken by University of the West of England (UWE) and Designability, particularly looking at demographically under represented areas (e.g. older women, BAME, not Bristol based and more rural areas) and questions in need of more exploration, as suggested by partners.
- To revisit research questions from the previous two rounds of engagement, to understand changes over time in attitudes towards the concept of CAVs, including likelihood of using them.
- To explore how CAV technology can be harnessed to enhance and enable mobility for older adults and those with mobility-related conditions, contributing to the development of a stronger and more inclusive society.
- To explore levels of understanding and initial reactions to the developed Human Machine Interface (HMI) (by Designability) from older adults not previously engaged with in this field of research.

Terminology

To support accessibility, we tended to use the terms 'driverless vehicles' or 'driverless cars' within the public focus groups. Throughout this report, we have used 'driverless vehicles' or 'CAVs', apart from when using direct quotes from participants when we have accurately reported whatever terminology they have used.

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.   Focus group methodology

Coverage of issues

The focus groups used a structured topic guide and sessions were digitally recorded and transcribed. Three out of the four focus groups lasted one-and-a-half-hour and covered the following topics:

- Introductions and initial reactions: participants were asked to introduce themselves, mention how they travelled to the focus group, the first three words that came to their mind when hearing the words 'driverless vehicle', and if they had heard of driverless vehicles before.
- Likelihood of using a CAV: participants were asked to say how likely they would be to use driverless vehicles if they were deemed to be safe to use by the Government.
- Exploring mobility needs: participants were asked to think about journeys they might make on a day-to-day basis, and how easy it is for them to currently make these journeys, and if they think it will become more difficult as they get older. Participants were then asked to reflect on how a driverless car could help them make day-to-day journeys, and if having access to a driverless vehicle would help participants make more or additional journeys.
- Exploring features of the HMI: participants were introduced to the HMI through watching a short clip from the FLOURISH simulator, demonstrating how to use the HMI. Cards displaying different HMI functions were then used to explore participants' initial reactions and understanding of the different features.
- Likelihood of using a CAV: following the above discussions, participants were asked to revisit the question about the likelihood of using CAVs to understand whether their position had changed or not and the reason for this.

The fourth focus group was only able to last one hour. The discussion was also through an interpreter. Due to the shorter timings, and time allocated to translating ongoing conversation, the discussion was only able to cover initial reactions, likelihood of using a driverless vehicle, mobility shortfalls, and ideas around the design of the vehicle.

Initial reactions and likelihood of using: comparing to round 1 and 2

Traverse has conducted two previous rounds of engagement with the public. The first round was carried out at the beginning of 2017, and the second at the beginning of 2018.

In previous rounds, members of the public were asked to provide their initial reactions to driverless vehicles and state their likelihood of use. In order to test out assumption that awareness of driverless technology would increase over the lifespan of the FLOURISH project, and to explore any resulting changes in attitudes towards the technology, we repeated these questions during each round of engagement. To demonstrate any changes, the first chapter (Initial reactions) includes smaller sections where findings from round 1 and 2 are reflected on in comparison with those of round 3.

About the participants

The table below provides a summary of the profile of participants across the four focus groups. We set up the focus groups with support from existing community groups which normally hold discussion sessions or meetings with older adults. The community groups were chosen to help us to meet our

aim of engaging with demographically under-represented groups within the FLOURISH project, specifically: older women, BAME, non-Bristol and rural locations. We then invited older adults to sign up and participate on a first-come-first-served basis.

Table 1: focus group participants

Group 1 London 10 participants	Group 2 Settle 10 participants	Group 3 London 7 participants	Group 4 London 15 participants
Urban 8 female/2 male 60 – 85 year olds 1 visually impaired 1 hour 30 mins Recruited with support from Ageing Better Camden	Rural 7 female/3 male 50 – 80 year olds 1 hour 30 mins Recruited with support from Settle Community and Business Hub	Urban 5 female/2 male 60 – 85 year olds 2 visually impaired 1 hour 30 mins Recruited with support from Kilburn Older Voices Exchange	Urban 15 female, all BAME 50 – 80 year olds 1 hour Recruited with support from Hopscotch Asian Women's Centre

Section 1: Focus group findings

flourish

2.   Initial reaction

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 very brief discussion. There were often differences within groups, with both negative and positive attitudes represented. Below we set out a word cloud illustrating the frequency with which words were identified by participants across the four groups.

> Aim: To revisit research questions from the previous two rounds of engagement, to understand changes over time in attitudes towards the concept of CAVs, including likelihood of using them.

Figure 1: words used by participants

Dangerous

Across all of the groups, concerns about safety were 'top of mind'. The most commonly utilised word was 'danger', or 'dangerous'. Participants who had safety concerns often cited the many unknowns about the technology and said that they would not trust the technology to work without any errors.

"Scary, no assistance, breakdown" Group 1

"How does it drive without a driver?" Group 4

These participants often emphasised the need for more information on driverless vehicles, suggesting that the concept of driverless vehicles when not accompanied with supporting information increases concerns around safety.

Excitement and optimism

Many participants used words that expressed their excitement and optimism about driverless vehicles, such as 'wonderful', 'confident' and 'fantastic'. In Groups 1 and 2 it was also quite common to use words such as 'science fiction' and 'robots' which suggested that driverless vehicles were part of a futuristic new world.

"Wonderful idea, presumably the future, confident" Group 1

Participants were uncertain about the timeframe for developing driverless vehicles. Many of the older participants hoped that they'd become available within their life time so that they could take advantage of them.

"I think it's a fantastic idea, I hope to live to see it, I think it could be particularly beneficial for older people" Group 2

"I've got bad arthritis so I wish I had one" Group 4

Unpredictable

Some participants had doubts and concerns about driverless vehicles. Anxiety about how they would operate alongside manually driven vehicles was a key issue for some.

"Would it really become reality?" Group 3

"I think it's complex, it's not so much about the mechanism or the driving, but the unpredictability of the other drivers" Group 1

Some participants were also sceptical about whether diverless vehicles would deliver on the promised benefits, such as reduced congestion, an improved environment and fewer problems finding parking spaces.

Looking back at initial reactions

Round 1	Round 2
• Participants' primary concerns and questions focused on the safety and viability of the technology. • Widespread concern that the vehicles might not be affordable for people, especially when first launched. • Participants with mobility issues were most immediately positive about driverless technology and the opportunities for freedom that it could potentially offer them.	• Often sceptical and dubious than positive. • Questions or expressing concerns about safety and viability. • Participants with mobility issues were most immediately positive about driverless technology and the opportunities for freedom that it could potentially offer them.

2.2.   Levels of awareness and knowledge

Most participants in Groups 1, 2 and 3 had heard about driverless vehicles. However, most said that they had a fairly limited understanding of them. Participants who had heard of driverless vehicles had mainly done so through the news items about accidents that had occurred, or articles about what could happen in an accident.

"The only thing I've seen was in the paper last week: they were speculating on what happens when there's an accident - who's responsible? Is it the person who's in the car because they hadn't had it serviced or looked after, or would it be the manufacturer who hadn't set it up properly" Group 2

A small number of participants in Groups 1, 2 and 3 had an awareness of ongoing trials such as the driverless vehicle scheme in Milton Keynes. Two participants mentioned that they had seen or experienced driverless technology in real life: one had seen a driverless vehicle in a museum in London, another had been in a 'semi-driverless' car, where the driver only had to touch the steering wheel occasionally.

"We saw it on TV the other day, in Milton Keynes, there are robots that deliver your food. I don't know how they do it" Group 2

A few participants in Group 4 attended by older BAME women, mentioned that they had never heard of driverless vehicles, and some explaining was needed to enable participants to understand the concept.

The majority of participants assumed driverless vehicles would be powered by electricity. Throughout the discussion participants referred to this assumption through, for example, assuming the vehicles would make less noise and need several charging points to function.

Looking back at levels of awareness and knowledge

Round 1	Round 2
• Quite common for participants to have some familiarity with the concept of driverless vehicles. • Participants frequently drew attention to similar forms of technology which are now regarded as safe and "normal".	• Most participants across all 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.

Most of participants engaged with throughout the three rounds have had some initial awareness of driverless vehicles. However, in rounds 2 and 3 participants have been more aware of news coverage of accidents involving driverless vehicles. This, many times lead to increased doubts and anxiety around the reliability of driverless technology. Although participants emphasise the need for more information to increase reassurance, the information which they currently come across might not help to do so. Contrastingly, the group with only Black, Asian and Minority Ethnic (BAME) participants in the third and most recent round of engagement, where the majority expressed unawareness of driverless technology, were also instantly the most positive. This suggests more information might not always immediately lead to more reassurance.

2.1. Likelihood of using

Having given their initial reactions to driverless vehicles, participants were asked to say how likely or unlikely on a scale of 1 to 5 they would be to use driverless vehicles if they became available in their area.

To enable participants to make sense of the question and the topic more easily, a few assumptions were introduced. Assume that:

- We are talking about 25-30 years in the future.
- There will be a mix of driverless vehicles and manual cars/public transport.
- The cost of a privately hired driverless vehicle is assumed to be equal to the cost of a taxi.
- Driverless vehicles will be a bit more expensive when first rolled out but then eventually go down in price.
- The vehicles will be fully autonomous. This means that users should not need to intervene at all during a journey.
- They have been safely rolled out by the Government.

Although presented with a few assumptions, participants immediately had queries and concerns they wanted clarification on, before answering the question. They particularly sought to understand if driverless vehicles would be shared in the community or privately owned, what kind of distances they could travel if they were electric, and who would be able to use them.

The table below presents participants' likelihood of using driverless vehicles if they became available in their area.

Table 2: likelihood of using

How likely or unlikely would you be to use driverless vehicles if they became available in their area?	1 Very unlikely	2	3 Unsure	4	5 Very likely
Group 1 Mix of 60-80+, mix of male and female, 1 visually impaired, urban	2		3	2	3
Group 2 Mix of 50-80+, mix of male and female, rural	3	2		2	3
Group 3 Mix of 60-80+, mix of male and female, 2 visually impaired, urban	1		3	2	1
Group 4 Mix of 50-80+, female only, BAME, urban	2	1	1	3	7
Total	8	3	7	10	14

I would be likely to use driverless vehicles
...Because I think it will be safe

A few participants in Groups 1, 2 and 3 specifically outlined increased safety as their reason for being likely to use driverless vehicles. These participants expressed confidence in the technology and viewed it as an opportunity to take the pressure off people driving, especially for older adults.

> *"One of the things I see quite a lot is elderly people, who shouldn't be driving, driving. It's not safe but their whole social lives depend on it. This is going to be an issue for me as I get older – I don't actually like driving, but it's about independence." Group 2*

Participants sometimes felt that sharing a vehicle with other people would make them feel safer, and less anxious about being exposed to new technology.

Some participants strongly emphasised that their level of likelihood to use a driverless vehicle was based on the assumption previously outlined - that driverless vehicles in this scenario had been deemed safe to use by the Government - and that they would like the same reassurance in a real-life scenario.

…Because it will feel normal in the future

A few participants across all groups who said they were likely to use a driverless vehicle, did so based on the assumption that in 25-30 years' time, everyone will be used to this type of technology and comfortable using it. To make sense of their reasoning, participants sometimes referred to other modes of transport that have been safely introduced throughout time, for example trains and aeroplanes.

> *"We all get on aeroplanes, we don't know about aerodynamics etc - we trust in the technology." Group 2*

Participants in Groups 1 and 4 more specifically referred to a generational shift that they anticipate in acceptance towards driverless technology. They thought that children growing up today would get used to driverless vehicles quickly because of their constant exposure to other technology.

> *"We're talking about the year 2044, the generation that are now in their prams doing technology. They'll just take to it like ducks to water having grown up with it." Group 1*

However, they also emphasised the education that would need to accommodate these intergenerational differences, to ensure older people would not be left behind.

> *"This will be a learning process, so I don't know. But I am happy." Group 4*

…Because I like to try new things

A few participants in Groups 1 and 2 expressed excitement at the thought of trying a driverless vehicle. New technology was emphasised by these participants as interesting rather than scary. They emphasised the opportunities for an easier and more convenient life if having access to a driverless vehicle, especially in order to remove stress around driving long distances and on motorways.

These participants generally expressed trust in the technology and believe that driverless vehicles could contribute to a safer and more organised society, in terms of transport.

> *"I'm excited by it, I think it could be contributing to a more cohesive society - us getting into our own little steel boxes. I hate driving down motorways especially - it shuts you off from everybody; you've got to get in front of people. Driverless cars might take the pressure off us." Group 2*

… Because it will be easier to get around when I get older

Participants in Group 4 who mostly said they would be very likely to use a driverless vehicle if they became available in their area, specifically highlighted the possibility of increased independence and ability to get around by themselves.

> *"Our children get busy and so there's no one around to take us out, so this will useful"*
> *Group 4*

These participants referred to poorer health, disabilities, and mental health problems as factors to declined mobility and increased dependency, and viewed a driverless vehicle as something that could aid their future mobility.

I am unsure as to whether I would use driverless vehicles
…But would do so if I knew they were reliable

A few participants in Groups 1 and 3 had reservations around using a driverless vehicle, finding it difficult to trust the reliability of the technology. They were concerned the vehicle would not sense all things around it, especially in a busy place like London, and questioned replacing human control with computers.

> *"I'd need to know a lot more about it. I'm a control freak - I won't even have an automatic car, as I don't think you can modify it quickly enough, especially in London when you've got people all around you doing daft things. So I'd want to know more." Group 1*

One participant specifically mentioned that it depended on whether the driverless vehicle had a designated path and a controlled speed, comparable to a tramline. This was argued to increase the feeling of reliability.

…Because I'm worried about logistics

In Groups 2 and 3 a few participants worried about the logistics of a driverless society and struggled to understand how the vehicles would function.

> *"I don't see how you could cope with the logistics of getting a driverless car where you want it. It's going to be worse than the buses isn't it, because so many people are going to want one car. Do you call it up? Do you have to walk miles to get one?" Group 2*

Because participants mostly assumed driverless vehicles would be electric they also noted small things that could potentially become troublesome, such as finding a charging point for the vehicle.

I would be unlikely to use driverless vehicles
…Because I don't trust them

Participants across all groups who stated they would be very unlikely to use driverless vehicles mainly did so because of lack of trust in the technology. Two out of three participants with visual impairment, expressed much dislike of the idea of driverless vehicles, doubting they would either feel safe in the vehicle or outside as a pedestrian. They feared their mobility would become more difficult in a world with less human assistance. They additionally feared they would be more restricted and unsafe as, as pedestrians with visual impairments, they would not be able to hear

(based on their assumption that the vehicles would be electric and make less noise) or see the vehicle, or know if it had seen them.

"I can't see or hear, how do I know where it's driving. I'd be frightened. I'd be like being on a rollercoaster. It's absolutely no good for people like myself." Group 3

A few participants in Group 2 did not necessarily think the technology was far away. However, they insisted that more work and research need to be done before they could be safely rolled out, particularly in a rural setting, with less predictable road conditions and surroundings.

A few participants, all current drivers, were particularly worried about giving up control to a computer. They were concerned about the loss of morality in decision-making, and did not trust computer systems to always choose the safer, but also most morally right, option.

"The question really is about control, the reason I say very unlikely, is because is there a way I can override the decision of the computer - on what basis does the computer make a decision to hit that thing there, or that thing there, and hits something over there? These are technical questions which need to be answered to give people the confidence to get in." Group 2

Looking back at likelihood of using driverless vehicles

How to read the chart: In round 1 and 2, participants were asked how likely they would be to use a driverless vehicle on a scale of 1- 10, where 1 was very unlikely and 10 was very likely. For purposes of analysis, participants' positions on these scales have been translated into graphs, where 1-3 on a scale translate into very unlikely/unlikely, 3-6 translates into unsure, 7-10 translates into very likely/likely.

In round 3, participants were asked how likely they would be to use a driverless vehicle on a scale of 1- 5, where 1 was very unlikely and 5 was very likely. For purposes of analysis, participants' positions on these scales have been translated into graphs, where 1-2 on a scale translate into very unlikely, 3 translates into unsure, 4-5 translates into very likely.

Likelihood of using driverless vehicles
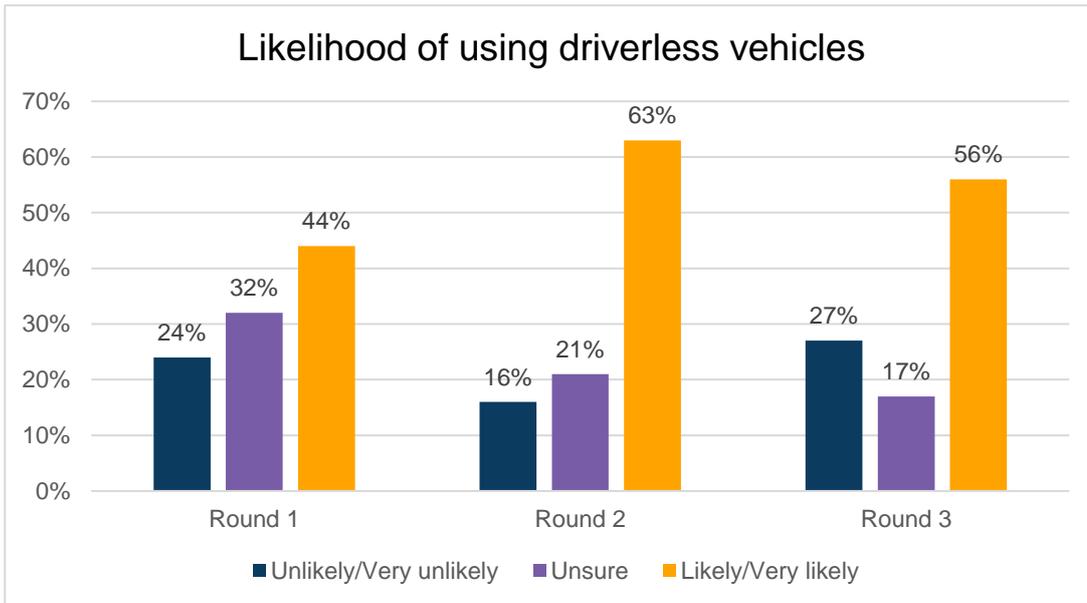
Throughout the three rounds of engagement with the public, the reasoning behind being likely or unlikely to use driverless vehicles has been very similar.

Reasons for being likely to use driverless vehicles have mainly included:

- more independence;
- more convenience; and,
- assuming they are safe.

Participants who were relying on some sort of mobility technology to get around were overall more likely to use a driverless vehicle compared to other groups.

Equally, for all three rounds of engagement, participants who would be unlikely to use a driverless vehicle have stressed lack of trust in the technology and concerns around unanswered questions as their main reasons for positioning themsevels on the other side of the scale.

3. User needs: Mobility

Participants were asked to think about their current day to day journeys, and how easy it is to make these journeys. After doing so, they reflected on whether having access to a driverless vehicle would make it easier to travel, and allow them to go on additional journeys. As part of this discussion they were encouraged to think about design and features of the vehicle that would be helpful to them.

> Aim: To explores how CAV technology can be harnessed to enhance and enable mobility for older adults and those with mobility-related conditions, contributing to the development of a stronger and more inclusive society.

Participants often drew attention to their own experiences and difficulties, and highlighted how inaccessibility of public transport makes older people feel ignored and excluded from society. The worst-case scenario would be for them to no longer be able to make their daily journeys.

Most participants can envision how driverless vehicles could relieve the stress and anxiety of making difficult journeys, both local or longer distance. However, it is important for older adults that the vehicles are designed in an easy-to-use way and that this technology does not take away human assistance completely. This was particularly emphasised by visually impaired participants.

3.1. What do older adults expect from driverless vehicles and how might they want to use them?

Participants were asked if they thought having access to a driverless vehicle would allow them to go on journeys they don't currently make, or perhaps would find more difficult as they get older.

Vehicle set-up matters

This question raised concerns and questions among participants across all groups. They wanted to know how far the vehicle could travel, if it would stop on the way, if you could drop the vehicle off at any destination, and how many people it could hold.

> *"If I want to go to Bangladesh, and I take the vehicle to Heathrow, can I send the vehicle back home?" Group 4*

These initial questions sometimes led to larger discussions around participants' initial assumptions of where a driverless vehicle would be most beneficial. Assumptions differed widely, with some participants arguing that they would be more suitable and beneficial for motorway travel, while others thought they would work as a good alternative to local community transport, or to get around in shopping centres.

> *"I can see the benefit of driverless cars on a motorway, going from say London to Birmingham. That's probably a good thing. But in an urban area with children and older vulnerable people; no, no unless it's 100% safe." Group 3*

Longer journeys

There was an agreement across all groups that a driverless vehicle could be helpful for longer journeys, especially among London based participants. Both current drivers and non-drivers stressed that there were journeys, outside London particularly, they would like to make for leisure, such as visiting national parks, the seaside, family, and friend, that currently they did not feel comfortable making. This was because they were concerned about driving long distances, driving in the dark, or anxious about changing public modes of transport along the way, or ending up alone in an area they are not familiar with.

> *"I'd like to go on journeys outside London, but I'm increasingly thinking no, because sometimes it's too far and I don't like driving at night." Group 1*

Local journeys

Participants who lived in London could also see how a driverless vehicle would ease local journeys. They explained that current regular journeys often include more than one bus, which adds journey time, inconvenience, stress and anxiety. Having a driverless vehicle that could take you from A to B was agreed to be a much simpler option. Participants in Group 4 specifically agreed that having access to a driverless vehicle would decrease their dependence on others and possibly enable them to go on more local journeys alone.

> *"Local is fine, but far away I still need somebody" Group 4*

Support arrangements to ease the journey

While reflecting on if and how a driverless vehicle could contribute to easier and increased mobility for older people, participants were asked to think about what vehicle features would contribute to making journeys more convenient, comfortable and secure. Across all groups, participants had several suggestions on how to ensure a functional and accessible design.

Booking a driverless vehicle

The majority of participants across all four groups would like to be able to call a driverless vehicle using their phone. Participants were generally happy with either being able to call and talk to a person, or using an app. A few participants compared a future driverless vehicle service to some of today's transport options: one participant imagined it would be possible to pick up and drop off driverless vehicles at specific locations, similar to public bike hire schemes while others thought there would be an organised fleet of different vehicles always available on the streets when you needed them, similar to Uber cars.

> *"I imagine we'd have a selection of cars already there, and wouldn't need to call anyone." Group 3*

Support arrangements

Participants across all groups emphasised the importance of the right support arrangements being in place. They stressed that older people find it difficult to walk long distances and that the vehicle should preferably be able to pick up passengers near to their homes.

Participants across all groups emphasised their current difficulties with getting in and out of different public transport and cars. Participants highlighted the need for an accessible vehicle design, making it easy for users to get up and down from their seats, especially for older people with potential disabilities or knee problems. In Groups 1 and 3 participants drew from their experiences using buses, and suggested features such as ramps, to decrease the gap between vehicle and pavement.

> *"For elderly people with mobility issues getting in and out of a car is difficult. So, this is an opportunity to maybe design them a bit differently. The problem is going from standing to low-sitting and visa-versa." Group 2*

Participants in Group 1 reflected on how driverless vehicles could accommodate other current difficulties with their day-to-day journeys. They particularly wanted to know how long it would wait for passengers to get in, and if there would be any parking costs, especially if booking a vehicle to take you to and from hospital appointments.

> *"If you've got a lot of shopping, will it wait for you to put it in?" Group 1*

There was a general concern among some participants that human assistance would be difficult to replace, especially for older people with disabilities or visual impairments. These participants felt anxious about making the journey and arriving at your destination alone.

> *"Once I've driven somewhere I don't know where I am. With a dial-a-ride bus, the driver will escort you, understand your problems. It's essential." Group 3*

Safety arrangements

Participants stressed that the right safety arrangements needed to be in place. It was particularly highlighted how driverless vehicles could be unsafe for both pedestrians and manual cars. Participants assumed the vehicles to be electric, and thus to be very quiet, posing a threat to people with visually impairments or hearing problems. Participants stressed their view that driverless vehicles would need to be able to clearly communicate with pedestrians, especially those more vulnerable due to failing sight, deafness or mobility issues, as well as other, perhaps non-driverless, vehicles on the streets.

Across all groups, participants emphasised the need for appropriate emergency communication. Participants suggested vehicles have the ability to send automatic messages to emergency services. It was stressed that all users need to be informed about the measures to be taken in an emergency before using a driverless vehicle.

> *"If there's any accident, we need a button that alerts someone." Group 4*

Participants brought up different examples of situations they assumed would cause problems, such as electrical shut downs and sensor failure, and emphasised the need for the right safety features to accommodate these situations. Participants were unsure about how the vehicle would adapt to

different surroundings, and queried what would happen if they had been produced in a country outside the UK, with different security laws and rules of the road.

A few participants wanted to know that there would still be someone in the vehicle in case something happened. Or that someone would be there the first couple of times they used the vehicle, to ensure everyone would be properly instructed.

> *"Would the car come around with no one in it? I thought driverless cars would have to have someone inside who could drive in case it broke down or whatever." Group 2*

> *"When we're given the car we need full training." Group 4*

Communication arrangements

Participants touched lightly on communication functions, and emphasised that vehicles must be able to communicate with and listen to the needs of the user. For longer journeys, a few participants felt anxious about not knowing if the vehicle would stop if they needed it to, and if so, would it know the most suitable place to pull over. This was emphasised both for local and longer journeys.

> *"I might get in to get down the road, but another time I might want a 3-4 minute journey. It would be nice to know where it was stopping rather than asking people." Group 3*

Payment methods

In Group 3, participants discussed payment methods. Participants generally thought that driverless vehicles need to be cheaper than current taxis, if they wanted to serve the purpose of increasing mobility of older adults. Participants stressed that many older adults are relying on their freedom pass to get around, and that they avoid getting taxis because of cost. An easy payment method was also highlighted as a requirement, to ensure older adults would feel comfortable using driverless vehicles without support from others.

> *"In Edinburgh when using the tram I was totally dependent on someone else to buy my ticket, and had I been alone I couldn't have done it." Group 3*

Shared services versus privately owned

Participants had varied initial assumptions about whether the vehicle would be shared with others or not. Across all groups, the idea of sharing a driverless vehicle with others did not bother participants too much. The majority of participants assumed that driverless vehicles would be communal and pointed to benefits such as lower user cost and having other people around to socialise with, or to support you if needed. However, they also emphasised there being an option of going alone depending on your needs.

> *"I hate taking expensive taxis, if these are going to be same price range, then yes - if we can have mini-bus version, and it also means there'll probably be other humans to help you in and out." Group 1*

A few participants found it concerning that there would not be anyone onboard monitoring the safety of the passengers. Some participants in Group 2, were worried about the safety of women, not knowing if they would face harassment or feel unsafe sharing with men, especially during the night time. Others, in Group 3 were worried about letting strangers know about their destination.

Across all groups, there was some concern around people taking advantage of the system. Participants wondered whether all people would be eligible to use driverless vehicles and, if so, this would result in less availability of vehicles for those who really needed one. This was contradicted by others, who expected shared services not to be constantly in use and wondered if vehicles would end up wasting parking space on the roads.

> *"Where there's a limited supply of vehicles there has to be some sort of system of priorities... or is it first come first served?" Group 2*

4. User need: Exploring the HMI

The FLOURISH programme has included designing a user interface for people to interact with and control a driverless vehicle. This work has been led by one of the partners called Designability. During our focus groups, participants were invited to give their views on this interface by reviewing different functions. Participants in Groups 1, 2 and 3 were introduced to the Human Machine Interface (HMI) through watching a 2-minute video clip from the FLOURISH simulator. This was to enable the participants to be able to more easily visualise what the HMI looks like and how to interact with it. A4 cards with different screen options from the HMI screen were then passed around to participants. The cards were used to help participants visualise the

> Aim: To explore levels of understanding and initial reactions to the developed Human Machine Interface (HMI) (by Designability) from older adults not previously engaged with in this field of research.

actual screen of the HMI, to obtain accurate reflections on the different functions of the HMI, and the level of understanding of the different screen options.

Facial recognition

The HMI can use facial recognition once you enter the vehicle, to quickly recall the user's preferred settings.

Please look at the bar below to load your display settings
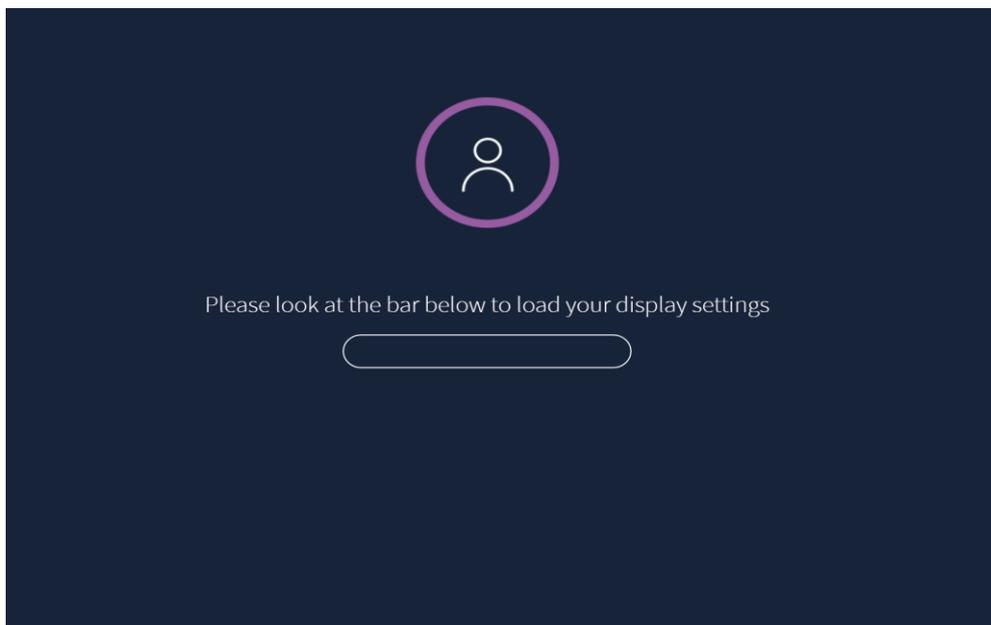
Figure 2: facial recognition HMI display

Participants were asked what they thought about this feature, and if this made them feel more or less comfortable using a driverless vehicle.

Most participants began with stating that they had heard of facial recognition before. Some thought the facial recognition feature was concerning and scary. These participants instantly assumed that users themselves were the key to get the vehicle moving. As a result of this assumption, they

Restricted External

concluded that users could become more at risk if there was a vehicle theft, or hijacking attempt. Others were worried that the facial recognition would not work accurately enough. They stressed that looks and specific facial recognition features, such as eyes, change with age and that current facial recognition technology is sometimes very sensitive to movement or light. They wanted to be assured this type of technology would work in all circumstances, to not risk being stranded somewhere, with the vehicle refusing to start due to too poor facial recognition quality.

> *"There was a discussion about ID, with the government saying they'd use people's eyes as their identifying feature. I myself have no Iris, so it comes to me and it says 'Doesn't recognise'." Group 3*

Some participants in Group 1 highlighted problems with facial recognition features if wanting to share the vehicle with other passengers, and wondered what would happen if users wanted to go to different destinations, but with only one screen.

> *"That concerns me. If you're 4 or 5 of you - who puts in the information? If you've got two people fighting over two screens? How does it override?" Group 1*

Others were more confident. These participants were normally familiar with personalised recognition features from other technology in their lives, such as mobile phones and computers. They could see the benefits of having access to personal settings, especially in a personal vehicle, and to ensure only registered users could go in the vehicles. However, they stressed the importance of ensuring assistance when programming settings the first time around.

Voice or touch
The HMI gives the user a choice of using voice or touch to communicate with the vehicle.
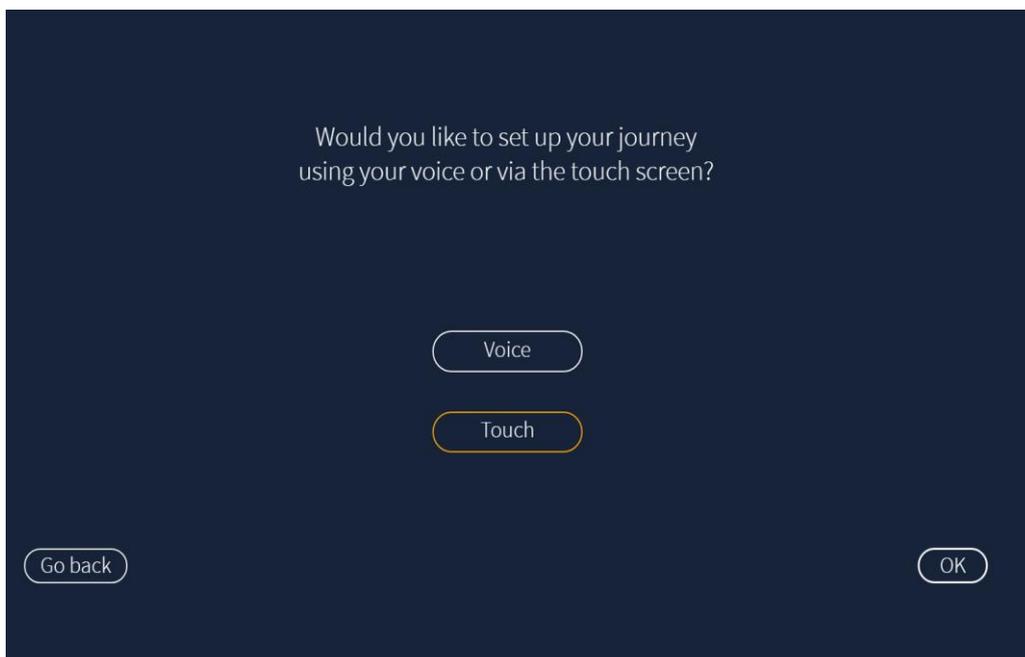
Figure 3: voice or touch HMI display

Out of the two options, the majority of participants preferred to communicate with the vehicle using their voice. Touch was viewed as more complicated, and difficult for older people who might struggle with stable hand movements.

However, most participants said they would like to have both options available. They also pointed to the importance of ensuring there were additional accessible communication options (e.g. braille), particularly for those with reduced sight and hearing, but also for users with different accents.

A few participants noted problems with voice control. Participants with hearing problems were particularly concerned that the vehicle would struggle to understand them, and likewise that they would struggle to understand the vehicle. They pointed to personal troublesome experiences with speech recognition and doubted the technology would be much improved in the future.

"We deaf people get frustrated with this kind of thing. It misunderstands us." Group 3

In Group 2, a few participants suggested that being able to programme your destination before getting in the vehicle, perhaps with someone else next to you who could confirm the address, could possibly relieve anxiety of getting in on your own and ending up at the wrong destination.

Journey summary
After programming your journey, but before setting off, the HMI summarises the journey on the screen. Participants were asked if they thought the information was clearly presented.
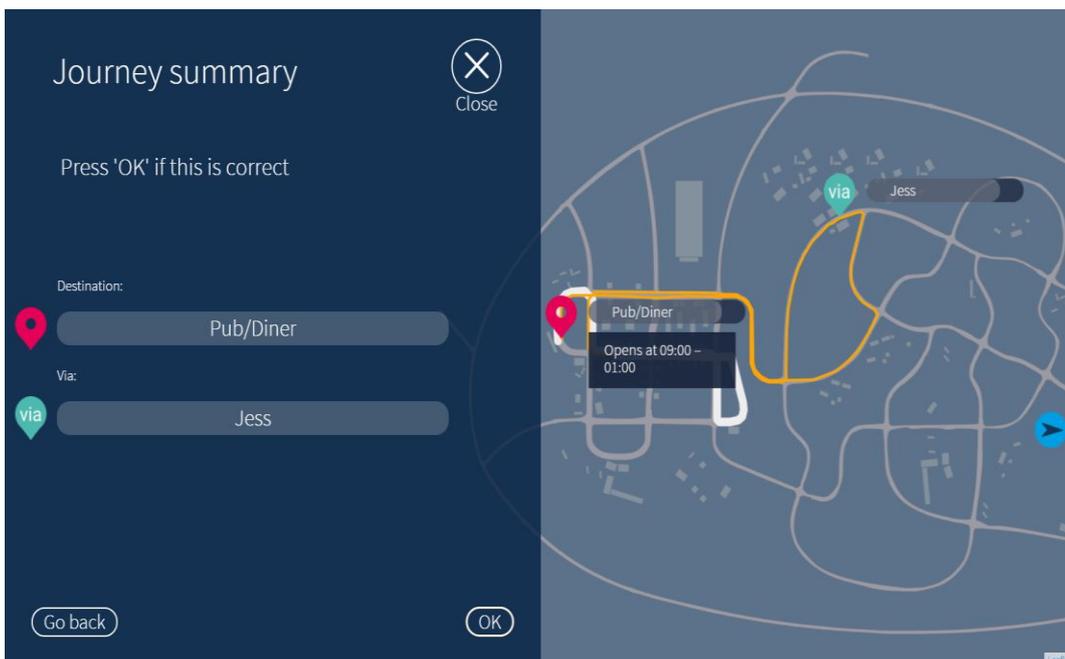
Figure 4: journey summary HMI display

The map initially confused participants. There was agreement between participants in all groups that the starting point was not clearly presented.

"I don't want a map at all - it's messy, I'm not interested, it's confusing; I like the bit on the left it says where I'm going..." Group 2

"I'm having problems now reading, and I need to be very, very clear. Often when you make things bigger, it actually becomes less clear." Group 1

Some participants were worried that they would not be able to clearly read the screen due to its size, or that they would have to know the postcode to get to where they wanted to go. They understood addresses might be saved in your personal settings for privately owned vehicles, but were anxious about getting in to a shared driverless service or a driverless taxi, knowing they might have to pre-programme the journey with exact address details.

Participants in Group 2 queried who would control the given route option on the screen. They emphasised their feeling that the control of route option should rest with the user, and wanted the vehicle to give a choice of several different routes, as rural road conditions are sometimes unpredictable.

> *"There's quite a few hills round here. I'm not sure I'd fancy going over the tops - would the car be able to? It would be interesting to say 'I'd rather go here, but I'd rather not go right up by highland cows on the tops, cos it's snowy, I'd rather stick to the main roads which have been gritted'. So, there is some need for flexibility in picking a route." Group 2*

Journey progress

Participants were introduced to two different screen settings that display the journey information while travelling, for example how much time is left until arriving at your destination. One display shows the vehicle moving on a map, while the other display summarises the current location, any stops along the way, and the final stop in three simple text boxes.

Across the groups, the majority of participants preferred the map option to the summary screen display, particularly when going somewhere new. It reassured participants to know it was possible to follow the vehicle's route on the map, and know instantly if the vehicle were to go off the suggested route.
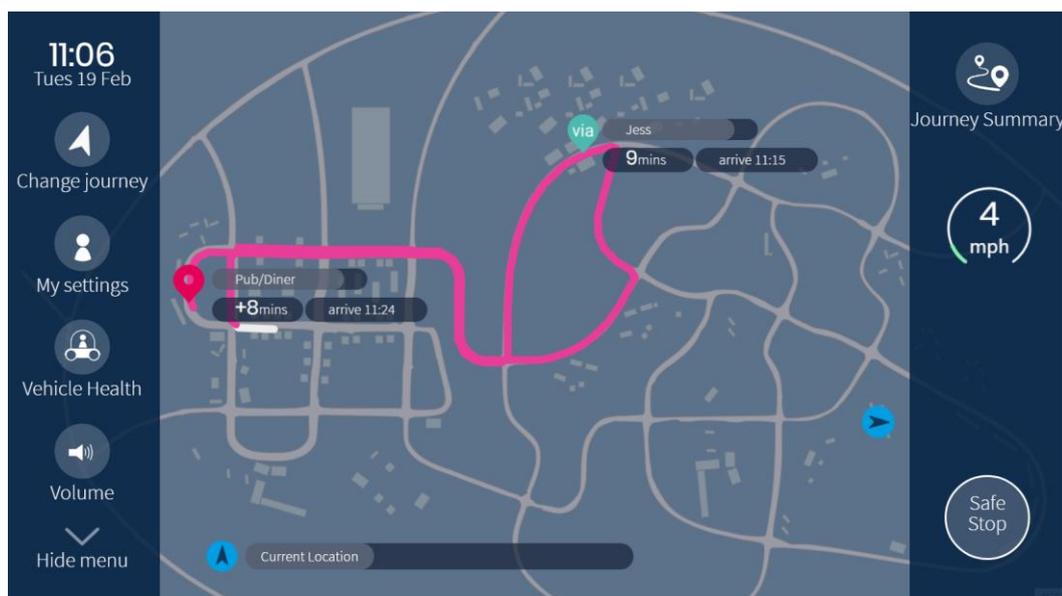

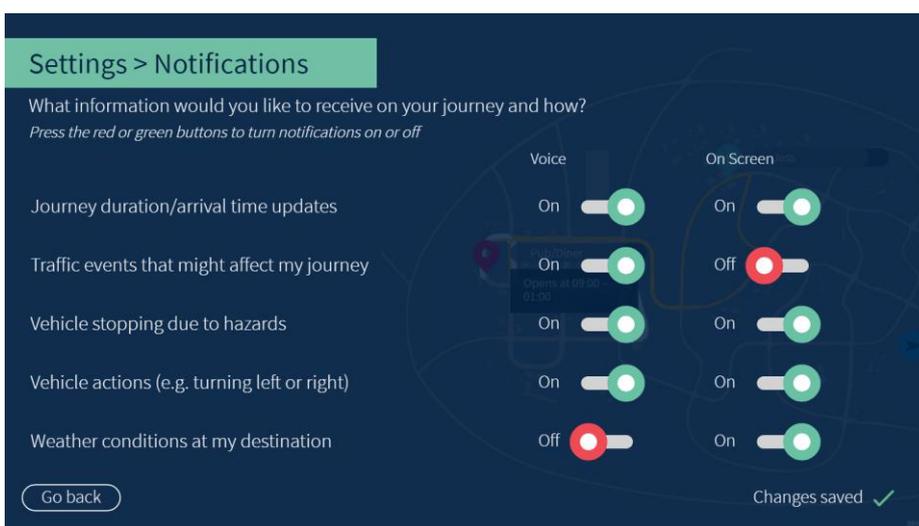
Figure 5: journey map HMI display

"This [the map] is great when you don't trust the machine and when you're not used to it, but I suspect that when you trust it this [the summary] will be more helpful. Particularly because it gives you safe stop and show map [options]I think this one will be more popular." Group 1

Figure 6: journey map HMI display

In Group 2, it was noted that both screen displays are lacking information about more rural features, such as if the route suggested would include going over hills, which normally affects weather conditions, or on smaller roads, which sometimes can be obstructed by animals.

Journey notifications

It is possible to choose which updates you would like to receive while on your journey. Participants were introduced to the five standard updates, and asked which updates are more/less important and why.

Figure 7: journey notification HMI display

Notification	Participant reaction
Journey duration	Participants across groups generally agreed that they wanted to know how long the journey would take, and any updates to arrival time. To get live updates on changes to arrival time was viewed as a convenient feature. However, participants felt the number of updates needed to be synchronised with the journey duration time. If going on a shorter, more local journey, where participants knew the area, it was pointed out that updates would not need to be as frequent.
Traffic events	To most participants, updates about traffic events, such as road works or accidents, were more of a given than an optional choice. They viewed this as necessary and expected the vehicle to keep them up to date with any unforeseen problems along the way. To be told if there was a problem further along the route was highlighted as increasing trust in the driverless technology. Most participants were also positive about the idea of being able to re-route if there was a problem on the original route.
Vehicle stopping due to hazard in the road	If the vehicle suddenly had to stop, the majority of participants wanted to know why. They said that they would be curious to know what was the reason for stopping, and that knowing would make them feel more secure. In Group 1, however, a few participants felt that too many updates would result in more stress and inconvenience for the user, and less time to relax and enjoy the journey.
Vehcile turning left or right	The majority of participants said they would not care about getting updates on whether the vehicle would turn left or right while on their journey. However, one visually impaired participant stressed how updates which seem simple to the user, might be of great importance to people outside the vehicle, particularly if you suffer from sight or hearing loss.
Weather conditions	The majority of participants thought it would be interesting to receive updates on weather conditions along the way. This option was particularly well received in Group 2, where it was stressed that weather can be very changeable and affect road conditions in rural, more hilly areas.

Vehicle health

The final card displayed updates on whether the vehicle was in good condition, showing the status of breaks, tyres, network, engine and battery. Participants were asked if this display reassured them that the vehicle was safe to use, or if there was other information they wanted to be displayed, to feel more comfortable using the vehicle.
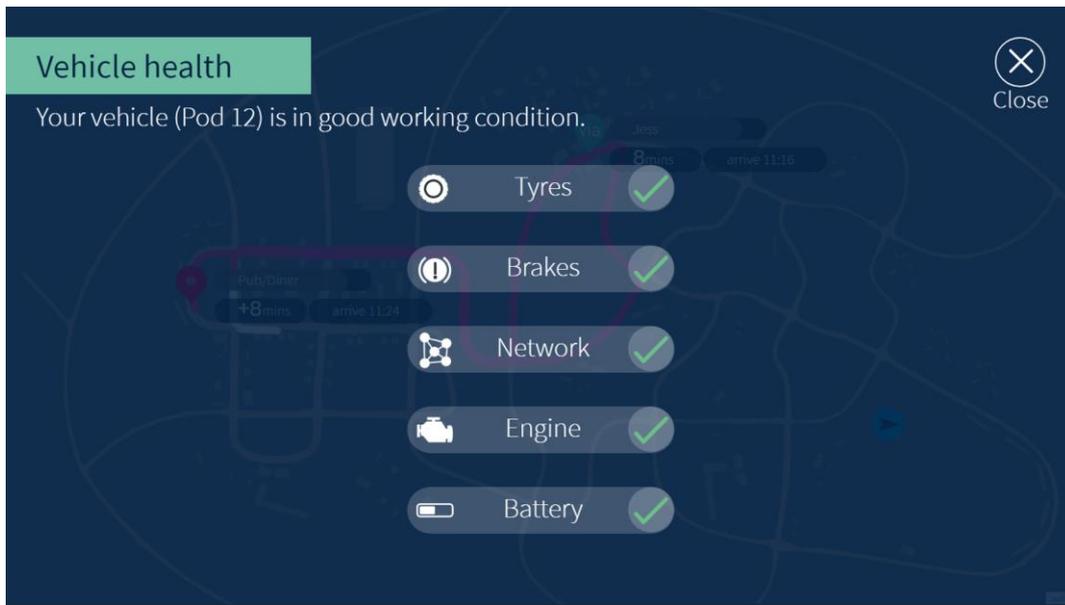
Figure 8: vehicle health HMI display

Participants were initially anxious when getting introduced to this card. Rather than being reassured, they saw the vehicle health display as a confirmation that something might go wrong during the journey.

> *"What happens if one goes red during the journey?" Group 1*

There was a general agreement across groups that if the vehicle was hired or communal, they assumed and expected it to be in good condition, while if privately owned they could see how updates like these might be useful.

> *"You don't get into a taxi and the driver tells you when it was last serviced and how many miles it's got left - I wouldn't want to know that." Group 2*

The battery and network symbols were the most controversial among participants, especially those in Group 2. Some of this was due to concerns about electric vehicles and how long their batteries will last. Assumptions that battery life would not be long lived, and that the user might be travelling a distance not covered by charging points or network connection, made participants question the functionality of these vehicles in rural areas even more.

After some reflection, participants could see the usefulness of the vehicle health display, to understand what might be wrong if something happened. However, it was stressed by some that they wanted early updates or warnings.

Section 2: Video diaries findings

5.   Video diaries

5.1.   Video diaries methodology

Seven young people (18 – 26 year olds) with different mobility issues participated in a video diary project as part of this round of engagement. Participants were asked to go on four different journeys and reflect on the following in short video diary clips:

Before the journey:

- Introduce the journey you are going on – where are you going and how are you getting there? How long does it normally take?
- How do you feel now, and how do you usually feel about taking this journey?
- Reflect on any current difficulties with this journey you might have due to your mobility issue. Tell us about any instances related to this journey in the past that stand out to you.

After the journey:

- How did you feel on the journey? Were there any parts of it that stood out to you?
- How would you feel about taking this journey in a driverless vehicle?
- How would this journey be different if using a driverless vehicle?
- What features would you like to see in the driverless vehicle? (E.g. what features would make it easier to use a driverless vehicle for this specific journey).

Participants were briefed over the phone and had a total of two weeks to complete their video diaries. The outcome of this research is a short summary video available at www.flourishmobility.com . Summary findings are also outlined below.

The video diary project aimed to capture the 'in the moment' thought processes of people with mobility challenges, and how an end to end journey could be different with a driverless vehicle.

About the participants

For the video diary project, seven young adults were recruited. The table below provides a summary of the participants.

Table 3: video diaries participant information

Video diary participants:
7 participants
4 male / 3 female 18 – 26 year olds Mix of urban/suburban/rural Recruited from within and outside London All participants have long-term mobility issues that impact on their ability to get around (e.g. use of crutches or limited walking capacity). Of these, 4 participants rely on assistive mobility technology (wheelchair and mobility scooter).

5.2.   Summary findings from video diaries

Regular travel often means relying on friends and family

Participants are often dependent on others to get to places. This sometimes results in inconvenience but also in the feeling of being burdensome.

A driverless vehicle, participants hoped, could enable young people with mobility issues to be more independent.

Travel by public transport often means relying on staff and strangers

Participants noted that at times their needs were ignored by bus drivers at bus stops, not waiting long enough for them to get on. Participants also described how there is only room for one wheelchair on a bus, and that users will have to rely on other wheelchair users to understand the unspoken rules of waiting in line for the next available bus with wheelchair space.

Participants emphasised that being able to make journeys in a driverless vehicle would be less of a struggle, not only physically but also emotionally: not having to constantly feel ignored or rely on strangers to help you.

Regular travel can be too restrictive

How participants feel about making their journeys varies depending on their day-to-day condition. Some days are more painful than others, and if making a journey on a particularly bad day this normally leads to anxiety of the conditions worsening during the journey.

Being in the same position for a long time is difficult. Having access to a driverless car was suggested by participants as a possible way of having access to a more comfortable, spacious and less stressful and painful journey.

> *"I would not have to worry about sitting in that same position for a long amount of time because the car would be able to sort all of that for you and it would just take away*

Aim: To explores how CAV technology can be harnessed to enhance and enable mobility for older adults and those with mobility-related conditions, contributing to the development of a stronger and more inclusive society.

one of the other stresses from your life that you can focus on other things like your mobility."

As journey duration often impacts on participant's mobility issues and wellbeing, it was often suggested that they would want updates on journey time, and knowing they are using the quickest route possible.

Travel by public transport can mean having to prove your mobility needs

Some participants mentioned travelling on public transport caused a lot of frustration. As they are young, and sometimes their disability is not visible, they often have to prove their mobility needs to others. Some journeys participants made ended in arguments with fellow passengers about who should give up their seat.

"People make a lot of judgements on how young you are and how disabled you can be, and I think that's one of the reasons that I generally avoid travelling because it's scary it's very, very scary."

Being able to use a driverless vehicle for their journeys would mean not having to interact with other members of the public. It was emphasised that this would be a huge relief.

Parts of public transport can be inaccessible

When using public transport, all participants referred to problems caused by inaccessibility. The gap between the train and the platform, or between the bus and the pavement, a lack of lifts at stations, and changing transport modes along the way were all frequently mentioned. Participants explained that inaccessible public transport causes a lot of stress and anxiety before and during journeys.

If a driverless car could be designed in an accessible way, suitable for different needs, participants believe this would make a huge difference to even the shortest journeys for them. They also felt that having another transport option would increase their chances of getting to places which are currently too inaccessible if relying on public transport.

Parking can be difficult

If travelling by car, participants expressed nervousness about unknown amounts of walking along the way due to available parking spaces being too far away from your destination.

Having found a parking space, participants recounted how they sometimes experienced issues with having enough space to get in and out of the car. Participants mentioned that any help with parking, such as designated parking areas with larger spaces for the vehicle, knowing that the vehicle could drop you off close to your destination, and making it easy to get in and out, would be useful and make many different journeys much easier.

"One of the problems I did have this morning actually was finding a suitable place to stop and park and for me to get out of the car cause its quite difficult knowing where the disabled spaces."

6.   Conclusion

This report is a snapshot of views at a particular time. We engaged with very specific groups of society who were self-selecting rather than recruited, and there was a small sample size. Therefore, the views presented in this report cannot be extrapolated and considered representative of the views of the wider public. However, our engagement did provide us with insight as to the most prevalent views at this time, within this sector of society, on CAVs.

The focus groups and video diaries provided an opportunity for members of the public who stand to benefit from FLOURISH to provide feedback on the concept and to explore needs and expectations about different elements of the technology and stages of a journey.

Acceptability of the technology

- Sign up to focus groups was voluntarily, and spaces were immediately filled up, which suggests a great deal of interest in the topic among older adults.
- Participants have repeatedly stressed the need for more information on driverless vehicles to be provided to the public. While most participants have heard about the concept, the information reaching the public was normally commented on as vague and has increasingly been accident related.
- Participants who were more exposed to other forms of technology in everyday life, and had come across more information on driverless vehicles, often expressed more immediate trust in the technology. Equally, some participants who had never come across the concept previously, were instantly excited.
- Engaging with target groups, ensuring their voices are heard, and providing them with more information, could possibly increase acceptance towards driverless technology and also decrease wider feelings among older adults of sometimes being left out of future research.

Interacting with the vehicle and reflections on functionality

- Participants had several ideas around features which would make them feel safer and more comfortable when using driverless technology. When outlining their ideas, they often referred to current journey difficulties, and highlighted how inaccessible transport makes people feel ignored and excluded from society.

Benefits for people with mobility challenges

- Although participants raised many concerns, they were generally quite positive towards the technology, understanding that it could provide benefits for older adults and people with mobility issues. However, it has been strongly emphasised that more research on the technology is needed, to ensure driverless vehicles can be safely rolled out.

Fanny Goterfelt

Fanny.goterfelt@traverse.ltd