Public Views on Connected Autonomous Vehicles

A Multi-Method Study: Qualitative Activities Report

UKERC Working Paper

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Acknowledgements

Contents

1. Executive Summary

Connected Autonomous Vehicles (CAVs) may be key to reducing carbon emissions from land travel. Transport emissions are flatlining but not coming down, and AVs are seen as a techno-fix.

Energy and carbon reductions from CAVs are anticipated to come from numerous factors. These include technical aspects such as 'platooning' (travelling in long lines of vehicles at coordinated speeds), reducing drag and increasing fuel efficiency. However, research to date says carbon savings from AVs will mostly come from sharing them. This is because they could transport people all day instead of sitting unused for up to 95% of the day, as happens with private cars. This would reduce the number of vehicles required to fulfil travel needs, reducing the vehicle fleet and embedded carbon.

So, we were very keen on exploring public views on shared AVs; in car clubs, or as taxis or buses. People do not use such shared vehicles much now – so would AVs be any different?

Quantitative research through surveys has identified some factors that may affect whether people want to use shared CAVs, or not, through statistical analysis of survey responses. However, more realistic impressions can be gained from directly asking people about their views and preferences. We therefore investigated public views about (shared) CAVs in three ways:

- A **choice experiment**: where people were offered direct hypothetical choices between trips on current or autonomous vehicles of different types; and
- **Deliberations**: focus group-style guided discussions about what an AV future would look like; followed by
- An **MCDA (Multi-Criteria Decision Analysis) exercise**: a method of getting people to assess different options. It involves giving the options scores using criteria of different importance (or weight).

By using these three methods, we hoped to avoid a common issue in research: thinking that one method or theory can reveal everything. The *choice experiments* used a representative sample of the public, the other two methods also sought out non-typical views, from groups hypothesised to hold more extreme or polarised views about cars, about disruptive technologies, and about sharing.

The *choice experiment* offered direct hypothetical choices between transport modes for trips with varied costs, times, and convenience. The choices were converted into a Value of Travel Time Saved (VTTS), by which modes can be compared. It is assumed that the cheapest, most convenient option will be most popular. The experiment also measures the importance of factors that were not present to people on their choices. These 'imponderable' factors might include:

- The technology itself (e.g., embedded carbon, energy efficiency);
- The services it provides (e.g., travel and wait times);

- Psychological factors (e.g., trust, anxiety, safety, etc.), familiarity, or the rejection of new technologies, etc.

The *deliberations* asked people about 100% AV futures:

- How would they differ from today?
- Were they feasible or likely, and if not, why not?
- What might slow or speed up the transition to such a future?
- Are shared or private AVs more appealing, and why?

Open-ended questions like these revealed detail of the 'imponderables' of which the quantitative work quantified the strength. These include social, cultural and political issues, and also issues like trust, concerns, or subjective views based on age or gender.

The MCDA exercise then led people through 'objectively' assessing different options. Although we allowed people to assess different vehicle fleets (e.g. mixes of autonomous and non-autonomous vehicles in combination), almost all decided to compare transport modes. These were conventional and autonomous, private or shared, as the public chose. They also selected their assessment criteria, how important they were in comparison with each other, and the scores for individual modes on those criteria. This produced a 'rational' or disinterested assessment that often differed from what they themselves expected; e.g. car enthusiasts often scored buses highest.

We found that our three methods - perhaps predictably - came up with different insights. These highlight different sides of the issue, just as asking different questions gets different replies.

The choice experiments found that beyond service attributes (i.e. convenience), CAVs were preferred less than conventional cars. The deliberations raised 50% more concerns than benefits of CAVs, and yet the MCDA assessments mostly scored CAV options highly. Shared AVs came out generally as most preferable, although there were fears, such as about unmanned shared CAV taxis and buses.

Another key finding from all three activities was that views of shared CAVs seem to be based largely on how buses, taxis, and electric vehicles (EVs) are currently experienced. If these modes of transport currently fail people, perhaps they need to be sorted out for AVs to have a future?

2. List of Figures and Tables

3. Introduction

This working paper brings together reports written on the research undertaken in 2024 on the UKERC Autonomous Vehicle project – a multi-method research programme to investigate the likelihood of public uptake and use of Connected Autonomous Vehicles. The research was commissioned as part of the UKERC 4 programme of work Energy for Mobility, led by Profs. Jillian Anable and Christian Brand, to explore the "adoption, utilisation and energy pathways for the combined transition to electrified, autonomous and shared mobility services… that may lead to net increases or decreases in transport energy demand under a range of future pathways".

The research was operationalised in two separate work packages at an early point, with quantitative research in the form of econometric modelling and a choice experiment being undertaken by Dr. Eeshan Bhaduri supervised by Prof. Zia Wadud, and later a second qualitative work package was undertaken by Drs. Noel Cass, Llinos Brown and Theresa Nelson, under the supervision of Prof. Jillian Anable.

This Working Paper combines reports on the two work packages' three main research activities:

- A **choice experiment**: where people were offered direct hypothetical choices between trips on current or autonomous vehicles of different types;
- **Deliberations**: focus group-style guided discussions about what an AV future would look like, with what consequences for travel, energy use and society; and
- An **MCDA (Multi-Criteria Decision Analysis) exercise**: the public deliberators were led through a method of assessing different options: either vehicle fleet mixes or individual transport modes, involving both conventional and AV, and privately-owned and shared options. It involves giving the options scores using criteria of different importance (or weight), and is hypothesised to produce a more 'objective' and 'rational' assessment than deliberation, but in a more open-ended and participant-directed manner than a choice experiment.

It was hoped that the three methods together would produce a more rounded understanding of public views of (shared) CAVs, including representative and more extreme views, which should help policymakers and the industry anticipate the real-world acceptance, adoption and use of these modes of transport.

This Working Paper reports on the qualitative work package research activities.

4. Qualitative Research Activities report

The qualitative work consisted of deliberations and MCDA exercises. In practice, these were supposed to be combined in one 3-hour session (a Deliberative Workshop: DW) with the same members of the public taking part in the MCDA exercise after the discussion group (DG) phase in which they had deliberated together on CAV futures. Recruitment issues (availability of potential participants) meant that in one case (DW 5: Tesla/smart EV owners), the two activities took place in two sessions one week apart, in a shorter session. In reporting the activities, rather than combining the reports on DWs (which are available as an Appendix), we have reported on each activity in turn, instead referring to 14 Discussion Groups and 14 MCDA exercises.

Summary of deliberations

Executive summary

A total of 14 one-hour moderated discussions with members of the public on the topic of Connected Autonomous Vehicles (CAVs) and CAV futures were held in summer-autumn 2024 across eight Deliberative Workshops (DWs). The DWs were recruited to sample a wide variety of views from the general driving, non-driving and car-sharing public, and from divergent groups anticipated to hold more polarised views of cars, sharing, and innovative technologies. These included vintage and classic car enthusiasts, co-housing residents and off-grid dwellers, and Tesla/smart EV owners. The following summary lists the sub-themes of discussion in order of numbers of mentions. They are fully explained in the following sections.

Benefits of CAVs were thought to include: increased safety, reduced energy and carbon emissions, convenience, disabled and older accessibility, greater accessibility in the sense of availability, better use of travel time, increase in employment in programming and manufacturing, innovation, reducing the number of vehicles required, being algorithmically efficient, allowing appropriate sizing of vehicles for trips, reduction in congestion, being cheaper, reducing need for parking space, reducing crime, allowing smaller vehicles, reducing problem driving, and saving driver wage costs.

Concerns about CAVs outnumbered anticipated benefits by 50%, and were thought to include: safety, removing the joy of driving, unemployment of drivers e.g. public transport drivers, being an undesirable new technology, reducing human control, inspiring distrust, having environmental impacts e.g. in the manufacturing process, and battery generation, being exclusionary through high costs, bolstering a need for cars, crime and potential hackability of CAVs, sharing with other passengers, surveillance and privacy, increased/induced travel, affordability, reducing human

interaction, affecting health, introducing control of travel, inequalities, relying on robot ethics, involving risky traffic/street interactions, allowing exploitation of ownership, depreciation, increasing energy and carbon emissions, not being child friendly, storage issues, involving new vehicle production, digitalisation, precluding living vehicles and not being instantly available.

CAV roll-out was thought to involve changes in travel and the labour market, to require enforcement by the government, to change the make-up of the total vehicle fleet proportions, to reduce shopping and affect parking space.

Most participants felt that the CAV transition was likely (or inevitable), and that factors that might accelerate the transition were thought to include: political will and legislation, generational changes, cultural and financial issues, climate policy and infrastructure investment. Slowing factors which may hinder a CAV transition included: cultural issues, regulatory concerns, political issues, fear of new technology, cost, and trust. There was a reliance on technological optimism and determinism, but it was felt that manual driving would still exist, and that the transition would be over long timescales.

There were outstanding queries relating to: insurance, ownership and the fleet composition, the looming tax revenue gap from electrification, responsibility and liability, control and management, appearance and design, and whether the technology already exists.

Discussions on the CAV fleet composition focused on modes of CAV transport and ownership/sharing and included: public transport modes and the need for this to be manned, other shared modes, from fleet/car club modes to taxi/Uber modes, private ownership, freight, deliveries and alternatively fuelled (non-electric) vehicles.

Acceptability issues that were discussed included key conditionalities: infrastructure provision, specific uses/modes, safety, fair and equitable deployment, maintaining manual options, sustainability, government management, and human over-rides in both a context of improved public transport and being electric. There was virtually no discussion of education increasing acceptability, and some discussion of expected resistance.

Other issues discussed included: political issues, EV specific comments, urban/rural comparisons, class and status, infrastructure, the supremacy of cost, geopolitics, comfort, climate change, technical feasibility and road upkeep.

Methodology

Recruitment

Appendix A details the processes of recruitment. The intention from the outset was to recruit not just 'general public' participants with opinions representative of the population, but to purposively sample for anticipated marginal or more extreme views along with some more generally representative views.

Fieldwork

In total eight workshops (DWs) were convened, split in to two phases: the Discussion Group (DG) in which participants deliberated together on CAV futures, and the MCDA exercise. Most groups ran over a 3-hour period with a 15-minute break in the middle. The exception to this was DW5: Tesla and smart EV Owners, which instead ran as two one-hour sessions, a week apart. This was to accommodate participants' availability.

In groups where there were five or more participants, groups were split randomly into two breakout discussions, each facilitated by a member of the research team. Notes were taken in one breakout group by a third member of the research team, and more were created from recordings of the breakout session in which none were taken, after the workshop. This resulted in a total of 14 hour-long DGs being facilitated, recorded, and summarised by the lead author in the respective Summary Reports available as Appendix B. These summaries consist of bullet points capturing the content of the discussions from notes and from the original Zoom meeting recordings and transcripts.

The summaries were then uploaded to NVivo qualitative research analysis software and inductively coded for the themes of discussion. The resulting coding framework is provided as Appendix C. Some sample characteristics are provided in Appendix D. The following table summarises the nature of the participants in the different Deliberative Workshops (DWs) and DGs (Discussion Groups). The last three DWs were recruited from the general public by Scout Field Experts, a professional recruitment company.

Participants were provided with an incentive of £60 in online shopping vouchers to compensate them for their time. The project was granted ethical approval by the relevant Ethics Committee (BESS+FREC) at the University of Leeds on 12th March 2024 (ref: 1006), and an amended application was granted approval on 16th April 2024 (ref: BESS+FREC 2024-1006-1615).

Table 1: Discussion Groups carried out

Deliberative Workshop	Attendance	Codes for DGs	Date/time
1: Vintage car group	8, two discussion groups of 4	DG1B and DG1B	29th May 2024 0900
2: Co-housing and off-gridders	7, two discussion groups of 4 and 3	DG2B and DG2B	4th July 2024 0900
3: Co-housing and off-gridders 2	7, two discussion groups of 4 and 3	DG3B and DG3B	7th July 2024 1300
4: Classic car fans	5, two discussion groups of 3 and 2	DG4B and DG4B	7th Aug 2024 1800
5: Tesla/smart EV owners	2 in one discussion group	DG5	5th Nov 1930
6: Public-drivers	8, two discussion groups of 4	DG6B and DG6B	14th Nov 1800

7: Public-non-drivers	7, two discussion groups of 4 and 3	DG7B and DG7B	22nd Nov 1830
8: Public-car-sharers	4 in one discussion group	DG8	28th Nov 1830

The Discussions - Framings

The participants in the DWs were provided with some basic information about CAVs at the start of the workshop, based on the slide reproduced as Figure 1 below. The participants were told that our discussions were based on CAVs at level 4 or 5 automation. They were then told that "We want to know your opinions on CAVs and how they might in reality be rolled out (or not) in the UK, and how this might affect the energy use and carbon emissions of land transport. We are not promoting CAVs, nor are we taking a position on whether or not they are 'a good thing'. The whole point of these deliberative workshops is to get your views, because academics and technology developers and policy makers all need to know the broadest possible set of views around this technology to inform their thinking. However, we don't want 'just' opinions – we really want to know WHY you have these opinions, and so we apologise in advance for continually asking 'why?'".

Figure 1: Definitions of automation given to participants
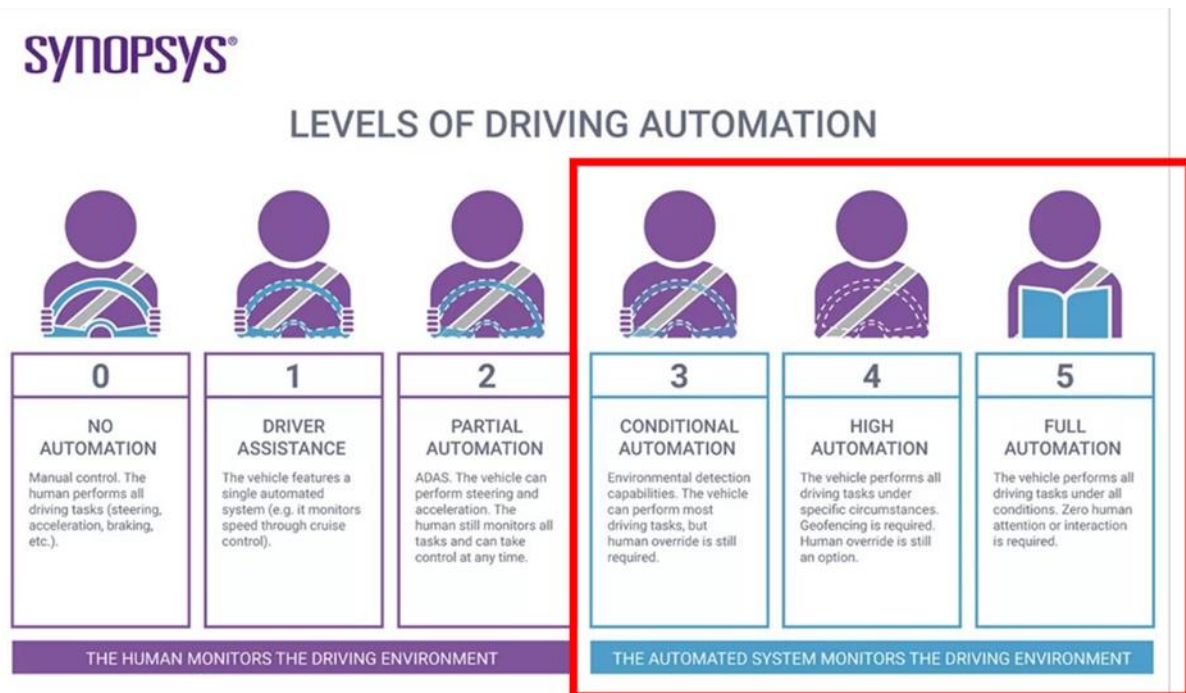
Basic rules for the discussions were also provided:

- No wrong answers – except when they are! (i.e. we reserve the right to correct people if we think they are saying things that are untrue)
- No talking over others, for politeness and for us to be able to record what is said
- Always try to give some reasons, rather than just stating opinions

- We may ask specific people to give a response sometimes, to make sure everyone gets a say.

The discussions were split into two rough sections, with two headline questions. These are reproduced below, along with the potential prompts that were used to get discussion going again if/once it dried up.

Headline question 1: *"Even if you do not believe it to be likely or technically feasible, try to imagine a world where every vehicle manufacturer has swapped to only producing AV vehicles. This is how most people assume the change would happen – with AVs gradually taking over streets from 'normal' vehicles. What would such a world look like? What effect would it have on people's everyday lives and travel? What other impacts would it have? We would like you to think about the change-over and also an all-AV future."*

Prompts:

- Do people travel more or less, or the same, in this world? Why?
- Would you be using AVs in this future?
    - If so, how?
        - If they don't understand – as a car/pod? Taxi? Car club/bus?
    - If not, why not?
- Does everyone across society's travel consume more or less energy, or produce more or less carbon emissions, and why?
- What effects would shifting to AV production only) have on the economy, and why?
- Have you thought of all land transport of different modes (freight, public transport etc.), not just individual transport? Make sure you do!

Headline question 2: *"How likely do you think this future scenario is? Why? If you don't think this scenario is likely, or have another idea of how things might pan out, What alternative future(s) (if any) do you think will actually come about? And Why?"*

Prompts:

- What, apart from technological feasibility, makes the alternative future you have proposed/we are discussing more or less likely?
    - Politics?
    - What companies/manufacturers are like?
    - What the public are like?
    - Environmental concerns, targets or policies?
    - Any other influences on how things are likely to turn out?
- What makes these alternatives more or less acceptable – and what do we mean by acceptable?

This may seem a limited number of questions, themes or prompts for an hour of discussions, but the facilitation of deliberation proceeded smoothly in almost all cases and the discussions developed freely, with participants intuitively providing e.g. benefits and concerns, conditionalities of support and explorations of how the roll-out of CAV technologies might proceed in practice. A full example 'script' of a Deliberative Workshop is provided as Appendix E.

Thematic Analysis

The sections of the following analysis are based on the inductive coding of the material, roughly following the order the issues were raised across most workshops. Within themes, sub-themes are discussed according to their popularity – i.e. in the order of the number of data segments coded for that sub-theme. This is indicated after the sub-theme title, along with the number of discussion groups providing data to that sub-theme: e.g. (137 in 8) for the 'Benefits' parent code shows that in total, there were 137 segments of text across 8 DWs coded as benefit of CAVs. It is followed by an analysis of the similarities and differences across DWs.

Benefits, Concerns, Changes, Likelihood, And Queries

A list of all the benefits and concerns raised by participants is given in Figure 2.

Figure 2: Benefits of and concerns about CAVs raised across all groups, coloured by car preference

Benefits of CAVs	Concerns about CAVs
Increased safety (especially for women), reduced energy and carbon emissions, convenience, disabled and older accessibility, great accessibility in the sense of availability, better use of travel time, employment in programming and manufacturing, innovation, reducing the number of vehicles required, being algorithmically efficient, allowing appropriate sizing of vehicles for trips, reducing congestion, being cheaper, reducing need for parking space, reducing crime, allowing smaller vehicles, reducing problem driving, and saving driver wage costs.	Safety, removing the joy of driving, unemployment of drivers, being undesirable new technology, reducing human control, inspiring distrust, having environmental impacts, being exclusionary through high costs, bolstering need for cars, crime and hackability, sharing with other passengers, surveillance and privacy, increased/induced travel, affordability, reducing human interaction, affecting health, introducing control of travel, inequalities, relying on robot ethics, involving risky traffic/street interactions, allowing exploitation of ownership, depreciation, increasing energy and carbon emissions, not being child friendly, storage issues, involving new vehicle production, digitalisation, precluding living vehicles and not being instantly available.

Green benefits and concerns perceived more by 'non-drivers' than 'drivers''; red concerns more by 'drivers' than 'non-drivers'.

Benefits (137 in 8)

As can be seen from Figure 3, perceptions of benefits and concerns were reasonably equal across most DGs, with the possible exceptions of DG3A Co-Housing and Off-Gridders 2, DG4B Classic Car Fans, DG6B Public – Drivers, and DG7A Public – Non-Drivers discussing noticeably more Concerns than Benefits, and DG1B Vintage Cars raising more Benefits than Concerns. DG2B Co-Housing and Off-Gridders are the only authentic group to raise more Benefits than Concerns, and these were mostly linked to Public Transport and Shared modes of deployment.

Figure 3: Benefits and concerns numbers across DGs

	A : Benefits	B : Concerns
DG1A Hacked Vintage Cars	5	5
DG1B Hacked Vintage Cars	8	5
DG2A Co-Housing and Off-gridders	8	8
DG2B Co-Housing and Off-gridders	12	10
DG3A Co-Housing and Off-gridders 2	5	9
DG3B Co-Housing and Off-gridders 2	3	5
DG4A Classic Car Fans	4	5
DG4B Classic Car Fans	4	11
DG5 Tesla or Smart EV Owners	6	6
: DG6A Public - Drivers	7	10
: DG6B Public - Drivers	4	8
: DG7A Public - Non-Drivers	6	11
: DG7B Public - Non-Drivers	5	6
: DG8 Public - Car-sharers	11	12

(Green = most coded segments, red = fewest)

On a purely quantitative analysis, 20 unique benefits were raised by participants, compared to 30 concerns being raised. It is also important to note that on some issues, the opinion was divided on whether CAVs were beneficial or detrimental – safety and employment being two key examples.

Increased safety (17 in 6)
The most often cited benefit was increased safety. This was frequently raised without any argument being made as to why the assumption was made. One group suggested it would arise from the reduction of human error and accidents, another talked about the risk and accidents due to 'human nature'. A third suggested that CAVs would be smaller vehicles due to there being no need for safety features, crumple zones, etc., "that make even Minis huge." Safety was welcomed by a participant who drives every day, "and I don't always like it". Motorway journeys, in particular, were thought to be 'smoother' and safer by CAV, and the 100% CAV future was assumed to reduce drink driving. One group mentioned that empirical trials (San Francisco was mentioned) appear to be proving that CAVs are safe. Trams (the driverless Docklands Light Railway was mentioned) were seen as intrinsically safer than autonomous road vehicles due to running on tracks.

Safety in the sense of personal security and a lack of crime was also mentioned, one participant seeing CAVs as similar to a taxi, without the issues of crime and confrontations.

      Safe for women (2 in 2)
One participant (female) pointed out that travelling alone in a driverless AV was safer for women, associating drivers with danger. Another thought that a CAV bus (with other humans) was safer.

Reduced energy and carbon (13 in 6)

Numerous groups thought that energy use and carbon emissions would be reduced by CAV use, and saw this as a positive 'selling point' for the vehicles. However, it was pointed out that this was dependent on the CAVs being electric, with one participant pointing out that this was not a given, and also, that the electricity used would have to be produced by renewable sources. Lower energy and carbon were also assumed to arise from smoother, slower or speed-matched driving, or from more appropriate sizing of vehicles, but 4 different groups worried that the anticipated reductions would only materialise if production of the cars had a low enough embedded energy/carbon: it was dependent on CAVs being more sustainable, or production/recycling issues being greener – rare earth minerals mining was mentioned. It was felt that having to produce so many new vehicles was an issue, compared to extending the life of older vehicles.

Convenience (12 in 6)

There was significant agreement that CAVs could be more convenient than current travel, with several talking about taxi levels of convenience, citing 'robo-taxis' and easier taxi-style travel. It was felt by one that this would be helped by algorithmic management. A Tesla driver stated that "convenience is also quite important and time is even more important", but felt that a shared taxi CAV, with stopping and dropping/collecting, would remove this convenience. He felt such a shared CAV might be suitable for "the lower socioeconomic [demographic...] But I can't see that being, I guess, the target demographic". The other Tesla driver assumed great convenience: "they're always on time, always there when you need them, they won't be held up in traffic". The removal of a need to park was cited as a key aspect of convenience, and one (car-sharer) participant pointed out that, like a cashless economy, this level of convenience was not "for all eventualities".

Disabled and older access (12 in 6)

The fact that CAVS could be used by people who were unable to drive due to old age and disability was seen as a key benefit. It was felt to be an important principle that they were open (and affordable) to everyone, but there was a linked concern that this would increase vehicle ownership and numbers. Elderly people visiting (grand)children was raised as an induced trip category, and there was some mode distinction made: an AV car couldn't help an older person into itself, whereas with public transport options, there might be someone to help. In other words, CAVs were not seen as intrinsically more accessible than current modes, except when in use. This accessibility was seen as extending to drivers: people with epilepsy and those "unconfident on the road".

Accessibility – availability (11 in 5)

The flipside of 'accessibility' was the ready availability of vehicles at any time – in CAV taxi or car-club modes, particularly. CAVs were thought of positively if they could improve transport accessibility in rural areas with poor public transport. Transport accessibility was linked to 'whole systems' impacts too – livelihoods and quality of life are all linked. CAVs might enable people to work who currently cannot. AV public transport, it was felt, might be more frequent and reliable, and a door to door service was particularly appealing.

Use of travel time (10 in 5)
Activities that could be done while travelling in a CAV were mentioned: sleeping, yoga, working (several mentioned this), talking to other passengers, playing music, enjoying surroundings, relaxing, decompressing/transitioning between work and home (like quiet public transport), drinking, and using a phone/iPad/entertainment system: "It's a bit like being a passenger in a way…you can behave as a passenger". One participant in a DW4: Classic Car Fans group, however, stated that he enjoys driving 50 miles to work and would miss it. One participant stated that in the future there might be a reduced need to commute. Use of travel time was particularly linked to commuting.

Employment (7 in 5)
The potential for CAVs to increase employment was almost exclusively mentioned as a possible counter-balance to the unemployment of drivers which was seen as an undoubted consequence. The new jobs were thought to be possible in coding and 'high-tech', cyber security and creative jobs, manufacturing AVs, and 'engineers'. It was pointed out that this shift in employment was similar to 'mining shifting to turbines' (i.e. similar to the shift from fossil fuels to electricity), but a 'skills gap' was a concern: it was pointed out that lots of people currently involved in selling and fixing traditional cars would not, it was said, be interested in learning new skills.

New technology (7 in 3)
A Tesla driver linked his enthusiasm for CAVs to his love of new technology, being a collector of 'toys' and gizmos. Although aware of the potential environmental impacts, e.g., of batteries, they were a fan of electrical devices, planning on installing solar panels and domestic batteries. A non-driver saw new technologies as beneficial, pointing out that current satnav and GPS technologies have achieved a lot. The cashless society was cited as a comparable, previously unimaginable technological advance.

Fewer vehicles (6 in 5)
Reducing vehicle numbers was seen as a positive consequence of CAVs, which would result in less space being required for parking. It was seen to emerge from either people avoiding ownership, from greater expense or missing driving, or from car-pooling. **Algorithmic efficiency of travel** (6 in 4)

This was expressed in a vague sense that CAVs were "clever technology" that could change the entire transport system to make it "smarter" or "more efficient". It was explicitly linked to one participants' daughter's school buses being demand-responsive transport.

Appropriate vehicle sizing (6 in 4)
Several groups felt that CAVs could be appropriately sized for the trip at hand, meaning that there could be energy and carbon savings. This was linked to there being a fleet of vehicles available, e.g. pooled in community hubs with a variety of sizes from single seater to many. One of the Classic Car Fans elaborated that efficient use of vehicles is important, and AVs might enable it. They cited their own oversized (7/8ppl) Land Rover an example of waste and oversizing, and they stated that (Sir) Clive Sinclair had the idea (his Pedelec C5) too early: personal transport,

right sized. He suggested that with smaller vehicles, motorways could have 7 or 8 lanes.

Reduced congestion (6 in 3)
A non-driver raised that CAVs would drive more smoothly (matched speeds etc.), and a car-sharer suggested reduced congestion as an 'on the surface' benefit, suggesting some cynicism. All other mentions of this benefit were in the suspect data from the first DW, where at least one participant appeared to be reading from an AI prompt.

Cheaper (5 in 4)
It was an assumption of several participants that CAVs would be cheaper, especially compared to current car ownership, specifically in London (car sharer), or compared with the "scam" of insurance costs (driver). Reduced cost was seen as a great selling point for CAVs, was hoped to exist relative to car, taxi and public transport modes, and was linked by one participant (non-driver) to reduced labour costs.

Less need for parking space (4 in 3)
This was mentioned three times in Co-Housing and Off-Gridder discussions, as a benefit for society rather than individuals, once by a participant who was used to parking a large vehicle (their home) on the outskirts of town and walking miles into the centre.

Less crime (3 in 2)
One participant suggested there could be less crime and fewer accidents (no chases), another was vague, and the third specified CAV could be like a taxi without possibilities for crime and confrontations.

Smaller vehicles (3 in 2)
Smaller vehicles were seen as a positive, this was linked to increased safety meaning no need for crumple zones and other safety features. One observed that the 'scifi' model of AVs seems to be tiny vehicles, and another suggested that people accepting a smaller, arguably less 'sexy' type of car, can be seen as a generational change already happening: although not appealing to themselves, they felt it would be acceptable to a generation' more interested in efficiency than drama or status'.

Reduce crime and problem driving (2 in 2)
On addition to the above, CAVs were pointed out as reducing car chases and accidents, and 'problem' driving (e.g. pointless, noisy, 'boy racers').

Reduced air pollution (2 in 1)
Again, this was only raised in the suspect DW1, possibly as part of an AI prompt.

Wage savings (1 in 1)
In the same DW, a genuine vintage car fan conceded that rural CAV public transport might improve thanks to wage savings on drivers. They also mentioned that they hadn't thought of this before the discussion.

Concerns (206 in 8)

It is worth noting that the number of discrete concerns, and number of discussions of concerns, are 50% higher than benefits. However, several of the concerns were repeated many times; those clustered in the next few sections.

Safety (28 in 7)
As revealed in the MCDA exercises, safety was seen as a key issue for acceptability of CAVs, and there were many statements that it was a vague concern. Specifically, there were concerns about safety on unmanned CAV public transport (also see section Modes: Public transport: Manned), a general suspicion of new technologies working properly, and a feeling that the technology was not developed yet, a hope that they would be safe ("*you have to trust them, I suppose?"*), concerns about interactions with other road users and different weather conditions, AI's rection times compared to humans, or technology's ability to anticipate human behaviour (e.g. a child running into the street, tractors and 'rogue drivers' were brought up.). Complex decisions – e.g. car, level crossing, horse all interacting, were also thought to be beyond technology. Another participant felt that "*100% safety*" was impossible, while another stated that "*there's been cases where sensors have gone and people have actually been hit by the cars because they've not been able to pick up like motion*". Some people, it was suggested, might refuse to ever use CAVs through fears and safety concerns – current AV trains like DLR are already scary for some. An older participant suggested that "*things go wrong. Machines go wrong, computers go wrong. I mean, what if they've all had a meltdown on the same day?*" – seeing this as part of a worrying trend of machines, robots and technology taking over from humans. While safety fears were seen as slowing acceptance and use, it was felt that this would decline over time as people got accustomed to CAVs. Other safety concerns raised were for a woman in a driverless car and surrounded, battery fires (a recent car park fire was cited – although it is now known that this was not due to an EV, requiring further research.

Joy of driving (23 in 6)
This was a concern shared across all types of respondents, that CAVs would remove the 'joy of driving'. It was suggested that conventional vehicle driving actually has some benefits: it is exercise for mind and body, and it is fun, that people like their cars, feel they 'need' cars, like driving, and don't like or trust change. Some of the things people like about driving were listed as the aesthetic, sport and speed aspects, and it was suggested that some will still want to drive for "*engagement with the world*". Some of this dehumanisation of CAVs was linked specifically to EVs by a Classic Car Fan ("*you can't fall in love with a diode"*), revealing the personal/sensual/romantic side of relationships with hands-on cars. Another participant remarked there was "*No relationship with a fridge – it does what it does!*" Desire was seen as part of the status symbol of cars, compared with EVs and CAVs having "*efficiency, but no drama*". Another agreed that the "*experience of drivers*" has not improved with efficiency of cars. Another Classic Car Fan perspective was to see themselves as a hardcore of 'oddballs' who would use simulators to get driving experience. Another stated that driving is a pleasure and that they would not buy a

CAV but use it for utilitarian trips like shopping, but not for holidays or visiting friends. They thought that the loss of driving skills was as a serious problem, even stretched to a mental health problem affecting prediction skills. They bemoaned that they would lose the pleasure of "*showing off*" a car to friends and family, "*the enjoyment of the ownership*", and that "*it just becomes another piece of public transport*". Another thought that a CAV would be a supplement to his fleet, and he would still look for driving pleasure. Another bemoaned the loss of the "*pretty route home*". A Telsa driver suggested that the appeal of a private vehicle is "*it's still ... our generation. We still like the joy of actually driving... instead of being driven around*", while in the first DW, a participant suggested people might feel "*special*", if they are "*chauffeured*" by CAVs, a point repeated by a car-sharer. Others asked if sport driving might be kept, others suggesting that there might be special times of day, or spaces, where manual driving could be preserved (see more below). A driver suggested that losing the joy of driving (especially an expensive car) would make ownership unattractive, a non-driver also pointed out that CAVs give no driving pleasure, meaning that self-driving cars would be less attractive and fewer would be sold, while another responded that technologists would find ways to make the 'driving' experience interesting while not driving – races would still be exciting even if drivers were not fully in control.

Unemployment (18 in 7)
Unemployment of drivers was a clear concern, with taxis, bus driving and Uber specifically being raised, and pointed out that these are often lower paid and immigrant drivers with easy access for lower-skilled workers. This would also impact people's ability to provide for their families. This 'enforced' unemployment may also affect public support, it was felt. New jobs, as mentioned, might compensate, but the drivers made unemployed may not be able or willing to do high-tech jobs. This unemployment was seen as compounding post-Brexit workforce problems, and be linked to exploitative work, and inequalities. One participant explicitly stated that they could imagine companies like Uber replacing human drivers. Long-haul freight drivers were also mentioned as at risk. Unemployment was linked by one group to removing rights, and a "*robot takeover*".

New Technologies (17 in 6)
In Co-Housing and Off-Grid groups there was general suspicion of new technology, especially with regard to safety, with one participant feeling CAVs were a "*ridiculous sci-fi future*", with uncontrollable technological advance a risk, always going wrong and concerns that technology takes away skills and makes us detached and dependent. A vintage car enthusiast also felt that technology is a "*snare and an illusion*" – trapping people in technology-dependence without important skills – e.g. being stuck navigating in floods. They admitted this was linked to a nostalgia – always for the things of one's youth. But they conceded that obsolete things are emotionlessly discarded when no longer useful. Another pointed out that satnav is often faulty – they never use it. He said satnav can be stupid, especially in the countryside, it "*gets you stuck behind tractors*". In the drivers' group, a female pointed out that there are limits to new technology; they still use a watch. They knew about delivery robots in Milton Keynes but asked how robots would check e.g. ID for

alcohol. Others in the driver group decried the robotic aesthetics of even EVs, assuming CAVs would be similar: "*it will look very modern, but I don't think it will look very nice*". A non-driver was concerned that older passengers would be expected to have (expensive) technology – e.g. smartphones, and this was extended as an argument that there is general resistance to new technological change with older people. Another repeated concerns about technology (e.g. AI) taking over from humans, with 'control' the key issue, linked to a car-sharers' wariness, stressing that human interaction is important and technology faceless, with less interaction isolating and robotic, and concerns about technology going wrong.

Lack of control (16 in 7)
This loss of control was repeated by several other participants as key to the resistance to CAVS. Co-Housing and Off-Gid participants felt safer if they could get out of a vehicle at any point, and felt that being 'gathered' into shared trips was beyond individual choice/control. A Classic Car Fan extended this to a concern about ownership and control – corporations deciding people's need to drive, and dispatching "*driverless Ubers*". A non-driver also expressed concerns about centralised control of CAV cars and security risks, hacking/hijack etc.

Distrust (13 in 5)
These concerns were reflected in general distrust of the transitions in transport. A classic car fan expressed a view that EVs just shift pollution from the tailpipe to elsewhere, adding cobalt mining concerns, Dieselgate was raised as a reason to be suspicious of the government advice, and a suspicion that hydrogen or biofuel would be proposed next. A Tesla driver cited "*many issues*" with CAVs, including the idea of robot ethics (see below). Other participants cited general distrust, often on safety grounds, one car-sharer mentioning the Terminator films as an influence, and another linked distrust specifically to manufacturers and their motives on environmental impacts: "*who knows. We're fed what we are fed.*", feeling that "*we are lied to*".

Environmental impacts (10 in 5)
Following on from that point, concerns about environmental impacts tended to centre on the manufacturing issues with EVs and their batteries, as well as the sources/impacts of energy generation, rather than CAVs per se. One Co-Housing and Off-gridder participant listed environmental benefits as depending on public transport modes dominating CAV roll-out, those AVs being electric, the source of the electricity, and production/recycling processes being greener, rare earth minerals mining was mentioned. Another from the same constituency, however, saw a tricky balance between avoiding the environmental impact of building new vehicles against the impacts of older vehicles. A vintage car owner asserted that "*energy involved in constructing a car outweighs the tailpipe*" – and that therefore keeping vehicles operational is "*offsetting*", asking if CAVs would be made to last as long as ICE cars. One participant from the drivers' group suggested that energy/carbon reductions from EVs were "*not proven*", with another agreeing and claiming that energy use would "*obviously*" go up. There seems to be a confusion here with the use of 'energy' as meaning electricity, but also a genuine issue with many opponents of EVs

conflating production impacts and embedded carbon with no overall lifetime savings of energy and carbon emissions.

High cost and exclusion (10 in 5)
Equity/justice issues relating especially to purchase cost were as important to participants as the environmental impacts. The same participant questioned accessibility, depending on cost, based on their only needing to hire a car perhaps twice a month. Accessibility/affordability would depend on incomes. High prices of EVs (again) were seen as meaning that CAVs would be priced out of the reach of most people, increasing exclusion, while older vehicles and ICEs were financially penalised – affecting the poor disproportionately over time. Purchase prices only apply to owners, meaning that the existence of private and public transport options would become a wealth/class distinction as it often is currently. This was seen as a particular issue of public transport options were not available for those who could not afford to purchase – again, as now. Another believed that non-drivers are non-drivers primarily because they cannot afford cars, and so use public transport. And that this would be maintained with CAVs. A non-driver assumed that they would use public transport options rather than buy one, while another listed how the private vehicles would likely be marketed as luxury items, and would therefore be exclusively expensive. No participant spontaneously imagined cheap or utilitarian versions of CAVs such as featureless "pods".

Deskilling (7 in 5)
The fact that CAVs would reduce the preponderance of driving skills was mentioned many times as a negative consequence. This was not a simplistic objection, as people put forward reasons. It was linked to a general trend whereby technology takes away skills and makes people detached and dependent, with a comparison made with the automation of retail. It was suggested that just as some reject cashless economies and automatic check-outs, some people will still want to drive for that "*engagement with the world*". The windmill dwelling vintage car enthusiast described (modern) technology as a "*snare and an illusion*" – trapping people in dependence tied with less skill and adaptive resilience, a point also held by a non-driver. Another vintage car enthusiast, however, saw this as a generalised, generational trend – people were increasingly happy to delegate in all areas of their life, including to technology.

Need for cars (7 in 5)
Several people stressed a need for cars in life and current society, to do specific high mobility or rural jobs, because of time pressures, for flexibility in emergencies, or from car dependency and an unwillingness to change. These aspects of car-centric society were seen as negative. One participant suggested that CAVs might be a "*hyped*" flash in the pan but thought that despite the car industry being huge ((£2.5bn/year was mentioned) "things always shift". Offering some (older) people the continuing choice to drive as seen as one way of addressing this car-centric conservatism.

Crime and hackability (5 in 5)
Hacking the vehicles and kidnapping the occupants, even by hostile states, was a fear expressed repeatedly. One participant suggested greater reliance on electricity systems and infrastructures would make them vulnerable to attack and sabotage, and another stressed that criminals would inevitably hack AVs and use them manually, otherwise they could not drive them and therefore use them for crime. A car-sharer linked this fear to a general distrust of "*centralised control*" of CAVs.

Other passengers (5 in 4)
Some felt that sharing a vehicle would be difficult – what about listening to music? Lack of individual choice/control was raised, as was the protection of personal data in a shared, smart vehicle. More 'traditional' fears (covid/infection, child safety, female security) were also mentioned.

Surveillance and privacy (5 in 3)
A related but slightly different issue was concern about privacy of data and surveillance, from the two Co-Housing and Off-gridder groups and also a vintage car enthusiast.

Increased travel (5 in 2)
Several people in one co-housing group felt that the accessibility of CAVs to non-drivers would inevitably increase the amount of travel in society, while one in the car-sharers group felt this would be a result of reduced costs.

Affordability (4 in 4)
Several participants felt that the uptake of CAVs was conditional on several factors with affordability key – again linked to EVs, meaning public transport options or shared modes were preferable. Costs were generally stated to outweigh the environmental benefits of car-free living.

No human interactions (4 in 2)
The lack of taxi drivers or ticket collectors to interact with was bemoaned (co-housing/off-grid and car-sharers), and in general, a car-sharer suggested that "*we are creatures of society and community*".

Health (3 in 3)
Three health concerns were raised: an increase in drink-'driving', a decline in active travel, and fears of infection in shared vehicles.

Control of travel (3 in 2)
Two participants expressed fears about 'dictatorial' control of travel, with possible shades of the '15-minute cities' conspiracy theories, although the deceptive nature of manufacturers (Dieselgate) was instead cited by one. Corporations 'like Uber' were thought to be controlling travel by one, and a third instead bemoaning the inability to choose routes- the loss of the 'pretty route home'.

Inequalities (3 in 2)
This concern was linked to financial inclusion but also raised 'inequalities of access' more generally.

Robot ethics (3 in 2)
This concern was philosophical, about the inability of machines/AI to genuine replicate ethical decision-making (the trolley-car problem was used as an example), by a Tesla driver, and two non-drivers.

Traffic or street interactions (3 in 2)
Strangely, only three participants (two of them classic car fans) raised concerns about interactions with other road users in non-CAV vehicles specifically.

Who owns benefits (3 in 2)
Alongside control, ownership was seen as an issue – faceless corporations, but also people who could afford CAVs using them to make more profit. A co-housing/off-grid participant elaborated that CAVs might undercut trains, as a "*safe luxury cocoon*", when transport should benefit the many, community and society, not individuals. But the profit-seeking nature of society is unlikely to aim at this.

Depreciation (2 in 2)
Two participants felt that this would argue against private ownership.

Increased energy and carbon (2 in 2)
This negative was felt by two to arise from increased travel or from working from home.

Not child friendly (2 in 2)
One non-driver assumed people would not trust their children to CAVs, and a Tesla driver would not use shared CAVs due to a need for child seats for small children.

Where stored (2 in 2)
The need for space to store CAVs was cited as an issue.

Avoid new vehicles (1 in 1)
As mentioned above – there was a generalised objection to new vehicles being built.

Digitalisation (1 in 1)
A generalised concern about the digitalisation of society was extended to CAVs.

Living vehicles (1 in 1)
One participant (a new age traveller living in a van) stressed that people live in vehicles (or tents) for cheapness, and that this would not be possible in a CAV.

No instant availability (1 in 1)
This was seen as a drawback of a shared/taxi CAV, in comparison with private ownership.

Changes (48 in 8)

This set of codes was used to record discussion of changes in surrounding society. Comments not discussed below were that change is always driven by consumer demand, and that technological change is anyway accelerating (see section **Technological optimism and determinism**).

Changes in travel (16 in 8)
As this was specifically prompted, there are responses from all groups. 10 felt that travel would increase, and 7 that it would reduce. The increases were generally assumed from greater accessibility (e.g. to non-drivers), or the anticipated cheapness of CAV taxis, while reductions were anticipated from fewer driving enthusiasts, and from more sharing and public transport use. Older people were specifically cited as resisting using CAVs or using them more to visit children.

Labour market (15 in 6)
The benefits of employment and concerns about unemployment have been summarised above. Unemployment wasn't raised by classic car fans, and employment as a positive was ignored by classic car fans and Tesla drivers.

Transition enforced by government (9 in 4)
Neither any co-housing/off-grid nor classic car fan participants raised this mode of transition explicitly. One vintage car fan stated that they would drive diesel until forced not to by legislation. One Tesla driver outlined extensively a conviction that CAVs would only be rolled out with a strong governmental steer, modelled on Norway's enforcement of the provision of EV charging infrastructure by the private sector. This included a package of policy carrots and sticks: financial incentives to buy combined with huge taxes on ICEs, access for EVs to bus lanes, no road tax, no VAT, and a 2025 ban on new ICEs. This would require political willingness to "*make it economic [...] make it a no-brainer and everyone changes [...] all behaviour is driven by the wallet*" in the UK. The other Tesla driver agreed and talked about taxes in the UK discouraging EV uptake. One member of the Public Drivers' group similarly felt that EV promotion in the UK was in the wrong order – pushing the vehicles and the ban before infrastructure had been sorted out. One non-driver also suggested that the transition would require massive government incentives - grants to car companies and their buyers, to make the transition happen. But this would be in a context of declining revenue from vehicle taxes. Another assumed the transition would primarily be driven by environmental/climate policy priorities.

Changes in fleet make-up (7 in 5)
The 'sharing' groups (Co-Housing/Off-grid and Car-Sharers) did not make specific suggestions on this issue. Two comments assumed the vehicle fleet (i.e. the proportions of cars, taxis, buses, etc.) would stay essentially the same. One Tesla driver felt it was too complex a 'multi-variable' question, while the other found seemed to find discussing anything but the privately owned mode difficult. One participant in the hacked first group (possibly prompted by AI summaries) suggested they would produce less congestion, in the same breath as arguing that there would be more owners of AVs and more vehicles on the streets. A participant in DW2 suggested that there could be fleets of differently (appropriately) sized vehicles, in a shared mode. A public-driver assumed that things would stay much the same as now, with drivers buying and non-drivers only able to afford public transport, and a public-non-driver was worried about the decline of public transport.

Modes of transition (5 in 2)

In the first DW, it was thought that the transition would begin with elite cars, mainly with very rich people buying them, and then generally filter down to more people accessing them, and even more slowly filter down to replacing taxis and to public transport. Another participant appeared to be reading an AI summary, suggesting a slow but smooth transition, with:

- After 5-10 years, limited deployment in cities and controlled environments, adoption by the elite first
- After 10-20 years, gradual expansion across urban areas, then to public transport
- After 20 years, more widespread adoption – to become the majority of vehicles sold and integrated into multi-modal systems.

Less shopping due to deliveries (1 in 1)

This reduction in face-to-face retail was mentioned by a van-dweller, talking about the 'van-friendliness' of cities.

Uses of space (1 in 1)

The same participant was interested in how much parking space might be freed up by the roll-out of CAVs, given that they cannot park in the centre of urban areas because of the size of their living vehicle.

Likelihood (141 in 8)

Many of the comments/discussions in this parent code are about factors felt to accelerate or decelerate the roll-out of CAVs. In this headline parent code, many comments are also covered below in terms of conditionalities and technological determinism. A cohousing resident felt sceptical about the likelihood that there would be a 100% transition, pointing out that there were still pockets of non-smart phone usage even now. Classic car fans mentioned technology hype cycles, the ability to e.g. set route choices already existing, and the needs to establish systems, then legislation, and then infrastructures, felt to be a massive programme with phases, implying the need for restrictions to access to roads, akin to the establishment of the 'smart motorway' system. As mentioned, one Tesla driver stressed that government compulsion was required, because "*the only way to make companies do things is by tell them they have to. They will always do everything they can to make the most possible money. And that's their job.*" They still felt the roll-out would not reach rural areas like Cornwall. The most expressions of uncertainty that a 100% roll-out was likely came from the Public- Drivers' group. Two felt it would never happen, others felt it would be partial, not in rural areas. Another felt it would be confused by a switch to promote hydrogen (they conflated CAVs and EVs a lot), car attachments were seen to be an impediment, and one felt "*75, 80% of the roads will be eventually*" but in 150, 200 years. Public-non-drivers felt it was more inevitable, but consumer/user uptake would be the main influence, determined by (relative) costs and 'whether people want it' (a view echoed by one car-sharer), one feeling that human over-ride would always be preferable than level 5 automation.

Accelerating or enabling (24 in 5)

Political will (13 in 5)
Political support, commitment, and investment were mentioned in DW1 (possibly AI prompted). One Co-Housing/Off-grid participant assumed local government as the appropriate actors to own and run an assumed shared service – they saw this as a political issue and felt public transport ought to be renationalised. Another saw political opposition to EVs as a slowing factor, and a third mentioned political will as lacking. The Tesla driver again stressed that Norway was 10-12 years ahead of the UK in terms of political will on such matters, stating that the UK hasn't had national planning since Thatcher broke up the Telecom industry, but in Norway companies (in different industries) seeking profit in cities were forced to provide coverage in deep rural areas. Public-driver responses agreed that the UK government would be slow, wanting to avoid the loss of tax revenue: conversation diverted to how governments might try to bring in new taxes.

Legislation (11 in 4)
As already hinted, numerous participants felt that the government would drive the transition. Classic car fans thought they might be "*legislated off the roads*", the Tesla driver stressed that "*the government aren't very good at delivering anything. So, you need to get private companies to do it, but you need to force them to do it.*" A younger female public-driver felt a ban on non-AV vehicles would result in a slow process of acceptance, borrowing, and adoption, "*a bit like current Tesla adoption*". Environmental legislation was seen as the main driver.

Generational change (10 in 5)
Nearly as many participants felt that the transition would be a process of generational change whereby traditional drivers would simply 'die out'. Half of these comments were from the classic car fans who saw themselves as the targets of the transition; pointing out 'peak car ownership' in younger people, the number of driving tests going down, except automatic car tests. One sensed "*the end of a golden age of the car*", reducing back to weekly use as his grandfather did. It was thought younger people accept a smaller, arguably less 'sexy' type of car, being more interested in "*efficiency than drama or status*", linked to less interest in display, ownership, and DIY (example of getting someone in to put shelves up). A public-non-driver pointed out children knowing only CAVs would replace drivers, another that this would take 2 generations, and a car-sharer saw it as no different to being chauffeured as they had been, to school.

Cultural (3 in 3)
More cultural reasons for adoption/acceptance of CAVs included the aforementioned acceptance of 'chauffeuring' in childhood school runs, and (in the case of Norway, again), a liberal, educated social cohesion culture based on more equality, similar to California, and different to the UK's class society and Anglo-Saxon selfishness – good for 'ultra-capitalism' but not for social programmes.

Financial (3 in 3)
A Norwegian-origin Tesla driver stressed financial incentives to buy combined with huge taxes on ICEs, another participant felt taxi modes would financial viable in big cities, and a non-driver suggested the need for something similar to a scrappage tax was thought to be needed to incentivise replacement of vehicles.

Climate policy (2 in 2)
These comments have been summarised in the above, arising from a classic car fan and a non-driver, suggesting that the strength of commitment to climate goals will influence the speed of implementation.

Infrastructure (2 in 2)
A classic car fan and a Tesla driver stressed the importance of availability and coverage of infrastructure in driving accelerated transition to CAVs.

Slowing (55 in 8)
Resistance to change was discussed – two classic car fans felt that they would be passive resisters, one not using tech unless it was genuinely useful. A younger female participant felt that the non-availability of enough (non-intermittent/renewable) electricity for a transition might slow progress.

Cultural (17 in 7)
Various cultural factors were thought to be likely to slow transition, mostly relating to car attachments. Co-housing/off-grid participants referenced general 'cultural issues', a culture of private car ownership, associating cars with achievement (and buses as "*slumming it*"), seeing cars as an extension of bodies, and being 'insular' and resistant to change. They felt a culture change was required, along with assumptions about a need to privately own things – signs of which were taking place i.e., in streaming music. Social practices such as regular weekend leisure car use would have to change, and the unpopularity of car clubs was seen as suggesting that these changes are not likely. Many of the cultural issues raised by classic car fans (e.g. over status, ownership, pride etc.) have been raised above, in addition, one questioned the likely uptake of shared vehicles, based on owned cars being domestic family spaces. The non-Norwegian Tesla driver raised an interesting issue – describing himself as "*not into politics, I just do what I am told*" – perhaps reflecting likely cultural acceptance of change. Other cultural issues were around media-worrying depictions of autonomous vehicles in films particularly.

Regulation (9 in 4)
Many participants thought that regulation would slow development and roll-out in the UK, with a sense that this was about safety culture, but also about liability and 'conflicting jurisdictions' (possibly AI prompted).

Political (7 in 6)
One participant in a co-housing/off-grid group cited the UK's First-Past-The-Post electoral system as a slowing factor – slowing change in general, while another reflected on the reality of likely private providers – asking how CAV systems would be designed to maximise user needs and their profit a the same time. They worried CAVs would be developed in an unplanned competitive way like the current system,

so that none of the perceived benefits would materialise. They concluded that a CAV system (shared) would work best, in a perfect world which we don't have. A car-sharer felt that the interests of oil companies were a key blockage for the transition.

Fear (7 in 4)
Safety fears and fears of older people and parents with children were cited as explained above. This was also linked to fears about new (always malfunctioning) technology in general.

Cost (6 in 5)
Much discussion of costs has been covered above, but in addition, a Co-Housing/Off-grid participant pointed out that even with the costs of driving continually increasing, private cars are still cheaper than all other options – this was assumed to continue. Other discussions were about getting economic and (dis)incentives right, which a public-driver participant would lead to stop-start development as tax revenues went up and down.

Trust (4 in 4)
Trust (including public trust of private companies) was mentioned in the hacked group, with the (almost certainly AI-prompted) listing of trust as being influenced by safety records, customer satisfaction, convenience, environmental benefits, material impact, affordability and accessibility (especially in PT mode).

Technological optimism and determinism (18 in 7)
This code was added when it became clear that many participants assumed that CAVs would roll out as a taken-for-granted. Some (usually male) saw this as a good thing, while others pointed to current technology (e.g., a talking satnav) being unimaginable even a short time ago. Pre-existing attitudes probably flavoured these views. A 'green' participant suggested material impacts on CAVs might be less with the development of greener materials, while a classic car fan (based on witnessing massive technological changes) suggested that "*we are using current frameworks which limit what we imagine might happen*". A Tesla driver pointed to the existence of AV taxis in America and saw resistance – similar to Luddites or the UK miners' strike - to 'inevitable' technological change; 'labour to brain power'.

Driving remaining (5 in 3)
As mentioned, several participants assumed that the transition would never be 100%, and that some manual driving, be enthusiasts, emergency services, criminals etc. would remain.

Timescales (3 in 3)
Specific timescales were offered for the transition: up to 40-50 years (co-housing/off-grid), by 2050 or in 150, 200 years (drivers), in 10-15 years, more than 100 years, perhaps 200, and staged (non-drivers). The stages were seen as e-buses and automated buses and trams first, or trains underground, then overground, with taxis taking longer due to their number.

Queries (27 in 7)

This section contains issues that were raised more generally in discussions.

Insurance (9 in 6)
Many wondered about the role of insurance, as it was unclear where responsibility would lie for accidents. Both co-housing groups included participants with some experience of sharing cars informally and trying to set up a formal 'car club' in their co-housing projects, with insurance proving the main issue, as the industry is very conservative and risk-averse. A Non-driver was worried about insurance premiums rising, while a driver felt the industry was "*a scam*".

Ownership (7 in 5)
Participants asked who would own CAVs - individuals, companies, or communities, or the government? An off-gridder worried that rich people would own and control CAVs, and that 'claimed' green benefits (i.e., some form of carbon incentive) would be used to make money for a small number, not to benefit wider society. Similar views were found in the other co-housing/off-grid group, in which one participant could see the advantage of CAVs only if it filled in for a lack of public transport, in a community transport mode, rather than private ownership. A driver assumed that a shared CAV service would be run by the government or councils. See section 3.2 for more discussion of modes.

Tax revenue gap (6 in 4)
As already highlighted, this was an unexpectedly common theme of discussion, raised by contemporary media discussion of EV use reducing tax revenue. Oddly, most questions about this were asked in the non-driver group, including asking how the revenue from speeding tickets would be replaced.

Responsibility liability (4 in 4)
As mentioned, this issue was linked with insurance, assumed to lie with manufacturers, and was seen as not an issue with CAV trains.

Control and management (2 in 1)
The pro-nationalisation participant mentioned earlier asked who would decide routes, whether it would be the users, and if the shared services would be available 24 hours a day.

Appearance or design (4 in 2)
Aesthetics were raised by two groups, the first group whose (unique) suggestion of smaller, pod vehicles might have been AI-prompted, and drivers who criticised EV (Tesla?) design as robotic and boxy, anticipating a boxy look "*a bit like a Nissan Note kind of thing, but on a worse scale.*"

Technology exists (2 in 1)
In the classic car fans groups, one participant asked if any CAVs currently existed – in London? It was suggested this might build public confidence slowly. In the other, it was suggested that satnav technology exists and is useless and angering - people might "*turn against*" it.

Modes

Public transport (48 in 8)

All groups discussed the public transport mode of CAVs to some extent. DW1 thought it was the most preferred mode, in rural areas. DW2 participants saw it as the most appropriate, equitable, beneficial and fair system, nationalised and local council run, as a political issue. The other co-housing/off-grid groups also mentioned it being exciting if fewer cars could require less parking space, and public transport modes could be maximised and be on demand, seeing CAV as potentially remedying problems with transport access rurally, being potentially demand responsive and/or community-owned/run. They also, thought that the public transport mode would have to be accessible for people with e.g. dogs, plants, scooters, bikes - whatever was necessary for travel – too many rules would stop it being used. It would also need to be integrated, ticketless, and multi-modal (allowing other modes to be carried). Classic car fans saw trams and trains as an obvious CAV deployment, while the two Tesla drivers suggested CAV buses would have to be "*clean and brand new*" to be attractive; both interestingly used buses and one used an electric scooter for daily travel, rather than their Teslas. The scooterist preferred this mode to using a bus: "*the main thing I don't like about buses is it's dirty, smelly, especially if it's wet outside*", so a smart clean interior would be required. One driver expressed range anxieties about CAV buses, another accepted tram automation or public transport in cities, but would avoid if they could afford private ownership, or a taxi-like service. Non-drivers predictably devoted a lot of attention to this mode of development.

Manned (10 in 5)

There was a clear preference for CAV public transport to be manned by humans, even if driven autonomously. The groups stating this preference most often were the non-drivers and car-sharers (most from London, and therefore used to good public transport provision). This was a request for a trained person to intervene if there were problems (implied, between passengers), for safety, e.g. in case of malfunction, to help older or disabled passengers with accessibility, to respond to medical emergencies, crime etc., and to deal with "*children misbehaving*". It was suggested that drivers would have to retrain as, essentially, security guards, and one participant said that this was 'going to backwards, to the days of ticket inspectors.

Shared modes not Public Transport (46 in 7)

Participants seemed to grasp the idea of shared modes of CAVs quickly. Co-housing/off-grid groups assumed that there would be a fleet of differently sized vehicles, which would save emissions, some having private vehicles, but more being shared. These might replicate quiet public transport trips which are positively calming, or 'decompression/transition' trips between work/home. A classic car fan understood breaking with ownership more on the lines of car leasing/PCP (Personal Contract Purchase) schemes and saw this as attractive to a new generation not being hung up on ownership. They also felt that automated vehicles and their sharing were two debates that could be debated independently. A Tesla driver felt that resistance to AVs might follow that to EVs, based on financial factors such as

value, depreciation, and cost of replacing batteries. When asked if that was an argument for shared CAVs rather than privately owned ones they grudgingly agreed.

Drivers supported shared and taxi modes in big cities where they would be commercially viable, felt that such 'car sharing' could reduce vehicle numbers, however one participant confirmed that they had known about car/lift-sharing schemes for many years and never known anyone use one. Asked if they would personally use them, one participant stated that they would – with no reservations about them or sharing, particularly if they were available as quickly/easily as cars are now, saving depreciation and the need to park them. However, some felt shared vehicle (rather than ownership) CAVs would be less desirable, citing the need to access a vehicle quickly, and safety concerns for females. Another younger female stated that they would want a choice between the two options, choosing between a private, more expensive option and the shared, efficient, assumed commuter option. The drivers also suggested that such safety concerns are behind lift and car-sharing schemes not being used now, as well as Uber licensing concerns. Non-drivers argued that car-sharing was essential to reduce emissions with CAVs, and this would require more infrastructure, suggesting that people with CAVs might share them with their connections. Car-sharers also assumed sharing, and with their experience of car-sharing services, seemed to assume that this was the default mode for CAVs. One suggested it would be like having a chauffeur every day: a car experience without concerns about insurance, maintenance, tax, and being smart-programmable from their diary.

Taxi or Uber (16 in 7)
Co-housing/off-grid participants appeared to assume that shared CAVS would be a 'taxi-like' service, or robo-taxis, which would be cheaper and thus induce travel. They were seen as safer for women, but there were concerns that taxis don't like dogs, muddy boots – would community CAVs be similarly exclusionary? The Norwegian Tesla driver stated that he had used shared vehicle taxi services and saw stopping and dropping/collecting other passengers as removing their convenience ("*money drives the world around, convenience is also quite important and time is even more important*"). He would accept/use a car-club style shared AV, but not a literally shared vehicle one, which he stated might be suitable for "*the lower socioeconomic [demographic]... But I can't see that being, I guess, the target demographic*". Three driver participants stated that they would retain a personally owned car and use shared CAVs occasionally, perhaps with friends, as they now use a taxi. One stated that this was the ideal of not using or owning a car, which is too expensive to do currently, and they imagined shared CAVs as "*a 2-wing-doored 'Johnny car' from Total Recall*".

Car club or fleet (12 in 6)
Specifically on the mode of CAVs shared in a car club or fleet mode, co-housing participants specifically had some experience of trying to set up community car clubs and found insurance was a major barrier. They saw such fleet loan schemes as an early mode of CAVs, and saw it as easier to organise than car-sharing clubs – the unpopularity of which was seen to demonstrate a broader dislike of sharing. Their key advantage was said to be avoiding ownership/running costs. The Norwegian

Tesla driver had also experienced car-sharing in Oxford – to avoid terrible parking. One driver participant seemed to confirm the comment about dislike of sharing vehicles, but another felt it might work in London and cities, but would not have coverage in rural areas, requiring huge numbers of vehicles. In a non-driver group, one older male saw benefits for commuters, transportation of goods, and carpooling (filling cars up with people).

Private ownership (15 in 6)
In DW2, as mentioned, there was a comment about the UK's 'culture' of private ownership, and an assumption that this was slowly changing, e.g., with trends in streaming, not owning, music. They also felt that private ownership would dominate the roll-out unless there was a central imperative to deploy shared modes, and that this would perpetuate the current inequalities of car ownership. In DW3 it was pointed out that the CAV fleet might replicate the situation today, with poor public transport provision requiring private CAV ownership and use in rural areas. Classic car fans argued that CAVs could not operate in rural areas. The problems of dirt/mud on road markings, a lack of virtual environmental infrastructure, or provision for removing blockages e.g., on single-track lanes were raised. It was thought that CAVs in rural areas would require 'driver' cooperation/organisation even more than the present system - it was asked if satnavs can even map passing spaces. Others variously looked forward to giving up ownership – they personally had an oversized Land Rover, saw private ownership as pointless with shared modes, felt family cars are sacred domestic space, and would miss private ownership as a source of pride. Participants in the public-drivers group conversely felt that losing the joy of driving combined with assumed high cost would make ownership unattractive. A non-driver felt that they might need to own a CAV if they had a family and wished to avoid taking children on public transport.

Freight (7 in 5)
Freight was raised by participants, although in framing the discussions they were asked to focus on passenger transport. This was seen as an obvious and commercial use for CAVs, as improving flow and matched-speed platooning (this word was not used). A Tesla driver suggested this was efficient, but drivers raised freight deployment as a potential slowing factor for CAV roll-out. Non-drivers also saw this as a good mode of use.

Deliveries (1 in 1)
Only one participant specifically talked about CAVs being suited to deliveries, although delivery drones and robots were mentioned in other discussions, and at least two MCDA exercises included delivery vehicles as one of the options assessed.

Bicycles and pedestrians (7 in 4)
A small number of references to other, active modes of transport were made. Co-housing/off-grid participants asked about CAV bikes, and asked whether CAVs would reduce active travel, causing unfitness, stressed that active travel was improving and suggested older technology options, such as bikes, were preferable to high-tech solutions. A classic car fan, as mentioned, felt that Sinclair's C5 mini-

velomobile was a good solution, and pointed out that BMW makes enclosed motorcycles, but that these are expensive and niche. As mentioned, the Tesla owners stated that they do not use their vehicles much, instead relying on shopping deliveries, buses and an electric scooter: price and convenience are driving their choice.

Alternative fuels (6 in 3)

A surprising number of references were made to other fuel sources for transport, particularly hydrogen, but with one mention of biofuel and several of diesel, seen as reliable. These were thought to slow the transition to (implicitly problematic) electricity. The recent involvement of Elon Musk in the 2024 US election was seen as a political influence, and the geopolitics of competition with China was mentioned (in a driver group).

Conditionalities (82 in 8)

When coding the data, it became clear that some participants were expressing conditional support for CAVS, and so these codes were set up to record what these conditionalities were.

Co-housing/off-grid participants expressed conditional acceptance if they could get out of a vehicle at any point, if it was convenient, if it was demand responsive and available in the countryside, was staffed, and was accessible with dogs, scooters, wheelchairs, bikes (as a multi-modal public transport option, essentially). A classic car fan pointed out that their support was on the basis of what is good for society, rather than their own preference. A Tesla driver stressed that any shared vehicle would have to be "*clean and brand new*", and a driver suggested that relative cheapness was the key conditionality. Non-drivers saw environmental benefits only manifesting if there was required infrastructure and sharing dominated, but also suggested that manual driving could be regulated to non-busy hours and weekends, for people to drive faster, or with their children, similar to a car-sharer suggestion that they could be allowed in their own separated lanes, at least at first, to increase public trust.

Only if infrastructure is provided (11 in 6)
The necessity of infrastructural investment or provision was the most commented on conditionality. As already mentioned, this was key in rural areas or 'older cities', and was seen as a complex phased process, with no sign that the UK has political will to provide it or force private companies to do so. It was pointed out that EV charging infrastructure has not been developed, despite a ban on new ICEs, making them mostly useful within cities for short utility journeys. Japan was cited as another country with efficient, convenient, regular and safe public transport, showing that it can be done.

Only for specific uses (10 in 5)
The specific uses for which participants felt CAVs were suitable were filling gaps in public transport in a community provision mode, and perhaps for family holidays (cohousing/off-grid), urban taxi mode or 'mundane' tasks like shopping (classic car

fans), longer (e.g. motorway) journeys, for leisure, in agriculture, deliveries, and freight (drivers), on motorways (non-drivers) and for younger people in rural areas as a car substitute (car-sharers)

Only if safe (8 in 6)
Safety was seen as a key conditionality for acceptability and public support.

Only if fair and equitable (8 in 4)
This was seen as a key conditionality by the co-housing/off-grid groups and seen to apply to shared or public transport modes and not private ownership, which was likely to reflect present conditions and inequities. A non-driver was worried about the equity of expecting especially older people to have smart technologies to use CAVs.

Only if driving still allowed (8 in 3)
As already hinted, numerous participants felt that CAVs would only be accepted if manual driving was still allowed in some form. One participant suggested that he would be happy for legal speed limits to be programmed into vehicles, numerous drivers stressed that they would want to retain a car to drive, and thought others would too. Non-drivers suggested that those wanting to practice the 'dying art' could be allowed to do so in set places, and respected people's right to choose to drive.

Only if sustainable (8 in 3)
'Smart' CAVs were hoped to be more smart, renewable, recyclable, running on green energy, using green materials (co-housing/off-grid). Drivers were conversely suspicious about their green credentials, referencing EVs, one stating that lower emissions would be dependent on electrification and renewable generation, another denying that EVs reduce "some kind of other heat going into the atmosphere" and calling for research.

Only if government directed (6 in 4)
It was felt that government ought to lead and regulate CAVs, to avoid current inequities, that legislation would drive private industry innovation, and political will was required to 'make it economic'. It was thought that this would require massive investment and financial (dis)incentives. However, one classic car fan said that government shouldn't be able to tell manufacturers to do this.

Only if human override (5 in 3)
Maintaining human over-ride (i.e. no level 5 automation) was seen as essential in three groups – all three public groups. It would be e.g. required by emergencies services, in case of malfunctions, or applied to routes only.

Only if public transport sorted out (5 in 2)
One co-housing/off-gird and the car-sharing group particularly stressed the needs to sort out (particularly rural) levels of provision and lower prices, to make public transport a viable CAV option.

Only if electric (2 in 2)
Although it was assumed by most that CAVs would be electric vehicles, twice this was made explicit.

Acceptability (31 in 6)

The above has summarised most of the issues that were identified as affecting the acceptability of CAVs, for the participants and, in their views, for society. Additional suggestions were that elites and middle class would welcome the transition, and that (especially social) media are very important to acceptance, citing Covid. A younger male agreed that blogs and social media affect credibility and the uptake of new ideas. A car-sharer also suggested that popular/well-known brands would increase acceptability, along with proven safety, positive reviews etc.

Resistance (15 in 5)
People who want to continue to drive manually were seen as potential resisters by participants in DWs1, and 5. Non-drivers suggested it would be older people, Tesla drivers suggested 'Luddites', while drivers proposed resistance from 'a lot of people' (the general population and protesters, clarified), and a classic car fan suggested there would be a generalised anger leading people to turn against the technology. Unemployment, unaffordability, love of driving and a general resistance to change were also cited.

Education (2 in 2)
Only two participants suggested that education was the way to gain acceptance. One said this would require a lot of education of the public, particularly on safety, trying to "bring people along", and convincing them that it is a safe way of traveling. It was suggested that this acceptance was fragile, and that if there were, for example, a high-profile personality or celebrity who had a crash in an AV, that this might strongly affect people's acceptance of it. A second, older male said this transition would require education, community meetings, reassurance, openness about how it works and risks, answering questions etc.

Other issues and themes

The following lists other themes that were raised, although again, many of them have been summarised above.

Political issues (27 in 7)
Co-Housing/off-grid participants saw ownership of public transport CAVs as a political issue, felt that the success of CAV roll-out would depend on how seriously carbon commitments and policies are taken, had fears about regulation, stressing a need for individual freedom and mentioning human rights, questioned control, asking if certain trips e.g. to protests would be stopped, along with general data/privacy/location concerns – companies always collect data, wanted to avoid current inequalities continuing, along with exploitative owning of assets by the wealthy, saw a desirable transport system as one which allowed everybody a fair ability to travel and choose where they wanted to travel to, regardless of ability and economics, and saw rural public transport as a necessity, which should not be primarily profit-orientated. They raised Brexit, outdated infrastructure, government priorities, only rich people being able to afford transport, and stressed that CAVs should not undercut transport as a 'safe luxury cocoon' like the car, and should

benefit the many not just private individuals, but saw this as unlikely. They felt transport planning was non-existent, so the anticipated benefits of CAVs would not materialise, as they would only work properly in an impossible utopia. By contrast, one classic car fan saw independent vehicle maintenance as 'anti-capitalist', and another called for 'ultimate responsibility' and user protection, one Tesla driver cited the control economy style of Norway, and one driver raised Elon Musk and geopolitics as affecting EV roll-out. Non-drivers called for investment and retraining of drivers, while car-sharers bemoaned the UK's transport system as worse than abroad and had suspicion of manufacturers' claims of EVs' environmental performance.

EV specific (26 in 8)
This cynicism about EVs was found across ALL groups and has been cited many times above. CAVs were not assumed to be EVs by all participants, but most discussed aspects of EVs with the assumption that EV issues (production impacts, electricity demand, batteries, range etc.) would apply to CAVs too. EVs rather than CAVs were seen by some as producing most energy and carbon savings. The electrification transition in the UK was discussed with reference to declining tax revenues and mistakenly mandating a ban before establishing a charging infrastructure.

Urban or rural comparisons (23 in 7)
As summarised above, there was consensus that CAVs would appear in cities first, and be suitable for motorways and major roads, with concerns that they would never materialise in rural areas, which have yet to see e,g, decent public transport or EV charging infrastructure. Improvements in infrastructure in general were seen as necessary in rural areas and 'older cities'. The urban context was seen as ideal for shared/taxi modes, with 'grid-based cities as in American' suggested as the ideal trial context by one driver. Trams were seen as one good urban mode, and rural coverage was seen as requiring too many new vehicles, even in a car club mode.

Class and status (17 in 7)
These comments have again been summarised above, but focused on the benefits accruing to richer people who could afford private ownership and/or hire them out, and the costs excluding poorer people, with an assumption that like EVs, richer people would adopt and benefit first. One Tesla driver liked the idea of being chauffeured, whereas non-drivers stated that people can't afford cars, except the rich, and that the working class would have to rely on public transport. The financially excluding, it was suggested, might be the objectors to the transition.

Infrastructure (10 in 4)
As mentioned many times above, infrastructure was seen as key to a successful CAV roll-out. Rural and electricity and charging infrastructures were all critiqued as inadequate, leading to doubts that CAVs would materialise rurally, or even in cities, from some.

Cost determines everything (10 in 3)

As a general point, it was clear that cost was seen as a key factor in transport mode purchase or use, to the extent that a few suggested that it 'determines everything' (often, it was suggested, along with convenience).

Geopolitics (3 in 3)

As hinted, the American election and China were mentioned as geopolitical influences on CAV trajectories, with imports from these countries possibly dominating. In a Co-housing/Off-grid group there were additional concerns about the security of smart systems, which could be hacked, even by hostile states.

Comfort (2 in 2)

Surprisingly, only a few comments were made about the comfort anticipated of CAVs – with massage seats, heated seats, and Bluetooth music mentioned by a car-sharer.

Climate change (2 in 1)

Only co-housing/off-grid participants mentioned climate change specifically, as potentially threatening all technological progress before CAVs could be developed.

Feasibility technical (2 in 1)

Classic car fans saw CAVs as technologically feasible but threatened by the extent of infrastructural requirements to support the vehicles.

Road upkeep (1 in 1)

Finally, one Tesla driver suggested that roads would have to be maintained better for autonomous vehicles' (assumed to be) thinner tyres.

Multi-Criteria Decision Analysis (MCDA) Exercises

The following explains and analyses the outputs of the Multi-Criteria Decision Analysis (MCDA) exercises that were carried out as the second half of the Connected and Autonomous Vehicles (CAVs) Deliberative Workshops (DWs), with the exception of the DW5: Tesla/smart EV owners, where the deliberative workshop was split into two parts to facilitate participant availability. The process that was carried out is explained in section 4.2.2 and an analysis is provided in section 4.2.3. Some methodological reflections are provided in the concluding section 4.2.3.6. The details of outputs are in the individual Summary Reports for the DWs (Appendix B), with analysis of deliberative discussions provided in section 4.1.3.3.

Executive Summary

The summary of the **key findings** across groups is:

- Car users do not consistently score car options highly, a surprise finding to themselves as well;

- The most important criteria were Safety, Affordability, Convenience, Accessibility and Environmental Benefit, confirming many studies' findings;

- Some key criteria usually assumed to produce a preference for private use of transport modes (convenience/time wasting/privacy concerns) were considered of much less importance than Safety and Affordability;

- The high importance placed on Safety and Affordability may have resulted in the higher weighted scores for shared and public transport modes; and

- Although many criteria were used by most groups, group-unique criteria seem to reflect the specialised interests of the different groups sampled.

To foreshadow the **methodological reflections** to some degree:

- The exercises clearly had some value in forcing the participants to focus their thoughts from the preceding discussions of the workshop.

- All but one group unsurprisingly chose to compare different transport modes (AV or not) with each other, rather than attempting the more difficult task of comparing different CAV futures or fleet mixes (e.g. AV public transport, but non-AV cars, or 70% AV vehicles, 30% non-AV).

- Although some individuals struggled with the task, the groups managed to produce useful results, although several groups were unable to finish their scoring exercise properly.

- The process of trying to identify what was important to them/to society enabled many participants to think beyond their own situated interests – for example stating that they personally felt comfort was important in a transport mode, but that they 'ought' not to make it a heavily-weighted criteria in the exercise, as it is of low importance to society.

- Thus, the outputs of the process represent to some extent a disinterested analysis of the 'acceptability' or 'preferability' of different modes of transport.

- The exercise also had the effect of surprising participants with the weighted scores outputted on numerous occasions.

The last point is of key interest. When presented with the order of preference according to their weighted scores, many participants were surprised that they had produced a result where public transport or shared options were scored highest, expecting private and/or car options to 'win'. This perhaps underlines that the 'preference' for private and car modes is culturally hard-wired, a 'taken-for-granted' which can be 'undone' when a process of *deliberated* rational decision-making is undertaken. After an hour of discussion and through an hour of having to reason with each other about what is important to them collectively, groups of citizens were able to co-produce a decision-making 'machine' to assess the different modes of transport that might figure in a future where CAVs are a technological possibility/near inevitability. In doing so they were forced to rationalise with each other what assessment criteria are relevant and most important, before scoring the various options they had chosen. The results often surprised them – suggesting that they

were not previously 'consciously' aware of what the conclusions of their rational assessment of the options would be. The value of such rationalised post-deliberative decision-making should be considered for future exercises in scenario-building and technology evaluation, although these should build on extensive deliberative discussions rather than being taken in abstract with no deep exploration of the topic at hand. The exercises should also provide enough time to complete the process to the satisfaction of all concerned. As the methodological reflections section indicates, this study should be taken as a valuable but flawed dry-run of such a process.

The MCDA exercise process

An example 'script' of a full DW is provided as Appendix E. It was followed with adapted timings for all groups except DW5: Tesla/smart EV Drivers, which was split into two hour-long sessions. The MCDA process was explained in plenary using the slides provided in Appendix F, as having four stages: choosing **Options**, **Criteria**, **Weightings**, and applying **Scores**. The actual process was undertaken (when there were enough participants) in break-out sub-groups. The research team had set up an example to make the process understandable using a familiar analogy – the assessment of biscuits. The humour of this example also hopefully helped as an icebreaker in preparing the participants to undertake a somewhat dry and alien task.

The four tasks summarised are:

- **Options**: The groups were asked to choose options to assess against each other, either 'AV futures' or modes of transportation. We directed that they should at the least compare one privatively-owned and one shared option – as key to our study. Only 2 groups decided to assess 'futures', and struggled to understand and complete the assessment, whereas assessing transport modes was more straightforward. It was difficult to assign criteria that could apply across different futures with different proportions of automation.
- **Criteria**: They were asked to then work out how they want to assess the options they had come up with. They were instructed that the criteria should be applicable to all options rather than only applying to some and should be expressed in positive rather than negative terms to enable the maths of the MCDA spreadsheet to work (e.g. a high score should reflect a 'good thing' like affordability rather than a negative like cost).
- **Weightings**: They should then work out how important each of the criteria were, compared to each other. This process was totally flexible – they could rank one criterion as supremely important above all others, grade them in a stepped order, or any other form or ranking.
- **Scores**: Finally, each of the criteria were applied to the options, rather than the other way around, as the relevant comparisons were between the options' scores on each criterion – scoring all of the criteria for each option in turn would have been too complex and require re-scoring.

The exercise was then carried out in plenary (if <6 participants) or in break-out groups. Some details of the make-up of the different groups, with commentary on recruitment issues, is provided in Appendix D.

The spreadsheet was screen-shared to facilitate participants' understanding of what was going on. In practice, we refined the process through the course of the Deliberative Workshops, based on our experience of running the exercise. In early groups, we attempted to get the group to come to a consensus on weightings and on scores before we recorded the results in the spreadsheet. Due to the time taken resulting in failing to complete scoring, we settled on a process where individual participants would apply scores (out of 5, or out of 10) to each criteria/option, and these were averaged (mean) to produce a collective figure.

At the end, either in break-out rooms or in plenary, participants were presented with the 'final result' of their completing the exercise: the weighted scores. The criteria weightings and weighted scores of Options are provided in Appendix B in summary reports for each DW. In a few cases, enough time was available to gather reactions to this, and we could explore with participants how the result was produced; for example, from specific scores for heavily weighted criteria for some options. In practice, this was a difficult technical process, and little time was available at the end of the session. The time was used to thank participants for their efforts and release them rather than go over the allotted time.

Analysis

In total, 14 MCDA exercises were carried out in plenary groups (DWs 5 and 8) or in breakout sub-groups (all others).

Table 2: MCDA groups

Deliberative Workshop	Attendance
1: Hacked Vintage car group	8, two MCDA sub-groups of 4
2: Co-Housing and Off-gridders	7, two MCDA sub-groups of 4 and 3
3: Co-Housing and Off-Gridders 2	7, two MCDA sub-groups of 4 and 3
4: Classic Car Fans	5, two MCDA sub-groups of 3 and 2
5: Tesla/smart EV owners	5 in one MCDA group
6: Public-Drivers	8, two MCDA sub-groups of 4
7: Public-Non-Drivers	7, two MCDA sub-groups of 4 and 3
8: Public-Car-sharers	4 in one MCDA group

The following is an impressionistic analysis of the results of the MCDA exercises. The results are individually presented in the Summary Reports for each Deliberative

Workshop (Appendix B), with a screenshot of the MCDA spreadsheet, and a summary of the options, weighted criteria, and final weighted scores, with rudimentary analysis. A list of all criteria applied by all (sub)groups is provided as Appendix G, sorted by the strength of their weighting in the (sub)groups. The options assessed by all groups (with final assessment scores and 'ranking') are provided in Table 3. All exercises produced 5 criteria and so the average weighting of all criteria had they been weighted equally would be 20%. Therefore, weightings above 20% reveal criteria thought to be of more than average importance.

Car users do not consistently score car options highly

As a blunt form of analysis, the MCDA results of **'pro-car' groups** (classic car fans – 4 sub-groups, Tesla/smart EV owners – 1 sub-group, Public-Drivers (2 sub-groups) can be compared in their assessments to the **non/less-car groups** (Co-Housing and Off-gridders – 4 sub-groups, public non-drivers (2 sub-groups, Public-car sharers -1 sub-group) in terms of their criteria and weightings, and also their final assessments of modes of transport.

In **DW1** (suspected hacked[1] vintage car enthusiasts) both sub-groups ranked **privately owned AV cars highest**. **However**, in the genuinely recruited **DW4 Classic Car Fans**, one sub-group voted highest for 'the status quo', but scored **private AV cars *lowest*** under shared options, and the other ranked **AV and non-AV cars *below* shared AVs** (pool/taxi) but above AV buses. **DW5** Tesla drivers ranked **AV cars *below* AV train and taxi** options, while **DW6** Public-Drivers ranked **AV and non-AV private cars *below* AV taxis and delivery vehicles** in one sub-group, and **AV cars *below* AV trains** and equal with AV buses, with **manual cars** the *lowest* scored, in the other.

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[1] See Appendix

Table 3: Raw options, final assessment scores and rankings, by sub-group and option types; transport modes or futures/fleets

MCDA sub-group	1A	1B	2A	2B	3A	3B	4A	4B	5	6A	6B	7A	7B	8
Transport mode Options														
Privately owned AV cars	8	8	7			[5]	9							
AV car (private)									42		19			
Fully autonomous (Private)										7				
Full AV Private Car													19	
AV mini-car			NF*											
Private ownership of AVs						5		6						
Semi-autonomous. Hybrid, some driver control (Private)										7				
Conventional cars	7					[5]								
Manual car											15			
Non-autonomous (Traditional Noddy Car)										7				
Private non-AV								5						
Non-AV car												11		
Normal car – non-autonomous private car													13	
Private non-autonomous ownership-current car						5								

	C1	C2	C3	C4	C5	C6	C7	C8	C9
Semi-AV private car (50% human controlled, 50% AI controlled)								21	
Shared AV (car pool various sized vehicles)					7				
Car pool community AVs									
Car pool AVs	7				9				
AV public transport		NF							
AV public transport (bus)					4	40			15
AV buses	8	6			12		19	11	23
Autonomous, minibus-sized public transport				6					
AV train (DLR)						43			
AV train							20	13	
Non-AV train								14	26
AV Ubers	8								
Fully autonomous (Flee – similar to Uber services)						9			
AV taxis		6		[5]	12		17	9	22
Autonomous taxi-Uber									14
AV taxi (on demand) – arrive within 5-10 minutes, similar to current taxi					6				
Autonomous micro-Vehicle (hireable, similar to taxi)				5					
AV taxi/car club					42				

Non-AV taxi								34				
Normal taxi-Uber											14
Semi-AV bus	7										
AV bike		7									
Commercial Delivery Fully Autonomous vehicles									9		
Autonomous Delivery											16
Status quo (no AV)					15						
Autonomous emergency service vehicle				NF							
Autonomous campervan				NF							
Non-autonomous campervan				NF							
Futures/fleet options											
Government (public) type car club type AV (shared amongst people you know but ownership someone else)		8									
Private car club – Private EV ownership IN a car club type scheme (people you know)		6									
Local government ownership (mixed private/shared travel (up to minibus size) FULLY SHARED – MAGIC algorithm thingy		8									
Local government ownership (mixed private/shared travel (up to minibus size) incl buses similar to now (timetabled)		7									
Private ownership of AVs		4									

NO AVs happen- same as now				**10**										
Some AV cars for some people, but not PR				**13**										
PT (trains, bus uber) all AV – cars still private, non-auto (or little)				**18**										
Everything AV				**20**										
Everything AV AND shared – right size for trip				**21**										

*NF: assessment/scoring of these options was not finished.

[5] – scores could be assigned to 2 different rows/modes.

NOTE: Actual scores are not comparable between sub-groups as different scoring schemes (i.e. out of 10, out of 12) were used.

Colours represent rankings: Green = highest ranked in sub-group, Yellow = second highest ranked, Red = lowest ranked.

In the **non-/less-car groups**, **DW2** (Co-Housing and Off-Gridders) sub-group 1 ranked **AC cars equal *first*** with AV bikes and above AV taxis, sub-group 2 ranked **private AV cars *lowest*** of all. **DW3** (Co Housing and Off-Gridders 2) sub-group 1 scored **private non-AV cars third** and **AV cars *last*** below AV public transport options, and sub-group 2 **AV and non-AV cars second *below*** AV public transport minibuses with AV taxis.

Therefore, there is some evidence that the **'traditional', that is to say privately-owned and/or car options, fared reasonably badly against other modes, including multiple shared modes of use, even amongst 'car fans'.** As commented above, there is a question whether these results are due to the MCDA genuinely producing a more rational deliberated assessment of the options in breaking down the assessment process into discrete stages, or not. The value of doing so, and producing to some extent counter-intuitive results, is to highlight that shared modes have advantages that are not often perceived, until citizens are asked and facilitated to deliberate at length, and then to deliberate together on what the most valued criteria are for assessing transport modes in abstract.

Most important assessment criteria

The **most important criteria** (in terms of number of references and weights ascribed), when alternative phrasings (i.e. risk for safety and cost for affordability) are combined, were:

- **Safety** (35, 32, 31, 29, 29, 28, 26, 24, 23, 20, 16) = **26.6% mean of 11 weights.**
- **Affordability** (24, 23, 23, 22, 22, 22, 21, 21, 20, 19, 18, 18, 18, 14) = **21.2% mean of 14 weights**
- **Convenience** (26, 25, 21, 19, 18, 14, 11) = **19.1% mean of 7 weights**,
- **Accessibility** (25, 23, 21, 21, 18, 16) = **20.7% mean of 6 weights** and
- **Environmental Benefit** (24, 22, 21, 20, 19, 19, 18,17, 14, 13) = **18.7% mean of 10 weights.**

Although many other criteria might achieve more than a 20% weighting as unique instances or as a mean average across (sub)groups, only these criteria were selected in more than 5 exercises, which suggests that they are considered important by a wide variety of citizen groups sampled for expected divergent opinions. For a full list of criteria and weightings see Appendix G.

Private use criteria – Affordability ranked above convenience/time wasting/privacy concerns

Research comparing preferences for private use or sharing of CAVs has often stressed the importance of factors such as **privacy, convenience** and (wishing to avoid) **waiting time** to a preference for private use over sharing. Given that the deliberated MCDA exercises produced a greater preference for shared modes over private, the reasons for this are worth exploring.

One **DW1:** Hacked Vintage Car group which did **rank private AVs highest** placed importance on Personal information/data security/**privacy** (20%) but not on privacy in person (i.e. not sharing a vehicle), *per se*. This sub-group also valued Round-the clock service/**Convenience** (14%), but lowest. **DW2** (Co-Housing and Off-gridders) also v**alued Privacy** (and personal) safety/safeguarding (21%) – this combined several similar issues, including data privacy and surveillance concerns with personal safety when using the vehicle, and they **ranked private AV and AV taxis highest**, offering some support for the importance of these criteria in preferring private modes. **DW4** (Classic Car Fans), **however**, might have been expected to value privacy highly, but only ranked Security/Privacy (hacking risk) (14%) **lowest**.

Waiting time was not explicitly raised by any (sub)group, despite it being a key factor of Value of Time studies that e.g. produce preference for private modes of CAVs in choice experiments. However, this may be to do with the restriction to choose only 5 criteria (and 5 options). This could be addressed in future confirmatory studies to retest the methods of this study. However similar/comparable criteria were used. Reliability/**ease/speed** of use/access (25%) was highly valued **by DW5** (Tesla owners) but still resulted in AV trains and taxis scoring higher than private modes, and **DW6** (Public Drivers) valued **Availability of vehicle** (18%) well below Safety and Affordability, resulting in second place weighted scoring for AV cars and bottom place for manual cars. Non-drivers (**DW7**) ranked Ease of access (19%) in fourth place, and ranked train options highest, while Car-sharers (DW8) ranked Convenience (time) (11%) lowest, and scored all other modes above non-AV cars, with AV taxi/Ubers scoring slightly better. So, it seems that the **criteria that are assumed to account for the low preference for shared** AV modes in choice modelling and survey studies **do not figure as most important** in our groups, and this **may account for the poor performance of privately owned** options.

Convenience was mentioned by **6 out of 14** MCDA groups as a criteria, but only **one group** weighted it **most highly** (in **DW4** (Classic Car Fans)), others weighting it **second** (**DW2**: Co-Housing and Off-gridders), **fourth** (four groups, of all types) or **last** (one group – **DW8** car-sharers). It does **not seem to be a key criterion** for transport assessment across the groups, with its **low importance to car-sharers** being of particular interest – it perhaps explains their acceptance and use of this mode, despite it being less convenient than private ownership. The deliberations of the group reveal that they chose to use car-sharing services such as ZipCar in London, because of the cost and inconvenience of running and using a privately-owned car in the city. This suggests that shared modes may be of particular interest and utility to such groups – when car-use is made more inconvenient and costly by such policy 'sticks' as the (cited by participants) Ultra-Low Emissions Zone charges and parking costs, and the congestion of traffic in the capital.

Finally, **cost** or rather **affordability** is consistently stressed as a, or *the*, **key factor in transport choice**, especially in choice experiment studies. **Cost/affordability/cheapness per mile/of service** was used as a criterion by **ALL 14** MCDA groups, ranked:

- **First** by **DW2**: Co-Housing and Off-gridders1A and **DW3**: Co-Housing and Off-Gridders 2B.
- **Second** by **DW1**: Hacked Vintage car groupA, **DW2**: Co-Housing and Off-griddersB, **DW6**: Public-DriversA and B, **DW7**: Public-Non-DriversA, and **DW8**: Public-Car-sharers.
- **Third** by **DW3**: Co-Housing and Off-Gridders 2A, **DW4**: Classic Car FansB, and **DW5**: Tesla/smart EV owners

This demonstrates that **cost *was* important across all participant types,** second only to Safety. This may have produced better weighted scores for shared modes, as **many** (sub)groups **assessed** usage of **shared** services and **public transport** modes to be **cheaper than private** ownership, on the bases that a) new models of cars such as **EVs** and those with some degree of **automation** are **currently** far **more expensive** than ICE cars, and b) the **costs of purchase** and **running (insurance, parking, maintenance** etc.) are not paid by the individual with shared modes. Many (sub)groups in deliberation stressed that **ownership** would be **financially exclusive,** at least at first, but probably for some time. The **income** of participants was **not collected** or used as a sampling criterion. Future studies could assess the effects of income/wealth on deliberated opinions, as they have been tested for influence in willingness to pay, attitudinal survey and choice experiment studies.

Shared mode criteria – safety and affordability?

Criteria that might be seen as positively privileging **shared** options (such as sociality) were almost non-existent, although Capacity (People and luggage) (16%), Storage/versatility (transport of people and their goods and equipment) (18%) and Enjoyability (15%) were raised in three groups, perhaps reflecting a positive valuation of larger shared vehicles, and Comfort (19%, 9%) was raised in two others. Although **privacy** was mentioned by 4 (sub)groups, it was relating to data and surveillance rather than the experience of sharing vehicles *per se*.

This means that **other (highly weighted) criteria** are likely to be **driving the *revealed* preference for shared options**. These include **safety** (with numerous groups stressing that trains are intrinsically safer than road options), **affordability**, and **environmental benefits** (with many stressing that carrying more passengers is more environmentally beneficial). **Safety** was used as a criterion by **12 out of 14** MCDA groups, but weighted **most highly** by **8 of** these, **Affordability** of some sort was used by **all** groups, but only ranked **highest** by **2**. **Safety** (or 'accident rate') was **second most important** criterion in another **3** groups, **Affordability** (as mentioned) to another **7**. The Safety, then Affordability ranking of the most important criteria is therefore a solid research finding across groups.

The MCDA groups that did **NOT use safety** (or similar) as an assessment criterion were **DW4:** Classic Car Fans A and **DW3:** Co-Housing and Off-Gridders 2B. They instead focused on unique criteria. In the case of the classic **car fans** these were **Enjoyability**, and in the case of the co-housing and off-gridders, '**people vs robots'**, '**storage/versatility'** and '**connectivity of transport system'**. This highlights that

unexpected criteria can arise, particularly if **safety** is assumed as a **sine qua non** expected of all transport modes.

Group-unique criteria

Other (near) **unique criteria** of interest include:

- **DW1**: Hacked Vintage **car** groupA's '**Durability**';
- **DW2**: Co-Housing and Off-Gridders B's '**Benefit distribution (fairness)**';
- **DW3**: Co-Housing and Off-Gridders 2A's '**Feasibility within 50yrs**' and '**Fairness, justice, equitability, social cohesiveness**';
- **DW4**: Classic Car Fans B's '**Adaptability for size/utility**';
- **DW5**: Tesla/smart EV owners' '**Trust in the morality of algorithms**';
- **DW6**: Public-Drivers A's '**Capacity (People and luggage)**';
- **DW6**: Public-Drivers B's '**Maintenance'**; and
- **DW** 7: Public-Non-Drivers A's '**Comfort'** (also shared by Tesla Drivers)

These can be related to the specific interests of the groups – the Summary Reports should be read to see how these criteria were important to their discussions. However some superficial connections can be seen:

- A group whose interest is in old technology values durability;
- The two key 'sharing positive' or 'alternative' DWs value fairness and justice;
- Tesla drivers (in effect one key participant) questioned the ability and morality of algorithms usurping human ethical judgements, with personal experience of reasonably high-level vehicle automation;
- Driving/car-owning members of the general public raised practical criteria to do with vehicle capacity and maintenance; while
- Participants used to public transport (and taxi) experiences stressed comfort, along with tesla drivers who might be expected to value a high level of comfort.

Accessibility: A surprise to the researchers was the **high importance** placed by many groups on 'accessibility' of the transport modes; meaning how usable they were by all members of society. The highest importance was placed by the **DW1**: Hacked vintage car group B (23%), **DW2**: Co-housing and off-gridders B (21% with affordability), **DW3**: Co-Housing and Off-Gridders2 A (18% with affordability), **DW7**: Public-Non-Drivers A (21% with inclusivity) and **DW8**: Public-Car-sharers (16%). Again, the individual Summary Reports and the Summary of Deliberations should be used to see how this criterion was discussion before the MCDA exercise, but the key advantage of CAVs in extending travel opportunities to more groups in society was appreciated, and perhaps seen as more applicable to shared or **public transport** modes, particularly if the latter could be **manned by humans** – a key reflection and preference of many groups.

Methodological reflections and limitations

The experience of conducting these exercises was fairly fraught for facilitators and participants. The first reflection is that the process would have benefitted from **more**

time so that the deliberations, disagreements, and if possible, methods of reaching a consensus could be captured in depth for analysis. As explained above, after early exercises failed to accomplish scoring all options satisfactorily the process became more focused on achieving results, truncating these discussions. Replicating this methodology would be best carried out in a more time rich way, as part of an extended (half-day or full-day) deliberative event, perhaps a **Citizens' panel/jury/assembly,** with time for more discussion and more resources for analysis and reporting on them.

In retrospect, it would have been better to make these sessions more directly **comparable**, in different ways. One option would be to **set a series of transport modes as Options in advance** for them all to compare. Instead, each sub-group was allowed to choose its own Options to compare. In practice, all but one sub-group decided to compare transport modes, and there was a lot of overlap, so the extra intelligence gained by offering a free choice is probably outweighed by the potential value of comparability. The idea of comparing different AV futures was taken up only by the DW3: Co-Housing and Off-Gridders 2A sub-group, and it proved difficult with the criteria that could be applied across Options with multiple modes being different qualitatively to the simpler mode-applicable criteria. The criteria chosen (with weitghtings) were:

- Feasibility/pragmatic 'realisticness' -in next 50yrs (22%)
- Environmental benefit (22%)
- Perception of safety (including unhackability) (20%)
- Affordability and accessibility (18%)
- Fairness, justice, equitability, social cohesiveness (18%)

It is interesting that this was the only sub-group to make the distinction about *perception* of safety, and also to use a criterion that reflected the effects of the AV futures on society (social cohesiveness) rather than being an assessment of the transport modes themselves. A sub-group in the other Co-Housing and Off-Gridders DW (2) used Benefit distribution (fairness) (21%) as a criterion, reflecting similar concerns. This is the sort of difference in interest hypothesised in the research design – that individuals more involved in 'sharing' social relations might place more importance on such qualitative aspects of transport issues and prefer shared forms of transport.

Offering free choices of Criteria and Weightings produced more complex and more interesting data for comparison, although the comparison is complex. Specifying these in advance would have reduced the usefulness of the data produced, and also undermined the purpose of the purposive sampling of likely divergent opinions across different groups. It would have had the same straight-jacketing effect of many survey and choice experiment studies in assuming the assessment criteria of interest to members of the public in advance of open-ended research.

The spreadsheet used to conduct the exercise (see Figure 6 (p.107)) only allows 5 Criteria and 5 Options to be used. A more in depth and unhurried study such as the proposed extended deliberative event could offer more Options and/or Criteria, with time for consensus to be reached if there was a number limit, or for extended

assessment if not. The absence of expected criteria from the exercises (e.g. waiting time) might be an artefact of this unfortunately necessary truncation of options.

Gaining group consensus for the criteria weighting and scoring stages proved to take too much time in early exercises, resulting in incomplete scoring at the end. If the process was run for a longer time, the argumentation at these stages could provide much valuable data about the contentious issues and differences of opinion within the groups. Instead, in later exercises, individual participants were asked to apply scores (out of 5, or out of 10) to each criteria/option, and the results were either averaged on the fly (in a couple of cases) or at the end of the process, to produce collective figures. Again, more time and resource would provide more data and analysis of these processes and highlight key differences in argumentation about both the importances of individual criteria to different individuals and the scoring of options. This could include constructing *individual* weightings and scores (and thereby weighted scores) from the recordings of the groups if the time required to assign anonymised tags to participants' contributions in the (always flawed) automated transcripts was available. This is beyond the resource available for the project. The anonymised auto-transcripts are however archived with the UK Data Service [add link].

The income of participants was not collected or used as a sampling criterion. Future studies could assess the effects of income/wealth (or other socio-demographic factors) on deliberated opinions, as they have been tested for influence in willingness to pay, attitudinal survey and choice experiment studies.

5. Conclusion

The qualitative research activities allowed members of the public coming from different starting positions to explore their feelings and opinions about CAVs within groups of similarly-minded people, and then to attempt to convert these opinions into a quasi-rational assessment either of vehicle fleets or, more commonly, transport modes.

The findings are not entirely coherent. This is unsurprising given the mixed purposive sampling approach: sampling for anticipated extreme views on cars, innovative technology and sharing, and then general public views of (non-)drivers and car-sharers. The initial hypothesis was that the different groups sampled would have different views on CAV futures.

The deliberations were extremely wide-ranging, and there were differences in the issues raised by different groups – we have highlighted that 'drivers' and 'non-drivers' raised slightly different benefits and concerns that appear to fit their different pre-existing attitudes. E.g. those who are less wedded to cars focus on whether CAVs (shared) could reduce the number and efficiency of use of vehicles, and worry about inequalities of access, while drivers were more worried about losing the joy of driving.

The deliberations were able to go into more detail of acceptability and conditionalities of support. These suggested that CAVs' roll-out would be more acceptable only if:

- Infrastructure is provided (probably by the state);
- CAVs are used for specific limited uses;
- They are 100% safe
- As a transport system they are fair and equitable;
- Some manual driving is still allowed;
- The vehicles are sustainably produced and operated;
- The state directs their roll-out;
- Humans can over-ride them;
- They function properly as a public transport mode; and/or
- They are electric.

The prevalence of political reasoning amongst non-drivers was notable too. Although they might be seen as the natural 'market' for using shared CAVs, they were focused on ensuring safety of users, and of ensuring fairness and equity in access an accessibility. Their experiences of public transport and taxis coloured their expectations of whether non-privately owned CAVs would be a second-class option for the transport-deprived, rather than an improved transport system. In other words, they anticipated that existing transport hierarchies and priorities would continue into an autonomous vehicle future.

MCDA exercises revealed that participants were able to let go of their pre-existing attitudes and preferences to a surprising degree. They were able to objectively engage with the idea of comparatively assessing different specific transport modes, both conventional and autonomous, from the disinterested viewpoint of 'society' or an idealised policymaker. While it was predictable that drivers appeared to dislike shared options, and non-drivers, car options, while non-drivers also favoured bus and train options, drivers *also* liked some shared options, and many drivers scored car options worst.

Across all groups, autonomous, shared, and non-car options appeared to be the most favoured. This seems to lend support for the idea that autonomous ride-hailing services and (mini)bus modes may have public support, acceptance, and up-take. Their high assessments may be because of the higher weight placed on the most important criteria of safety, affordability, accessibility and environmental benefit, on which shared and public transport modes scored higher, given the removal of ownership and maintenance costs from users, the carrying of more passengers etc. Convenience criteria were also weighted heavily and favour privately-owned modes, but could not outweigh the benefits of collective forms of transport in an objective/rational assessment.

These findings provide a balance to those of the quantitative, choice experiment, activities conducted by colleagues, which suggest a pure convenience-based preference for privately-owned CAVs, which is tempered by other imponderable factors which we may have fully explored with the qualitative activities.

References

The working paper does not contain references. These can be found in the Research Report.

6. Appendices

Appendix A: Recruitment of DWs

Initial Recruitment Approach

The original sampling rationale was to recruit and run 8 DWs that would sample participants from groups with highly divergent views. These groups were developed based on conceptual framing of being pro or anti for the following three categories: 1) innovation and technology, 2) car-based modes of transport, 3) the concept of sharing, (see figure 1). The conceptual grouping was discussed with the research team, and groups of people who could be deliberately sampled were identified (see figure 2). A recruitment strategy was developed for each of these groups.

Eight groups were chosen as the smallest number that could sample the variety of views, and attempts were made to recruit through gatekeepers.

Figure 4: Original sampling rationale

- Positive and negative attitudes towards these features, especially in travel/transport, gives 2^3 combinations of attitudes, a priori

Group	A	B	C	D	E	F	G	H
Innovative tech	+	+	+	-	-	-	-	+
Car	+	+	-	-	-	+	+	-
Sharing	+	-	-	-	+	+	-	+

Figure 5: Ideal types fitting sampling rationale

Initial contact with gatekeepers from the eight groups was positive, with several gatekeepers expressing an interest in the work. However, recruitment proved difficult with gatekeepers often not responding to emails. Despite a continue effort by the research team to develop alternative recruitment methods, and identify additional gatekeepers, recruitment for some groups was unsuccessful (summarised in Table 3)

Table 4: Recruitment approaches and issues encountered

Group	Ideal types of groups to recruit	Recruitment approach	Issues
A	AV and EV Car clubs	Several EV car clubs were identified and contacted.	Unwillingness to distribute invites to members.
B	Tesla Fans and Owners	Contact with Tesla Owners' Group UK at All Electric event: QR leaflets offered Distribution via Virtuocity (Leeds University Driving Simulation users) email list	TOG refused leaflets, offered to recruit directly. 8 participants offered, unresponsive to communication. Virtuocity leaflet hacked.
C	Una-bombers, and alt-tech loners	Impossible to design a recruitment strategy apart from personal contacts of lead researcher – off-gridders.	Facebook Off-grid living groups used to identify potential recruits
D	Hermits / Tiny house occupiers	Impossible to design a recruitment strategy apart from personal contacts of	Facebook Off-grid living groups used to identify potential recruits

		lead researcher – off-gridders.	
E	Eco-primitive, Tipi Valley	Impossible to design a recruitment strategy apart from personal contacts of lead researcher – Residents of Tipi Valley contacted	Agreed initially to gatekeep and recruit, then no communication
F	Low tech informal car clubs	CoMoUK contacted for help in recruiting car clubs.	Official car-sharing companies contacted – no responses. More informal groups impossible to identify/contact
G	Vintage car enthusiast clubs	DVLA list of secretaries of clubs used – all clubs with 'vintage' in the title contacted.	Very low response rate.
H	Eco or Co-housing, cyclists, CAV bus users (Scotland)	Personal contacts and online list of co-housing groups used to contact directly. Stagecoach Scotland operate a CAV bus, leaflet provided to users.	No responses from CAV bus users.
I	General public	Prof Anable's 'Golden Questions' used to construct a questionnaire to sample general public by traveller types.	Unexpected response rate, which we suspected were imposter participants

Modified Recruitment Approach

Given these challenges, a modified recruitment approach to was undertaken, and a recruitment company used to find participants for some groups (summarised in Table 4). A recruitment agency was used for recruiting participants for groups 6, 7 and 8.

Table 5: Recruitment of DWs and DGs

Deliberative Workshop	Recruitment Approach	Corresponding initial group	Attendance	Breakout groups	Codes for DG breakouts

1: Vintage car group*	DVLA list of club emails	G	8	2 groups of 4 people	DG1A and DG1B
2: Co-Housing and Off-gridders	Co-Housing contact emails, Facebook groups	C, D, E, H	7	2 groups of 4 and 3 people	DG2A and DG2B
3: Co-Housing and Off-Gridders 2	Co-Housing contact emails, Facebook groups	C, D, E, H	7	2 groups of 4 and 3 people	DG3A and DG3B
4: Classic Car Fans	DVLA list of club emails	G	5	2 groups of 3 and 2 people	DG4A and DG4B
5: Tesla/smart EV owners	Personal contacts, snowballing	B	2, 5 (two sessions)	1 group of 2 people, 1 group of 5 people	DG5
6: Public (Drivers)	Recruitment agency	N/A	8	2 groups of 4 people	DG6A and DG6B
7: Public (Non-Drivers)	Recruitment agency	N/A	7	2 groups of 4 and 3 people	DG7A and DG7B
8: Public (Car-sharers)	Recruitment agency	N/A	4	1 group of 4 people	DG8

*DW1 should be treated with caution, as participants did not appear to accurately reflect the intended characteristics of vintage car enthusiasts.

Appendix B: Summary Reports of DWs

Deliberative Workshop 1 (Vintage Car Enthusiasts 1) Summary Report

General observations

This group was recruited via DVLA contacts for 'historic' (7) and 'vintage' (12) car clubs, and then 30 with 'UK', 'GB' and 'early' in the title, to try to target larger groups. Despite these efforts, there were few responses. Secretaries of these groups were asked to advertise an Online Surveys recruitment survey link to their members.

Unfortunately, the survey link appears to have been misused, as 55 out of the 56 responses were deemed likely to be inauthentic. Indicators of inauthenticity included submissions from locations outside of the UK and the use of ChatGPT-generated content in open-ended responses to questions about participants backgrounds. Despite these challenges, we ran the workshop. One participant appeared to rely on ChatGPT for most of their verbal responses during the workshop, while others demonstrated some engagement. However, the overall quality of the discussions was much lower compared to workshops involving participants who met the intended recruitment criteria (e.g. genuine, non-ChatGPT generated responses and based in the UK).

First Discussion Session

Breakout Group 1

Here are the summarised discussion topics from the Breakout 1 group:

- Benefits from AVs were seen as including reduced congestion, increased safety (from reduction of human error and accidents), and reduced air pollution.
- There would likely be benefits for people with disabilities and older people who cannot normally drive.
- Employment and economic effects might include drivers losing jobs, so there would be a need to find new jobs for them – in coding and high-tech... This might impact on the acceptability across society of these new technologies. Further, there was concern that AVs would impact on people's ability to provide for their families.
- A positive attribution was that AVs would likely reduce air pollution as well as energy and carbon emissions. However, environmental benefits would only manifest if AVs were also EVs.
- In addition, there might be improved safety, reduced congestion, and reduced traffic jams.
- It was also brought up that conventional vehicle driving actually has some benefits: it is exercise for mind and body, and it is fun. So, it was asked, in an AV future, what happens to driving? Is there no more sport driving in this AV future?

- It was suggested that people could work while commuting – but that in the future there might be a reduced need to commute.
- It was asked who would own AVs – individuals, companies, or communities?
- It was asked what the potential for drinking while driving an AV to impact safety might be?
- It was discussed whether the vehicle fleet would change or whether it would stay the same as now in terms of numbers of i.e. of cars and buses. There was a general thought that it would mainly remain the same in terms of proportions of buses and cars and taxis. However, vehicles might change – e.g. to smaller pods.
- In terms of how the changeover to AVs might happen, people thought that automation would come in first with elite cars, mainly with very rich people buying them, and then generally filter down to more people accessing them, and even more slowly filter down to replacing taxis and to public transport.
- In acceptability and willingness to change, there were suggestions that people in general resist change, that cars are what they are used to, and so the fleet might continue to be dominated by cars, e.g. with similar aesthetics, sizes, functions, as today. This is also because people were felt to take a long time to discover new skills or to get used to new technologies, so they may stick with what they currently know.
- However, AVs might make people more broadly feel 'special', if they are 'chauffeured' by AVs.
- In terms of public acceptance and objections, people thought that present car fans may resist automation and AVs because they do not include some of the things people like about driving: e.g. the aesthetic, the sport and speed aspects. The enforced unemployment of drivers may also affect the public support, it was felt.
- The imposter participant who was almost certainly using ChatGPT reeled off a list of what might affect public support, including:
  - political support,
  - perceptions of the public,
  - safety concerns,
  - awareness,
  - education, pushing benefits and safety,
  - social impacts, including
  - people losing jobs,
  - political commitment and investment,
  - opposition and lobbying.
- They also suggested a slow but smooth transition, with:
  - After 5-10 years, limited deployment in cities and controlled environments, adoption by the elite first,
  - After 10-20 years, gradual expansion across urban areas, then to public transport,
  - After 20 years, more widespread adoption – to become the majority of vehicles sold and integrated into multi-modal systems.
- The same participant said this would require a lot of work in terms of education of the public to increase acceptability, particularly on safety, trying to "bring people along", convincing them that it is a safe way of traveling etc. It was suggested that this acceptance was fragile, and that if there were, for

example, a high profile personality or celebrity who had a crash in an AV, that this might strongly affect people's acceptance of it.

- Others suggested that elites and middle class would welcome the transition, while people who were excluded financially might object, that people were unconvinced of the desire to change from driving, and negative impacts, and that there would be opposition based on unemployment.

Breakout Group 2

Here are the summarised discussion topics from the Breakout 2 group:

- The group started off thinking about what AVs might look like and what an AV future might be. There were comments about how they might be seen as a status symbol similar to larger cars currently on the market, and the sorts of people who buy them. However, it was thought that there was an opportunity for AVs to be smaller cars.
- There was discussion about job market transformations. Job losses for drivers might be compensated by new jobs, e.g. cyber security and creative jobs. However, this was debated, on the basis of a skills gaps – lots of people currently involved in selling and fixing traditional cars would not, it was said, be interested in learning new skills.
- One participant (the apparent genuine vintage car enthusiast) stated that increased demand for rare materials needed to be considered – materials in batteries etc. They also stated that they would drive a diesel until forced not to by legislation. They stated that they could see no benefit from changed production and manufacture – but their comments were often about EVs not AVs *per se*. They also asked how the tax revenue gap from petrol duties would be made up by governments, and raised the issue of vehicles from China and America dominating sales (and therefore imports).
- By comparison, other participants in this sub-group listed assumed benefits uncritically – e.g. one suggested that there would be less congestion due to automation, even while arguing that there would be more owners of AVs and more vehicles on the streets.
- With regard to public transport and freight, again, everyone but the genuine vintage car owner felt that these would be improved by AVs, by improving flow. The vintage car enthusiast conceded that rural PT might improve thanks to wage savings on drivers. They also mentioned that they hadn't thought of this before the discussion.
- It was felt that there was potentially reduced car ownership, but also AVs' accessibility (which might increase ownership) came in a lot in the conversation. It was pointed out that AVs should be open and affordable to everybody regardless of disability.
- Safety aspects were seen as highly influencing whether the roll-out was successful or not, along with convenience.
- There were two different views in terms of the environmental impacts. The manufacturing costs involved in making all these AVs were raised, but it was felt that energy and carbon impacts might be reduced if AVs were all electric. However, it was also asked whether hydrogen cars might be involved: it was felt that

- Extrapolating from this, while direct (i.e. fuel) impacts might be less, it was felt that people would travel more and raise energy consumption and carbon impacts.
- Rural areas were also discussed: AVs were thought of positively if they could improve transport accessibility in rural areas with poor public transport.
- Asked about the likelihood of a fully automated future, everyone but the vintage car enthusiast assumed it would, based on extrapolated trends in technological development, and technological optimism. The dissenter noted that electrification is an assumption (raising hydrogen as an alternative); suggesting that we do not really know how AVs are going to be fuelled.
- When asked what might slow roll-out they cited cost, requiring subsidies (VCE), regulation and conflicting jurisdictions, and trust (including public trust of private companies).
- Trust was seen as being influenced by safety record, customer satisfaction, convenience, environmental benefits, material impact, affordability and accessibility (especially in PT mode).

Multi-Criteria Decision Analysis

The members of the breakout groups were reassigned from the initial ones.

Breakout Group 1

CRITERIA DESCRIPTION	Safety	Affordability	Environmental benefits	Durability	Convenience	WEIGHTED SCORE
(highest most important)	17.00	13.5	11.5	8.5	9.5	60
	28%	23%	19%	14%	16%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Privately owned AV cars	8.5	5.5	9	8	8	8
Conventional cars	10	7	5	7	7	7
Car-pool AVs	8	8	6	7	7	7
AV buses	8	9	10	5	6	8
AV Ubers	9	9	8	5	8	8

Options selected were modes of transport:

- Privately owned AV cars
- Conventional cars
- Car-pool AVs
- AV buses
- AV Ubers

Assessment criteria in descending order of weightings were:

- Safety (28%)
- Affordability (23%)
- Environmental benefits (19%)
- Convenience (16%)

- Durability (14%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- All AV modes except Car-pool AVs (i.e. privately owned, buses, and Ubers) were ranked equally highly, overall, with the car-pool AVs and conventional cars ranked equally next.
- Conventional cars were ranked highest for safety
- AV buses and Ubers were seen as the most affordable options, with private AVs the least –conventional cars were seen as less affordable than all other modes of AVs (or in quantitative terms – TCO/use was seen as lower for AVs, unless they are privately owned).
- AV buses were seen as most environmentally beneficial, conventional cars the least, but car-pool AVs were ranked worst of AVs, while privately owned were seen as highly green – an anomaly?
- Privately owned AVs were also seen as most durable, with AV buses and Ubers scoring worst for this, based on assumptions about amounts of use.
- Finally, private AVs were seen as the most convenient – always available at home or destination – along with AV Ubers. The two other car options were assumed to be more convenient than the public transport option.

Breakout Group 2

CRITERIA DESCRIPTION						
	Accessibility	Round-the clock service/Convenience	Safety	Personal information/data Security / Privacy	Cost (user)	WEIGHTED SCORE
(highest most important)	8.00	5	10	7	5	35
	23%	14%	29%	20%	14%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Private AV Ownership	10	10	10	7	3	8
Semi-automated bus (buses understand road signs & drive, but still have driver)	10	6	7	7	5	7
Fully-automated bus (no driver)	8	8	6	5	3	6

Options selected were modes of transport:

- Private AV Ownership
- Semi-automated bus (buses understand road signs & drive, but still have driver)
- Fully-automated bus (no driver)

Assessment criteria in descending order of weightings were:

- Safety (29%)
- Accessibility (23%)
- Personal information/data security/privacy (20%)
- Round-the clock service/Convenience (14%)
- Cost (to user) (14%)

NB the genuine VCE essentially performed an assessment/scoring with their proposed weightings, ranking Affordability first, followed by Convenience (reflecting mainstream stress on car benefits?), followed by Safety (assumed), and finally "I think the environmental benefits are overstated and the durability is questionable" – reflecting a general cynicism about EVs and new technology again.

The scores combine with weightings produced the following prioritisation/preference of modes:

- Overall, private AVs were ranked above semi- and then fully-autonomous buses
- Fully automated buses were seen as less accessible than the other two options, which received 'fully accessible assessments' [why?]
- They were also seen as fully convenient, with semi-automated buses seen as the least convenient [why?]
- Privately owned AVs were seen as perfectly safe, with the presence of a human on semi-automated buses seen as increasing safety.
- For some reason fully automated buses were scored lower on privacy and data concerns [why?]
- Costs were highest for semi-automated buses, because of the presence of a member of staff [check], with the other options seen as equally cheap. [NB this was a negative attribute – which will affect the overall rankings]

Overall, the scores in this group do not seem to make much sense and should not be relied upon.

Deliberative Workshop 2 (Co-Housing and Off-Gridders 1) Summary Report

General observations

Originally, there were to be different Deliberative Workshops run with a) eco-housing residents, b) co-housing residents, and c) off-gridders, given that these might be expected to have different attitudes, especially between (e)co-housing residents and off-gridders regarding 'sharing' – based on an assumption that off-gridders are generally more solitary and self-reliant, expressing independence rather than a desire to live communally and share things. This was hypothesised to affect willingness to use shared modes of AVs, which is tested in the report below. Due to recruitment issues, only 2 eco-housing residents were recruited, one of which attended each of DW 2 and 3, and both workshops included co-housing and off-grid recruits, based on their availability for different time slots. One co-housing resident was using the computer of another resident, and they contributed to the discussion out of interest, with no request for an incentive payment, resulting in a full complement of 8 participants, and raising the male attendees to 2/8. The DW took place shortly before the UK General Election.

First Discussion Session

Breakout Group 1

Here are the summarised discussion topics from the Breakout 1 group:

- Co-housing participants had some experience of sharing cars informally and trying to set up a formal 'car club' in their co-housing projects, with insurance proving the main issue.
- While accessibility for older people was appreciated, there was concern that lower paid and immigrant drivers would lose taxi, bus driving and Uber jobs which are easy access for lower skilled workers.
- It was thought that travel would increase, e.g. from people who cannot drive, but that there might be less need for parking space and car parks.
- It was pointed out by an off-grid midwife that some people such as medics have to own their own vehicle to do their job visiting people. The same person saw accessibility as a benefit while there were concerns about surveillance and privacy, and general concerns about digitalisati0on.
- One co-housing resident assumed that they would be safer, but based on a general hope that this could be trusted: "you have to trust them, I suppose?"
- A fully-automated future was seen to remove the need for public transport – which was seen as an issue, as the low-cost option. They didn't want to see buses disappear, but would be happy on an automatic bus, except for the lack of a trained person to intervene if there were problems (implied, between passengers).
- The off-gridder questioned who would own the vehicles – the government? And wo would decide routes, the users? Would the shared services be available 24 hours a day?
- Another participant assumed local government would be the appropriate actors to own and run an assumed shared service – they saw this as a political issue and felt public transport ought to be renationalised.
- There were crimes about crime – e.g. hacking into the vehicles to control them, kidnap? The same participant questioned accessibility, depending on cost – based on their only needing to hire a car perhaps twice a month. Accessibility/affordability would depend on incomes. They wondered if autonomous cycles were a possibility, and would prefer a transport system of ACs, with less beeping or 'crazy drivers'.
- Another assumed that there would be a fleet of differently sized vehicles, which would same emissions, some having private vehicles but more being shared.
- An AV fleet was seen as similar to community car clubs, but there were concerns about a decline in healthy active travel which is being prioritised (including in Leeds) – would AVs lead to la less healthy population?
- There were queries of how much parking would be reduced from the off-gridder who is willing to walk a couple of miles after parking their van, They also observed that Leeds is van friendly, and thought about automated deliveries reducing trips to shops.
- Two participants pointed out that the roll-out of AVs would depend on how seriously carbon commitments and policies are taken.

- A co-housing resident suggested that environmental benefits were due to electrification rather than autonomy of vehicles (there might be autonomous petrol cars), and mentioned robo-taxis, suggesting that price is the main driver of travel behaviour – cheaper or easier taxi-style travel would, they said, increase travel.
- It was suggested that the transition to AVs would be slow, and that it might not be complete when other issues (climate change was mentioned) would cause other massive changes to transport.
- Technical issues were seen to be outweighed by one by regulatory issues, For instance Republicans in the USA were seen as hating EVs and banning them for political reasons. Although they believed AVs would be safer, they suggested social, cultural issues and fear would slow adoption.
- The other male participant agreed and further suggested other delaying factors, including:
    - lack of political will,
    - the UK's First Past The Post electoral system,
    - a culture of private car ownership, including
    - associations of cars with freedom and achievement (a colleague had referred to using a bus as 'slumming it')
- They suggested that culture change was required, along with assumptions about a need to privately own things – signs of which were taking place i.e. in streaming music. They felt climate change impacts might speed up the transition, but only when its effects were felt, and that the vehicles would have to be tightly regulated.
- This suggests a general technological optimism from the two males?
- The off-gridder had fears about regulation, stressing a need for individual freedom, mentioning human rights, and felt that AVs were best suited to deliveries and public transport (PT). They suggested there have been Leeds trials of Co-op deliveries. And would feel safer if they could get out of a vehicle at any point.
- Finally, a cohousing resident felt sceptical about the likelihood that there would be a 100% transition, pointing out that there were still pockets of non-smart phone usage even now.

Breakout Group 2

Here are the summarised discussion topics from the Breakout 2 group:

- On the idea of a 100% AV future, initial responses were that it would facilitate other activities (e.g. sleep) while travelling, make travel more accessible no non-drivers (increasing travel), link people to their surroundings and potentially other shared passengers, but that it might (further) deskill people if driving was not required.
- Asked whether people will travel more or less, they felt shared travel might encourage more travel, that it would depend on affordability, accessibility, and comfort, that it would reduce 'problem' driving (e.g. pointless, noisy, boy racers!), and would depend on how convenient it is, which would be helped by algorithmic management. It might also replicate quiet PT trips which are positively calming, or 'decompression/transition' trips between work/home, but what about wanting to e.g. play music rather than talk?

- It was felt that being 'gathered' into shared trips was beyond individual choice/control, but that travel time could be used to sleep/do yoga, and that vehicles could be sized to trip needs (smaller for travel, bigger for e.g. family).
- One participant felt private AVs would be the norm (like cars) unless there was a 'central input' to share. Others agreed that people are very connected to cars as extension of body, but perhaps not driving might break this link, as well as making it inclusive. It was felt there would be residual driving as a hobby/obsession. .
- Control was questioned asking if certain trips e.g. to protests would be stopped, along with general data/privacy/location concerns – companies always collect data
- In terms of economic impacts there were concerns that current exploitative patterns would continue, that lower paid drivers would lose jobs, that rich people would own and control AVs, and that claimed green benefits would be used to make money for a small number, not to benefit wider society.
- There was support for car club style sharing modes from the start of the transition, otherwise private ownership (and inequalities of access) would dominate. The public transport mode was seen as the most equitable, beneficial and fair system, and easier than essentially car sharing, which is so difficult to organise now.
- Environmental benefits were seen as depending on more PT mode used, the AVs being electric, the source of the electricity, and production/recycling issues being greener – rare earth minerals mining was mentioned.
- Likelihood of an AV future was thought to depend on safety, regulation (e.g. like the current bus fare cap) – as profits underlie everything, with risk of polarisation into rich with AVs and worse options for others otherwise. This would probably require a government who are pro-PT, with Labour mentioned hopefully in a UK context
- One participant felt unable to pontificate about the future, the others felt government needed to lead and regulate, otherwise we would get a reflection of the current situation. This required PT for all including rural, as a necessity, capping profit-making of transport or all markets
- An indication of 'success' would be if everybody had a fair way/was able to travel and choose where they wanted to travel to, regardless of ability and economics. It was pointed out that transport links to the whole system – livelihoods, quality of life, energy systems, all linked. It might enable people to work who currently can't.
- A smart AV system might reduce energy and carbon, if smarter, renewable, recyclable, more sustainable. It might encourage more long distance travel. Green energy might make this less problematic. It might encourage hybrid working/WFH with energy impacts. The environmental costs of constantly new technology were raised again (by the New Age Traveller), and another participant countered with technological optimism of greener materials.
- There were concerns about (lower) age limits and safety/security/surveillance.
- It was felt that vintage car users and boy racers would hold onto their vehicles.

Multi-Criteria Decision Analysis

The members of the breakout groups were reassigned from the initial ones.

Breakout Group 1

CRITERIA DESCRIPTION	Affordability	Convenience And accessibility	Privacy (and personal) safety/safeguarding	Safety (general/technical)	Environmental benefit	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	9.00	8.5	8.5	7.5	7	40.5
	22%	21%	21%	19%	17%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
AV bike	9	5	8.3	5.8	9	7
AV private car	5.3	8.2	10	7	4	7
AV taxi	7	9	6	3	5	6
AV public transport						0
AV mini-car						0

Options selected were transport modes:

- AV bikes
- AV private car
- AV taxi
- AV public transport
- AV mini-car (i.e. a pod-like one or two person vehicle)

Assessment criteria in descending order of weightings were:

- Affordability (22%)
- Convenience and accessibility (21%) – this referred to being able to use the mode even if e.g. disabled
- Privacy (and personal) safety/safeguarding (21%) – this combined several similar issues, including data privacy and surveillance concerns with personal safety when using the vehicle
- Safety (general/technical) (19%) – this referred to the likelihood of avoiding accidents only
- Environmental benefit (17%)

The scores combine with weightings produced the following prioritisation/preference of modes, bearing in mind that there was not time to score the last two modes:

AV bike and AV private cars scored the same, with the AV bike scoring highest on the Affordability and Environmental criteria and the car on the others, with an AV taxi scoring lower, despite high scores for convenience and accessibility, and environmental benefit (because of transporting more people).

Breakout Group 2

OPTIONS	Affordability and accessibility	Environmental Impact	Safety (users)	Benefit distribution (fairness)	Convenience	WEIGHTED SCORE
WEIGHT (highest most important)	8.00	9	6	8	7	38
	21%	24%	16%	21%	18%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Private AV ownership	3	1	9	1	8	4
Local Government Owership (mixed private /shared travel(up to minibus size) incl buses similar to now (timetabled)	8	8	7	5	7	7
Governement(public) type car club type AV (shared amoungst people you know but ownership someone else)	8	7	8	6	6	7
Private car club - Private AV ownership IN a car club type scheme (people you know)	4	7	9	3	6	6
Local Government Owership (mixed private /shared travel(up to minibus size) FULLY SHARED - MAGIC algorithm thingy	8	7	7	8	9	8

Options selected were AV futures – different fleets constituted of different mixes of modes, with ownership also included:

- Private AV ownership
- Local Government Ownership (mixed private /shared travel(up to minibus size) including buses similar to now (timetabled)
- Government (public) type car club type AV (shared amongst people you know but owned by someone else)
- Private car club - Private AV ownership IN a car club type scheme (people you know)
- Local Government Ownership (mixed private/shared travel (up to minibus size) 'FULLY SHARED - MAGIC algorithm thingy': this was intended to capture a fully smart system where rides would be hailed and algorithms would determine absolute travel needs and satisfy them with the correct size of shared vehicle.

Assessment criteria in descending order of weightings were:

- Environmental impact [meaning benefit] (24%)
- Affordability and accessibility (21%)
- Benefit distribution (fairness) (21%)
- Convenience (18%)
- Safety (users) (16%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- The 'magic algorithm', local government owned system of demand responsive, correctly-size vehicles was assessed the highest, receiving the highest scores for fairness and convenience, equal highest for affordability and accessibility, and highly overall.

- Next most highly scored were the local government owned fleet of cars, minibuses and timetables buses and the localised, community AV car club option. The former scored joined highest for affordability and accessibility (with other broadly PT options) and on environmental benefits (due to high numbers of passengers per vehicle), while the latter scored equal highest with private AVs on safety – assuming that smaller vehicles would be safer or result in fewer casualties in an accident.
- The community AV car club came next and the privately owned AV car option last, mainly because of environmental benefits – assuming shared usage would reduce production and fuel energy and carbon, increasing fleet efficiency.

Deliberative Workshop 3 (Co-Housing and Off-Gridders 2) Summary Report

General observations

This was an all-female group. There were participants living off-grid in a van (a second-generation New Age Traveller living with her daughter) and in a 'park home'/caravan, as well as members of co-housing projects and one member of a specifically environmental co-housing.

First Discussion Session

Breakout Group 1
Here are the summarised discussion topics from the Breakout group 1:

- The first impressions from each participant were that it was an exciting prospect, especially in fewer cars could require less parking space, and PT could be maximised and be on demand.
- …that it was clever technology and could change the entire transport system to make it smarter, but that there were concerns about safety and the security of smart systems, which could be hacked, even by hostile states.
- …that rural public transport is anyway terrible from a lack of drivers, which AVs could remedy, although it was likely to require privately used vehicles in the countryside, with a general suspicion of new technologies working properly, and a feeling that the technology was not developed yet (the Traveller participant).
- That we could anticipate the AV transition from EVS – with huge financial implications and exclusions, which is an issue with this country, for example with older vehicles already being fined or penalised. As with EVs, there was a balance with the potential environmental impact of old tech but the desire to avoid building new things.
- On impacts, it was felt that different trips for different reasons could be satisfied with appropriately sized shared vehicles, in which case it might ideally reduce unnecessary car trips.
- It was felt that it should reduce travel/trips, if it was deployed as PT, but with concerns about exclusion through prices and the lack of PT currently.

- Another participant suggested that people would use AV (and normal) PT if it was provided, and that it would require infrastructure to support it, they used an example of their daughter's school transport by demand responsive minibuses, but they agreed that such systems might not be rolled out in the countryside.
- It was said that successful rollout would depend on pricing/economics, and a mindset change from car-based social practices of regular e.g. weekend leisure car use, but that Cambridgeshire was showing signs of more cycling and active travel.
- Car-free living was said to be possible (using hire and PT) but expensive, which for most people outweighs positive environmental considerations.
- The Traveller participant stressed that people live in vehicles (or tents) for cheapness, not possible in an AV? And that a lot of drivers would lose their jobs, compounding post-Brexit workforce problems. Again, problems with current (rural) PT infrastructure (few train stations, high cost) were pointed out.
- There was a suggestion that driver jobs might be replaced by high tech ones.
- On the issue of how likely a fully autonomous future is, it was thought to likely be very slow transition (up to 40-50 years), in UK's outdated/inappropriate road systems (especially in older parts of cities), starting with smaller schemes in cities. One participant felt it was not a government priority,
- There were concerns people would be priced out, and problems in rural areas were raised again, with a new station proposal being vocally opposed on the basis that PT is disliked.
- It was felt that people like their cars, feel they 'need' cars, like driving, and don't like or trust change, with the EV transition seen as a good indication. People were seen as insular, car-dependent and focused, and hard to change. Car clubs' lack of popularity was seen as demonstrating a dislike of sharing.
- However, it was suggested that If alternatives were provided and good then there might be a mass changeover.
- Economics were raised again it was pointed out that even with costs of driving continually increasing, they are STILL cheaper than other options. Urban sharing schemes (i.e. like car clubs) might succeed if ownership costs could be avoided.
- Insurance (experienced as a problem for co-housing car clubs) was pointed out to be very conservative and risk averse, and so it might stop AV systems as not cost effective.
- EVs (Teslas specifically) were raised as showing that new technologies still have safety issues.
- There was a question of who would be able to afford private AVs, only rich people? And a suggestion that they might own fleets to make money, as in our present system, people with resources make more money from them.

Breakout Group 2

Here are the summarised discussion topics from the Breakout group 2:

- The future AV world was feared to be more private car mode, similar to today. It was pointed put that people would not share smart cars full of personal

data. So shared model would be better, if it had the convenience of taxis. Personal opinions were that it might be better, but old tech options are just as good – a bike or old car.

- There were safety concerns about interactions with other road users, different weather conditions, with totally driverless options seen as safer for women.
- One participant felt it was a ridiculous scifi future, with uncontrollable technological advance a risk, especially for safety. Technology always goes wrong. Concerns that technology takes away skills and makes us detached and dependent. Comparison with automation of retail. Some will still want to drive for that engagement with the world.
- One participant could see the advantage if it filled in for lack of PT, in a community transport mode, rather than ownership. And perhaps for a family holiday further.
- When asked how that community mode might function, another participant pointed out that it is like taxis, but better, but taxis don't like dogs, muddy boots – would it still be exclusionary? And the appreciated aspects of e.g. trams are the interactions with the ticket collector. The price (cheaper than taxi, Uber) was important, and also who it benefits. It might undercut trains, as a safe luxury cocoon, when transport should benefit the many, community and society, not individuals. But the profit seeking is unlikely to do this.
- Another participant was concerned about it being part of a dictatorial determination of how people travel (with reference to Dieselgate), and also questioned where AVs would be stored. They raised older people having fear of AVs, fears of parents for children and babies, fear of covid.
- There was a preference for some human staff presence for AV PT, for safety – otherwise again, private ownership might dominate. The scifi model of AVs seems to be tiny vehicles, they said.
- Also, thought that PT mode would have to be accessible for people with e.g. dogs, plants, scooters, bikes, whatever was necessary for travel – too many rules would stop it being used. Would also need to be integrated, ticketless? And multi-modal.
- Another participant was trying to match these calls with the reality of likely private providers – how will it be designed to maximise user needs and their profit? There was a concern that it would be developed in an unplanned competitive way like the current system, so none of the perceived benefits would materialise. So, it would work best, in a perfect world which we don't have.

Multi-Criteria Decision Analysis

The members of the breakout groups were reassigned from the initial ones.

Breakout Group 1

CRITERIA DESCRIPTION	Feasibility/pragmatic realisticness -in next 50yrs	Environmental benefit	Affordability - accessibility	Fairness - Just - equitable Cohesiveness	Perception of safety (including unhackability)	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	10.00	10	8	8	9	45
	22%	22%	18%	18%	20%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
No Autonomous Vehicles happen - same	0	6	12	15	21	10
some AV cars for some peopl, but not PR	10	14	15	9	15	13
PT (trains, bus, uber) all AV - cars still private, non-auto (or little)	15	19	19	21	17	18
Everything AV	16	24	19	24	17	20
EVerything AV AND shared - right size for trip	9	29	27	27	16	21

Options selected were different fleet mixes coming in over time (a difficult concept that caused problems with the first assessment criteria, see below):

- No AVs happen, transport system, remains the same
- Some AV cars for some people, but no public transport
- PT (trains, bus Uber), all AV – cars still private, not autonomous (or very few)
- Everything AV
- Everything AV and shared – right size for trip: this option is similar to DW2's 'magic algorithm' option of correctly/efficiently-sized demand responsive public transport

Assessment criteria in descending order of weightings were:

Feasibility/pragmatic 'realisticness' -in next 50yrs (22%): this combined different criteria that then cause problems in the scoring, They included how easy it would be to create and run the option, but also mentioned (and then excluded) was the idea of how the option would be owned and operated – "who would have the keys, where would they be stored?". The facilitator excluded this as detail of options, not an assessment criterion. In scoring, the diverse aspects of these criteria were replaced by feasibility in the sense of likelihood of happening, and to make this usable, a timescale of 50 years was added.

- Environmental benefit (22%)
- Perception of safety (including unhackability) (20%)
- Affordability/accessibility (18%)
- Fairness, justice, equitability, social cohesiveness (18%): this combined several criteria that were felt to be important and were sufficiently related to take as one

The scores combined with weightings produced the following prioritisation/preference of modes:

- 'Everything AV AND shared - right size for trip' scored highest overall, scoring highest on Environmental benefit, affordability and accessibility, and fairness.

There was a sense in which one of the participants favoured this option anyway, and directed the scoring to reflect that this option was the 'best of all worlds'. However, it scored lowest on Feasibility within 50 years.

- Everything AV was next most preferred, scoring just behind the top option on most criteria except perception of safety, where they both scored lower than other options.
- AV PT with private and non-autonomous cars came below these options, scoring just below on all criteria but equally on affordability and accessibility and safety with 'Everything AV'.
- AV cars but not PT came next, with no AV as the bottom option, despite the BAU option scoring higher for the less-weighted criteria of fairness and safety.

It should be noted that one of the three participants in this group struggled to understand the criteria and the scoring, and the scores for safety as they ran out of time were '5 for everything' – reflecting the inability to engage as clearly as they wished. Another of the participants seemed to have a clear understanding and consistently scored the options more if they were AV, more if they were PT rather than cars, and finally, the highest score for their own suggested option of everything AV and shared at the right size. The third member of the group seemed to understand and go along with these evaluations.

Breakout Group 2

CRITERIA DESCRIPTION	Environment Impact - Running day-to-day (Emissions & Energy)	People V Robot - e.g.added value of being autonomous	Affordability	Storage /Versatility (Transport of people and their goods and equipments)	Connectivity transport syst	WEIGHTED SCORE
(highest most important)	8.50	8.5	9	7	7	40
	21%	21%	23%	18%	18%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Private Autonomous Ownership	8		2	8	8	5
Autonomous Mini-bus size, public transport	8		8	6	7	6
Autonomous Emergency Service Vehicle	8					2
Autonomous Micro-Vehicle (hireable - similar to taxi)	8		5	2	8	5
Private Non Autonomous ownship - current car	4		4	8	8	5
Autonomous Campervanc	8		1	8		
Non autonomous Campervan	4		3	8		

Options selected were transport modes:

- Privately owned AVs
- Mini-bus sized AV public transport
- Autonomous emergency service vehicles
- AV micro-vehicles (hireable similar to taxis)
- Privately owned non-autonomous cars (current)
- Autonomous campervans

As can be seen from the results, AV emergency service vehicles were only scored for environmental benefit [check why].

Assessment criteria in descending order of weightings were:

- Affordability (23%)
- Environmental impact (i.e. benefit_) – running day-to-day (emissions and energy) (21%)
- 'People vs Robots' – e.g. added value of being autonomous (21%)
- Storage/versatility (transport of people and their goods and equipment) (18%)
- Connectivity of transport system (18%)

As can be seen from the titles, a lot of effort was put into deciding and combining criteria. One criteria (People vs Robot) was not used to score the options [check whether difficult or just ran out of time].

The scores combined with weightings produced the following prioritisation/preference of modes:

- AV minibus public transport was assessed highest by a small margin, scoring equal highest for environment benefit along with all other AV options, and highest for affordability.
- Non-AV cars, private AVs and AV taxis scored equally next – scoring higher for system connectivity. Other modes were not scored completely.

Deliberative Workshop 4 Summary (Classic Car fans) Summary Report

General observations

This was an all-male group of 5 classic car fans from around England, mostly living in rural contexts, most from ex-engineer or mechanic backgrounds, one a chairman of a classic car club, and the others members.

First Discussion Session

Breakout Group 1

Here are the summarised discussion topics from the Breakout group 1 (two people):

- The pair agreed on technical feasibility, although beyond current technology, with unpredictability of humans a key worry. While they could see change taking place, the change-over period was seen as problematic, with one pointing out that they have no car less than 20 years old, have one over 100 years old.
- Suggested that carbon emissions will be socially unacceptable, insurance might force the change-over.
- Change was seen as unimaginable by the other, where their demographic "male, certain age. White. Certain mindset" would be legislated off the road due to their fondness for fossil fuels. However, change was also seen as inevitable – a talking satnav was unimaginable 20 years ago.

- Such technology was viewed as a 'snare and an illusion' – trapping people in technology-dependence without important skills – e.g. being stuck navigating in floods.
- Resistance to change was discussed – both felt that they would be passive resisters, one not using tech unless it was genuinely useful (windmill dweller), wondering about the situation in rural areas – you couldn't use an AV car to pull a sheep out of a field [nature of vehicles as 'tools']
- The other was generally cynical about EVs (especially EV cars) – they saw a driverless tram or train as an obvious deployment. But not in rural areas as cars, questioned by both – dirt/mud on roads and markings? No needed virtual environmental infrastructure? No provision for removing blockages no single-track lanes? Would require cooperation/organisation even more than present system. Mapped passing spaces?
- It was suggested that there *might* be fewer traffic movements in general. Again, this was based on a technological optimism (based on witnessing massive technological changes) – "we are using current frameworks which limit what we imagine might happen". Evidence based on 'peak car ownership' in younger people, number of tests going down, automatic car tests. Sense of the end of a golden age of the car – back to weekly use as grandfather did.
- Car ownership might not be seen as essential in the future – said by participant who can WFH (foster parent) with a massive Land Rover that is not used much (10x/yr), and sized for rare maximum use.
- Discussion of EV cynicism – 'you can't fall in love with a diode' revealed the personal/sensual/romantic side of relationships with hands-on cars. "No relationship with a fridge – it does what it does!" Desire as part of the status symbol. Efficiency, but no drama. Part of generational change – they related to their own oddball hankering for bygone technologies, and being ignored/replaced. Links to changing nostalgia – always for the things of one's youth. But also, obsolete things are emotionlessly discarded when no longer useful.
- However, it was felt that AVs (especially in urban taxi/PT mode) would be useful and used even if available now).
- There was a mention of economy leaping onto new things – hype cycles? The car economy is huge (£2.5bn/yr?) but things always shift. Again, EV cynic expressed view that EVs just shift pollution form the tailpipe to elsewhere, cobalt mining concerns, raised Dieselgate as a reason to be suspicious of the government advice, suspected hydrogen or biofuel would be next.
- The windmill dweller agreed, 'energy involved in constructing a car outweighs the tailpipe' – keeping vehicles operational is 'offsetting'. What are the lifespans of these new vehicles? ICEs have been refined for 120yrs. EVs were popular at the turn of the century, could go full circle.
- The EV cynic agreed that whole life calculations are what counts, therefore cars that are inefficient now are better if they last a long time: "got vehicles, so keep using them".
- The windmill dweller described the enthusiast tinkering as self-justified as recycling, but also anti-capitalist – fighting the constant drives for new vehicles, more complication and plushness.

- The EV cynic agreed – the only 'real' measure of improvement for a driver is journey times coming down, they haven't since the 50s. The machines have improved, but not the experience of drivers.
- Moving the discussion to societal effects, the EV cynic suggested land use is key – too much tarmac already in the UK (as much as France, in a quarter of the area) – so efficient use of vehicles is important, and AVs might enable. Own oversized (7/8ppl) Land Rover an example of the waste and oversizing. Clive Sinclair had the idea too early – personal transport, right sized. Motorways could have 7, 8 lanes.
- The windmill dweller suggested AVs could be journey shared or empty when used, pooled in community hubs and a variety of sizes from single seater to many. Ideal would be a Sinclair C5 but with weather protection and range. BMW made an enclosed motorcycle, but expensive and niche. 'Door to door appropriately sized' sounds like a great future, and with smaller vehicles due to no need for safety features, crumple zones etc., that make even Minis huge.
- The EV cynic agreed, then he could get rid of his Land Rover, there was a discussion about safety designs – they should make the driver more wary, not less.
- Asked if people would accept a smaller, arguably less 'sexy' type of car, it was argued again to be a generational change already happening – not appealing to themselves, but acceptable to generation more interested in efficiency than drama or status, 'unnecessary ownership will be anathema eventually'. They saw themselves as a hardcore of oddballs who would use simulators to get driving experience.

Breakout Group 2

Here are the summarised discussion topics from the Breakout group 2:

- First response was that they will be a good experience- taking the risk and accidents due to human nature our of driving.
- Second was a concern about ownership and control – corporations deciding people's need to drive, and dispatching 'driverless Ubers'.
- Third response was 'as a chairman of classic car club, driving is a pleasure.. you'd be taking that away'. They wouldn't buy but would use for 'mundane activities' like shopping but not [check?] for holidays or visiting friends.
- Second responder has experience of AV-style vehicles, they require a very controlled environment, and still have problems. They would require more 'facilities' and charging….
- First agreed full automation is way off, but they would welcome it, for safety again: 'I drive every day and I don't always like it'. They can't see 'car-sharing' happening – they would have individual cars, but it will take a while – but they think the legislation is now in place.
- Second saw this as something for future generation, current technology is not good enough, and new generations are happy with delegation of skills, and no ownership (example of getting someone in to put shelves up). They assume less travel under full AV – no need for vehicle enthusiasts or 'just driving around'.
- First responder unsure – might increase miles, he drives to get places, not for pleasure. He suggested legal driving could be ensured and programmed in

(which he would be happy with). The third felt that an AV would be a supplement to his fleet, and he would still look for driving pleasure.

- There was concern about current technology – GPS and SatNavs and speed limits, and their glitches. But a response challenging technology's ability to anticipate human behaviour (child running into the street). Another felt that the threat of liability would ensure safety. The first responder felt that the cars would be able to machine learn all this from each other, over time: both safe driving, and best route to take.

- The 'control concern' participant asked others how often they override SATNAV, as it would be impossible with AVs? They replied they never use it. He said SatNav can be stupid, especially in the countryside, 'gets you stuck behind tractors' – people might anger and 'turn against' it. The others pointed our that you can train current tech to avoid country roads or e.g. roads too small for a motorhome.

- Asked about other activities while in an AV, chairman said they would never use one. Control concerned would suggest everyone gets one (like they have a motorbike?), third would use phone/iPad/entertainment system: "It's a bit like being a passenger in a way…you can behave as a passenger", could drink and drive. Control concerned said drinking would go up, bad for health. All agreed this could be a bad shift in 'someone has to stay sober' going out practices.

- Other (non-personal) options were then discussed. Public transport like 'Total Recall' cabs? Lorries with A-to-B routes would make sense commercially as AV, it was asked if there are driverless trains in London, Liverpool airport buses… building public confidence.

- It was asked what the point of ownership would be if there was AV PT.

- On economic effects, health (accidents) would improve, tax revenues would go down (referencing EVs), less economic activity from repair and maintenance 'these things always have an impact on governments and where they lose money' – control concerned.

- It was countered that these e.g. tax concerns would apply to shared/rented vehicle systems. But first responder questioned shared vehicles, based on owned cars being domestic family spaces. Chairman pointed out PCP schemes are already short-term ownership, could be like that, and again, about new generation not being hung up on ownership. Control concerned agreed, imagined events to view customised vehicles, without the ownership, social and 'showing off' sides. The chairman pointed out that there are two debates: automated vehicles and the shared aspect, could debate either independently.

- On politics, control concerned called for 'ultimate responsibility' citing Dieselgate and need for user protection. The first responder talked about safety and liability: manufacturer's? And cited the changeover period as the most dangerous. The chairman said that government shouldn't be able to tell manufacturers to do this.

- The changeover was seen as an all-or-nothing or as problematic. Tractors and rogue drivers were brought up. Feasibility was then questioned – 'a dream since the 70s', need system, then legislation, and structures…infrastructure, cameras, a massive programme with phases, with restrictions for access: a complex transition.

- The loss of driving skills was seen as a problem, even stretched to a mental health problem affecting prediction etc. Chairman bemoaned loss of 'showing it off' to friends/family, 'the enjoyment of the ownership', 'it just becomes another piece of public transport'
- First responder saw travel time as work time, chairman saw potential lowering of stress, first enjoyed WFH lack of stress, but control concerned enjoys driving 50 miles to work and would miss it. First pointed out need to separate personal experience for what's good for the country. Control concerned bemoaned the loss of the 'pretty route home'.
- On environmental benefits, EVs were seen as more influential than AVs. The discussion immediately switched to monitoring, cameras, and privacy concerns.

Multi-Criteria Decision Analysis

The members of the breakout groups were reassigned from the initial ones.

Breakout Group 1

CRITERIA DESCRIPTION	Cheapness per mile for user	Enjoyability	Reliability	Availability/accessability - usability	Environmental benefit	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	7.00	6	9	10	8	40
	18%	15%	23%	25%	20%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Privately owned car AVs	6	9	21	5	5	9
AV Taxis	19	6	23	5	5	12
Car pool community Avs	12	8	16	5	5	9
AV buses	22	6	24	5	5	12
Status Quo	18	28	26	5	5	15

The options selected were fleets of different types of Avs, and then 'status quo' as indicating the current mixed non-AV fleets of vehicles, causing issues with comparability:

- Privately owned car AVs
- AV Taxis
- Car pool community AVs
- AV buses
- Status Quo: in effect, this was used by at least one participant to mean 'personal use of a car', rather than a multitude of options.

Assessment criteria in descending order of weighting were:

- Availability/accessibility – usability (25%): The time ran out before this criterion was scored, therefore 'average' scores of 5 were attached to each.
- Reliability (23%):

- Environmental benefit (20%): The time ran out before this criterion was scored, therefore 'average' scores of 5 were attached to each, which was seen as justified as "that's what we have now, so it must be the baseline".
- Cheapness per mile for user (18%): The 'for user' addition was to clarify for comparisons between personal use and other-owned fleets.
- Enjoyability (15%): Despite stating that enjoyment was important to them personally as drivers, they agreed that it was the least important criteria when considering which option was most acceptable or desirable from a collective viewpoint.

The scores combined with weightings produced the following prioritisation/preference of modes (bearing in mind that environmental benefit and usability/access were not scored, and that individual members were offered the opportunity to apply their personal scores and reasoning):

- Status quo (15)
- AV taxis and AV buses (12)
- Privately owned car AVs and Car pool community AVs (9)

Breakout Group 2

CRITERIA DESCRIPTION	Accident Rate	Security/Privacy (hacking risk)	Adaptability for size/utility	Convience	Cost (day to day cost / running cost)	WEIGHTED SCORE
(highest most important)	8.00	5	6	9	7	35
	23%	14%	17%	26%	20%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Private AV ownership	10	3.5	1	10	1	6
Shared AV (car pool various size vehicles)	10	2.5	10	6	4	7
Private non-av	4	9	1	10	1	5
AV public transport (bus)	10	2.5	1	2.5	5	4
AV Taxi (on demand) - arrive within 5-10 minutes, similar to current taxi	10	2.5	6.5	7.5	2	6

Options selected were different fleet mixes coming in over time (a difficult concept that caused problems with the first assessment criteria, see below):

- Private AV ownership
- Shared AV (carpool various size vehicles)
- Private non-AV
- AV public transport (bus)
- AV Taxi (on demand) - arrive within 5-10 minutes, similar to current taxi

Assessment criteria in descending order of weightings were:

- Convenience (26%):
- Accident Rate (23%): In fact, the scorings applied were for safety (normal cars rate worse than all AV options)
- Cost (day to day cost / running cost) (20%): Scores were for cheapness.

- Adaptability for size/utility (17%):
- Security/Privacy (hacking risk) (14%): Again, the scores were for security rather than risk, as normal cars were scored highest.

The scores combined with weightings produced the following prioritisation/preference of modes:

- Shared AV (carpool various size vehicles) (7): This high score was mainly produced by the extreme score differences for criterion 'Adaptability for size/utility' (10 versus 1), which was also well scored for the AV taxi option in second place.
- AV Taxi (on demand) - arrive within 5-10 minutes, similar to current taxi, and Private AV ownership (6)
- Private non-AV (5)
- AV public transport (bus) (4)

Deliberative Workshop(s) 5 (Tesla Car owners) Summary Report

General observations

The Deliberative Workshop for Tesla drovers had to be split into two sessions (of 1hr15mins and 1hr) because of inability to get a quorate number of participants (4) available for one 3hr session after months of recruitment efforts and timeslots being offered to a pool of 16 several times The first, discussion, session was an all-male 'group' of only 2 Tesla owners, both long-time residents in the UK but originally from elsewhere. Highly educated and wealthy (compared to some of our other groups), they were fans of new, digital, innovative and electrical technologies in general, and their view of modal choice and transport decisions was firmly located in utility-maximisation rationalities; i.e. AVs would inevitably develop, and would successfully permeate the transport system if their use could be made cheap, comfortable, convenient and time-saving. One of the participants, from Norway, had a developed view of the political and economic conditions that would be required to 'impose' CAVs, based on the conditions of the successful roll-out of EVs (and broadband etc.) in Norway: a strong state insistence of blanket infrastructural coverage as a condition of commercially operating in the country.

Given the small number of participants, no breakouts were required. Both owned Teslas with some degree of automation – the limited 'auto-pilot' package available in the UK. One owns a Model Y, the other a Model 3.

First Discussion Session

Here are the summarised discussion topics from the group (two people) on the first question:

- They noted the existence of AV taxis in America, and resistance – similar to Luddite or miners' strike - to 'inevitable' technological change, 'labour to brain

power'. 'Losers' in the transition were viewed as taxi drivers and long-haul drivers.

- Logistics, the Norwegian participant (NP) said, would be made streamlined and efficient which "can only be a good thing", which Australian-style 'land-trains' of lorry fleets on the motorways.
- The other participant (OP) pointed out the need for constant tarmac repairs for autonomous vehicles' thinner tyres?
- NP suggested AV taxis would reduce the need for private vehicle ownership in cities. He had experienced car-sharing schemes, based on terrible parking space in Oxford. OP would hang onto private ownership, describing their Tesla as 'my toy' - they also have an electric helicopter. But they do not use the Tesla in town or to commute, relying instead on buses (disliked as dirty and crowded) or electric scooter (quicker, cleaner, another 'toy'?). NP concurred that they don't use their Tesla much, relying on shopping deliveries. They would not use shared AVs due to having small children and needing car seats. He says change based on need/demand (and economics).
- NP stated that 'once legislation comes, they will follow' - a consistent theme of state directing private development, based on Norwegian experience.
- OP stated resistance to AVs might follow that to EVs – based on financial factors: value, depreciation, cost of replacing batteries. Asked if that was an argument for shared AVs they grudgingly agreed.
- Asked if financial (dis)incentives would be the main factor in uptake OP agreed and NP spelt out a package of policy carrots *and* sticks that were very successful for EV roll-out in Norway: financial incentives to buy combines with huge taxes on ICEs, access to bus lanes, no road tax, no VAT, and a 2025 ban on new ICEs. This requires political willingness to "make it economic [...] make it a no-brainer and everyone changes [...] all behaviour is driven by the wallet". OP concurred and talked about taxes in the UK discouraging EV uptake.
- Asked what would enable a shift to 100% AVs given that not everyone can afford private vehicles the discussion shifted to 'dumb taxis' and AV buses that would have to be 'clean and brand new' to be attractive. OP was a very unenthusiastic bus user.
- Asked about energy, carbon and travel distances going up or down, OP fell back on concerns about environmental impacts of EV batteries, but made clear they are an electrification fans, planning domestic solar panels, batteries. NP stated that price and convenience drive travel. ON non-car modes, Norway invested in buses, but scooters are cheaper and more convenient.
- NP expanded on Scandinavia being '1-20 years ahead' on technology but also having political will to impose it. political will.
- Asked about induced trips, non-drivers and the elderly visiting (grand)children were mentioned.

The second half of the discussion was prompted by asking about the likelihood of a 100% AV future, and the reasons for any proffered alternative future:

- NP saw it as very likely (except in rural areas like Cornwall), driven by commercial viability and strong state backing/enforcement, as in Norway: "The only way to make companies do things is by tell them they have to. They

will always do everything they can to make the most possible money. And that's their job." OP thought it unlikely in 'only' 50 years, given the UK's cautious safety culture – that has not allowed Tesla's autopilot yet and agreed that rural areas have not yet caught up with EV (i.e. charging) infrastructure.

- On infrastructure, NP again drew on Norway – the UK hasn't had national planning since Thatcher breaking up Telecom, but in Norway companies seeking profit in cities were forced to provide coverage in deep rural areas: "the government aren't very good at delivering anything. So, you need to get private companies to do it, but you need to force them to do it." He linked the acceptability of this model in Scandinavia to liberal, educated social cohesion based on more equality, similar to California, different to the UK's class society and Anglo-Saxon selfishness – good for 'ultra-capitalism' but not for social programmes. OP concurred, and again referred to the unpopularity of governments raising money through taxes (if they were to be responsible for infrastructure, implied), also stating that "I'm not into politics and I' just do what I'm told". Asked what this meant – who was telling him to get a Tesla or AV, he instead says he like technology as a hobby, as toys, for showing off: "it doesn't feel like a car it feels like a toy.

- OP saw AVs as like limousines, being chauffeured. Asked if they would be willing to use shared AVs, OP was unenthusiastic, seeing it as a bus-like space (having to share space with people was a negative): "the main thing I don't like about buses is it's dirty, smelly, especially if it's wet outside", so a smart clean interior would be required. NP had used shared taxis, saw the stopping and dropping/collecting as removing the convenience ("money drives the world around, convenience is also quite important and time is even more important"), and would accept/use a car-club style shared AV, but not a literally shared one: which might be suitable for "the lower socioeconomic [demographic...] But I can't see that being, I guess, the target demographic".

- OP agreed that part of the appeal of a private vehicle is "it's still ... our generation. We still like the joy of actually driving ... instead of being driven around"

- On how AVs would be 'sold' to society, increasing acceptability, OP again saw it as a matter of convenience "they're always on time, always there when you need them, they won't be held up in traffic". NP instead stated that they had many misgivings about AVs (not really revealed in the discussion), particularly on 'robot ethics' and safety – the trolley dilemma and I, Robot were mentioned as illustrating very difficult decisions that humans struggle with, and "the people who right the algorithm to these cars are answering these questions... how can I trust that the Google engineers have a morality that corresponds with mine or at least is acceptable to society? [...] They [AVs] almost need to become fully artificially intelligent and make decisions like a human". OP reflected that these safety issues might hold up full automation, in the UK at least.

- Asked whether the proportions of different vehicle types would change with 100% automation, NP responded that it was a huge 'multi-variable' questions (they make systems models) - there would probably be fewer tais because they would have operating costs and no advantages over car club AVs, but ultimately, he couldn't answer. OP again fell back on pricing, depreciation as the key factors in how many AVs/EVs there are, seeming to ignore that other sorts of vehicles than cars were being referred to.

Multi-Criteria Decision Analysis

The MCDA session involved 5 people – the two original participants and three more, one female and two male, one Greek.

Options selected were modes of transport:

- AV public transport - not privately owned
- Non-AV taxi
- AV taxi/car club
- AV train (DLR)
- AV car - private

Assessment criteria in descending order of weightings were:

- Safety (31%)
- Reliability/ease/speed of use/access (25%)
- Affordability of service (19%)
- Comfort (19%)
- Trust in the morality of algorithms (6%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- AV train (DLR) (43)
- AV taxi/car club (42)
- AV car – private (42)
- AV public transport - not privately owned (40)
- Non-AV taxi (34)

Deliberative Workshop 6 (Public drivers) Summary Report

General observations

The group was a good mix of ages and genders as asked of the recruiters; two retirees, two managers, equal numbers of male and female and with three younger participants. Their homes seemed to mostly be rural, which clearly had an influence on the findings – this is not a problem, as it offers a valuable contrast to views mostly from cities in other groups. However, it leads to an underlying reason for car dependency and a tendency to see CAVs as an urban solution to an urban problem, in the data. Some underlying suspicion of/resistance to EVs was also present, affecting the view of AVs.

First Discussion Session

Breakout Group 1
Here are the summarised discussion topics from the Breakout 1 group:

- For first impressions, one participant felt that AVs would be 100% safe. Another did not believe it would ever manifest, especially everywhere – i.e. not in rural areas with no infrastructure. Grid-based cities as in American trials might work. They preferred personal control. A third felt the joy of driving would be lost, and couldn't see it happening in their lifetime, while the fourth thought technology was close, and positive in terms of shared and taxi modes, in big cities – where it would be commercially viable. Car sharing could also reduce vehicle numbers.
- The first participant felt people would probably travel more, depending on costs, although older people might resist using them. Expected trips would be longer motorway journeys, which they expected to be smoother (speeds, no braking), and safer.
- Another participant pointed out that an AV car couldn't help an older person into itself, whereas with public transport options there might be someone. They personally wouldn't want to share an AV - they had seen car club offers and not used.
- Insurance was discussed, responsibility was uncertain.
- Another participant confirmed that they had known about car/lift-sharing schemes for many years and never known anyone use one. The last felt that some would travel more and some less, balancing out. Driving for leisure was mentioned again: "may find older and young people use it more".
- Asked if they would personally use them, the fourth participant would – with no reservations about them or sharing, particularly if they were available as quickly/easily as cars are now, saving depreciation and the need to park them.
- The second participant was cynical that AVs would appear, and would not trust them, also seeing their use as urban not rural, where public transport is not even available. The third would use them, like a taxi, but would like to retain a car to drive and be independent. These two older participants suggested they might be 'stuck in their ways', 'whether what we have got is right or wrong'.
- The first respondent agreed that he would retain a car and use AVs, possibly shared with friends, like a taxi.
- On energy impacts, there was suspicion about EVs and their construction and purchase costs (including battery impacts), assuming diesel would be in place for years.
- Older female agreed about these doubts re: EVs, pointed out poor electricity infrastructure rurally, and suggested greater reliance on electricity ran risks of sabotage etc.
- Younger female suggested energy use would be lower but asked about freight and EVs. The younger male questioned electricity generation sources and carbon/battery production. Lower emissions would be dependent on electrification AND renewable generation.
- Older female suggested farm machinery, lorries vans, could easily switch, another suggested trains. Others brought up delivery, drones, trolley/robots, as potentially viable. The last participant agreed rail but were not sure about other vehicles. They knew about delivery robots in Milton Keynes. It was asked how robots check ID for e.g. alcohol.

- Buses had not been discussed, and were thought to be possible, but the younger male still expressed range anxieties.
- General EV charging/quietness/speed issues were raised by older female - preferred diesel 'for the time being'.
- Asked about likely future viability, the young male repeated that it would be in cities not rural, and would not replace cars and people's attachments to them. Repeated EV cynicism - 'no soul'. 'more of a tool rather than a passion'. It was asked whether driving tests would stop, and whether children could use?
- Older male thought an AV future will come, slowly, overlapping with manual car usage – concerns about design/history being lost.
- Older female thought technology is advancing in those ways anyway, metal boxes, no mechanics, computer diagnoses etc. Pointed out cashless payments etc.
- Asked about acceptability – older male suggested change happens and is accepted, he understands human preference for control but personally could just use cars to get from A to B. Improved safety meant AVs were accepted as positive result of losing skills, joy of driving etc.., e.g. with automatic cars, ABS, phone banking...
- Older female stressed limits – still use a watch. Would accept AV as a taxi, but keep car.
- Older female has an automatic car, accepted the change, but mainly in urban areas, like trams.
- Young male thought change would be gradual and imperceptible, and so accepted.

Breakout Group 2

Here are the summarised discussion topics from the Breakout 2 group:

- A young female participant was not keen, thought new jobs might balance driver job losses, and thought people would travel less, being uncertain about lack of research and loss of control.
- Another felt it would all be down to cost: if cheaper, it might overcome scepticism, but more research/testing was required to overcome doubts about e.g. safety, and that many would still drive, with those who couldn't drive able to buy one, but probably preferring cheaper public transport.
- It was thought human over-ride would always be preferred over level 5 autonomy and limited by legislation: taking control away was like removing rights, and would then result in robot takeover and unemployment.
- Another felt 100% safety was impossible, and AVs do already exist and operate, but they still preferred over-ride.
- Asked about the vehicle fleet in an autonomous future, one felt it would stay the same, based mainly on cost: e.g. non-drivers can't afford cars, and use public transport. Another thought people generally prefer to have a car if possible, and even if AV buses were more regular and reliable they would stick with a car. Again, a young female suggested it was all down to cost – as current reticence with EVs shows. They repeated safety concerns: "there's been cases where like sensors have gone and people have actually been hit by the cars because they've not been able to pick up motion" so might lease or use a taxi rather than buy privately.

- Asked about car club style use of AV cars, one felt it might work in London and cities, but would not have coverage in rural areas, requiring huge numbers of vehicles. A male participant stressed that losing the joy of driving (especially an expensive car) would make ownership unattractive.
- A younger female thought a ban on non-AV would result in a slow process of acceptance, borrowing, and adoption, a bit like Tesla adoption gradually mainstreaming now.
- On energy/carbon reductions, the first response to accept AVs would be lower carbon, but then to ask about loss of tax receipts from cars, and whether it would affect road upkeep. They were told the two are not related, but there was agreement that roads need upkeep (again, affected by rural context). Slightly older male suggested EVs still "produce heat when there's really warm up and things like that so there's no petrol fumes, but there will be some kind of other heat going into the atmosphere" resulting in little change, but they thought there should be more research. Another agreed that the reductions from EVs were not proven. The new participant just joining said energy sue would 'obviously' go up and expressed cynicism about EV changing infrastructure and EVs being 'pushed'. They used the 2035 target being dropped as 'showing' the cart had been put before the horse and not enough research done first.
- Discussion then moved to the likelihood of a 100% autonomous future and reasons for it manifesting or not, slowly or not. The new participant felt it would happen, slowly, confused by hydrogen cars, they felt soon after EVs, AVs would appear, perhaps by 2050.
- Another suggested it would be slower/longer, with resistance from 'a lot of people' (the general population and protesters, clarified), progress being pushed by politicians, more like 100 years- past imaginations of e.g. flying cars in 2030 had not come true.
- Another younger female felt it will happen, but not in her lifetime, and as it would have to involve HGVs and buses it would take longer than people expect. The slightly older participant felt that it would never reach 100%, with push back coming from car enthusiasts, meaning only "75, 80% of the roads will be eventually" but in 150, 200 years.
- Asked about what societal factors might speed or slow the transition, the last participant to join (older, male) suggested politics: acceleration of change is happening (covid and AI cited) and individuals like Elon Musk contribute [political context – just after Musk and Trump in power], although EVs slowing due to hydrogen, it will be pushed forward. Geopolitics of Chinese competition also play a part. Another (male) felt funding could slow it down - 'they' wouldn't get a lot of money at first to progress would be 'very up and down'. Another felt there would have to be substantial financial incentives to start with, costing a lot in the short run. This would fall to the government to convince e.g. car enthusiasts, which would cost the public through taxes. The second younger female felt the availability of enough (non-intermittent/renewable) electricity for a transition might slow progress.
- Asked how they saw themselves in the autonomous future, the oldest male stated that they would keep a car initially but use an AV taxi - "some kind of taxi service that's going to be supplied by the councils that are funded by the government somehow, and there'll be some kind of pricing fix through the energy companies, of course", and eventually 'ditch the car' 'in the very far

future'. They had had expensive cars but felt insurance is 'a scam', and it is expensive to run a car: "going forward, I think it'd be great not to own a car." They currently have a hybrid, had had an EV, but feel it all comes down to price. They would prefer to get taxis or Ubers, but they are currently expensive, but AV ones should be cheaper and more attractive, than car ownership in general.

- Asked about privately owned AV pod-cars or shared taxi/car club options, the male felt that a shared one would be less desirable, if you were in a hurry or emergency, a young female would not want to share a vehicle with strangers, for personal safety. The other younger female would want a choice between the two options, choosing between a private more expensive option and the shared, efficient, assumed commuter option.

- It was pointed out that lift-sharing options exist now but are not used, and asked if AV would change that. The female participants repeated the safety concerns, the males then agreed, pointing out Uber licensing concerns.

- Asked about future AV design/shape, one felt EVs are terrible and robotic looking. The older male pointed out that they had had an EV but the charging infrastructure was not satisfactory, but their wife had one for ideal, "1500 miles a year going from A to B", use. They imagined an AV taxi to be a 2-wing-doored 'Johnny car' from Total Recall. The other male expected more sensors changing the design, and a boxy look "a bit like a Nissan Note kind of thing, but on a worse scale." The younger female agreed, anticipating "as many seats as possible that they can fit in the car": "it will look very modern, but I don't think it will look very nice".

- Again, asked about pods in chains, it was felt that this would result in "no like individuality and no character anywhere. I just think it would just look horrible."

Multi-Criteria Decision Analysis

The members of the breakout groups were reassigned from the initial ones.

Breakout Group 1

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
CRITERIA DESCRIPTION	Capactiy (People and luggage)	Safety	Availability	Affordability	Environment/Green Credentials	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	6.00	10	8	9	5	38
	16%	26%	21%	24%	13%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Fully Autonomous (Private)	6	9	10	4	8	7
Semi Autonomous, Hybrid, some driver control (Private)	6	5.5	10	5	7	7
Non autonomous (Traditional Noddy Car)	8	5.5	10	6	6	7
Fully Autonomous (Flee - simlar to uber services)	9	9	8	10	9	9
Commercial Delivery Fully Autonomous vehicles	9	9	8	10	9	9

Options selected were modes of transport:

- Fully Autonomous (Private)
- Semi Autonomous, Hybrid, some driver control (Private)
- Non autonomous (Traditional Noddy Car)
- Fully Autonomous (Flee - simlar to uber services)
- Commercial Delivery Fully Autonomous vehicles

Assessment criteria in descending order of weightings were:

- Capacity (People and luggage) (16%)
- Safety (26%)
- Availability (21%)
- Affordability (24%)
- Environment/Green Credentials (12%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- Fully Autonomous (Flee - similar to uber services) and Commercial Delivery Fully Autonomous vehicles
- All other options: Fully Autonomous (Private), Semi Autonomous, Hybrid, some driver control (Private), and Non autonomous (Traditional Noddy Car)

Breakout Group 2

CRITERIA DESCRIPTION	Criteria 1 Availability of vehicle	Criteria 2 Safety - general	Criteria 3 Affordability	Criteria 4 Maintenance	Criteria 5 Environmental friendliness	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	14.00	25	17	11	11	78
	18%	32%	22%	14%	14%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Manual Car	25	16	9	18	8	15
AV train	13	23	21	14	24	20
AV Bus	6	21	24	17	22	19
AV taxis	12	22	12	22	17	17
AV Car	19	23	12	22	16	19

Options selected were modes of transport:

- Manual Car
- AV train
- AV Bus
- AV taxis
- AV Car

Assessment criteria in descending order of weightings were:

- Safety – general (32%)
- Affordability (22%)
- Availability of vehicle (18%)
- Maintenance (14%)
- Environmental friendliness (14%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- AV train (20)
- AV bus and AV car (19)
- AV taxis (17)
- Manual car (15)

Deliberative Workshop 7 (Public non-drivers) Summary Report

General observations

Non-drivers were 4 males (one older, one Asian) and 3 females, living mainly in cities. This means that they may have been able to access better quality public transport.

First Discussion Session

Breakout Group 1

Here are the summarised discussion topics from the Breakout 1 group:

- The 100% autonomous vehicle future was thought to reduce drink driving and increase unemployment for some e.g. Uber and taxi drivers, which might be compensated by manufacturing AVs.
- They were thought to increase possibilities for disabled non-drivers. Another brought up non-drivers and those with e.g. epilepsy, who might increase usage, or balance the drop in numbers from drivers avoiding AVs giving no driving pleasure.
- There were safety concerns and questions about who would be responsible for accidents, and the knock-on effect on insurance.
- Another participant thought things would operate smoothly on motorways, but car culture (e.g. films) would change completely.
- It was asked how the revenue from speeding tickets would be replaced.
- One participant pointed out that people love driving – meaning that self-driving cars would be less attractive and fewer would be sold, and there would need to be manual override for emergencies and the emergency services. They also suggested criminals would hack AVs and use them manually (as they would have to). This would make driving a 'dying art', and people would go to set places to enjoy driving.
- It was suggested that manual driving could be regulated to non-busy hours and weekends, for people to drive faster, or with their children (assuming people would be scared to use AVs with children). Some people might refuse to ever use it through fears and safety concerns – current AV trains like DLR are already scary for some.
- One (older) participant re-asserted safety concerns as likely to make people avoid AVs: "things go wrong. Machines go wrong, computers go wrong. I mean, what if they've all had a meltdown on the same day?" -seeing this as part of a worrying trend of machines, robots and technology taking over from humans.
- Another responded that technologists would find ways to make the 'driving' experience interesting while not driving – races would still be exciting even if drivers were not fully in control.
- On other transport modes, one participant felt that public transport would have to have humans involved for safety – e.g. to respond to medical emergencies, crime etc. Another felt that public transport use would decline with the

availability of AV cars/taxis, and with safety concerns if there were no staff available, based on current concerns with e.g. school children misbehaving.

- The reliability of current (and therefore future) GPS and satnav technologies was questioned as good enough for AVs.
- When asked if they would use AVs, one stated that they would use AV buses, another that they might use an AV car only if their circumstances change, e.g. if they have children and need to ferry them around (not on public transport), a third would use AV public trans[ort (at least at first) as AV cars (he assumed) would be extremely expensive. Another agreed with this, but assumed their driving husband might use an AV car. The last participant would probably use AV public transport, but unwillingly, because of safety concerns. They suggested drivers would have to retrain as, essentially, security guards, and were concerned that older passengers would be expected to have (expensive) technology – e.g. smart phones.
- This was extended as an argument that there is general resistance to new technological change with older people. Another agreed that it would be a generational change, with children who mainly know AV growing up and replacing the previous generation.
- Another concern was whether the AV could be over-ridden in terms of destinations or routes.
- Asked about whether this 100% autonomous future will transpire, almost all agreed that it will happen, but with qualifications. One felt it will never be 100%, with older people refusing, and exceptions made to allow them the freedom not to use AVs. Another felt it would take a very long time, and they were still worried about safety, unemployment and people's choice not to be involved – especially drivers who enjoy driving. Another could imagine companies like Uber replacing human drivers but felt that there would never be 100% AV fleets, with humans still being needed, and people wanting to drive manually for pleasure. The last felt that it would be a total transformation, generationally, over more than 50 years (i.e. two whole generations). They also assumed technology would continue to develop, towards e.g. flying cars.
- Asked about factors that might speed up or slow development, one suggested governments and environmental regulation – assuming that AVs would drive more smoothly (matched speeds etc.) and thus save energy and carbon, another suggested that there would have to be massive government incentives - grants to car companies and their buyers, to make the transition happen. But this would be in a context of declining revenue from vehicle taxes. Another suggested consumer/user uptake would be the main influence, and that this was determined by (relative) costs and 'whether people want it'. Another saw the government driving it forward and public resistance as slowing it down (not wanting to use – again from safety concerns). Something similar to a scrappage tax was thought to be needed to incentivise replacement of vehicles.
- Asked whether they could imagine UK governments pushing this programme forward, and given the example of Norway, participants felt Norway was smaller with a smaller population and more wealth, and that the UK would be a lot slower, with little tax revenue, perhaps following progress by the USA. Another agreed that it would be very slow progress with governments not wanting to give up tax revenue, with another agreeing that it would not be

'mandated'. Discussion diverted to how governments might try to bring in new taxes.

- Public opposition was expected, but also that it would decline over time as people got accustomed to AVs. Objections were anticipated based on safety concerns.
- Asked to define 'acceptability', the concerns about technology (e.g. AI) taking over from humans were again raised, with 'control' the key issue. Another suggested safety was key but assumed it would be proven with empirical trials (e.g. in San Francisco – Los Angeles?) - they were unconcerned. A third cited safety and cost as the main acceptability factors, with no intrinsic objections.

Breakout Group 2

Here are the summarised discussion topics from the Breakout 2 group:

- Concerns about safety – e.g. responses to unexpected human movement – were raised, and whether machines can act ethically/cautiously like humans.
- Unemployment for already poor delivery and taxi drivers was raised as a concern.
- It was felt that non-drivers or those unconfident on the road could travel more by AV, and AV public transport might be more frequent, reliable, cheaper without labour costs. Commuting might be transformed completely – with everyday technology part of 'driving' too.
- Another felt that technology is advancing quicker elsewhere (e.g. Japan – bullet trains) balancing public safety with affordability. Another suggested car technology is nearly there but electric infrastructure isn't.
- Safety concerns included battery fires (car park fire cited – was not E V]), requiring further research, unmanned public transport, reacti0on times of AI,
- It was hoped that energy and emissions would reduce but pointed out that infrastructure needs to be in place first, in aging cities, along with increased car sharing.
- One participant suggested diesel was a more dependable fuel source than electricity at the moment, hydrogen cars were suggested as another technological trajectory. The need for electric and other (e.g. charging) infrastructure was mentioned again.
- Economic impacts anticipated included employment changing from drivers to engineers, similar to mining shifting to turbines
- Retraining of public transport sector (with resistance slowing), safety measures, might slow transition, along with people "from low-income backgrounds may struggle to adjust". It was pointed out that rural areas were unlikely to transition as fast as urban. Costs (EV as comparator again) meant not an option for lower paid. Regulatory and political framework as well as social willingness were seen as additional slowing factors.
- Timescales for the transition were proposed from 20 years (EVs) to >100yrs. Not in 30yrs, perhaps 200. One felt possible in their lifetime, possibly buses and trains first. Another said 10-15yrs, and cited EV production transition as due to be done by 2035. The EV transition was mentioned a lot. Challenging but not impossible was a general impression. Younger male participant pointed out contradictory evidence on people adapting to technology change – slower timescale allowed easier adaptation and acceptance, but EV phase-

out is an example of a shorter timescale making transition mor acceptable and smooth.

- Another suggested e-buses and automated buses and trams seemed more interesting and viable in their lifetime than replacing every car. Another suggested staged replacement of underground rail, then overground... taxis would take longer due to their number.
- Other modes discussed were delivery robots (concern on pavements – wheelchair users and prams), pilotless planes, long trains, freight.
- Safety for women in a surrounded car was raised (by a younger woman). It was thought that a bus with other humans was safer. Another (older, male) felt it would be great for security with less crime: "A lot of good can come out of Automation", which they saw as fast, accelerating, and positive.
- On acceptability, two males stated technological progress was self-organisation (a current trend), inevitable ("like garlic bread"), and fast. It would be improved by transparency and sustainability.
- The female participant agreed that e.g. AI was coming in and made things faster/better, but asked about the decline of knowledge and skill, e.g. of driving and coping in complex emergencies. They also questioned the ability of algorithms to cope with complex decisions – e.g. car, level crossing, horse all interacting.
- Younger male used example of ChatGPT to show people are more willing and adjust behaviour with technology use, older male said this transition would require education, community meetings, reassurance, openness about how it works and risks, answering questions etc.
- Female participant felt in 20yrs there would still be no level 5 automation – human control/over-ride would still be wanted. Replace costs for manual cars would also slow transition, people can't afford cars, except the rich. Others agreed that the working class would have to rely on public transport – it comes down to cost, and affordability. And that sharing might increase acceptability and first-hand experience, middle class have connections others don't.
- The female participant stressed the importance of (especially social) media in e.g. Covid and in the speed of acceptance. Younger male agreed that blogs and social media affect credibility and uptake of new ideas.
- The older male saw benefits for commuters, transportation of goods, carpooling (filling cars up with people).

Multi-Criteria Decision Analysis

The members of the breakout groups were reassigned from the initial ones.

Breakout Group 1

OPTIONS	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
CRITERIA DESCRIPTION	Affordability	Ease of access	Safety	Comfort	Accessibility/inclusivity	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	15.00	13	20	6	14	68
	22%	19%	29%	9%	21%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
AV Bus	20	14	9	5	6	11
AV Taxi	5	18	8	15	4	9
AV trains	13	10	17	10	9	13
Non-AV car	7	9	9	12	20	11
Non-AV train	13	8	18	10	16	14

Options selected were modes of transport:

- AV Bus
- AV Taxi
- AV Trains
- Non-AV Car
- Non-AV Train

Assessment criteria in descending order of weightings were:

- Safety (29%)
- Affordability (22%)
- Accessibility/inclusivity (21%)
- Ease of access (19%)
- Comfort (9%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- Non-AV Trains (14)
- AV Trains (13)
- AV bus and Non-AV Car (11)
- AV Taxi (9)

Note that trains were ranked first and taxis bottom, by non-drivers – this suggests scoring to some degree relied on how these modes work for them at the moment?

Breakout Group 2

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
CRITERIA DESCRIPTION	Safety	Reliability	Affordability/cost effecitveness	Environmental Friendly (low carbon emissions)	Human Control/ Not hackable	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	15.00	15	11	8	13	62
	24%	24%	18%	13%	21%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Semi-AV Private Car (50% human controlled, 50% AI controlled)	24	22	14	20	21	21
Full AV Private Car	20	20	10	24	20	19
AV Taxi	22	23	18	23	24	22
AV Bus	19	21	30	26	24	23
AV Train	30	26	20	24	30	26

Options selected were modes of transport:

- Semi-AV Private Car (50% human controlled, 50% AI controlled)
- Full AV Private Car
- AV Taxi
- AV Bus
- AV Train

Assessment criteria in descending order of weightings were:

- Safety (24%)
- Reliability (24%)
- Affordability/cost effectiveness (18%)
- Human Control/ Not hackable (21%)
- Environmental Friendly (low carbon emissions) (13%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- AV Train (26)
- AV Bus (23)
- AV Taxi (22)
- Semi-AV Private Car (21)
- Full AV Private Car (19)

Deliberative Workshop 8 (car sharers) Summary Report

General observations

This group ran with only 4 people (3 women and one man), despite being recruited by the professional recruiters. One non-attendee had been mugged, another's new laptop would not let them access Zoom. The decision was made to proceed anyway. The participants were from London, with the exception of one having moved from London, so this group may provide a more urban perspective.

First Discussion Session

Here are the summarised discussion topics from the group:

- As first responses, participant A (female, self-employed) was positive, seeing AVs as exciting, and similar to a taxi, without the issues of crime and confrontations, but with unemployment for the drivers.
- Participant B (female, self-employed) suggested they would require/create a more patient society, being slower, that drivers would be unemployed, and that there would be less crime and fewer accidents (no chases), with the 'on the surface' benefits of less congestion, more convenience, fewer vehicles (because cars would be more expensive, or shared more), but with concerns about driverless shared taxis and inequalities of access to the expensive vehicles.
- Participant C (female, London) agreed and was wary and fearful, arguing that human interaction is important and technology faceless, with less interaction isolating and robotic, and concerns about technology going wrong and the costs of vehicles and repair being extortionate.
- Participant D (male, self-employed) felt they would be accessible to more people, but worried about security issues, unemployment and safety in bad roads and weather, also preferring human override. When asked he clarified that he was thinking of AVs as a service rather than private ownership (a sense that they mostly did?).
- Asked about the amount people would travel, whether they would own privately or use a service or autonomous public transport, B felt PT would be needed, but that it might need to be banned – ging 'backwards' to ticket inspectors. If PT could be as efficient, convenient, regular and safe as e.g. Japan then it would be attractive, but this would require investment in infrastructure. They were not a fan of Av cars (referencing Terminator films) but were happy about trains (referencing DLR) as it is on tracks. AVs were assumed to be cheaper than present situation for car ownership in London – with lots of charges, an expensive way to travel – and also efficient and accessible.
- A felt AVs might catch on for younger people in rural areas but would not change travel patterns - 'people have to do what people have to do'. AVs seemed familiar from upbringing going to school in a taxi – your life in someone else's hands. Concerns about navigating potholes, bad weather, safety more worrying that who/what was in control.

- Participant C felt younger people might be receptive and agreed that other countries' transport systems work better in less congested roads, fewer 'signal failures' (rail). AV PT might work brilliantly done well, but she would not be an early adopter. More concerns about responsibility/liability, but not for trains on tracks.
- Participant B expressed concerns about centralised control of AV cars and security risks, hacking/hijack etc. A rare risk on a plane – but not acceptable in an everyday vehicle.
- Participant D suggested AVs could operate in a separate lane, and suggested trust would be an issue, lessening as people got used to them.
- On energy and carbon emissions, participants C, A and B agreed that AVs, as EVs, would result in lower emissions, C seeing this as a 'good selling point' but A and B expressing EV cynicism:
- A questioned manufacturing and production environmental impacts: 'Who knows. We're fed what we are fed. Would like to think it goes down', feeling that 'we are lied to'. B asked how is electric generated. 'They' was used of vehicle manufacturers with questioned motives.
- On likelihood, C saw it as part of inevitable (and in the past, unimaginable) technological change, like cashless society: mostly convenient but not for all eventualities. They felt it would happen based on consumer demand. B agreed that technology fans would adopt for convenience, and non-drivers for accessibility, but stressed lack of control and human interaction, referencing COVID and a 'return to basics' - "we are creatures of society and community". They felt AVs would roll out in certain contexts and spaces (cities) with a certain population. Asked if sharing AVs would provide human interaction, they raised concerns about safety (seeing Ubers as safer because of a driver).
- D felt that only cars would be fully autonomous, with PT having human involvement in case of malfunction. A felt it will be inevitable, but 'in context': operating like a train service (do we even know there is a driver?) or a techno uber service it could be beneficial as like her, people like to have their 'own box'. They also felt there would be push back from the oil industry.
- Asked about other accelerating or slowing factors, B felt a major accident or issues that are brought to light could make people wary. And like A, that oil companies will not 'roll over', they will work out how to profit. C worried about insurance and how to get assistance with a faulty AV, stressing it would come with downfalls. A felt it would be no different to calling the AA but agreed that fear might stall growth.
- A suggested it would be like having a chauffeur every day: a car experience without concerns about insurance, maintenance, tax, programmable from diary etc. B agreed it would be made attractive by manufacturers/advertisers: 'how the car might make you feel 'but at an affordable price'': massage seats, heated seats, Bluetooth music, convenience, accessibility, not doing long drives, working while travelling: 'wouldn't be a hard sell' , but would be expensive.
- C conceded that this sounded amazing if it all worked properly but was still wary. D felt popular/well-known brands would increase acceptability, along with proven safety, positive reviews etc.

Multi-Criteria Decision Analysis

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
CRITERIA DESCRIPTION	Affordability (5 cheapest)	Safety	Accessibility (physically)	Environmentally friendliness	Convenience (time)	
	C1	C2	C3	C4	C5	WEIGHTED SCORE
(highest most important)	12.00	20	9	10	6	57
	21%	35%	16%	18%	11%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Normal taxi/uber	14	13	19	13	15	14
Normal Car - None autonomous private car	10	14	16	9	20	13
Autonomous Public Transport	16	14	13	20	12	15
Autonomous Taxi/uber	14	12	16	16	16	14
Autonomous Delivery	15	20	7	17	14	16

Options selected were modes of transport:

- Normal taxi/Uber
- Normal car – non-autonomous private car
- Autonomous public transport
- Autonomous taxi/Uber
- Autonomous delivery – this was clarified to mean a 'white van' delivering items ordered

Assessment criteria in descending order of weightings were:

- Safety (35%)
- Affordability (21%)
- Environmentally friendliness (18%)
- Accessibility (physically) (16%)
- Convenience (time) (11%)

The scores combine with weightings produced the following prioritisation/preference of modes:

- Autonomous delivery (16)
- Autonomous public transport (15)
- Normal taxi/Uber (14) and Autonomous taxi/Uber (14)
- Normal car – non-autonomous private car (13)

Appendix C: Codes Used to Analyse Deliberative Workshop Data

Name	DWs	Coded segments
Acceptability	6	31
Education	2	2
Resistance	5	15
Alternative fuels	3	6
Benefits	8	137*
Accessibility - availability	5	11
Algorithmic efficiency of travel	4	6
Appropriate vehicle sizing	4	7
Cheaper	4	5
Convenience	6	12
Disabled and older access	6	12
Employment	5	7
Fewer vehicles	5	6
Increased safety	6	17
Less crime	2	3
Less need for parking space	3	4
New technology	3	7
Reduce crime and problem driving	2	2
Reduced air pollution	1	2
Reduced congestion	3	6
Reduced energy and carbon	6	13
Safe for women	2	2
Smaller vehicles	2	3
Use of travel time	5	9
Wage savings	1	1
Bicycles and pedestrians	4	7
Changes	2	2
Changes in fleet make-up	5	7
Changes in travel	8	16
Labour market	6	15
Less shopping due to deliveries	1	1
Transition	2	4
Transition enforced by government	4	9
Uses of space	1	1
Class and status	7	17
Climate change	1	2
Comfort	2	2
Concerns	8	207*
Affordability	4	4
Avoid new vehicles	1	1
Control of travel	2	3
Crime and hackability	5	5

Name	DWs	Coded segments
Depreciation	2	2
Deskilling	5	7
Digitalisation	1	1
Distrust	5	13
Environmental impacts	5	10
Health	3	3
High cost and exclusion	5	10
Increased energy and carbon	2	2
Increased travel	2	5
Inequalities	2	3
Joy of driving	6	23
Lack of control	7	16
Living vehicles	1	1
Need for cars	5	7
New Technologies	6	17
No human interactions	2	4
No instant availability	1	1
Not child friendly	2	2
Other passengers	4	5
Robot ethics	2	3
Safety	7	28
Surveillance and privacy	3	5
Traffic or street interactions	2	3
Unemployment	7	18
Where stored	2	2
Who owns benefits	2	3
Conditionalities	7	11
Only for specific uses	5	10
Only if driving still allowed	3	8
Only if electric	2	2
Only if fair and equitable	4	8
Only if government directed	4	6
Only if human override	3	6
Only if infrastructure provided	6	11
Only if public transport sorted out	2	5
Only if safe	6	8
Only if sustainable	3	8
Cost determines everything	3	10
Deliveries	1	1
Discussion sub-groups	0	0
DG1A Hacked Vintage Cars	1	1
DG1B Hacked Vintage Cars	1	1
DG2A Co-Housing and Off-gridders	1	1
DG2B Co-Housing and Off-gridders	1	1
DG3A Co-Housing and Off-gridders 2	1	1
DG3B Co-Housing and Off-gridders 2	1	1
DG4A Classic Car Fans	1	1

Name	DWs	Coded segments
DG4B Classic Car Fans	1	1
DG5 Tesla or Smart EV Owners	1	2
DG6A Public - Drivers	1	1
DG6B Public - Drivers	1	1
DG7A Public - Non-Drivers	1	1
DG7B Public - Non-Drivers	1	1
DG8 Public - Car-sharers	1	1
EV specific	8	26
Feasibility technical	1	2
Freight	5	7
Geopolitics	3	3
Infrastructure	4	10
Likelihood	7	18
Accelerating or enabling	7	47
Climate policy	2	2
Cultural	2	2
Financial	3	3
Generational change	5	10
Infrastructure	2	2
Legislation	4	11
Political will	5	13
Driving remaining	3	5
Slowing	5	5
Cost	5	6
Cultural	7	17
Fear	4	7
Political	6	7
Regulation	4	9
Trust	4	4
Technological optimism and determinism	7	18
Timescales	3	3
Political issues	7	27
Private ownership	6	15
Public transport	8	38
Manned	5	10
Queries	3	3
Appearance or design	2	4
Control and management	1	2
Insurance	6	9
Ownership	5	7
Responsibility liability	4	4
Tax revenue gap	4	6
Technology exists	1	2
Road upkeep	1	1
Shared modes not PT	7	18
Car club or fleet	6	12
Taxi or Uber	7	16

Name	DWs	Coded segments
Urban or rural comparisons	7	23

*Numbers here include segments in sub-codes.

Appendix D: Some Sample Characteristics

Discussion group	Attendees and characteristics	Comments
DW1(Hacked) Vintage Car Enthusiasts	5 male and 3 female. One older white English male, others black African.	Suspected hacked apart from one attendee.
DW2: Co-Housing and Off-Gridders	2 male (one an unpaid partner of an official attendee) and 6 female attendees, including one Traveller, two off-grid, and 1 eco-housing resident.	A range of ages, all white British origin.
DW3: Co-Housing and Off-Gridders	All-female group, one off-grid in a van (second generation Traveller living with daughter), one in a park home, members of co-housing, and one eco-co-housing resident.	Range of ages, all white British origin.
DW4: Classic Car Fans	5 classic car fans from around England, mostly living in rural contexts, most from ex-engineer or mechanic backgrounds, one a chairman of a classic car club, and the others members.	All male, one living in a windmill and a fan of all older technology.
DW5: Tesla and smart EV owners	2 middle-aged male Norwegian and Asian origin deliberators, joined by 2 white males and an Asian ethnicity female for MCDA. Educated and wealthy.	The hardest group to recruit, excellent discussions but a confused MCDA
DW6: Public - Drivers	Two retirees, 2 managers, 4 male and 4 female and with 3 younger participants.	Rural home locations affected discussion slightly.
DG7A: Public – Non-Drivers	4 male (one Asian), 3 female	Urban locations influence public transport availability.
DG8: Public – Car-sharers	4 in total, 3 female, 1 male, 3 BAME	London/urban and one ex-

		London, users of hire cars.

Appendix E: Deliberative Workshop Script

Deliberative Workshop Topic Guide example.

1800 Introductions etc. (c20mins)

FACILITATOR 2: Welcome everyone! [Introduce the three of us from Leeds]

Go through Zoom functions:

- Location of microphone symbol for muting – if you don't want us to hear you, or in the break, click it off.
- Keep cameras on unless audio is breaking up, then try without. Again, can click off in break.
- Raised hand button, or raise hand on camera – we will try to answer things straight away
- DO NOT CLICK THE LEAVE MEETING BUTTON at any point
- If you cut out, please join again using the link in the email, and we will let you in.
- If you do really need to go for any reason, let us know, click camera and mic off, and try to return as soon as you can.

FACILITATOR 1: To remind you of what you have signed up for, this will be a 3 hour workshop with a break in the middle. If certain tasks are finished quickly, then there may be a couple of short breaks.

We are exploring the topic of Connected and Autonomous Vehicles or CAVs or Autonomous Vehicles or AVs or 'self-driving vehicles', or whatever you want to call them. We will explain what these are in a few moments, but first we have a few formalities to get through. Firstly, we need to record this meeting as we explained in the information and consent forms, can we do that now? Thanks!

[**CLICK RECORD**]

[**click CC option – BOTH!**]

As the documents we sent you explained, this recording will only be used to get a transcript of the discussions, and we will remove all identifying material, so any quotes and outputs will be anonymous.

The consent form also said that you consent to us keeping hold of your consent details, the transcript being stored in anonymous form, as well as the exceptions to keeping your contacts secret. We have to get your individual consent recorded, so… [**name**] do you agree to all that? [Use all names] Thanks!

FACILITATOR 2: remind people that they can ask questions at any point, now and after the workshop. Any questions now? If not, or you think of something later, you can email us on email on the information sheet.

Ask people to introduce themselves one by one, first with something (simple or brief) they want to share about themselves. I'll go first… I live in Lancaster with my grown up son [name], and I can't drive!

[go around the room/screen] [write down if you need to!]

FACILITATOR 1: First, before we start discussions, we would like to share some basic information about Connected Autonomous Vehicles so that people are all on the same page, and we don't have to keep answering questions.

[**FACILITATOR 2** share screen and **FACILITATOR 1 read the slide**]

Do you have any questions or queries?

FACILITATOR 1: We want to know your opinions on AVs and how they might in reality be rolled out (or not) in the UK, and how this might affect the energy use and carbon emissions of land transport. We are not promoting AVS, nor are we taking a position on whether or not they are "a good thing". The whole point of these deliberative workshops is to get *your* views, because academics and technology developers and policy makers all need to know the broadest possible set of views around this technology to inform their thinking. However, we don't want 'just' opinions – we really want to know **WHY** you have these opinions, and so we apologise in advance for continually asking 'why?'!

FACILITATOR 2: So the meeting splits into two main discussion sessions, around a break. The first one will be in breakout groups, and will discuss the possible future of AVs in the UK, at the end of which we will share what each group thought, and then break. Then the second main task is a process of recording your thoughts about different possible futures, and getting you to assess them. We will give detailed instructions on this before we break out into groups again. At the end we will share what we did with each other again, before the end of the workshop. Is that clear/OK?

FACILITATOR 1: Rules for the whole meeting area and breakouts are:

- No wrong answers – except when they are! (i.e. we reserve the right to correct people if we think they are saying things that are untrue)
- No talking over others, for politeness and for us to be able to record what is said!
- Listen to others and respond, don't shut down.
- 'Yes, but', rather than 'no', where possible!
- Always try to give some reasons, rather than just stating opinions! The point is that you should be able to justify the opinion in a way that is reasonable to others.
- We may ask specific people to give a response sometimes, no-one is forced to, but we want to make sure everyone's views are collected if they are happy to provide them.
    – we will send you into breakout groups and you will come back automatically DO NOT CLICK ON LEAVE MEETING.

[**FACILITATOR 2** assigns breakouts and timer]

[**THERESA** drops in and out and take notes?]

FACILITATOR 1: Now we will go into first breakout group, we will send you in there, and one of us will be in each. We will bring you out in the end, so you don't need to click on any buttons to go in and out. We will set a timer, so we will come back here after an hour exactly. If you end up out somehow, please rejoin again, using the link in the email…

1820 First session (c60mins):

[**Check CC option AND RECORD locally**]

Split participants into two (random) groups, each discussing the following headline question for 30 minutes:

[30 mins]

Even if you do not believe it to be likely or technically feasible, try to imagine a world where every vehicle manufacturer has swapped to *only* producing AV vehicles. This is how most people assume the change would happen – with AVs gradually taking over streets from 'normal' vehicles. What would such a world look like? What effect would it have on people's everyday lives and travel? What other impacts would it have? We would like you to think about the change-over and also an all-AV future.

Possible prompts for facilitation:

- Do people **travel** more or less, or the same, in this world? Why?
- Would **you** be using AVs in this future?
    - If so, how?
    - If they don't understand – as a car/pod? Taxi? Car club/bus?
    - If not, why not?
- Does everyone across society's travel consume more or less **energy,** or produce more or less **carbon** emissions, and why?
- What effects would shifting to AV production only) have on the **economy**, and why?
- Have you thought of all land transport of different modes (freight, public transport etc.), not just individual transport? Make sure you do!

1850 [30 mins]

The second headline question is:

How **likely** do you think this future scenario is? Why? If you don't think this scenario is likely, or have another idea of how things might pan out, What **alternative** future(s) (if any) do you think will **actually** come about? And Why?

Possible prompts:

- What, *apart from technological feasibility*, makes the alternative future you have proposed/we are discussing more or less likely?
    - Politics?
    - What companies/manufacturers are like?
    - What the public are like?
    - Environmental concerns, targets or policies?
    - Any other influences on how things are likely to turn out?

- What makes these alternatives more or less *acceptable* – and what do we mean by acceptable?

1920 Middle session: (c10mins)

Whole group: we each summarise and feedback discussion from sessions, 5 minutes each LB and NC. And ask Theresa if we missed anything?

Check if people are happy with the summary. Don't encourage too many questions/alterations due to time limits!

1930 Break – (c15 mins)

We will now have a 15 minute comfort break – switch off your mic and your camera if you want, but make sure you are back here and ready at [**TIME**] exactly!

[Facilitators mute and talk over the mobile if necessary! Shared Word doc to copy notes things in now]

Task for facilitators in break is to make sure we understand what each group said in first session. Collect anything we missed.

1945 Third session. Breakout groups: random allocation again to encourage some cross over of ideas (c60mins)

Hello again! [get everyone back in] Get comments to check they are in.

[**Check CC option AND RECORD locally**]

Intro [c.5.]

[**FACILITATOR 2** sets up new breakout groups]

FACILITATOR 1: We are going to break into slightly different groups for the next main discussion, and the issue which are most interested in is whether or not AVs can, should, or will be rolled out in different forms or modes. I will explain what I mean by that. To do this we are going to have discussions as before, in small groups, but we are going to use a specific method. This has got 4 stages, all of which we will do in this next hour.

[**FACILITATOR 2** shares the stages slide]

Options: First, we will come up with different AV Futures that we are assessing [c.15 mins]: There can be many different options, but as bare minimum, we need to you assess the two basic options or **modes**: of AVs that are pretty much like normal cars and individually **owned**, and some form that is **shared** instead – whether that is shared like a taxi, or a minibus, or a car club car, or a bus. You can assess all 5 of these different options, if you want. We have used biscuits as an example!

[Facilitator 2 shares example spreadsheet]

Figure 6: Biscuit example MCDA slide

Step 2 – Decide on your assessment criteria?

	Crunchiness	Sweetness	Affordability	Dunkabiliy	Roundness
(highest most important)	8.00	5	7	5	2
	30%	19%	26%	19%	7%
OPTIONS	**Criteria 1 SCORES**	**Criteria 2 SCORES**	**Criteria 3 SCORES**	**Criteria 4 SCORES**	**Criteria 5 SCORES**
Hobnob	9	9	2	9	10
Bourbon	5	8	7	7	0
Cheddars	10	0	4	0	10
Digestive	5	7	8	8	10
Custard Cream	5	8	9	6	0

Step 1 – Decide on what your options are, and what you are going to compare?

Criteria: Second, we need to agree on **how** we are assessing these different options [c. 10 mins]. We are thinking of criteria that assess how acceptable or desirable these AV futures are. We will explain what we mean later. With biscuits, these might be crunchiness, sweetness, cost, dunkability and roundness.

Weighting: Thirdly, we need to discuss how **important** each of these things are, to you as a group [c.10mins]. You may think that dunkability is far more important than sweetness, and neither is as important as cost. We need to **rank** the importance of the criteria.

Scores: Finally, you will go through the options, and **score** them according to the criteria [c.20mins]. This will produce a final 'score' for the options – but what this actually means will depend on what you put into the model – and you or we can explain this to the rest of the group at the end.

We are using a specific form to record what you think, and this only has space for 5 options and 5 criteria – just to let you know up front! This is to limit the discussion to an hour, but if you have other ideas of what could count as options and criteria, we will have them recorded in the discussion anyway. But we will only select 5 of each, and you can discuss which to include.

Hopefully this will all make sense in the session – questions and discussion are good! But we would still like the form to be completed by the end!

So now, we will break up into small groups again – but we will change the members to get a different group of people talking. See you after the session, the timer will send us back here again at the end.

1950 MCDA [c.55mins]

[Check CC option AND RECORD locally]

Into the activity. Facilitators work on the MCDA spreadsheet throughout.

Prompts regarding the MCDA:

Options/AV Futures: *"We are thinking about a set of different ways in which AVs might fit in the transport system of the future – what do you think are different options?"*

This could ideally be comparing AV cars, taxis, ride-hailing, car clubs and buses - so a more straightforward comparison of modes. At most basic it could be comparing privately owned and shared modes. Or private, shared, and a mix, or AVs only, a mix, or no AVs (as transport system futures). [All of these are different 'things', which makes direct comparability difficult but also makes for more interesting write up/discussions. Try to get them to consider the different options for 'what count as options', but if they struggle, go for the above the above and ask for their agreement/decision.

Criteria: *"How would you assess these different options we have come up with?"*

MODES: *"Think about assessing using these different transport modes – how would you compare how good they are , one against another?"*

MIXES: "Think about assessing these different transport systems with different vehicles in them – how would you assess which is better than another? On what basis?"

What count as valid criteria will depend on the 'options' chosen. Again, remind them that the criteria:

- should be able to assess the different options;
- to work out which is more acceptable or desirable;
- and should be applicable to each of the options.

If they are struggling, could read out a list: **technical feasibility, environmental benefits, safety, comfort, coolness, healthiness/hygiene, cheapness, accessibility to all travellers, lack of materials needed to manufacture them, speed, convenience, privacy, sociability…you get the idea?**

Weighting: Hopefully by this point they should be getting the idea." The weights are how important you think those assessment criteria are, relative to each other. You can make one supremely important and the rest very low and equal, or do 5 ranked, or any combination. By assigning a weight number to each. You can use any numbers – 1 to 5, percentages, and the form still works, lower number least important, highest, most important.

Scoring: *"Now we will go through the options/futures, and apply scores according to the criteria."* [At this point, you should if possible share the form, with the results 'off the screen' so that they can't see the results live.[Again, points out of 5, out of 10, or percentages all work fine. Reassure them that **disagreement is fine** and is good for

us – we want to hear **WHY** they think the scores are set at different levels. And then they should try to reach one result – an average if nothing else works!

Thank them when they get through it , and explain that the results will be revealed in the last session. Let them have another break until 15 mins before the end time, if they are early.

2045 Summary and feedback. (c15mins)

[**Check auto-transcript option AND RECORD locally**]

Brief summary from each small group facilitator one after another, then highlight of areas of consensus and difference. Give everyone in whole group a 1 minute comeback on the findings – what do they think?

Say we will write up all of these discussions. Any questions before we end?

If they want to follow up, say we will send them reports.

Thanks and goodbyes.

[**END MEETING**]

STAY IN MEETING – quick discussion, record in notes document, save to OUTPUTS folder in SharePoint

Download the auto-transcripts

AFTER MEETING – copy to workshop folder

Appendix F: Slides explaining the MCDA process

Task – develop an assessment tool

1 – **Options** – different AV futures
     - minimum discuss 1 private use and 1 shared option

2 – **Criteria** – work out how you want to assess the options you have come up with

3 – **Weighting** – work out how important each of the criteria is, relatively to each other

4 – **Scoring** – based on the criteria and weighting you have decided we will apply the scores to each of the options.

Step 2– Decide on your assessment criteria?

	Crunchiness	Sweetness	Affordability	Dunkabiliy	Roundness
(highest most important)	8.00	5	7	5	2
	30%	19%	26%	19%	7%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES
Hobnob	9	9	2	9	10
Bourbon	5	8	7	7	0
Cheddars	10	0	4	0	10
Digestive	5	7	8	8	10
Custard Cream	5	8	9	6	0

Step 1 – Decide on what your options are, and what you are going to compare?

The Weighting and Scoring stages were also explained, although they are not highlighted om this slide.

	Crunchiness	Sweetness	Affordability	Dunkabiliy	Roundness	WEIGHTED SCORE
(highest most important)	8.00	5	7	5	2	27
	30%	19%	26%	19%	7%	100%
OPTIONS	Criteria 1 SCORES	Criteria 2 SCORES	Criteria 3 SCORES	Criteria 4 SCORES	Criteria 5 SCORES	
Hobnob	9	9	2	9	10	7
Bourbon	5	8	7	7	0	6
Cheddars	10	0	4	0	10	5
Digestive	5	7	8	8	10	7
Custard Cream	5	8	9	6	0	6

This slide was used to point out that although weighted scores might be equal, they resulted from different scores for the options, and the addition of the weighting of different criteria.

Appendix G: Criteria from all sub-groups with percentage weightings

- Safety (35%)
- Safety – general (32%)
- Safety (31%)
- Safety (29%)
- Safety (29%)
- Safety (28%)
- Convenience (26%)
- Safety (26%)
- Availability/accessibility – usability (25%)
- Reliability/ease/speed of use/access (25%)
- Reliability (24%)
- Environmental impact [meaning benefit] (24%)
- Affordability (24%)
- Safety (24%)
- Affordability (23%)
- Accessibility (23%)
- Affordability (23%)
- Reliability (23%)
- Accident Rate (23%)
- Feasibility/pragmatic 'realisticness' -in next 50yrs (22%)
- Environmental benefit (22%)
- Affordability (22%)
- Affordability (22%)
- Affordability (22%)
- Environmental impact (i.e. benefit) – running day-to-day (emissions and energy (21%)
- Human Control/ Not hackable (21%)
- Affordability (21%)
- Convenience and accessibility (21%) – this referred to being able to use the mod even if e.g. disabled
- 'People vs Robots' – e.g. added value of being autonomous (21%)
- Privacy (and personal) safety/safeguarding (21%) – this combined several similar issues, including data privacy and surveillance concerns with personal safety when using the vehicle
- Affordability and accessibility (21%)
- Benefit distribution (fairness) (21%)
- Availability (21%)
- Accessibility/inclusivity (21%)
- Personal information/data security/privacy (20%)
- Perception of safety (including unhackability) (20%)
- Environmental benefit (20%)
- Cost [cheapness] (day to day cost / running cost) (20%)
- Environmental benefits (19%)

- Safety (general/technical) (19%) – this referred to the likelihood of avoiding accident only
- Affordability of service (19%)
- Comfort (19%)
- Ease of access (19%)
- Storage/versatility (transport of people and their goods and equipment) (18%)
- Affordability/cost effectiveness (18%)
- Environmentally friendliness (18%)
- Convenience (18%)
- Affordability and accessibility (18%)
- Fairness, justice, equitability, social cohesiveness (18%)
- Connectivity of transport system (18%)
- Cheapness per mile for user (18%)
- Availability of vehicle (18%)
- Environmental benefit (17%)
- Adaptability for size/utility (17%)
- Convenience (16%)
- Accessibility (physically) (16%)
- Safety (users) (16%)
- Capacity (People and luggage) (16%)
- Enjoyability (15%)
- Durability (14%)
- Round-the clock service/Convenience (14%)
- Cost (to user) (14%)
- Security/Privacy (hacking risk) (14%)
- Maintenance (14%)
- Environmental friendliness (14%)
- Environmental Friendly (low carbon emissions) (13%)
- Environment/Green Credentials (12%)
- Convenience (time) (11%)
- Comfort (9%)
- Trust in the morality of algorithms (6%)