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To cite this article: Laura Pemberton, Alistair Sutcliffe & Nik Mehandjiev (2025) Choosing a driverless or conventional taxi: a quick or slow decision?, Behaviour & Information Technology, 44:20, 5048-5067, DOI: [10.1080/0144929X.2025.2504515](https://doi.org/10.1080/0144929X.2025.2504515)

To link to this article: <https://doi.org/10.1080/0144929X.2025.2504515>



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Choosing a driverless or conventional taxi: a quick or slow decision?

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ABSTRACT

Choice between driverless v. conventional taxis were investigated in two contexts: (i) forced choice experiment, (ii) structured interviews on attitude. The experiment varied destination urgency, positive/negative autonomous vehicle (AV) news, with scenarios varying cost, safety and pressure. Most participants were conservative, choosing conventional taxis (PT group) in most scenarios, while a minority (AV group) chose driverless taxis. In the scenarios, choice was associated with cost and safety, although cost and safety did not discriminate between PT/AV choice. In the interviews, PT group choice was influenced by dependability, uncertainty about AVs and familiarity while the AV groups' choice was influenced by positive AV attitudes and assessment of AV reliability. Females tended to be more conservative than males, while several participants considered AVs might be more dependable safety may be challenged in less developed countries. Decisions in the scenarios were rapid, involving < 5 variables, while the interview decisions involved many contextual influences and trade-offs. Key user experience issues were dependability, service quality, and customisation. Fast-path, conventional v. autonomous taxi choice is likely to depend on safety, attitude and prior experience while slow-path attitude formation involves dependability, uncertainty, journey context, and regulation. Several recommendations for AV adoption are given including introduction strategies, marketing and design considerations.

ARTICLE HISTORY

Received 10 January 2025
Accepted 29 April 2025

KEYWORDS

Autonomous vehicles; taxis;
user experience; fast/slow-
path decisions; mixed
methods

1. Introduction

Attitudes to autonomous vehicles have been investigated in several studies reporting a variety of influences on AV (autonomous vehicle) purchase with little consensus apart from cost and safety being common concerns (Gkartzonikas and Gkritza 2019; Wang, Zhang et al. 2020; Othman 2021; Kyriakidis, Happee, and de Winter 2015). Many investigations have used surveys of attitudes to AVs framed by the TAM (technology adoption model, Davis 1989) and elaborations thereof, e.g. UTAUT (Venkatesh and Bala 2008; Venkatesh et al. 2003, 2012). However, the intent to use or purchase an AV is likely to be very different from deciding to hire an AV taxi rather than a conventional person-driven (PT) taxi. Purchase decisions are high value and merit careful consideration, hence are more likely to invoke slow-path or system II processing (Kahneman 2011). In contrast, decisions to take an AV taxi are more likely to be made quickly without time for significant slow-path or system II reasoning. Since slow-path decisions tend to stimulate mental model-based reasoning with several influencing variables, TAM models and

their underlying theory of planned behaviour (Ajzen 1991) are suitable frameworks for investigation. However TAM interpretations may be unsuitable for taxi choice decisions which are more likely to involve fast-path processes with fewer influencing variables. This contrast provides the motivation for our study, to investigate how different decision processes might influence AV choice in different contexts.

Surveys of public attitudes to AVs have tended to pose general questions about AVs as a general technology, although some were focussed in specific contexts. For example, comparing AVs with conventional vehicles in a range of VR simulated driving conditions (Derakhshan et al. 2024); comparing video and text representations of driver v. passenger roles in AVs (Charness et al. 2018); or investigating how real-life experience of riding in AV taxis affects attitude and choice (Madigan et al. 2017). Other studies have compared purchase with hiring autonomous vehicles (Haboucha, Ishaq, and Shifan 2017; Kyriakidis, Happee, and de Winter 2015). Although some common themes emerge from these diverse studies, such as concerns over safety, risk and

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/0144929X.2025.2504515>.

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cost, the diversity of decision influences cited in the literature has not produced a consensus about the more important influences on AV choice. The decision process model of Nordhoff et al. (2019) describes seven classes of decision influences based on 28 variables. Nordhoff's model is related to a system II mental model-based approach to decision making.

Most AV studies have adopted quantitative survey-based methods reporting a variety of attitude and value-based influences; however, a mixed-methods, interview-based approach (Patel et al. 2023) reported several contextual influences, such as the journey type, which were not reported in quantitative studies, suggesting that the decision process merits further investigation. The focus of our study was to compare AV-related decisions within the framework of Kahneman's system I/II model (Kahneman 2011). We investigated people's choice between AV and conventional taxis within a fast-path context since this scenario is likely to be encountered in the near future in contexts where slow reasoned decision may not be possible. Then we investigated slow-path decisions about AV adoption more generally, using a mixed-methods approach (Clark and Creswell 2008) to complement the existing literature dominated by surveys. More specifically our investigation was motivated by two research questions:

1. What decision processes are invoked in choice of AVs in time-pressured (fast-path) and general reasoning (slow-path) decisions to choose AVs rather than conventional vehicles?
2. What is the range and relative importance of salient variables influencing decision making in AV/PT choice contexts?

The following hypotheses were posited to differentiate fast/slow-path decision processes:

H1. Fast-path (system I) decision processes will be associated with a small number (≤ 5) of variables whereas slow-path (system II) decisions will be associated with a larger number of diverse variables.

The limit of five variables was chosen to conform to working memory limits (Baddeley 1990) in fast-path decisions, whereas slow-path decisions tend to involve long-term memory with more variables.

H2. Slow-path (system II) decisions will be associated with reasoned arguments, trade-offs between >5 variables and evidence of mental model-based associative reasoning.

Hypotheses 1 and 2 tested the assumptions of Kahneman's (2011) decision theory in which system 1 fast-path decisions are characterised by reference to memory of previous, similar decisions with minimal reasoning. In contrast, system II decisions are produced by

deliberate reasoning with multi-variate mental models. The fast-path, time-limited scenario targeted quick decisions when participants were faced with a forced choice, as encountered in taxi ride hailing situations. If participants had experience of AV taxis this decision should be influenced by their prior experience, otherwise the decision should reflect rapid evaluation of a few pertinent variables, e.g. cost, safety, and urgency. The non-time limited phase encouraged deliberate mental model-based reasoning, which we expected to represent pre-adoption decisions if participants had no prior experience, or post-hoc rationalisation if they had. Although previous research had shown a diversity of possible decision variables, some consensus was apparent that cost and safety were important. We added time pressure and past experience in the form of news stories to propose four salient variables for fast-path processing, leading to a third hypothesis:

H3. Adverse experience (via positive/negative AV news stories) will influence choice: negative AV news will be associated with fewer AV choices than positive news stories.

In the following sections of the paper, previous research in AV attitudes and decision making is reviewed, then the study design and methods are described followed by the results of the first fast-path component and then the second slow-path component. The results are summarised and discussed in relation to decision-making theories, technology acceptance and the implications for public attitudes to AVs.

2. Previous research

Many surveys on the acceptability of AVs have been reported, citing several variables, attitudes and values that influence adoption (Adnan et al. 2018; Rahman et al. 2017). A review by Gkartzonikas and Gkritza (2019) reported nine important positive influences: AV awareness, innovation, safety, trust, environmental concerns, subjective norms (peer pressure), self-efficacy (control), sensation seeking, and compatibility/utility(-convenience), with negative barriers of cost, privacy, security, and lack of control. Othman's (2021) review of AV acceptance noted safety, liability-responsibility concerns and that information on AV accidents increased fear. Most people were not willing to pay more for AVs, while younger males tended to be most pro AVs. Othman also reported ethical trade-offs between eliminating human error and software reliability problems, the dilemma of avoiding harm, and the situation awareness problem for drivers taking over in emergency. Tan et al.'s (2022) survey reported benefit influences of pleasure, anxiety, prior knowledge/attitude contrasted

with barriers of perceived risk and anxiety influencing acceptance, with benefits having a stronger influence than anxiety. In a survey on AV adoption attitudes, Charness et al. (2018) noted loss of control with older females reporting stronger concerns; while the personality trait of conscientiousness increased concern, openness and extroversion had positive influences on adoption. Comparing AV purchase and taking AV taxis, Wang, Jiang, et al. (2020) reported a positive AV attitude was a key influence on purchase likelihood while prior attitude, perceived risk and sharing AV taxis with strangers were negative influences. In this survey only 20% of respondents had a positive attitude to AVs, although younger males were more positive.

In a survey by Kyriakidis, Happee, and de Winter (2015), respondents enjoyed manual driving more than fully-automated journeys, although 75% of all respondents were also fascinated by self-driving vehicles. Respondents were concerned about risks such as software hacking and safety, and the majority were not willing to pay substantially more than for manual driving, indicating that cost is also an issue. This survey reported no significant gender or age effects apart from males' willingness to pay more and being less concerned about safety than female respondents. König and Neumayr (2017) highlighted concerns regarding legal implications, safety and software hacking, while Hulse, Xie, and Galea (2018) reported that risks may be mitigated by positive prior experience.

Potential purchase of AVs has been considered as a rational decision involving significant costs and utility trade-offs with several influences including safety, legal issues, driving enjoyment (hedonics), and values such as ecological awareness and predisposition to adopt new technology, with gender and age being significant moderator variables (König and Neumayr 2017; Kyriakidis, Happee, and de Winter 2015; Adnan et al. 2018; Charness et al. 2018). Haboucha, Ishaq, and Shiftan (2017) compared purchasing AVs with sharing an AV via a subscription model, finding that cost safety, controllability and risk were important influences moderated by age, spending power, attitude to new technology and environmental concerns. Cavoli et al. (2017), in a wide-ranging review of surveys on attitudes to AVs comparing purchase and hire, found that cost and safety were important with utility in terms of journey time and opportunity to perform secondary (non-driving) tasks during the journey. Younger males and early technology adopters were more likely to purchase AVs.

While most AV studies have been based on surveys, Derakhshan et al. (2024) used Virtual Reality (VR) to compare preferences for AVs, semi-AV, manual car and taxi simulations with a range of scenarios varying

driving conditions and hazards. Little differences were found between the simulations in intent to use, usefulness, anxiety and trust although there was some reduction in anxiety for semi-AVs, and taxis produced more anxiety. Charness et al. (2018) compared reactions to driver in the front seat with passenger back seat expectations using video and text representations. However, the presentation mode had no significant effect on AV concerns or adoption. Madigan et al. (2017) provided a real-life experience of a journey in an AV taxi before assessing participants' attitudes and preferences. Participants reported that expected performance (utility), social influence (friends, word of mouth), and facilitating conditions (accessibility/convenience) were key antecedents for behavioural intention (choice), although expected effort was not significant. There were no moderating effects of age, gender or previous experience. Cost, risk and trust were not considered in these studies.

User experience-oriented research has highlighted the importance of affective reaction, satisfaction, simple interaction styles and customised driving experience to counteract increasing anxiety with automation in a TAM-framed survey (Cho et al. 2017). Predictability, comfort and added-value service quality features, with customised driving preferences, were reported in a group workshop study (Niculescu, Dix, and Yeo 2017), while Kim et al. (2020) reported safety, trust, service quality and personalisation as key influences, proposing clear explanation of AV qualities in virtual taxi stands to facilitate choice between conventional and AV taxis.

The Unified Theory of Acceptance and Use of Technology (UTAUT, Venkatesh et al. 2003) which builds on the Acceptance Model (TAM: Davis 1989) and the Theory of Planned Behaviour (Ajzen 1991) has been the most commonly used theoretical framework in AV (Autonomous Vehicles) research. UTAUT was used by Madigan et al. (2017), who found that utility and facilitating conditions (social influence, convenience) were important antecedents for intention. TAM-AV studies were reviewed by Adnan et al. (2018), who noted that performance expectancy, perceived effort, and social influences were significant antecedents for intention, with ethical concerns and cost as additional influences in some studies. Rahman et al. (2017) compared UTAUT, TAM and Theory of Planned Behaviour in a study of driver-assistance technology, finding that TAM (utility, ease of use) had the better predictive accuracy for behavioural intention. In a field experiment analysing behavioural intention across several AV driving scenarios, Xu et al. (2018) found that positive experience influenced perceived ease of use, combined with trust and safety as important predictors of acceptance.

Nordhoff et al. (2019) proposed a process-based model for decision making, with 28 relevant factors

combined in seven classes: prior exposure to AVs, domain-specific evaluation, affective and moral evaluation, subject socio-demographics, travel behaviour and personality. Prior exposure and evaluation led to intention to use and actual use of AVs, while demographics and travel intentions influenced the outcome through moderating effects. The model presumes discrete stages of information processing, in line with most of the technology adoption models, which may be more applicable to Kahneman's system II decision making in contexts such as purchasing a car or enrolling in a car-sharing initiative.

In contrast, decisions to use AV taxis may be made under time pressure in contexts which do not allow the slow-path decision-making process presumed by TAM-related models. Fast-path decision-making (Ajzen and Fishbein 1980, Petty & Cacioppo 1986; Cacioppo et al. 1986) tend to involve few variables and require less cognitive effort. In contrast, slow path is cognitively intensive and requires building a mental model (Johnson-Laird 1983) of the problem then applying reasoning rules or first principles or strategies to arrive at the decision (Payne, Bettman, and Johnson 1993). Most everyday decisions such as hailing a taxi are more likely to be fast path, motivated by desire to minimise cognitive effort (Kahneman 2011). Few studies have investigated the ecology of AV decisions, although a mixed-methods study by Patel et al. (2023) on AV ride sharing and taxis based on 11 interviews reported several decision themes which were not found in survey investigations; they included taxi locations (convenience), wait time, ride-share company, comfort, and destination, as well as the common themes of trust, safety and cost.

In conclusion, apart from safety concerns, there is little consensus about the range and importance of variables influencing AV adoption, and choosing between conventional and driverless taxis.

3. Methods

3.1. Experimental design

A mixed-methods approach was adopted (Clark and Creswell 2008) with a VR simulation experiment to investigate AV/PT taxi choice by presenting a series of realistic choice scenarios depicting taxi ranks with both AV and conventional taxis. Since real-world experience with autonomous vehicles is limited apart from some examples in the USA and China, we employed a VR simulation of AV/PT taxi choice scenarios. VR facilitated precise manipulation of key decision-making factors (Parsons 2015), such as cost and safety, enabling the exploration of choices between

autonomous and human-driven taxis. By providing a balance between real-world realism and the control of laboratory experiments, VR enhances ecological validity while maintaining experimental rigour (Holleman et al. 2020; Neo, Won, and Shepley 2021). VR experiments can correspond well with real-world findings (Taufik, Kunz, and Onwezen 2021) and invoke responses representative of real-world behaviour (Dickinson et al. 2020). The first, fast-path phase of the experiment tested participants' choice and rationale for their choice, with eight scenarios manipulating cost, safety and AV availability in a repeated measures within-subjects design, and between-subjects manipulation of scenario decision criticality and favourable v. unfavourable information biases. Fast-track conditions were simulated with an instruction to make their decision as quickly as possible with a 20s time limit for each decision. Walking towards the preferred taxi simulated real-life behaviour rather than more artificial means of capturing choice by button selection or speech. Decision time and choice were recorded for each scenario then a short interview was conducted to capture participants' decision rationale in terms of the manipulated variables and any other influences they wished to cite. We chose an on-the-street ride-hailing scenario rather than selecting taxis via ride-hailing apps (e.g. Uber), because the street context encourages more rapid decision making, although choice between conventional and AV taxis is likely to be present on taxi apps in the near future. The second general phase of the experiment consisted of a structured interview exploring participants' attitudes to and choice of AVs more generally. There was no time limit on this interview in which participants were asked to explain their own attitudes and rationale for their choice of AVs or conventional vehicles, encouraging more considered, system II reasoning.

The between-subjects manipulation compared decision critically via the context (either going to the airport to catch a flight or going to a friend's house) and the sentiment of the news article (good/bad news on AV safety), following hypothesis 3:

- (i) News: presented as either positive news about reliability and safety of AVs or negative news stories about AV crashes and reliability problems. News was presented in a video immediately before the experiment and reinforced by a headline advert displayed during the VR simulation.
- (ii) Scenario: journey to the airport or to a friend's house. This manipulated urgency and time constraints. The airport scenario was chosen to encourage fast-path decisions by making time-urgency critical, while time should be less salient in the

friend's house scenario. The scenarios were not associated with a specific hypothesis although both were expected to produce different decision rationales evident in the qualitative data.

Participants were randomly allocated to either destination scenario, friend's house or the airport context. This gave a 2×2 between-groups design with 10 participants per group.

Choice between an AV or PT taxi was manipulated within subjects, with a partially factored, repeated measures design with three variables: cost (expensive, cheaper), safety via a brand surrogate, contrasting a well known brand with a good safety reputation (Volvo) with an obscure brand with no known reputation (Bimantra); and Time with an enforced wait of 20 minutes for the AV taxi, and none for the conventional taxi. Cost and safety were randomised in a fully factorial design, within a blocked design for wait in eight scenarios: four no-wait condition, followed by four with 20 minutes wait for the AI taxi, summarised in Table 1:

The motivation for the within-subjects design was to assess the relative influence of cost and safety on participants' choice, compared with the presence (S5-8) or absence (S1-4) of a bias against AV choice in the wait condition. Sample sizes were limited by availability of research funds; however, the group sizes were adequate for between-subject statistical tests, while the more important manipulations were within subjects.

The four dependent variables were:

Choice: a binary decision to take either an AV or a PT taxi.

Decision time: time pressure was manipulated with a countdown display in seconds with a 20s cut off. This manipulation was intended to encourage rapid fast-path decision making.

Post-test AVs are safe, single question on 1–7 (disagree–agree) scale.

Post-test AVs involve risk, single question on 1–7 (disagree–agree) scale.

Table 1. Summary of the experimental design. 1(a) between groups, $n = 10$; 1(b) within subjects.

	1(a)	
	+ve News	-ve News
Airport	10	10
Friend's house	10	10
Scenarios	1(b)	
	Time	Cost & safety
1–4	No wait	Randomised 2×2
5–8	AV taxi wait + 20 mins	Randomised 2×2

Pre-test attitudes (see Appendix B for details) were assessed by:

- IT: five questions on 1–7 scale adapted from Martínez-Córcoles, Teichmann, and Murdvee (2017)
- Attitude to AVs: four questions on 1–7 scale adapted from Charness et al. (2018)
- Prior experience with AVs: seven binary (Y/N) questions on experience as a driver or passenger for different levels of automation from none to simple cruise control to full hands off driverless cars; adapted from Lajunen and Sullman (2021) and the SAE (Society of Automotive Engineers) scale
- AVs are safe: single question on 1–7 (agree–disagree) scale
- AVs involve risk: single question on 1–7 (agree–disagree) scale

3.2. Experimental procedure

The experimental procedure was:

- Subject briefing and consent
- Questionnaire on participant demographics (age, gender, educational background)
- Pre-test attitude and experience questionnaires (see Appendix B)
- View video for their assigned news group. Participants were shown either a positive or negative news video relating to AVs. Both videos lasted 20s
- Virtual reality choice experiment for eight scenarios in their assigned news/destination group
- Complete post-test questionnaire: AV safety/risk.

The sequence within each scenario:

Exposure to the scenario conditions overlaid on the VR scene for 10 s: cost, safety and wait time (see Appendix C for details of prompts for each scenario). The scenario conditions prompt was removed after 10s, then the decision countdown timer started (20s).

Presentation of the VR scene (see Figure 1) with the countdown time prompt.

Instructed to walk towards either the AV or PT taxi to make a decision.

Participants were encouraged to verbalise their decision rationale after making their choice in each scenario.

The experiment was conducted in an immersive VR room at the *****. Subjects wore shutter glasses

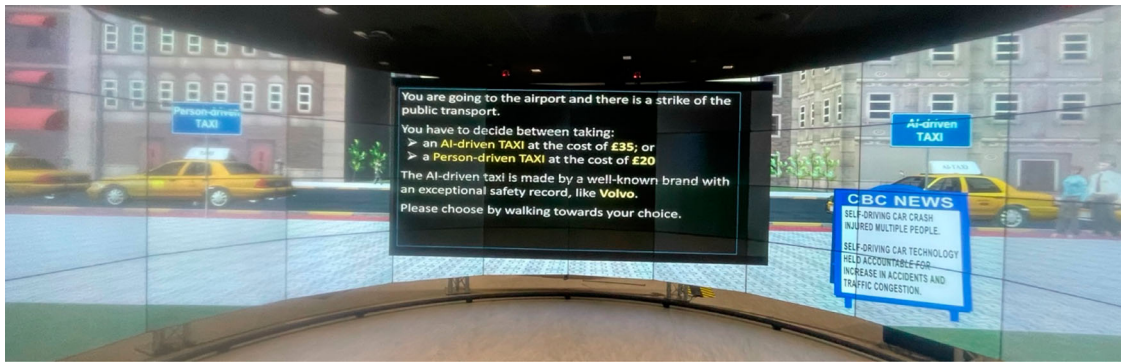


Figure 1. Virtual reality scenario showing the taxi choice and the scenario conditions prompt. Participants' choice was recorded by walking towards either the AV or the PT taxi.

with movement tracking for full 3D immersion. They were presented with a virtual taxi rank. The scenario prompt was presented (see Figure 1 and Appendix C) for 10 s and then removed. They then had 20 s to make their decision, by walking towards either the person-driven or the self-driving taxi. The participants' decision was automatically recorded when they walked (two or more paces) towards either taxi rank. Participants who had not made a choice by 20 s were reminded that they had to choose a taxi quickly and all did so.

Once they had made their choice, a thank you message was presented, and the participant returned to the centre of the virtual scene where the interviewer asked them to explain their choice with the following prompts: 'which influences were more important for your decision: cost, safety(brand) or wait' and 'are there any other factors influencing your decision making?'.

After completing all eight scenarios, a post-test interview was conducted to capture the rationale for their decisions and attitude to AVs more generally, including questions asking participants to rank the influence of the manipulated scenario variables, cost, safety (brand) and wait (time urgency), as well as any other contextual influences on their decisions. The interview structure and question prompts are illustrated in Appendix D. The final two questions asked the participants to reflect on their VR experience and rate the realism of the scenarios, their sense of immersion and their presence in the VR environment.

The post-test interview and responses collected during the scenarios were audio recorded and transcribed for subsequent analysis.

After all scenarios and interviews had been completed, participants completed a post-test questionnaire, capturing their assessment of AV safety and risk, using

the same questions as in the pre-test questionnaire as well as their attitude on the IT and AV scales. Volunteers were given a £15 voucher for participating in the experiment. The study was approved by the University of Manchester Ethics Committee.

3.3. Participants

Forty participants, (57.5% females) and (42.5% males), took part in the study. Most were young, 42.5% aged 18–26, 40% aged 27–42 with the remainder 43–58. Most (75%) had a driving licence. Nationality was split between 67% UK citizens, 32% Asian (India 5, Gulf States 3, Indonesia 2, China 2) and one USA citizen. All had higher-level education as they were either undergraduate, post-graduate students, researchers or members of staff at the University of Manchester, UK.

3.4. Data analysis

Quantitative data was analysed using SPSS with the following statistical tests:

T tests and 1-way ANOVA to investigate gender, nationality and age differences for all dependent variables. Total choices PT/AV, decision time, risk and safety AV ratings were examined post-test.

2-way ANOVAs on all dependent variables for scenario and news manipulations.

Hierarchical stepwise regression on all dependent variables with three pre-test predictors: step 1: age-control; step 2: prior AV experience, step 3: IT, AV pre-test attitudes. A second model added pre-test ratings of AV risk and AV safety to step 3. As the limited sample size precluded multi-variate statistical testing (e.g. PLS), stepwise regressions were chosen that enabled testing of influences on dependent variables (choice and post-

test rating) with several models to test different combinations of independent variable predictors.

Scenario analysis: total choices (PT/AV) for scenarios 1-8. Participants were split into two groups according to their total decisions in the eight scenarios:

AV-favouring group: four or more AV choices (9 participants, 5 × 4 AV choices, 4 × 5 AV choices)

PT-favouring groups: fewer than four AV choices (31 participants).

Qualitative data collected during the scenarios was analysed for following theme totals per scenario: cost, safety, brand, wait time, other influences; priority order and trade-offs between manipulated variables: cost-safety-time.

Data collected in the post-scenario interview was analysed for references to cost, safety, etc. then interview transcripts were marked up with any references to decision influences and contextual criteria. Initial references were grouped by similarity and then compared by two observers to arrive at emergent themes. The emergent themes were assigned to five category groups: prior experience, trust, contextual, external and other decision influences, with sub-themes in context, decision and external influences. Two authors completed the analysis, with each analysing 20 scripts. Inter-coder reliability testing was completed twice during the analysis process on four selected transcripts to confirm coder agreement. Inter-coder reliability was 86% on the initial check; code theme differences were reconciled and inter-coder agreement was 97% with the second sample. The final coding scheme is illustrated in Appendix A.

Frequencies of references to themes were scored for each participant to yield totals by themes and manipulated variables for each scenario (1-8) and theme totals for the post-test interview.

4. Results

4.1. Prior experience and pre-test attitudes

Attitude to IT and AVs were generally favourable; although participants considered AVs to be risky they also agreed that AVs were safe (means >3.5 on 7-point scales; see Table 2). There were no gender differences in any of these measures. Prior experience was limited

(mid-point <5.5 on scale range 0-11), although males reported more experience than females.

There were no significant differences by age or nationality (t tests).

4.2. Dependent variables: influence of destination and AV news

Total decisions were conservative with most participants choosing conventional taxis (PT) in 236 out of 320 total choices, with nine participants making = >4 AV choices and 31 making <4 AV choices. Females (n = 23, mean 6.20 PT choices, SD 1.02) were more conservative than males (n = 17, mean 5.18, SD), $t = 2.469$, $p < 0.01$.

Decision times showed no significant differences (t tests) between the outcome (PT, AV taxi means 16.80, 17.53) and there were no gender differences.

Two-way ANOVAs were carried out with destination (airport/friend's house) and news bias (positive/negative AV reports) between groups on the dependent variables. Decisions (total PT choices out of eight scenarios) was not significant overall although news was significant, confirmed by t test, $p < .01$, with more AV choices associated with positive AV news than with negative news. Destination and news showed no effects for decision time or post-test safety/risk scores.

Rating of AV risk and safety showed no significant pre/post differences: risk means 4.85 (pre), 4.95 (post), safety means 4.22 (pre), 4.37 (post), t tests.

Four significant correlations were found between the pre-test scales; unsurprisingly, pre – and post-test risk and safety scores were also correlated (see Table 3).

4.3. Decisions: influence of pre-test attitude and experience

To analyse possible effects of pre-test variables attitude to IT, AVs and prior AV experience as predictors for the dependent variables, five regression models were used. The results from the final stage of the stepwise hierarchical regression tests are illustrated in Table 4.

Table 2. Means and SD () for pre-test variables IT, AV attitudes and prior experience, by gender.

Variable	Male	Female
AV risk	4.88 (1.22)	4.83 (1.34)
AV safety	4.35 (1.46)	4.13 (1.46)
AV attitude	4.40 (1.22)	4.22 (1.30)
AV experience	5.86 (2.35)	4.46 (2.07)
IT attitude	4.81 (0.56)	4.67 (0.53)

Table 3. Correlations between pre-test attitude scale averages and pre/post safety, risk ratings.

Variable 1	Variable 2	r, significance
Pre-test IT	Prior experience	0.611, **
Pre-test AV attitude	AV safety, pre	0.525, **
Prior experience	AV safety, pre	0.338 *
AV risk, pre	AV safety, pre	–0.358 *
AV risk, pre	AV risk, post	0.519 **
AV safety, pre	AV safety, post	0.786 **

Table 4. Regression analysis on PT choice, safety and risk post-test ratings, with predictors: age (step 1), prior experience (step 2), and pre-test AV attitude, pre-test IT attitude (step 3) in models 1–3, with pre test ratings of AV safety and AV risk added to step 3 in models 4 and 5.

Dependent variable	Predictors	R ²	Beta (variable), sig
PT Choice	Age (control), Prior Experience, AV attitude, IT attitude	R ² .023 Non significant	Ns
AV Safety (post-test)	Age/Prior Exp/AV attitude, IT attitude	*** R ² 0.607	Age – .376 ** AV attitude .446 **
AV Safety (post-test)	Age/Prior Exp/AV attitude, IT attitude, Pre Safety	** R ² 0.607	Pre Safety .617 *** Other vars ns
AV Risk post-test	Age/Prior Exp/AV attitude, IT attitude	R ² 0.22 Non significant	Ns
AV Risk post-test	Age/Prior Exp/AV attitude, IT attitude, Pre Risk	R ² .291, *	Pre Risk .468 ** Other vars ns

Note: Only the results from step 3 are reported.

There were no significant predictors for choice (PT/AV), possibly because choice data was skewed towards conventional taxis (31/40 chose PT in >4 scenarios). Pre-test attitude ratings did not predict post-test ratings or AV risk and safety, apart from AV attitude and safety. Pre-test predicted post-test ratings for safety and risk.

Summary of statistical analysis. There were no gender differences in pre-test attitudes or experience, although pre-test attitudes to safety, risk and experience were positively correlated. The regressions showed that experience and pre-test attitudes had no influence on choice, although pre-test attitudes to risk and safety did influence post-test attitudes. Correlations indicated that participants' attitudes to risk and safety were similar before and after the scenarios.

4.4. Scenario phase

4.4.1. Variable/themes reported

The frequency of the manipulated variables and emergent themes (see Appendix A) in the scenario phase of the experiment are illustrated in Table 5. As expected from the scenario prompts, the manipulated variables (cost, safety and wait time) were more frequent, followed by brand and trust which were often associated with safety; however, context and other decision influences were also cited. Four variables, cost, safety, wait-

time and brand, accounted for 78.1% of the influences cited during the scenario phase.

While most participants appear to have made fast-path decisions considering <5 variables, a minority did not conform consistently to system I decisions. Seven individuals who were higher-frequency citers made eight or more references to context and other influences and 37 cited at least one non-prompt variable, i.e. reference to context or another decision influence in at least one scenario. There were no gender differences in variable frequencies.

4.4.2. Scenario decisions: effect of cost, safety & time

To investigate the reasons for their decisions, participants were split into either PT-favourers if they selected person taxis in five or more scenarios (31 participants: 20 female, 11 male) or AV-favourers if they selected AV taxis in four or more scenarios (9 participants, 6 × 4 AV choices, 3 × 5 AV choices: 6 male, 3 female). There were no significant gender differences in any of the pre-test variables, or differences between the PT/AV groups (see Table 6), although AV prior experience did approach significance ($p = 0.053$, t tests).

Participants' responses for each scenario were analysed for frequency of references to the manipulated variables – cost, safety, and time – to determine the relative influence for each prompt. Influence was also assessed from the rank order of these variables reported immediately after completing the eight scenarios.

Table 5. Reported total theme frequencies for the scenario phase of the experiment.

Variable/Theme	Mean	SD
Cost	9.55	3.67
Safe	7.85	4.08
Wait-time	6.65	2.04
Brand	3.45	3.26
Trust	0.77	1.89
Prior experience	0.67	1.23
Context	2.33	2.55
Decision influences	2.05	2.11
External influences	0.88	1.45

Table 6. Means and SD (), for pre-test variables IT, AV attitudes and prior experience, by PT/AV choice group.

Variable pre-test	PT-favouring	AV-favouring
AV risk	4.87 (1.35)	5.22 (0.49)
AV safety	4.29 (1.30)	4.67 (0.50)
AV attitude	5.60 (0.79)	5.70 (1.02)
AV experience	0.74 (0.61)	0.98 (0.80)
IT attitude	3.55 (0.53)	4.78 (0.63)

Table 7. Total AV choices by the PT group by scenario, where H = high cost, + = good brand and wait for the AV taxi = Y.

Scenario	Prompts Cost/Brand/Wait	AV choices
1	H + . N	4
2	H - N	2
3	L + . N	24
4	L - N	2
5	H + . Y	0
6	H - Y	2
7	L + . Y	5
8	L - Y	1
Total		40

Note: Favourable scenarios are highlighted in bold.

Table 8. Frequency of first-ranked variables reported for each scenario for the PT group.

Scenario/ Prompts Cost/Brand/ Wait	Most important variable 1st rank citations		
	Cost	Safe	Time
1	21	2	2
2	20	10	3
3	14	10	0
4	11	16	1
5	9	5	13
6	6	3	21
7	8	4	16
8	5	5	20
Total	94	55	77

4.4.2.1. PT-Favouring Group. Most AV choices (72.5%) followed the low cost, good brand prompts. Scenario 3, with the most favourable prompts, produced 60% of the AV choices, although scenario 7 which added the adverse AV wait-time received only 12.5% of the total AV choices. See Table 7.

The importance ranking of the manipulated variables reported by the PT-favouring participants showed cost, followed by safety, were the most important decision criteria in scenarios 1-3, the converse in scenario 4, with wait-time being more influential in scenarios 5-8; see Table 8. Cost and time were more important overall.

Safety was only ranked first more frequently in scenario 4, when the brand was negative reflecting a safety concern. In 19% of the scenarios participants could not decide on the rank order of the variables.

Table 9. Frequency of AV choices made by the AV-favouring group (n = 9).

Scenario	Prompts Cost/Brand/Wait	AV Choices
1	H + . N	6
2	H - N	6
3	L + . N	4
4	L - N	7
5	H + . Y	3
6	H - Y	3
7	L + . Y	3
8	L - Y	7
Total		39

Table 10. Frequency of first-ranked variables reported for each scenario for the AV group.

Scenario Prompts Cost/Brand/ Wait	Most important variable 1st rank citations		
	Cost	Safe	Time
1	0	3	1
2	0	1	0
3	5	4	1
4	7	1	0
5	1	1	0
6	0	1	0
7	1	1	1
8	2	2	1
Total	16	14	5

Note: No variables were cited for 35 scenarios.

4.4.2.2. AV Group. The AV group did not follow the PT group pattern, with only 7/39 (17.9%) AV choices selected in low cost, good brand scenarios; furthermore, they were not particularly sensitive to brand since less than half (41%) of the AV choices were made in good brand scenarios (1,3,5 & 7); see Table 9.

In variable priority order, cost and safety were more important overall, especially in scenarios 3 and 4. Time pressure did seem to dissuade this group from choosing AV taxis, apart from scenario 8 when costs were low even though the brand was poor. See Table 10.

Overall, in the scenario phase AV choice by the PT-favouring group was partially insensitive to cost (54% choices in high-cost scenarios, 46% low) and by the AV-favouring group (51% high, 49% low). However, the PT group did favour most AV choices with low cost and good safety, although this was negated by time pressure. AV choices by both groups were also insensitive to brand-safety (PT group: 43% good brand, 54% bad; AV group 51.4% good, 48.6% bad) and time pressure-wait (PT group 46% no wait, 54% AV wait; AV group 48% no wait, 52% wait). However, the PT group did choose more AVs in the low cost, good brand (safety), no-wait scenario: 60% of all AV choices.

Summary of the scenario phase: most participants made fast-path choices with fewer than five variables (cost, safety, time and brand), although seven showed some signs of system II multi-variate decisions. Most participants (31) chose PTs in most scenarios, with their infrequent AV choices being associated with low cost and good brands. The choices of the minority (9) of AV-favouring participants showed no association with specific scenario variables. Cost and time were the more important influences for the PT group, while safety and cost were more important for the AV group.

Table 11. Total reported frequencies for both phases, means and SDs with the more frequent sub-theme codes, top five or >10% of overall totals.

	Mean	SD
Cost	14.73	5.60
Safety	15.40	6.98
Wait-time	11.78	4.80
Brand	6.88	5.02
Trust	3.75	3.67
Prior experience	3.80	3.26
<i>Context sub-themes</i>		
Destination	3.15	2.43
Company	2.42	1.55
Trip type	1.85	2.32
Location	1.52	1.55
Time	1.43	1.17
<i>Decision influences</i>		
Attitude to AI/AV	2.03	2.09
Uncertainty	1.98	1.76
Familiarity	1.70	2.03
Dependability	1.58	1.68
Convenience	1.40	1.74
<i>External influence</i>		
news	2.43	2.06

4.5. General (interview) phase

Totals for all variables and the more frequent themes including both the general and the scenario phase are shown in Table 11.

Although cost, safety, and time variables dominated overall (55.1% total frequency), context and other decision influences were more frequent and diverse than during the scenario phase. Trust and prior experience was less frequent during the scenario phase than in the general phase. All participants cited cost, safety, wait-time and brand frequently, and all but two cited prior experience and/or trust. All cited >5 variables, with a mean of 14 contextual, decision and external influences (range 8–25), not counting the five common variables. The number of variables and more complex reasoning indicates that all participants engaged in system II, slow-path reasoning during the general phase.

Within the contextual influences, destination was most frequent, as might be expected since it was a manipulated condition (airport/friend's house), followed by company and the trip type (short/long journey, etc.). Attitude to IT was the most frequent decision influence followed by uncertainty about AI/

AVs and familiarity with conventional taxis, dependability usually favoured PTs although occasionally AVs. Only news (manipulated in the experiment) was a frequent external influences, all others having means <1.0. There were no significant differences between the PT and AV group totals and no gender differences for any of the variable or theme totals.

In the general interview phase, when references to decisions were made in the same utterance or the next one, variables and themes were attributed as arguments for or against PT or AV choices. Four DIs (dependability, attitude/personal preference, uncertainty, and familiarity) and two contexts (country location and time of day) were associated with strong attributions in favour of either AV or PTs.

After completing the scenarios, participants were asked to comment on any trade-offs between the manipulated variables, as reported in Table 12.

All participants reported at least one trade-off between cost/safety or time pressure (wait), and 10 reported either context or decision influences during the scenario phase.

Summary of interview phase. Four variables were frequent in both the interview and scenario phases (cost, safety, time & brand-trust); however, prior experience, journey context and decision influences were also frequent in the interviews. Argument-based system II reasoning linked choice to dependability, personal attitudes, uncertainty and familiarity (decision influences), location and time of day (journey contexts). Only news was a frequent external influence.

4.5.1. Excerpts main variables

The following excerpts illustrate how participants interpreted their priorities and trade-offs between the main scenario variables cost, safety-brand, and time pressure (wait) and other decision influences.

4.5.1.1. Cost. Overall few cost references could be attributed to either AV or PT choice in the general phase, although cost attribution was common during the scenario phase. Excerpts indicate that participants often preferred the cheaper option, whether it be an autonomous or human-driven taxi. For instance, P10, 'my first priority is the cost'; P18: 'I picked the AI one because it's cheaper'. Some participants are willing to pay a premium for the novel experience of riding in an AV taxi, P15: 'I would happily pay a bit more just for the novel experience of having an AI-driven taxi'.

4.5.1.2. Safety-Brand. Safety was a dominant decision criterion for several participants. P35: 'So the AI one had safety issues. So I would always choose something

Table 12. Trade-offs between scenario variables in importance rank order, apart from brand and safety which were considered related influences.

Variable 1, 2	N PT-favour group	N AV-favour group	Total Ps citing
Cost / safety	17	3	20
Time / safety	9	3	12
Cost / time	12	3	15
Brand – safety	21	3	24

that didn't have safety issues'; P37: 'Getting there safely. Safety, surviving the drive'. Some participants expressed a willingness to pay more for safety, indicating a trade-off between cost and perceived safety, e.g. P15: 'I wouldn't trade off £10 or \$10 for my life'.

Safety was closely associated with brand recognition for many participants, e.g. P12 noted, 'if it's Volvo, then I feel safe because it's a known brand, but it's still new still be a bit hesitant', while an unknown brand had a negative effect on safety, P13: 'I didn't know the brand so I'm not sure about the safety'.

Safety was associated with dependability interpreted as different reliability considerations for PT or AV taxis, as highlighted by P4: 'Because there is always risks with, you know, a person-driven taxi, stuff that is completely out of control, it's not just about the car, it's about the driver as well, because the driver could have been drinking, and I wouldn't necessarily even know'. Alternatively, software was more reliable and consistent than human error-prone drivers; P23: 'driver could be distracted talking on the phone, or lots of other things going on. Whereas with the AI, all of that kind of thing is eliminated'.

4.5.1.3. Time Pressure (Wait for AI taxi). Many participants emphasised the importance of wait time, especially in scenarios involving time-sensitive situations such as catching a flight. P15: 'I don't take many risks. I just want to make sure I'm there and I get my flight on time'. While wait time was crucial in scenarios 5-8, some participants often weighed it against other factors, e.g. P12: 'If I'm not in a hurry, I don't mind waiting an extra 20 minutes and saving some money'. In non-urgent situations, some prioritised safety over wait time, e.g. P13: 'I would wait just to make sure that I'm safe'. However, some participants expressed a strong aversion to waiting, regardless of the situation; P15: 'I really just hate waiting for anything'.

4.5.1.4. Brand & Trust. Trust and brand were closely associated with safety as influences for AV choice, e.g. P16: 'I know that the brand is quite, you know, familiar with me. And it's quite a big brand ... I will choose the AI self-driving car'; while P22 was less sure: 'I don't know. I feel like I noticed that familiarity of the brand in that situation for AI was something that made me consider that that would be a safe and a more positive option than in the previous one where I didn't really know anything about that brand'. However, some participants expressed indifference towards brand influences. P14: 'So Volvo is a reputable brand but it was not that important', and P25: 'I'm not really like

bothered about brands, because I don't really know much about cars anyway'.

4.5.1.5. Prior Experience. Prior experience was closely associated with familiarity and PT choice. Most participants had little prior experience with AVs. Several mentioned booking Uber (person) taxis commenting that the additional information and familiarity could be a positive influence. P26: 'f I'm booking an Uber, I can see the ratings. So that increases my trust in them. Because I am obviously more prone to choosing someone who has a good rating'.

4.5.1.6. Summary. Cost was not linked directly to choice; although safety was an important influence associated with safety and brand, while brand and trust were directly associated with choice. Time was linked to journey urgency and destination, while prior experience was associated with PT choice.

4.5.2. Context influences

4.5.2.1. Time of day. This theme was linked to safety with arguments for and against AV taxis. Arguments for AVs were associated with human reliability and error, e.g. P26: 'Only because I think, at that time of the day, when most roads are desolate, there's no one. Yeah, I would feel safer as a woman in an AI-driven vehicle than in a person, woman vehicle'; and P21: 'And then there are people who drive late at night despite being sleepy because they have to reach another place. So if we have an option of self-driving car, then it makes the thing more safer'; and arguments linked to availability, e.g. P15: 'And, it's probably, I feel really guilty by ordering a taxi at four in the morning, cause I'm making someone get up at four in the morning, even though I guess that's what they do, but I still feel guilty about it, and I don't really feel guilty about booking an AI taxi at an unreasonable hour'.

4.5.2.2. Destination. Participants cited the influence of destination in combination with time pressure. P30: 'So if I'm going to a friend's house, and he says, you know, arrive anytime between now and five o'clock, and I've got a three-hour window, then it matters not. But if I had a job interview, and I had to be there a specific time, well, then I'm going to pick something with a shorter way because I'm going to make sure I'm there'; and more generally, P21: 'Then it depends upon the situation on where I'm going and why I'm going to a place'. The theme was rarely linked to explicit choice although it did reinforce pro-PT familiarity arguments.

4.5.2.3. Company. This theme was associated more closely with PT choice, via AV safety concerns for others, particularly kin; P13: 'Yeah, for me, I might risk it if it's only me, but if it's with a family, no, I think twice before I choose'; P14: 'I think if it was small children, maybe safer to go with what are you familiar with'; and the need to consider others; P20: 'I think if I'm travelling with other people, I will take their opinions on choosing which vehicle'. This theme was also associated with pro-PT arguments for social support provided by human drivers; P12: 'With the normal taxi, I like talking to my taxi driver, can't really do that with an AI-driven taxi'; P21: 'Like if I'm going to a tourist destination, usually my first contact is the taxi driver. He's the one who can tell me what are the places to see? And then recommend places to eat? So that's one factor the human touch'.

4.5.2.4. Journey Type. The complexity of the environment influenced attitudes against the capabilities of AVs; P20: 'Another scenario is what kind of road is it. If the vehicle is driving, if it's a very narrow road or like the road has many people walking around'; P21: 'Then regarding road conditions, if it's if it's well developed, so it's fine, autonomous vehicles are fine. But then if I don't trust the infrastructure, I need to trust infrastructure to because the algorithm is based on the infrastructure'.

4.5.2.5. Location. Country location arguments were all against AVs on the grounds that whereas the AI software might be reliable in a well ordered traffic system (e.g. UK, USA), it could not cope with more anarchic traffic where few rules are followed (e.g. India); P10: 'But when I've worked in India for a couple of years, and I don't know if the car would do okay with the kind of traffic and the volume of people we have on the road. But in Dubai the roads are huge, and it's really safe'; P12: 'I think it works in countries that are developed. But I'm from Egypt and with the roads there and the way people drive and the lanes aren't even set up. So it just would not work there'; P30: 'I don't know how it's going to work on British streets that are really tiny and really complex and whatnot, I can see it may be working in kind of big American streets or in Singapore where it's all squared, right angle turns and so on'.

Summary of context: time of day was associated with safety on night-time journeys; destinations reflected urgency and time pressure. Company also had safety connotations via risk to kin, as well as a social benefit for PT choice when the driver was present to help. Location was strongly associated with safety and the

challenge for AVs in unpredictable developing-country road conditions.

4.5.3. Decision influences

4.5.3.1. Attitude to AI / personal preference. This could be either positive reasons for favouring AV choice, such as novelty, fun, and liking new technology, or a personal preference for PTs, often associated with familiarity and prior experience. Pro-PT arguments also expressed an adverse attitude to AI and AVs, accompanied by arguments based on preference for being in control or enjoying driving; P21: 'I have a personal love, driving. So I usually go driving myself. That's why I haven't gone much into self-driving cars'.

Pro-AV statements were justified by the novelty of the technology, a sense of adventure and occasionally improved safety; P18: 'Maybe because of the curiosity? I don't know, because I live my whole life being a passenger of person-driven taxi and maybe I want to try what if there is an AI-driven taxi available around the city and I just want to try it'. P15: 'I would happily pay a bit more just for the novel experience of having an AI-driven taxi'.

4.5.3.2. Dependability. Pro-PT arguments considered human drivers to be more reliable, flexible, and responsive. P39: 'I feel like I could tell the driver to drive quicker. Whereas like, like cars like the AI one, might have a limit and like, I can't really go too fast and like the person one could, like, exceed and like reach there in time'. Alternatively, AV could have software bugs, hence PTs are a safer choice. P36: 'So what makes me not trust an AI-driven taxi is the fact that if something goes wrong in the program, it might cause an accident'. Reliability arguments also cited the presence of human drivers to provide information, help with luggage, social chat or help in case of emergencies, e.g. P10: 'So if something were to happen, or like, we were like, if a person-driven car was to stop, like suddenly on the road, I know that me as well as there'll be one more person who would help find an alternative solution to get me to the airport. While he fixes this. For example, the same thing happens in the AI autonomous car, I have no idea, I'd have no idea what to do'. Pro-AV dependability reported human drivers might be linked to safety concerns; P18: 'Like the one that I forgot to mention is that as a woman, sometimes we are afraid of having men drivers, especially during midnight that sometimes they can do some shady things for us to us'.

4.5.3.3. Uncertainty. All were pro-PT arguments based on concerns about the lack of knowledge about how AI works, poor statistics on AV safety and other arguments

requesting more information to enable confidence in AVs; P 40: ‘Yeah. I mean, like, how long self-driving cars has been about as well. ... And you know, the statistics between self-driving cars and driving person-driven cars were equal in terms of crash rates, ... , then, yeah, that that would make me trust it more’; P 12: ‘I’m not sure how it works, but I feel like the AI or the way it’s programmed, there has to be a bit of a moral compass in it, which I have a problem with that because I don’t know what it would prioritise’. P13: ‘That’s why sometimes I choose if anything I don’t know about I’m not aware of how it works, the amount of safety I just don’t use it’.

4.5.3.4. Familiarity. These influences nearly all favoured person taxis based on past experience and habit, e.g. P22: ‘So I think the fact that person-driven cars are much more familiar to me, I do it myself. I’ve been around person-driven cars a lot. It just seems like much more of an easy option in terms of familiarity, comfort, safety, awareness’. P39: ‘I think my past experiences because, like, like, for me, I have a little bit, but not much experience. And so I’ll like tend to, like choose what I’m familiar with’.

4.5.3.5. Convenience. Influences relating to the availability, flexibility and adaptability of PT and AV taxis, including statements of comfort and satisfaction: P26: ‘Then I think at those points in time, you just really wish for a self-driving car, where you could just book the car, and then you could get in and reach your destination without all of this hassle’.

Summary of decision influences: Positive attitudes to IT were associated with AV choice, whereas PT choice was a personal preference also associated with familiarity. Dependability could be PT positive via the provision of human help or AV positive when automation was considered to be more reliable than error-prone humans. Uncertainty favoured PT choice and fear of the (AI) unknown.

4.5.4. External influences

These were infrequent apart from news, which was an anti-AV influence associated with safety concerns; P14: ‘And of course if you see on the news there are accidents that also plays on the back of your mind’.; P22: ‘I am very aware that I’ve seen a lot of negative news about AI-driven cars at the moment’. Some had a more nuanced interpretation, e.g. P25: ‘If I was hearing that ... it was unsafe. It just depends how often it happens. Because one case out of billions of cases it doesn’t mean that much but like the news just latches on to stuff’. Regulation was an important, if infrequent,

Table 13. Decision arguments: Valency by PT/AV-favouring group.

Variable	N All Ps citing (40)	N AI group Ps citing (9)	Notes
Trust/brand/safety	22	4	Few explicit associations, tacit favour for either PT or AV choice
AI/AV uncertain	19 (16 AV –)	3 neutral	Associated with AV – ve attitude
Prior experience/familiar	14 (all PT +)	3	PT-familiar habitual choice, 5 mental model of future experience
AI/AV attitude	13 (8 AV + & 5 AV –)	5 (all +)	8 PT-group AI attitudes, 3 +ve, 5 – ve
Country context	13 (9 AV –)	3	4 neutral; roads in developing countries too chaotic for AVs
PT dependable	13 (all PT +)	2	Adaptable (AI rulebound), flexible, more reliable than software
PT dependable/social	6 (all PT +)	0	Human driver social contact, help in emergency
AI dependable	9	4	Software more reliable than humans

Note: Only more frequent variables are reported showing the + ve or – ve influences on choice.

influence associated with the country location, for example, P18: ‘It’s in here in the UK, it’s a highly regulated country, in my opinion. And if the AI-driven taxi has already been licensed as a taxi, so there must be safety measurement that the government does to make sure that the taxi is doing fine’.

4.6. Decision influences summary

A summary of the contextual and decision influences which could be attributed to choice is given in Table 13 reporting the number of participants citing each influence.

Safety was associated with brand identity, and less frequently trust, as the most frequent influence cited by 22 participants, followed by uncertainty cited by 19/40. Uncertainty was associated with the need for more information about AVs, and five individuals described imaginary future experience speculating about positive or negative qualities of AVs. Prior experience/familiarity was cited by 14 individuals including three in the AI group. Thirteen expressed AV/AI attitudes, with eight being positive of which five were by AV-favouring individuals. PT group AV attitudes usually expressed novelty and the desire to try new technology. National location was the most frequent contextual influence; nearly all were arguments against AVs on the grounds of poor reliability in complex, developing-world road conditions. Dependability, including general reliability and social reassurance (19) of PTs were

frequent influences by PT-favouring individuals, while AI dependability was cited by nine participants, three of whom were PT favourers.

Four of the important decision influences for each participant were identified when decision valency could be explicitly attributed to influences in the same utterance, combined with the more frequent decision influences for each individual cited in the general phase, to provide a summary of the influences for each individual, illustrated in Appendix E. Eleven participants constructed mental models of possible future AV experiences, contrasting their views about safety and dependability. Five had ambivalent attitudes with positive and negative statements about AVs and PTs, including two who gave contradictory arguments both for and against AV choice. No common pattern of decision variables was apparent within the PT-favouring group, although prior experience, familiarity and dependability were frequent influences. Most of the AV-favouring group expressed both a positive AI attitude and dependability of AVs via software reliability in contrast to human error; however, three AV-favourers gave contradictory reasons for AV choice.

In the AV group the main influences were positive software reliability and dependability in contrast to human error, with a positive attitude to AI technology and preference for AI/AVs. Eleven participants constructed mental models of future scenarios of possible experience depending on AV regulation, dependability, social and environmental factors, with arguments for and against both AV and PT options. Four of these participants also expressed ambivalent attitudes with points for and against both options. Cost, and other decision influences (convenience, service quality, and control) were infrequent. Sustainability and ecological considerations were cited by the three non-drivers.

4.7. Choice alternatives and scenario realism

At the end of the interviews participants were asked about their choice if public transport or other alternatives were available. Public transport by bus was the most popular alternative choice, although six insisted they would take a taxi or drive in all circumstances; see Table 14.

Table 14. Alternative choices.

Alternative choice	N Ps citing
Public transport: bus	27
Public transport: train	2
Cycle	2
Walk	4
Drive/taxi	6

Cost trade-offs were cited as a choice criterion by 28 participants, while 25 noted that their choice would depend on availability and service quality (frequency) of the alternative as well as the journey context (distance). Five cited sustainability as an influence.

Two manipulation check questions requested views on the realism of the VR scenario, and whether the decision would be different if the 20s time pressure was removed. Twenty (50%) considered the VR scenario to be realistic, 15 (37.5%) were not sure while five considered the VR to be artificial and a poor representation of reality. Twenty-three participants (57.5%) reported that the 20s time limit was realistic and that their decisions would not have been different if more time had been allowed, while seven insisted they would always take their time with a slow-path decision, and 25% stated that it would depend on the context.

4.8. Results summary

The key results are summarised in Table 15 for the statistical analysis and scenario phase followed by the qualitative analysis in the interview phase. Most participants

Table 15. Summary of results (a) quantitative analysis and scenario phase, (b) qualitative analysis interview phase.

(a) Results quantitative analysis and scenarios.	
Analysis	Key findings
Pre-test Attitudes & Experience Regressions	No gender differences; positive correlations between risk, safety, and experience. Pre-test attitudes did not predict choice; attitudes to risk/safety predicted post-test attitudes.
Scenario Choices, ANOVAs	Most Ps made System 1 (fast path) decisions using <5 variables (cost, safety, time, brand). Scenario choice was not significant
Group Differences	PT group (31 Ps) chose based on cost and time; AV group (9 Ps) based on safety and cost.
Effect of News – ANOVAs	Negative AV news was associated with fewer AV choices, $p < 0.01$
Variable Sensitivity	AV choices were not consistently sensitive to cost, brand, or wait time.
Trade-offs	Common trade-offs included cost/safety, time/safety, and cost/time.
(b) Summary of qualitative analysis – Interview Phase.	
Theme analysis	Key findings
Shared Across Phases	Cost, Safety, Time (Wait), Brand/Trust
More Frequent in Interviews	Prior Experience, Context (Destination, Time of Day), Decision Influences (Uncertainty, Familiarity, Dependability)
System 2 Reasoning	Trade-offs, mental model reasoning, arguments for/against AVs and PTs, use of ≥ 5 variables by most participants.
More frequent Contextual Influences	Destination urgency, time of day, journey type, location, company (e.g. kin present)
More frequent Decision Influences	Positive attitudes to AVs/IT (linked to AV choice); Uncertainty, Dependability, and Familiarity (linked to PT choice)
More frequent External Influences	AV-related News (most frequent); Regulation (infrequent)
Main decision influences by Group	AV favourers = Positive AI attitudes, AV dependability; PT favourers = Familiarity, Uncertainty, PT dependability

were conservative, following their prior experience and familiarity with conventional taxis, with 31 selecting person-driven taxis in five or more scenarios; nine were classified as AV favourers, choosing AVs in four or more scenarios.

Scenario phase: news had a significant influence, with bad AI news leading to fewer AV taxi choices. Pre-test attitudes did not predict choice; furthermore, risk and safety ratings did not differ before and after the experiment. Cost and safety were ranked as more important influences than time by the PT group, with cost and time by the AV group. Scenario-level decisions were not sensitive to high cost and poor safety, although time was an adverse AV influence for the PT group. In the scenario phase most participants reported fewer than five variables conforming to system I decision making.

General phase: cost, safety, time and brand were cited more frequently overall, followed by references to trust, prior experience, contextual and decision influences including familiarity. Uncertainty reflected participants' prior experience with conventional taxis and fear of the unknown, coupled with dependability/reliability and convenience. Attitudes to AI and AVs also influenced personal preferences. External influences were infrequent, apart from news.

Choices and decision influences: the two main influences in the PT group were uncertainty about AV/AI linked to the need for more knowledge, and dependability with human drivers being more adaptable and better company. AI/AV positive attitudes and reliability were cited as the main influences by the AV group. Trust was linked to a positive brand and hence safety, although rarely directly linked to either AV or PT choice. Although cost and safety were the dominant concerns in the scenario phase, in the general phase a wide variety of influences were associated with choice, and although safety was tacitly linked to choice, cost was not. Two prominent contextual influences were the country location, where all participants considered that AVs would struggle with the road conditions compared with conventional taxis, and human-driver assistance in breakdowns.

Scenario v. general phase: participants generally reported four to five variables in the scenario phase (cost, safety, brand, time) with infrequent references to contextual variables and other decision influences. Most decisions were taken quickly, consistent with system I decision making. However, trade-off arguments involving all four variables were described and some subjects did make contextual arguments. Although some arguments may have been encouraged by experimenter prompts, most decisions in the scenario phase

did conform to system I criteria with quick decisions and fewer than five variables. In the general phase, although the experimental variables were still cited frequently, prior experience, trust, and several context and decision influence themes were also frequent. Most participants developed trade-off arguments for decision, and mental model-reasoning about the pros and cons of AVs, how the journey context and the driving environment could impact the reliability of AVs. The wide range of themes, arguments and decision strategies indicates that the general phase conformed to slow path system II reasoning.

The majority of participants reported that the VR simulation and scenarios were realistic.

5. Discussion

5.1. Results & hypotheses

Generally our results agreed with the expectations of the research questions. The scenario phase produced evidence of fast-path/system I decision making involving only cost, safety and time pressure; while the general phase followed system II characteristics, as many variables were considered with trade-offs and more complex, mental model-based decision strategies. However, not all participants followed system I-style decisions in the scenarios, with a minority considering other decision influences which were not manipulated in the experiment. The first hypothesis was only partially confirmed since 25% of the participants considered more than five variables. However, all subjects considered more than five variables with a range of trade-off and reasoning strategies in the general phase, confirming the second hypothesis. Consistent with empirical studies on Kahneman's (2011) system I/II distinction (Sloman 1996; Gigerenzer 2015; Gigerenzer and Gaissmaier 2015), our study indicates that the fast/slow path boundaries may not conform to precise definitions, in spite of our time pressure manipulation for rapid decision making.

Destination urgency in the airport/friend's house scenarios was not significant, although negative news was associated with fewer AV choices, confirming H3. Most participants chose conventional taxis with a minority of 9/40 choosing AV taxis in half or more of the eight scenarios. Cost and safety (brand) were probably important decision criteria since these variables were cited frequently overall and in trade-off arguments, which is consistent with many studies citing cost and safety/risk as influential AV decision criteria (Kyriakidis, Happee, and de Winter 2015; Haboucha, Ishaq, and Shifatan 2017; Gkartzonikas and Gkritza 2019). However,

there were no significant differences in frequencies of these variables between the PT – and AV-favouring groups and AV choice was generally insensitive to price and safety/brand. Conservative choice favouring conventional taxis influenced by safety concerns is consistent with general risk aversion predicted by Prospect Theory (Kahneman & Tversky 1979), probably reinforced by the uncertainty of utility gain for AV taxis.

In the general interview phase, context and other variables were critical influences on choice, as well as cost, safety, and time, which is consistent with Patel et al.'s (2023) report of contextual influences on AV choice. As to the country context effect, our non-UK subjects considered that while AVs may be safe in developed countries, they may be unsafe in less developed countries given the unpredictable driving conditions. This interpretation is not apparent in multi-national surveys (Gkartzonikas and Gkritza 2019; Madigan et al. 2017). Interpretation of national contexts will depend on the design of road infrastructure, where consistent layout and clear signage should improve AV performance (Vochozka, Pártlová, and Mayer 2024), as well as predicting the cultural factors that may influence driver behaviour (Deng et al. 2020, 2024, 2025). Decisions by those subjects who had little experience of AVs were influenced by uncertainty, coupled with prior experience/habit of using conventional taxis, consistent with Xu et al.'s (2018) report. Males tended to favour AVs more than did females, which agrees with Charness et al. (2018), although we found no age effect; however, our sample had few older subjects. Attitudes did show gender differences, with males expressing more positive preferences for AI and AVs, agreeing with several previous AV adoption surveys (Wang, Jiang, et al. 2020; Kyriakidis, Happee, and de Winter 2015; Cavoli et al. 2017). Some of the context variables we found have also been reported in survey studies, e.g. journey time (Cavoli et al. 2017) and convenience (Gkartzonikas and Gkritza 2019). Our findings support conclusions from AV user experience-oriented research, for example the importance of trust to support safety and counteract anxiety (Cho et al. 2017), while predictability, comfort and service quality features, with driving preferences agree with the findings of Niculescu, Dix, and Yeo (2017). Consistent with Kim et al. (2020) we found that safety, trust, service quality and personalisation were key influences, and uncertainty concerns support the need for explanation of AV qualities.

The diversity of contextual and other decision influences cited by our participants suggest a more multi-faceted model of decisions. For example, while control/dependability has appeared in several surveys (König and Neumayr 2017; Haboucha, Ishaq, and

Shiftan 2017; Gkartzonikas and Gkritza 2019), and may be related to utility reported in TAM surveys, our analysis demonstrated that antecedents to intent may appear as arguments for and against AVs consistent with system II decisions. Reliability was interpreted by our participants as either AVs being safer by avoiding human error, or as unreliability caused by software bugs. Dependability could reflect human drivers being more helpful in an emergency and adaptable to ensure arrival at the desired destination, contrasted with AV reliability through automation. These AV decision trade-offs supplement the ethical considerations reviewed by Othman (2021). In contrast to positive AI/IT attitudes as antecedents to AV adoption (Haboucha, Ishaq, and Shiftan 2017; Wang, Zhang, et al. 2020; Tan, Zhao, and Yang 2022), we found that positive AI attitudes were also held by subjects who chose conventional taxis.

Our mixed-methods approach, including qualitative analysis of decisions, provides a broader perspective on AV choice. We found that positive AI/AV attitudes were reasons for AV choice, as reported by Haboucha, Ishaq, and Shiftan (2017), although positive AI attitudes were not consistent in our choice groups. Wang, Zhang, et al. (2020) observed that positive AI attitudes were a minority in their survey. Although AV-favouring subjects were sensitive to cost and time pressure, they were less sensitive to poor brand and safety in the scenarios. Preference for conventional taxis among PT-favouring subjects was primarily influenced by cost and safety in an immediate fast-path decision context; however, in slow-path contexts, dependability, prior experience and familiarity contrasted with uncertainty and fear of the unknown, with trade-off arguments and mental models, suggesting more complex system II reasoning in attitude formation before people encounter AV taxis. Patel et al. (2023) also noted experience and contextual influences in driverless taxi decisions, although they did not analyse the association between these variables and their participants' decisions.

5.2. Decision models

Our findings support Nordhoff et al.'s (2019) MAVA models of AV choice. Domain-specific evaluation and travel behaviour are consistent with the contextual influences reported by our subjects; moral and affect is supported by the decision trade-offs we observed. However, we found only weak evidence for subject demographics in gender differences and no age effects, although our sample was limited. We did not assess personality in the MAVA model which has demonstrated

influences (Charness et al. 2018). TAM-oriented studies have also reported personality and affect-related antecedents to perceived utility and intent (Wang, Zhang, et al. 2020; Wang, Jiang, et al. 2020; Tan, Zhao, and Yang 2022; Charness et al. 2018; Kyriakidis, Happee, and de Winter 2015). We argue that the system II interpretation of our data concords with Nordhoff's decision process model and provides a more nuanced understanding of trade-offs and mental-model reasoning in AV adoption than posited by TAM/Theory of Planned Behaviour interpretations. Attitude-oriented decision models (Ajzen and Fishbein 1980; Ajzen 1991) are suitable for interpreting our slow-path interview-based findings, where choice was influenced by a combination of attitude (IT predisposition), utility attributes (cost), social influences and risk-related variables (dependability, safety). In contrast, fast-path decisions observed in the scenarios fit with simpler choice models such as Prospect Theory (Kahneman & Tversky 1979), where a utility gain (service, cost) is balanced against loss related to risk and safety. Fast-path decisions are also related to risk perception theories (e.g. Slovic 1987) where choice is influenced by the risk, severity thereof and ability to mitigate or control the risk. The negative influence of news, we found, with the need for safety regulation is supported by risk perception theories. The prominence of trust in our findings illustrates the importance of possible risk mitigation. The complexity and diversity of trust theories precludes extensive discussion; however, we note that trust was clearly related to reputation (brand), and that many participants reported uncertainty and lack of prior experience, hindering calibration of trust with experience (De Visser et al. 2020; Collins and Juvina 2021). The potential lack of control in AVs reported by several participants, coupled with risk and safety concerns, agrees with health-related decision theories; furthermore unpredictability of the AV environment relates to driver reliability. While computational models can simulate variations in human driver behaviour to optimise AV response strategies (Deng et al. 2020, 2024, 2025), predicting both AV and human behaviour in an uncertain future were key issues for many participants.

5.3. Adoption and policy implications

Our findings suggest that people without prior exposure to AV taxis will tend to be conservative and risk averse, favouring the familiar choice of conventional taxis. AV adoption could be fostered by:

- (i) Information campaigns to overcome the uncertainty and fear of AI reported by our subjects.

Testimonials of positive experience, clear explanation of safety features and regulation standards.

- (ii) Brand reputation awareness with safety information to help overcome user anxiety and fear of AV technology.
- (iii) Explanation of positive user experience based on testimonials, with attributes reported by our participants: comfort, service quality and dependability including recovery from operational problems.
- (iv) Customisation of the driving or driverless experience; some participants preferred hands-on driving, while others were content with full automation. Choice of controls and user experience could help adoption.
- (v) Marketing strategies could be tailored to different gender audiences, i.e. males enjoy driving experience, novelty and excitement of new automation, females appreciate service quality with more reassurance about safety and failure backup features.
- (vi) Introduction of AV technology should be adapted to different national contexts. In developed countries regulation and thorough testing should be sufficient to deal with expected road infrastructure and driving conditions; however, in developing countries more cautious introduction is advised with human driver backup and extensive testing in less predictable driving contexts.

5.4. Limitations

The study design was limited for quantitative analysis by our sample, composed of well-educated, younger subjects, and limited numbers; however, the sample was acceptable for qualitative analysis. The limited sample hindered generalisation of our findings, since only a minority of our participants chose AVs. The realism of VR simulation was an approximation of real-life experience and situated decision making, although most subjects did rate the VR and scenario as realistic representations. The claims for system I/II decision making have to be tentative, even with the time pressure to encourage fast-path decisions. Most of our subjects did not have prior experience of AV taxis, so the choice would be unfamiliar, hence biased towards system II decisions. In spite of these limitations the scenario decisions did show qualities of system I. External validity is limited by our subject sample and temporal context. Most subjects did not have AV experience, and we could not control their prior attitudes to AVs. Our conclusions on decision influences are limited by the subject sample, although we have triangulated

quantitative and qualitative evidence to analyse the decision process.

5.5. Future research

We will explore how attitudes and decision making evolve over time, as people gain more exposure to AVs, with large samples with more varied AV experience. Further studies are also needed with larger samples drawing participants from a range of socioeconomic backgrounds and age groups to assess the extent of conservative influences on AV choice. Further cross-cultural comparisons could illuminate how nationality, regulatory environments and cultural norms may shape AV perceptions and decisions. We will conduct comparative studies in regions with differing levels of AV adoption, such as the US where AV trials are common and Europe where uptake has been slower. Longitudinal studies following participant cohorts could illuminate the transition from initial exposure to AVs and probably system II reasoning to everyday choice as AV taxis become commonplace and taxi choice involves more habitual fast-path decisions. Understanding the role of positive or negative experience as well as external influences on choice also requires cohort studies.

Laboratory studies, while controlled, do not capture the full complexity of real-world decisions. We will collaborate with AV developers and AV taxi businesses to design real-world evaluation programmes, with ethnographic analysis to investigate richer understanding of user behaviour, user preferences, and behavioural patterns. Development of trust in AVs from regulation, vendor reputation and user experience needs further study to enhance user confidence in AV technology. This could include studying the impact of explanation and information to reduce uncertainty about AVs.

6. Conclusions

Key Findings: Decisions on AV adoption are likely to be framed by the decision context, with taxi/ride-sharing decisions invoking system I-style processing with a small number of salient variables. We argue that cost, safety and time pressure are important influences for taxi ride-sharing decisions, associated with prior experience and risk, although we could not assess these thoroughly given the relative inexperience of our subjects. In contrast, AV purchase and formation of general attitudes to AVs is likely to invoke system II reasoning with more decision influences, trade-offs and mental model-based reasoning. Our study also indicates that many contextual influences, ethical trade-offs and

personal attitudes may frame these decisions. External influence via news, reviews, word of mouth, etc. appear to be less important, although government regulation may be an influence.

Implications: The road travel environment may lead to very different assessment of the viability of AVs, demonstrating that people may be initially reticent to accept AVs unless they have a good track record in a well-regulated, controlled environment. In the future, as exposure to AV vehicles increases, we expect general system II reasoning will lead to attitude formation balancing dependability, safety and trust as more information facilitates decisions. Taking AV or conventional taxis will become a fast-path choice based on each individual's assessment of safety with cost trade-offs, coupled with memory of prior experience relating to dependability.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

LP was funded by the University of Manchester Business School.

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