Creating Safe Self-driving Services

Findings from Project Endeavour

dg:cities

INTRODUCTION

SELF-DRIVING CARS

Accessible, safe and low-carbon mobility is vital in supporting healthy economies and societies. As cities and towns respond to change, new technologies are becoming part of everyday life for citizens – in the public and private sector, planners are taking an adaptive, flexible approach to accommodate emerging technologies and mobility trends.

The increasingly severe climate emergency and global pandemic are influencing many of the trends that cities and urban systems were already experiencing. These include the shift from ownership to usership, the rising importance of urban accessibility combined with urban mobility, and the revived role of sustainable local neighbourhoods. As cities globally navigate the COVID-19 response and recovery period, urban mobility and the role of technology will stay close to the top of the agenda.

Autonomous vehicles are a rapidly developing technology; they offer an exciting opportunity to rethink urban mobility with sustainability in mind. Whilst technology is improving at a fast pace, there needs to be further evidence and insights as to how future mobility systems which utilise autonomous vehicles, can incorporate the needs of users and the wider communities in which they may operate. Included in this is the increasing potential offered by ride-sharing services as an additional, and complementary, form of on-demand public transport.

PROJECT ENDEAVOUR

OVERVIEW

Project Endeavour is a mobility project that is designed to accelerate and scale the adoption of autonomous vehicle services across the UK. The project builds on some of the findings from the MERGE Greenwich project, a similar Innovate-UK funded project that modelled the feasibility of autonomous vehicle services in Greenwich, and expands these to understand the value of autonomous vehicle services through demonstrations and live trials. Ultimately Project Endeavour set out to test the building blocks of future AV services in the real world.

The project ran between March 2019 and Autumn 2021. The project was led by Oxbotica, working alongside DG Cities and Immense. In Autumn 2020, three further partners joined the project: TRL, BSI, and Oxfordshire County Council. Each partner brought its own cutting-edge expertise to the project.

TRIAL AND ENGAGEMENT PROGRAMME

TRIAL OVERVIEW

During the course of the project, the consortium has delivered four autonomous vehicle trials. The objectives of these trials were to validate the technology, prove the concept of pop-up autonomy (rapid deployment of an autonomous vehicle trial) and to engage the public.

Two of the trials were based in Oxford, one trial was in Birmingham and the final trial was in Greenwich, in South East London. Due to Covid-19 restrictions, it was only possible to deliver public trials in Greenwich in August 2021, adhering to strict disease control guidelines.

Public trials ran for three weeks in total, from a base at Kidbrooke in The Royal Borough of Greenwich. Vehicles were operational Tuesday to Friday, allowing for approximately 20 vehicle slots per day. The first week was reserved for stakeholders, giving us an opportunity to test the trial procedures and ensure operations were running smoothly.

The trial was promoted across various media channels, including print ads, leaflets and social media campaigns, to reach a broad audience. The trial was open to all and accommodated over one hundred individuals. Passengers registered online for specific 1-hour slots, came to our trial base to check in, went through a safety demonstration, learnt about the project, then participated in a vehicle drive of about 20 minutes.

To reach an even wider audience and enable more people to experience vehicle autonomy, we also created a VR experience of the closed Oxford trial. Its development and outcomes are described further in this report.

METHODOLOGY

Project Endeavour utilised a mixed-methods approach to engage communities from across the UK:

Community Survey: an online survey was distributed via social media between May and August 2021. The survey explored:

- Perceptions of AVs, including safety, trust and accessibility
- Intentions of using AVs in the future
- Interest in AV ride-sharing services
- General demographic and travel attitudes.

In total, 2491 good quality responses were analysed.

Trial surveys: pre and post experience online surveys were used with participants during the Greenwich trial in August 2021. The survey explored:

- Pre- and post- measures of perceptions of AVs, including safety, trust and accessibility
- Post-trial experience of riding in an AV
- Post-trial feedback.

In total, 109 good quality pre-surveys were analysed and 55 good quality post-surveys were analysed.

Post-trial semi-structured interviews and online focus groups: over 50 trial participants were interviewed after the trial experience in August 2020, and over 25 took part in online focus groups between May and July 2020. These interviews explored attitudes and perceptions towards autonomous vehicles.

FINDINGS

The majority are either undecided or are not yet comfortable using self-driving vehicles: findings from our national survey show 26.8% would feel confident using an AV tomorrow if it were possible to do so. Over half would not (55.1%). The remainder are undecided (18.1%).

The safety case for self-driving vehicles has yet to fully convince the public: findings from our national survey show that three in 10 (29.9%) believe that self-driving vehicles will be safer than traditional vehicles, whilst 44.2% disagree. A quarter (25.9%) are undecided.

Live trials improved perceptions of safety by 15 percentage points: before the trial, 68.3% agreed that AVs would be safer than human driven vehicles, whilst after the trial 83.6% agreed, an improvement of 15 points.

Trust in self-driving vehicles is low, but a large minority is yet to be persuaded: findings from our national survey show almost a third (32.5%) think self-driving vehicles will be trustworthy, whilst two in five (43.8%) do not. Almost a quarter (23.6%) are undecided.

ANALYSIS

ACCEPTANCE AND INTEREST IN AVS

Self-driving or autonomous vehicles are a technology that many members of the public have little or no awareness off. As part of our national survey, we explored interest in using autonomous vehicles in the future. We found:

"There's less chance of human error, being on an autonomous vehicle, so I definitely think I would trust it."

- Just over a quarter (26.8%) would feel confident using an AV tomorrow if it were possible to do so. Over half would not (55.1%). The remainder are undecided (18.1%)
- Over a third (34.8%) of people aged 18-35 would feel confident using an AV tomorrow if it were possible to do so, however only a fifth (20.5%) of people aged 55 and above agree.

Those who attended the Greenwich trial noted that they would like to see more improvement before they use AVs in the future:

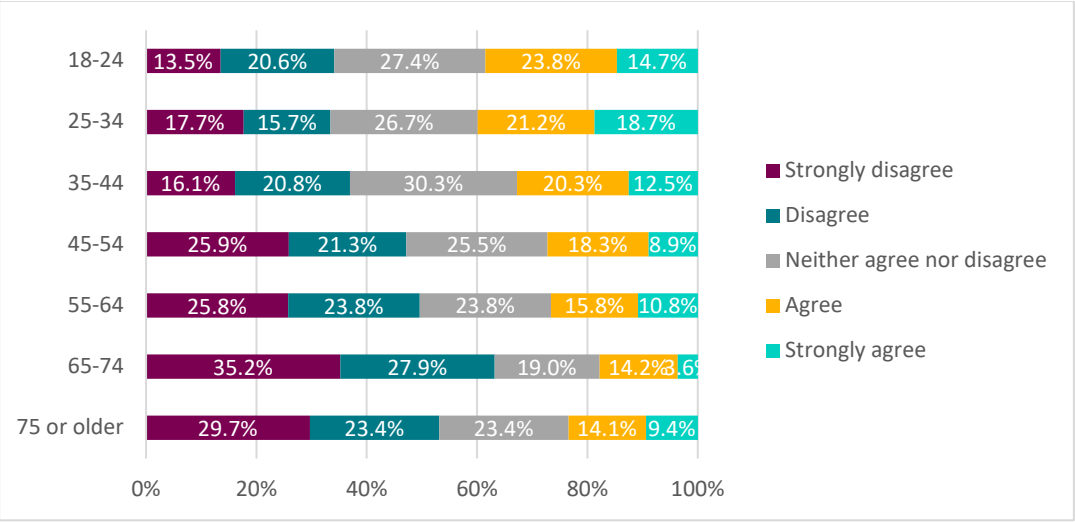
"I liked the concept behind autonomous driving but I don't think it's quite there yet. I liked it but I wouldn't put my life in its hands at the moment...Even in that short trip, that pre-planned short trip, it was a little bit jerky, indecisive ...it's got lots and lots of possibilities and I think it's three quarters of the way there. It's got a lot to go yet." Trial participant

SAFETY

Safety was a major concern for the public both in our national survey and at the public Greenwich trial. Data from the national survey showed that:

- Three in 10 (29.9%) believe that self-driving vehicles will be safer than traditional vehicles, whilst 44.2% disagree. A quarter (25.9%) are undecided.
- Safety perceptions differed by age: 39.4% of those aged 18-34 believe that self-driving vehicles will be safer than traditional vehicles, whilst less than a quarter (23.1%) of those aged 55 and above agree (figure 1). [1]

Figure 1: Agreement with "I think autonomous vehicles will be safer than human driven vehicles" by age



Base: n = 2491 (national survey)

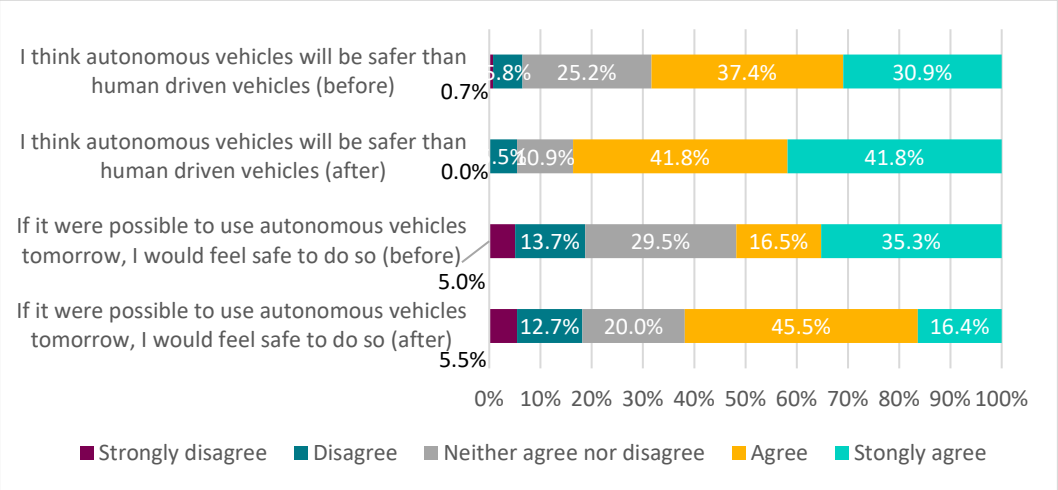
"I felt safer than I feel when I drive. I felt it's probably the safest drive I have had."

FINDINGS FROM THE GREENWICH TRIAL

We tested attitudes and perceptions of AV safety with participants before and after the live trial experience. We found that the live trial improved people's perceptions of the safety potential of AVs: before the trial, 68.3% agreed that AVs would be safer than human driven vehicles, whilst after the trial 83.6% agreeing illustrating a 15-percentage-point improvement.

Figure 2: Pre- and post- measures of safety from the Greenwich trial

[1] One way ANOVA: F(6, 2484)= 16.972, $p < 0.01$,, showed that there were significant differences between 2 major groupings of age, with younger ages 18-24 (M = 3.056 SD = 1.255), 25 – 34 (M = 3.075 SD = 1.351) and 35 – 44 (M = 2.922, SD = 1.246), seeing self-driving vehicles as safer than older groups 45 - 54 (M = 2.632 SD = 1.287), 55 – 64 (M = 2.620, SD = 1.311), 65 - 74 (M = 2.231 SD = 1.179) and 75+ (M = 2.500 SD = 1.309)



Base: Pre n = 109, Post n = 55

The value of AVs over other drivers was a positive for some respondents who saw the AV as a way to reduce the risk that human drivers pose:

"I'd take the AV any day over a human because I think that that actually would be safer than a human driver on a closed route. On a mixed route, I really wouldn't like to say, actually, I think I'd still take the AV as long as there was a driver in it to take control, should the need arise." Trial participant

Another participant highlighted the safety potential of more AVs on the road in the future and the impact that could have on overall road safety, compared to today:

"I would say it felt two, three times as safe...I think it will also be one of those things where the more of these there are on the road and the more testing that has been done and the more experience people have with them, that will obviously contribute to the perception of safety." Trial participant

TRUST

Trust is a key factor that influences if and how the public engaged with new technologies, such as AVs. In the national survey we explored public perceptions.

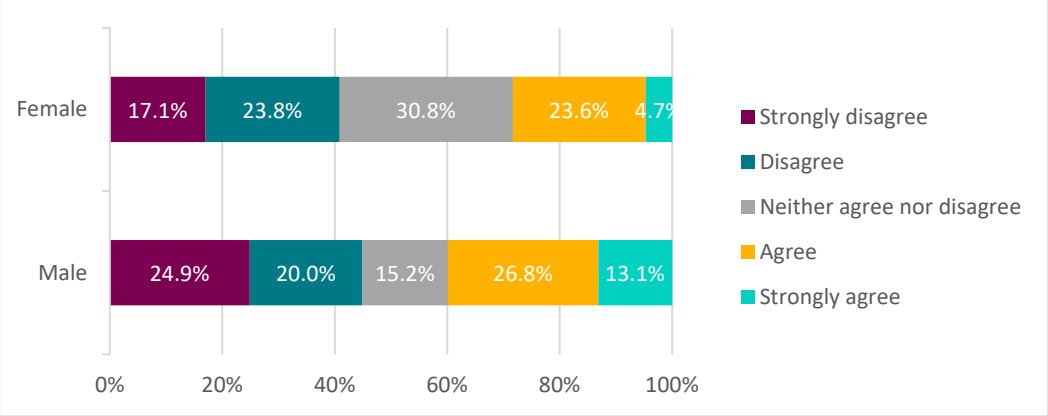
Our national survey showed that:

- Almost a third (32.5%) think self-driving vehicles will be trustworthy, whilst two in five (43.8%) do not. Almost a quarter (23.6%) are undecided.
- Trust in AVs differed by age: 43.3% of those aged 18-34 believe that autonomous vehicles will be trustworthy, but only a quarter (25.0%) of those aged 55 and above agree.[2]

[2] One way ANOVA: $F(6, 2484)= 16.219$, $p < 0.01$, showed that there were significant differences between 2 major groupings of age, with younger ages 18-24 (M = 3.075, SD = 1.249), 25 – 34 (M = 3.090, SD = 1.293) and 35 – 44 (M = 2.917, SD = 1.218), seeing self-driving

Our analysis highlights a difference in perceptions of trust between men and women. Men were, statistically, significantly more likely to state that they believed AVs were more trustworthy, whilst women were more cautious either for or against.

Figure 3: I think autonomous vehicles will be trustworthy, by sex



Base n = 2467 (national survey)

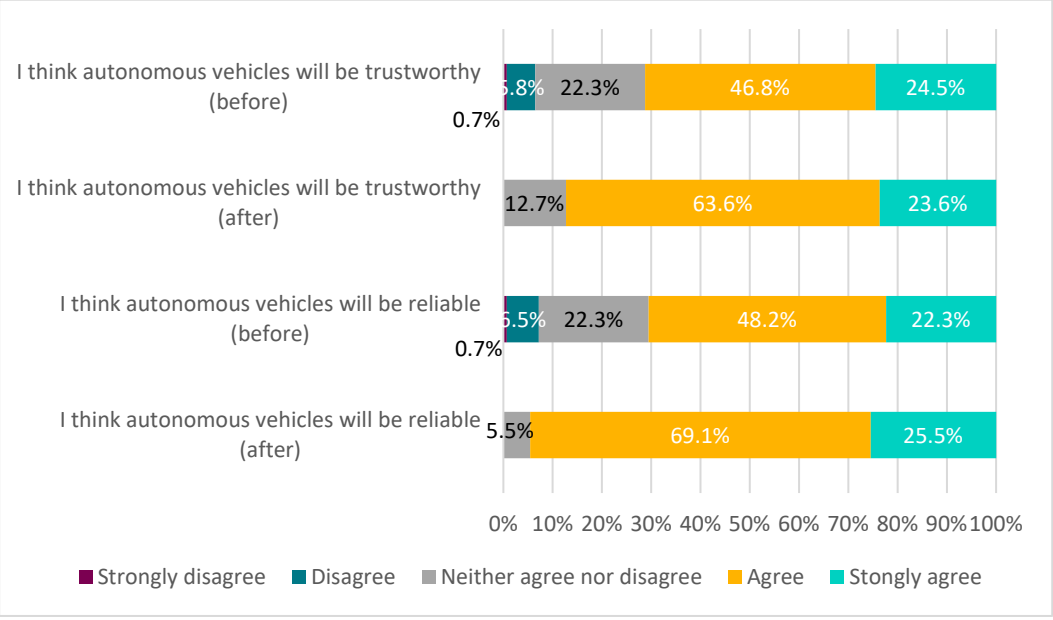
"If there was someone that can operate it in there, to take control, I would trust it. If it was just me and this car, then maybe not."

Trial participant

Findings from the Greenwich live trial

We measured perceptions of trust before and after the live trial.

Figure 4: Pre- and post- measures of trust and reliability from the Greenwich trial



Base: Pre-trial n = 109, Post-trial n = 55

vehicles as more trustworthy than older groups 45 - 54 (M = 2.630, SD = 1.238), 55 – 64 (M = 2.604, SD = 1.267), 65 - 74 (M = 2.328, SD = 1.187) and 75+ (M = 2.531 SD = 1.195)

Our data highlights that levels of trust in AVs were fairly high among participants before the trial began (74.5%), but this increased post-trial (87.2%). Views on reliability of AVs also improved.

Participants in the trial recognised the importance of trust to their experience and the future use of AVs:

"I didn't trust when I was stepping into the car. I just wanted to see whether it would do it or not...then once I saw it, I was continuously observing how the vehicle was reacting to the merges, the junctions, the roundabouts. I saw a couple of incidences and that it is making decisions, it is braking, putting brakes on...I felt my trust increased. The system is doing all the basics right." Trial participant

And;

"It was interesting because I was also looking at this screen on safety driver's information from there and trying to get an idea of where it's pulling the information. And clearly the car's getting more information than I, as a driver, I would normally get. I would really be able to perhaps do it subconsciously, pick up an awful lot of that. But I also think you zone out a little bit when you're driving. So, I felt the decisions the car was making when I was looking at them were probably right." Trial participant

The physical presence of a safety driver in the vehicle was an important factor that contributed to participants sense of trust:

"Having somebody in the driver's seat makes you feel safer. Knowing that someone can just brake if they need to. Even if it wasn't a trained person, just anybody, just having an emergency stop button, or something. If that wasn't there at all, and it was just you in the back. I think, just intuitively, I'd feel a bit weird." Trial participant

ACCESSIBILITY

Accessibility of AVs for users with different needs is a key consideration for the design of future services. As part of the live trial, we interviewed participants from different backgrounds to understand what they believe could be accessibility requirements for future vehicles and services.

"I saw the VR showed wheelchair access... I think AVs will need to be a bit wider so that you could get 2 wheelchairs in at the same time, or a wheelchair and somebody with a pushchair, but absolutely, I think that would be brilliant." Trial participant

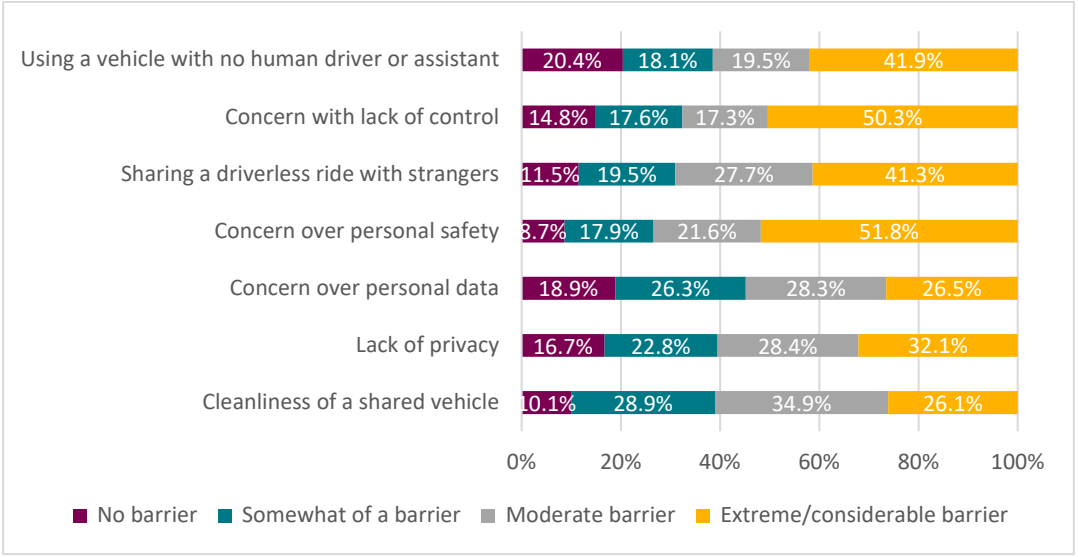
SELF-DRIVING RIDE-SHARE SERVICES

Self-driving ride-sharing services are one of the potential ways in which AVs could be deployed on UK roads. Ride-sharing services have

increased in popularity in urban centres and are often cited as one of the routes to reducing the number of privately-owned vehicles on UK roads.

We explored attitudes and perceptions towards self-driving ride-share services in the national survey.

Figure 5: Barriers to using a self-driving ride-share service in the future



Base n = 2467 (national survey)

Our data highlights that the public sees several considerable barriers to the use of self-driving technology in ride sharing services. The biggest barrier is *concern over personal safety*, which was closely followed by *a concern over a lack of control*. Well over two-thirds saw these two as major or moderate barriers to the adoption of self-driving ride-share services.

USING VIRTUAL REALITY TO ENGAGE THE PUBLIC

"Really enjoyed the VR experience – even my young kids enjoyed the experience using the home kit."

VR participant

USING VIRTUAL REALITY FOR REACH AND IMPACT

Project Endeavour produced two virtual reality films to engage communities safely throughout the COVID-19 pandemic. This enabled people across the UK to experience autonomous vehicles from home. A simple virtual reality (VR) headset was developed, which could be used with a smartphone. This was distributed to over 2500 members of the public who applied via Facebook from across the UK. We developed two videos to engage the public:

VR EXPERIENCE 1: SELF-DRIVING CARS TODAY

To showcase current AV technology, we developed a 3D film of the Oxford route. The video included the vehicle overtaking cyclists, operating around a roundabout and emerging from a T-junction. The video utilised visual aids to point out key technologies and was developed to be immersive and replicate what it would be like to travel in an AV in real life.

Figure 6: Still from the Project Endeavour VR Video

VR EXPERIENCE 2: SELF-DRIVING CARS TOMORROW

A second VR video was developed, which explored future potential of AV technology. The animation showcased designs of future autonomous vehicle-based mobility services, and included an AV, as well as a Connected and Autonomous Mobility stop.

Figure 7: Still from the Project Endeavour VR Video

FINDINGS

We trialled a VR experience to explore whether it supported outreach to different communities and the extent to which it could deliver a complementary experience to in-person trials.

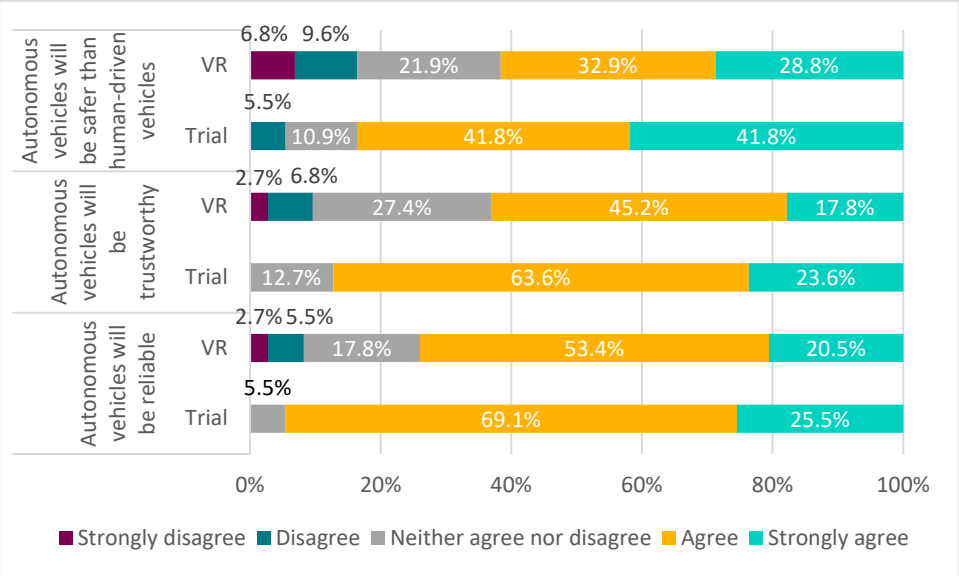
Over 2500 headsets were distributed to the public nationwide, and we received 73 responses. This compares trial feedback, where 100 members of the public participated and we received 55 survey responses, demonstrating a much higher response rate for in-person engagement.

"Great 'gateway' into getting a ride in an autonomous vehicle!"

PERCEPTIONS OF AUTONOMOUS VEHICLES

We measured perceptions of safety, trust and reliability at the in-person trial and after the VR experience. Our data highlights that the VR experience reached a wider audience than the in-person trials, in particular people who might have concerns about AVs and would therefore benefit the most from these educational activities.

Figure 7: Perception of AVs for VR participants



Base: VR n = 73; Trial n = 55

It is clear that the VR experience was a useful method of engaging members of the public on key issues related to safety, trust and reliability.

INTEREST IN THE TECHNOLOGY AND VIEWS ON TECHNOLOGY ADOPTION

We also explored the extent to which participants would feel safe about travelling in AVs tomorrow and whether the VR experience had helped them become more confident in the automated technology.

We found no significant difference between the two groups. The only difference is the prevalence of individuals who are not confident in AVs even after the experience. This is to be expected for this type of immersive but non-physical engagement and indicates that there might be other forms of engagement and knowledge-sharing which could be explored.

REFLECTION AND OBSERVATION FOR FUTURE VR ENGAGEMENT

There are several lessons we take away that may be of interest to other researchers and service designers when using VR to engage audiences with new technologies:

Maximise social media outreach and make sign-up simple: we were able to reach a broad audience by promoting on social media channels and making VR simple and accessible via personal smartphones. Costs, including distribution, were efficient and economical (<£5 per person) after users completed a simple online registration form with their details.

Integrate user feedback into the experience: A key challenge was capturing evaluation data after the VR experience was completed. We did not include a requirement to fill in a survey before the VR registration, or ask for a small fee to increase the perceived value of the experience, as we considered these to be barriers to participation. In future trials, we would consider building the survey into the video itself rather than as a separate link, and would also look to incentivise participation, e.g., through a prize draw.

Develop a sustainable and re-useable resource: a major benefit of the VR experience is that it has created a resource that can be continuously used in the future for other applications, including further research and engagement. We have been able to engage with primary and secondary schools and education engagement centres (e.g., Xplore! Wrexham) and provided them with VR headsets in order to promote STEM subjects. This will allow the videos and the headsets to be used beyond the life of Project Endeavour.

Understand drivers of trial participation: analysis of the trial and VR data highlights that those who attended the in-person trial had a positive perception of autonomous vehicles. There may be potential bias within this sample, for example it is likely include some self-selection of people interested in AVs and willing to make a time commitment to travel and attend the event. People who participated in the VR experience were also overwhelmingly of a positive attitude towards AV, but we observed a small group who mistrust the technology. This is important for future engagement, which must reach those with negative perceptions – although for these groups, barriers to participation are harder to overcome due to the initial negative position.

Consider accessibility at every stage of engagement: through the VR programme. we were able to reach people with disabilities, another key stakeholder group that could benefit from AVs. Whilst we took all possible steps to enable those with disabilities to attend the physical trial in Greenwich, our evaluation highlights that the trial did not attract many with mobility-related disabilities. We believe this may be due to the vehicles used in the trial (Ford Mondeo) which has limited accessibility for

those with accessibility needs. Virtual engagement strategies may therefore be more appropriate for reaching these groups but bespoke events for those with accessibility needs should be developed, given the importance and value of experiencing AV technology in person.

DISCUSSION

Project Endeavour was able to demonstrate the following outcomes for the safety, trust and accessibility of self-driving vehicles:

- Live trials highlighted that it is possible to measure and create improvements in people's understanding, views and trust of AVs.
- We found that attitudes and perceptions of AVs appeared to differ between groups. Our data shows that younger people are more open to adopting AVs, whilst older people are more sceptical.
- Those with mobility needs related to age are more likely to say they will adopt an AV which is likely to driven by a desire for greater independence.
- We also found that public engagement during the highlighted a tendency for participants to view AV AI as cautious and unable to adopt a more aggressive driving style often required for urban diving. Interviewees often characterised the behaviour of the AV AI as that of a newly-qualified driver.

A key finding for future demonstrations is that opinions of trust appeared to be shaped by the presence of key safety features. For example, the visibility of the vehicle's LIDAR system to passengers in the backseat, or the presence of a safety driver, were important tools to improve trust for participants. For others, the lack of a clear emergency stop button was a barrier to increasing trust, presumably due to a lack of control over the behaviour of the vehicle – even given the potential for such safety interventions to cause additional safety issues if used incorrectly.

We also recognise several key challenges that will need to be overcome in the future:

- Further trials need to be undertaken in more complex environments, to build more trust for future users. The live trial in Greenwich incorporated several challenging scenarios, but future demonstrations should look to incorporate challenging scenarios in both urban and rural environments.
- Participants shared a mixed view on the future of AV-based services. Some would prefer AVs for everyday journeys, others see the potential of AVs for specific sectors and uses (i.e., deliveries, long journeys, warehouses, construction sites and so on).
- At present, some feel the AVs are not yet suited for urban driving style environments, as they are too conservative in their driving styles, and are better suited for suburban or rural environments.

Issues of ownership will create challenges for the full potential of AVs in the future. Many people simply enjoy driving, and would not give up driving wholly, despite increased road safety due to AVs. User acceptance will be a challenge in the future. Getting everyone on board to use AVs will be a challenge in the future.

RECOMMENDATIONS

There are several key takeaways from this study and recommendations that we make to local authorities, technology developers and policy makers:

AV developers need to engage closely with diverse groups/members of the public:

It is very important that AV developers work closely with members of the public, and/or utilise research by organisations like DG Cities, when building and designing AVs. As demonstrated by the outcomes of this Endeavour trial, members of the public can be vocal and opinionated with their views towards AVs. People's perception of AVs, including the design, safety and overall performance of the technology, will influence if and when they will use it. For instance, some users find that the interior structure of the AVs (e.g., spatial layout, size, ability to sit in the front) and the presence of certain features (e.g., emergency button, improved communication between vehicle and passenger) are all important features that can encourage or deter people from travelling in an AV.

To ensure AVs are designed to reflect the needs of the public, it is important that AV developers engage with future AV users through customer research (workshops and focus groups) alongside AV public trials.

Government should deepen public engagement with further public outreach and trials: As demonstrated by the Endeavour trial, both face to face AV public trials and VR experiences are impactful ways to engage with the public on AVs. The Endeavour trials were successful in that they allowed members of the public to experience travelling in an AV on open roads, and to share their views about the journey during 1-to-1 interviews. The Endeavour trial was further proof that in-person AV experiences are positive ways of changing people's views and perceptions of AVs. For instance, users that were previously hesitant about AVs, felt more trusting of the technology after having travelled in one.

In order to address existing public hesitancies and distrust around AVs, it is essential and that more public AV trials are held, which include within them the capacity to learn and explore AV applications, understand public needs and map the assumptions and beliefs the public holds towards autonomous vehicles. The trials should be held nationwide, in mixed environments (e.g., on roads with higher speed limits, and in both rural and urban contexts), and should be made accessible to as many user groups as possible (e.g., wheelchair-accessible AVs).

More time needs to be spent exploring behaviour barriers to adoption and acceptance: The Endeavour project demonstrated several barriers preventing some people from wishing to adopt AVs. For instance, current AV technology is considered highly conservative with regards to safety,

and does not accurately mirror current human driving practices (e.g., the AV braking is abrupt, and the AI is sometimes unable to fully predict actions of other road users). Other barriers are related to a full uptake of AVs in the future, as some users simply prefer to drive, and would not give up driving, regardless of the presented benefits of AVs to date.

Further engagement is needed to better understand and map barriers to understanding and ultimately adoption. Physical and virtual trials, alongside robust longitudinal surveys, focus groups and workshops, are all useful around AVs. Trials will help to address barriers related to low AV knowledge or experience and would also provide an opportunity for developers to work closely on designing services and solutions that meet the needs of the public.

The Endeavour trial and associated research has clearly demonstrated the value of trials, and their role in informing and educating the public. As AV technologies continue to develop and progress, it is important that the public are actively engaged throughout the process. Without the public's buy-in, technological adaptations around AVs may not reflect the needs and preferences of the public, which will ultimately further deter some people from fully accepting and adopting AVs.

Overall research around AVs, and the technology's safety is integral to enabling the public to make an informed decision regarding the adoption of AV technology. Examples to address barriers around the performance of AVs in more complex road environments, and hesitancy towards predominately using AVs in the future. Surveys, workshops and other forms of direct public engagement would help to further clarify the barriers to using AVs in place of personal owned vehicles in the future. This information would help to propose solutions for informing further research and addressing these barriers.

CONCLUSIONS

Autonomous vehicles have the potential to reshape modern mobility by improving safety, accessibility and even the nature of the public's relationship with privately-owned vehicles. On-demand, service-based vehicle use, operated by autonomous vehicle technology, is often the preserve of science-fiction, but the Project Endeavour trials highlight both the distance the technology has travelled and the distance that still remains. For the public, the idea of a self-driving vehicle is in many ways still a novelty, even though autonomy features increasingly in the driving assistance technology (ABS etc) they access and use in their own vehicles.

Project Endeavour has also demonstrated that real world trials, surveys and workshops are essential in understanding and exploring the public's perceptions and views of AVs. As AV technologies continue to develop and progress, it is important that the public are actively engaged throughout the process. Without the public's input and buy-in, technological adaptations relating to or facilitated by AVs may not reflect the needs and preferences of the public, which will ultimately influence if and when the public adopts autonomous vehicles.

Overall research around AVs, and the technology's safety is also integral in shifting public views of AVs, and encouraging people to wholly accept the technology in the future.

ABOUT THE AUTHORS

DG CITIES

DG Cities is an urban innovation consultancy, specialising in helping clients harness the power of technology and data to transform our towns and cities. Within Project Endeavour, DG Cities is ensuring that public opinions are heard and shape the development of AV technology. DG Cities invited the public to share their views on autonomous vehicles, engage in live and virtual trials, and participate in online workshops and discussions as to the future of the technology.

Ed Houghton, Head of Research and Service Design, DG Cities

Ed is a thought leader in systems-thinking, system resilience, and AI in different contexts. He is a mixed-methods researcher who specialises in evidence-based policy and practice development. Ed leads the research and service design practice at DG Cities.

Kim Smith, Head of Smart Mobility, DG Cities

Kim is a transport specialist with over 25 years in transport planning, project delivery, policy formation and high-level strategy. Kim takes a strategic overview to ensure the successful delivery of DG Cities' mobility projects and coordinates new mobility proposals.

Hiba Alaraj, Project Manager, DG Cities

Hiba brings to DG Cities a background in master planning, project management and sustainability within the private sector. She has expertise in the energy and sustainability aspects of smart city innovation and is currently working on net-zero carbon, social sustainability and mobility projects.

Balazs Csuvar, Head of Delivery, DG Cities

Balazs leads the delivery of DG Cities' innovation projects, solving challenges through the integration of new technologies and holistic thinking. He has overseen the delivery of Project Endeavour since the project's inception and has recently focused on delivering the public and VR trials.