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"I trust Norway" – Investigating acceptance of shared autonomous shuttles using open and closed questions in short-form street interviews

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ABSTRACT

Shared autonomous shuttles (SASs) could improve the mobility infrastructure in the worlds' growing cities. This novel service could reduce congestion and improve both mobility and sustainability. To facilitate the implementation of SASs, more research is needed on the psychological aspects of sharing a small, intimate shuttle with strangers. The current study is among the first to use open-ended questions to investigate SAS acceptance. This investigation is based on the Multi-Level Model on Automated Vehicle Acceptance (MAVA). We had 236 participants answer short-form interviews including both open-ended questions and quantitative items. Quantitative data were analyzed using descriptive statistics and correlations, and qualitative data analyzed with directed content analysis. Respondents seem very positive about the proposed new transport service. We found that perceived usefulness, hedonic motivation, trust, and social influence shared large correlations with intentions to use. Other factors such as demographics, technology savviness and use of public transport did not share a linear relationship with intentions to use. Qualitative analysis suggests that, while most people do not mind sharing shuttles with strangers, some could find the social situation deterring. People seem most concerned with availability, effectiveness, travel cost and safety. The reported positive attitudes towards the service seem predicated upon trust in the government regulation and proper testing of the technology, that many think of as immature. Regulation and thorough testing may be paramount in keeping people positive. This study emphasizes the importance of trust and safety to adoption of SAS, while suggesting new factors that need further investigation.

1. Introduction

Shared autonomous shuttles (SASs) are a promising new form of transportation that has the potential to improve mobility and traffic safety, reduce congestion, and promote sustainability (Hult et al., 2016; Iclodean et al., 2020; Jones & Leibowicz, 2019; Matsunaka et al., 2020). Unlike automation of privately owned cars, shared autonomous vehicles (AVs) introduced to the public transport system have the potential to make mobility simple and cheap for more people, due to cost reduction and optimalization (COWI, 2019; Nenseth et al., 2019; PTV Group, 2015; Zhang et al., 2015). The success of these services depends on factors that needs to be well understood to promote adoption. Autonomous shuttles will also enable transport providers to offer efficient mobility as a service (MAAS). This is important as transport providers could circumvent the hurdle of first mile/last mile issues: getting to and from high volume transit. A ridesharing shuttle service could be requested through an app to come pick passengers up wherever they desire. Algorithms could calculate the fastest route between participants and estimate their transport time with real-time precision. There is, however, still a lack of research into the barriers of such services and the social situation that arises within small and intimate SASs (Greifenstein, 2024; Sanguinetti et al., 2019). Research has previously investigated the technical aspects of AVs, but there is now a growing interest in the psychological aspects of introducing SASs into the transport system (Azad et al., 2019; Cohen et al., 2020; Greifenstein, 2024). New methods are being developed to accurately measure and predict people's willingness to use SASs in the public transport system. In this paper, we will refer to the SAS as either buses or shuttles, to keep them separate from private cars.

There has been widespread testing of small SASs across Europe and

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in Norway (Hagenzieker et al., 2021). These have mostly been using small vehicles (six-eight passengers) at low speeds (12–15 km/h) with a steward on-board. The main transport provider in the Oslo-region, Ruter, has completed several tests of SASs and fully intend on developing it into a full service in the coming years (Green et al., 2022). Research has found that several of these early tests violate traffic regulations and provoke evasive maneuvers from other road users (Ceunynck et al., 2022). These SASs have engendered dangerous situations with their slow and passive driving (Mirnig et al., 2022; Pokorny et al., 2021), and may be susceptible to be taken advantage of by other road users due to its' passive driving (Bjørnskau et al., 2023). As Ruter's recent pilot concluded, surveys suggests that trust and optimism in the deployment of SASs decreased during the pilot period in the local area (Aasvik et al., 2024). This conclusion opposes other similar research that suggests interactions with SASs could improve perceptions of them (For a case using similar context, see: Mouratidis & Serrano, 2021). Hence, even though many people report high intentions to use SASs, they may not yet be technologically mature enough to be a natural part of people's transport (Bala et al., 2023; Mouratidis & Serrano, 2021). Perhaps motivated by Waymo's apparent success in USA, Ruter are determined to continue testing AVs using increasingly sophisticated technology and aim to launch a new service by early 2025 (Meyer, 2024; Ruter, 2023). More research is needed to expand our knowledge of how to best guide implementation of these services. This study will explore how existing technology acceptance models should be adapted to the reality of shared autonomous shuttles.

1.1. Literature review

One of the more notorious frameworks for investigating technology acceptance is the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2016). This model is an amalgamation of several previous behavior models and was recently adapted to the Multi-Level Model on Autonomous Vehicle Acceptance (MAVA; Nordhoff et al., 2019). This framework builds on previous research to suggest factors that explain and predict intentions to use AVs. The MAVA-framework is vast, and the original authors of the model suggest to adapt the model to the context in which it is being applied (Nordhoff et al., 2019). The model has nine main factors, including performance expectancy, effort expectancy, facilitating conditions, safety, service and vehicle characteristics, social influence, hedonic motivation, perceived benefits, and perceived risk. These are thought to share influence with other factors relating to exposure, socio-demographics, travel behavior, and personality. The factors identified in the MAVA may overlap with each other. Some research suggests that factors predicting intentions to use AVs can be adequately explained by just one factor, finding significant interrelations between MAVA-factors (de Winter & Nordhoff, 2022; Korkmaz et al., 2021; Nordhoff, Madigan, et al., 2020). Other studies find multiple factors a more sufficient solution (Etminani-Ghasrodashti et al., 2023; Kacperski et al., 2021). As such, the considerable MAVA and UTAUT-frameworks may need further examination, especially considering the new issues regarding the social situation arising inside small, shared AVs used in public transport.

Other approaches to AV acceptance have been proposed. The UTAUT-4AV achieves great explanatory power in multivariate analyses (Bellet & Banet, 2023). This adaption introduces satisfaction with current travel modes. Other studies point to other factors as important for understanding AV acceptance. Trust has long been one of the most investigated factors, and may indeed be critical for technology acceptance (Choi & Ji, 2015; Körber, 2019; Paddeu et al., 2020; T. Zhang et al., 2021). A recent paper indeed puts "trust & safety" as the most foundational step towards AV acceptance (Nordhoff et al., 2023). Furthermore, usefulness and ease of use are found important for AV acceptance (Etminani-Ghasrodashti et al., 2023; Jing et al., 2020; Schikofsky et al., 2020; T. Zhang et al., 2021). Allowing for productive activities while riding, faster travel or reduced trip cost may be constituent factors of this increased utility and may explain why this trait impacts intentions to use the service. Other important factors seem to be people's tech-savviness and their optimism about SASs (Aasvik et al., 2024; Bansal et al., 2016; Lavieri et al., 2017; Nordhoff et al., 2022). It seems to be the case that young men are most keen on this new technology. However, sociodemographic variables seem to have a somewhat inconsistent effect on intention to use when psychological factors are controlled for (Greifenstein, 2024; Nordhoff et al., 2019). Additional factors, such as the understudied social situation in shared AVs, may play a role in SAV acceptance.

The UTAUT is aimed at general technology and the MAVA is aimed at AVs. There is scarce knowledge about the specific factors that are most important to SASs acceptance specifically. The shuttles could be perceived as intimate (shuttles typically have six to eight passengers) and breaching a privacy barrier by driving you all the way home. Sharing a ride in this fashion may also inhibit people from using their private cars as a 'cocoon' to buffer against their hectic lives (Sovacool & Axsen, 2018). The social situation within such small shared vehicles is not well understood nor integrated into the MAVA (Nordhoff et al., 2019; Sanguinetti et al., 2019). However, rider-to-rider discrimination could be a crucial issue for the implementation and acceptance of SASs, particularly because of their intimacy and planned stewardless operation (Middleton & Zhao, 2019). Research remains to be conducted that gives insight into the distinction between AVs in general and SASs in public transport. This may lead to more factors needing integration into the MAVA, such as social security issues and the intimacy of a SAS.

1.2. Research question

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There is little research investigating UTAUT frameworks using open-ended questions and no interview studies using the MAVA (Williams et al., 2015). In a recent review, 80 % of published studies on SAV acceptance were purely quantitative. The rest were a mix of reviews, mixed-methods and qualitative studies. This leaves an unbalance that disfavor the knowledge generation, particularly in an emerging field such as AV acceptance. Moreover, the case of SASs may further benefit from mixed approaches, as little is known about the specific user needs in such a service. Because these services are largely unavailable, care should be taken in introducing people to this novel idea, and researchers should be wary of how their interactions with research participants color the participants perceptions of SASs (Delbosc, 2022). Using mixed approaches with proper information about the service could fill this information gap and map out differences between acceptance of AV and SAS.

In this study, we will employ a mixed-methods approach that seeks to better understand the relationships between key factors and how potential shuttle-riders make sense of them. We will use the constructs from MAVA and UTAUT as a foundation, as these represent the most used and contemporary frameworks. The research questions are 1) to what extent there is statistical relationships between MAVA-factors, and between MAVA-factors and intention to use a future SAS-service and 2) how do people perceive a SASs service when asked open-ended questions based on MAVA-factors. These will be investigated using a short-form street interview approach with qualitative and quantitative analyses.

2. Materials and methods

2.1. Survey design

We wanted to include both closed and open-ended questions to inform our research questions. To this end, we designed a short-form street interview questionnaire that accommodated both approaches. Information about the future service vetted by Ruter was given to participants including illustrations by the design firm "*Melkeveien*". The questions were informed by previous research from the Norwegian context and the MAVA-framework (Aasvik et al., 2024; Nordhoff et al., 2019). The survey included demographic information, questions on technological savviness, SASs information, nine MAVA-variables and finally some questions about improvements to the service. The nine MAVA-variables included were designed to cover factors relating to performance expectancy, perceived benefits, effort expectancy, facilitating conditions, trust, perceived risk, social influence, safety, hedonic motivation, service and vehicle characteristics, social situation, and intention to use. Several of these were covered by a single item due to the short-form nature of the survey. Because all previous research using the MAVA have been closed-ended questions, the current questions were adapted to accommodate our open-ended short street interview format. These included both a yes/no dichotomous answer and an open-ended enquiry asking them to elaborate "why" they chose as they did. The complete survey and an elaboration on survey design and items can be found in the supplementary materials.

2.2. Recruitment

Respondents were recruited at two locations by three students. The first location was a convention for electric and future mobility "EVS35" organized in the suburbs of Oslo. This collection was done for two days 11th and 12th of June 2022. This collection was organized to collect people who were likely to be familiar with vehicle automation and the current developments. The second location was along one of the main shopping streets in downtown Oslo, "Karl Johan's Gate" on 13th and 14th of June 2022. This collection location was chosen to gather a more general population who did not necessarily know much about SASs. In Oslo, the transport mode split is 31 % public transport, 29 % car, and 38 % by foot or bike (Statistikkbanken, 2024). This suggests that there is a fair share of travelers in the area who regularly use shared transportation already. The available public transport services include train, metro, tram, bus, and ferries. Although there have been several SAS pilots in the area, there were none at the time of data collection, piloted or otherwise. Norway has one of the largest shares of electric vehicles in the world, with about a quarter of the entire car fleet being electric (Statistics Norway, 2024). This suggests that many car users will be familiar with advanced driver assistance systems.

The data collection period lasted for seven hours each day. Participants were invited to answer some questions regarding the future of transport and incentivized with gift cards. Collection of informed consent and responses to questionnaires were filled out by hand on paper by the students. They were instructed to note any additional comments from participants.

2.3. Analysis

This study was designed to include both quantitative and qualitative data. This approximates a mixed methods approach (Johnson & Onwuegbuzie, 2004). The qualitative data in our study were processed in a numerical fashion using counts of emerging themes from a directed content analysis (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005). This kind of content analysis is appropriate when coding is guided by previous theory, which suits the purposes of this paper. This means approaching data with a predetermined bias. However, content that do not fit into the existing framework is all the more useful for expanding the horizons of the current paradigm (Hsieh & Shannon, 2005). We approached the text data with preexisting codes hailing from the MAVA-framework but were also attentive to information that did not fit neatly into this theoretical background. The first author was responsible for coding the interviews.

The short format of the current survey led us to only use dichotomous quantitative variables. The analysis was somewhat limited by this because it may impose a binarity of respondents' answers and underestimate the variability. However, when used correctly, such variables can still serve to measure sample-wide differences between respondents and uncover basic relationships between variables (Agresti, 2018). Quantitative analysis was done using MS Excel and Jamovi. Pearson correlation coefficients were calculated as it yields the same results between dichotomous variables as point-biserial or phi estimates. We recoded the constituent items of the tech-savviness scale to be at an ordinal level so that its' coefficient would be interpretable. Where there was no natural ordering of variables, we simply kept them dichotomous. Their interpretations remain as strength of the linear relation between the variables. For multivariate analyses, we coded dichotomous items as 0 = "no" and 1 = "yes". For these analyses, "unsure" were coded as missing. We tested a logistic regression model on survey items but discovered several problems with running such analysis. This included influential outliers and high residual values. Therefore, we did not go forward with the regression analysis. Qualitative analyses were done in MS Excel and IBM SPSS 29. An elaboration on methods and ontology is presented in the supplementary materials.

3. Results

3.1. Descriptive

Descriptive statistics for all numerical variables in the study are presented in Table 1.

There was an even split in the location for completion of the interview with more men in total. This may be because the EVS35-conference had a heavy skew towards men. There was also high familiarity with SASs pilots in Norway, even though the pilots have been mostly locally announced. Most participants had heard about self-driving cars and ADAS. Naturally, because of the sampling location, respondents score high on being early tech-users. Approximately half our sample are current users of public transport. Most people prefer SASs to look like buses instead of private cars, but most find the distinction irrelevant. There was a strong preference in our sample for facing the driving direction, but almost one in four prefers a social option. There was also a preference for a human driver, with one third preferring an autonomous driver.

There were several skews uncovered in the MAVA-variables. Respondents generally tended towards not disliking the proximity within SASs. They did not find them fun to travel with but perceived them as useful. Interviewees did not think it would be difficult to use them and did not find them unsafe before and after riding. Most people would trust the buses, think that their friends would use them, and regard comfort as important. A very high proportion of respondents were positive about using the SASs when available. Thus, it seems that our sample are positive about the prospect of introducing SASs into the transport system.

3.2. Correlation matrix

We calculated a correlation matrix to investigate the strength of relationship between study variables. The matrix is presented in the supplementary materials.

Whether participants were interviewed at the EV convention or on a shopping street has several significant correlations. They were more tech-savvy and preferred autonomous driving to a human driver. Markedly, there were more men at the convention. Women are less tech-savvy and prefer a human driver. Women also prefer less social seating options and trust the bus service less. Age, but not gender, share a negative significant correlation with intentions to use such a service when it becomes available. There are few significant correlations with most MAVA-variables; older participants report it to be less fun and less useful to travel with SAS. Using public transport correlates with finding such a novel bus service more useful and more fun.

Seating preference is uncorrelated with MAVA-variables, but those who prefer to sit in the driving direction also want autonomous driving.

Table 1
Frequencies and percentages of all numerical study variables. N = 236.

Variable	Levels	N	%
Place	EVS35	124	53 %
	Karl Johan Street	112	47 %
Gender	Men	159	67 %
	Women	77	33 %
Familiarity w/ pilots	None	87	37 %
	Heard of	87	37 %
	Seen	39	17 %
	Tried	23	10 %
Familiarity w/Self driving cars	None	66	28 %
	Heard of	116	49 %
	Seen	33	14 %
	Tried	21	9 %
Familiarity w/ADAS	None	24	10 %
	Heard of	18	8 %
	Seen	24	10 %
	Tried	170	72 %
Technology use	Among last	17	7 %
	Average	144	61 %
	Among first	75	32 %
Transport	Public transport	132	56 %
	Active mobility	153	65 %
	Car use	178	75 %
Preferred appearance of AV shuttle	Bus	130	37 %
	Private car	19	8 %
	Irrelevant	87	55 %
Seat preference	No preference	16	7 %
	Social	54	23 %
	Driving direction	166	70 %
Driver preferences	No preference	16	7 %
	Autonomous driving	80	34 %
	Human driver	140	59 %
Dislike proximity to others	Unsure	16	7 %
	No	140	59 %
	Yes	80	34 %
Fun to travel with	Unsure	3	1 %
	No	155	66 %
	Yes	78	33 %
Useful	Unsure	13	6 %
	No	61	26 %
	Yes	162	69 %
Difficult to use	Unsure	4	2 %
	No	203	86 %
	Yes	29	12 %
Unsafe before & underway	Unsure	13	6 %
	No	189	80 %
	Yes	34	14 %
Trust buses	Unsure	10	4 %
	No	48	20 %
	Yes	178	75 %
Friends would use	Unsure	15	6 %
	No	27	11 %
	Yes	194	82 %
Comfort is important	Unsure	11	5 %
	No	26	11 %
	Yes	199	84 %
Use bus when available	Unsure	5	2 %
	No	16	7 %
	Yes	215	91 %

Those who report wanting a human driver, trust the shuttle less.

MAVA-variables share some significant correlations. Those who find it uncomfortable being close to others also trust the buses less. Perceived usefulness, hedonic motivation (fun to travel), trust, and social norms correlated with intentions to use the bus. Those who trust the service in general are less likely to report feeling unsafe before riding and while riding.

3.3. Directed content analysis

For the qualitative analysis of open-ended questions, we conducted a directed content analysis of given text answers. Text answers were given to 11 questions about seating preference and driver preference and the nine MAVA-based questions. We approached the text with an intention to see what factors from the MAVA were being mentioned in their answers, and deductively coded them into this framework. If a response did not discuss themes related to the MAVA, or were unique in other ways, they were given other original codes to represent this. All text answers were coded in two separate steps, going from a set of broader categories towards the general aspects of the MAVA. This allowed for similarities and differences to more clearly crystallize. Quotes are still not direct citations because text answers were somewhat abbreviated in the data collection process. Not all participants gave open answers to all questions, answers were only written down where they had something to elaborate. A detailed presentation of the 11 questions analyzed is presented in the supplementary materials.

Because the qualitative analysis is theoretically directed and deductive, there is reason to assume that we end up finding increased mentions of themes we are looking for. Asking about the different factors from the MAVA-model will surely elicit responses that echo these factors' importance. Therefore, how many times a factor is mentioned, should not be taken as evidence for its' importance, nor as evidence for the legitimacy of the psychometric properties of the factor itself. This is not the goal of this paper. We seek information about how people use their own experience to make sense of a largely unknown future bus service. Therefore, it can be illuminating to see which factors emerge most commonly and how people construe these factors for themselves. There was also room for other, novel factors to be identified. Table 2 displays the total summary of categories identified across the nine included MAVA-factors, as well as the two depictions of vehicle characteristics: seating preference and driving direction.

The most identified factor was related to service and vehicle characteristics. This was most commonly regarding the availability of the service and the digital and MAAS-aspects of it. Some noted that they may be outside the intended service-area: "I live in the countryside". Several respondents also mentioned the importance of ticket costs, which was also coded under this factor: "Depends on travel cost". The second and third most mentioned factors includes trust and safety. These are often grouped together and can be heavily interlinked, which we also find in the correlation matrix. Respondents often cited their trust in governmental testing of the technology, and that SAS only would be implemented if they were found to be safe: "(I am) somewhat skeptical, but I trust their (the governments') testing". Hedonic motivations, such as pleasure and excitement for the novelty of a SAS, is also commonly mentioned: "Exciting new technology". Conversely, this factor also

Table 2
Summary of categories emerging in all open text answers about the nine MAVA-factors and the two depictions of vehicle characteristics.

Categories	Times categorized
Service and vehicle characteristics	107
Trust	98
Safety	93
Social situation	**79**
Hedonic motivation	68
Immature	**57**
Testing	**36**
Habit	**25**
If (contingent attitudes)	**12**
Travel behavior	12
Intentions	10
Perceived risks	10
Previous experience	8
Perceived benefits	7
Age	5
Social influence	5
Solidarity	**5**
Environment	**3**
Tech-optimism	2
Effort expectancy	1

Note. Bold = Extraneously identified categories to the MAVA-factors.

represents a fear of being motion sick or anticipation of unpleasant situations within the shuttles.

There were seven newly identified categories in our data as compared to the nine MAVA items already included in the questionnaire. While these do not stem from the MAVA, some of these can be argued as semantically belonging under other MAVA-factors, such as “Testing” being part of perceived risks that the government will work to mitigate. These respondents hinged their optimism on a confidence that the authorities only would allow such technology if it were tested thoroughly. “Immature” could also be put within the umbrella of trust, as they lack a belief that the technology can drive safely either currently or at all. Many seem concerned with the ability of the technology, and this uncertainty is the shaky foundation on which their positivity is built.

From the 11 individual questions, we see some variance in number of categories mentioned. The question about comfort only elicited responses regarding “Service and vehicle characteristics”, while others elicited up to seven different categories. The mean number mentioned was five categories, suggesting that even when asking about factors such as “intentions to use”, people draw on many different aspects to justify their answers. This cross referencing of factors seems very prevalent and gives novel insight into the factors’ inter-connectedness. We also find that the novel social factor of SASs divide opinions, with most comments suggesting a positive attitude towards sharing the vehicles with strangers. This seems to depend upon respondents perceiving the service as a traditional bus, expressing their expectations that “it is public transport”.

3.3.1. Additional open answers

At the very end of the questionnaire, there were four open questions about the service in general. These were not related directly to MAVA-constructs and are therefore presented by themselves in Table 3. These text answers underwent the same coding procedure using DCA as an analysis tool.

Most respondents prefer having the opportunity to be picked up by the door. Several note that this would be one of the main benefits of such a service. Those who were undecided said it depended on price, travel time, and their city size. When asked directly, most respondents also noted it would be OK to share such a vehicle. A common response was “(it seems) just like usual public transport”.

Table 3
Respondents’ coded answers to open questions about the SAS service.

Question	Category	N	%
PUDO [a] preference	Both	14	6
	Dependent	7	3
	Door	143	60
	Bus stop	71	30
Thoughts on sharing	Ok	221	93
	Unsafe	15	6
What would improve the service?	Availability	58	25
	Environment	3	1
	Hedonic motivation	6	3
	Larger	6	3
	Performance expectancy	29	12
	Safety	17	7
	Service and vehicle characteristics	47	20
	Smaller	2	1
	Social	2	1
What would make the service less attractive?	Autonomous driver	2	1
	Availability	14	6
	Hedonic motivation	6	3
	Larger	2	1
	Performance expectancy	38	16
	Safety	30	13
	Service and vehicle characteristics	58	25
	Social	8	3
	Solidarity	2	1

Note. [a] Pick-up/drop-of.

For both improving the service and making it worse, availability was mentioned so often that we decided to have these responses in a separate category, while usually coded as a Service characteristic. Most answers regarding performance expectancy regarded travel time and reliability of the service. This seems a very common concern: “We need to be able to trust its’ punctuality”. Service and vehicle characteristics mostly entail cost of travel. Some also mentioned accessibility design for wheelchairs, strollers, and visually impaired travelers. Trust and safety remain important: “if it brakes too hard, is unpredictable and moves slowly.”.

4. Discussion

In this paper, we investigated key aspects that impact intentions to use SASs identified by the MAVA-framework. We also investigated how people perceive a future SAS service using open-ended questions. In the quantitative analysis we find that people generally seem very positive to the idea of using SAS. This willingness to use shares a linear relationship with usefulness, hedonic motivation, trust, and norms. Other factors such as participants’ background variables, and preferences for seat orientation and driver preference do not significantly correlate with intentions to use. The qualitative analysis reinforces the idea that some factors are more salient to respondents than others. This may be impacted by the lack of reference to a novel service. Respondents often mention availability in their area, travel cost, and safety/trust. Directed content analysis suggests that respondents combine and use multiple factors when asked about their perceptions. Most seem to be fine with sharing a small SAS with strangers, but a substantial portion would dislike the proximity to others.

Intentions to use was heavily skewed with only 16 respondents (7 %) answering that they would not use it. This may partly explain why we were unable to meet regression assumptions. Only four of the included MAVA items were statistically significant in the correlation, which may also be another hint that the MAVA factors represent one underlying latent variable (de Winter & Nordhoff, 2022). While we find some significant correlations between study variables, the MAVA-factors seem less correlated in this study than other investigations (de Winter & Nordhoff, 2022; Korkmaz et al., 2021; Nordhoff, Madigan, et al., 2020). This may be an artefact of the dichotomous and skewed nature of variables in this study or suggesting a different structure for SASs in public transport than for AVs in general. As this paper is ill equipped to investigate factor structures, future research should continue this investigation. It is somewhat surprising that we do not find any effects of gender, tech-savviness, nor public transport use on intentions to use. It seems that participants’ background variables are less important when controlling for other key variables such as trust and norms. A similar report of a Norwegian sample where background variables were less important for intention to use was recently published, giving credence to this interpretation (Aasvik et al., 2024).

The qualitative analysis suggests that some factors hailing from the MAVA are repeated more often than others. People simply find it more prominent to mention aspects such as geographical availability, safety, and travel cost than their tech-optimism or effort expectancy. This is similar to other findings using similar approaches (Dichabeng et al., 2021). Energy consumption, air pollution, economy of transport providers, social equity, and legal liability, as identified by the moral-normative aspects of MAVA, seem to be less important for the sample in this study (Nordhoff et al., 2019). People seem more involved with their personal affairs and everyday commute rather than high-level reasoning about societal issues. Some of these findings may also be impacted by respondents’ lack of information about the service or the short form of the current interviews. While we provided rudimentary information about the service, we failed to implement information about cost, availability, or safety. This informational void may contribute to their fixation on these issues; they lack proper information for establishing comparisons with transport modes they already know and use. Before potential passengers evaluate factors like the shuttles' environmental impact, they seem more involved with whether it would be available, affordable, and safe to use.

All in all, our respondents seem to think about SASs as an exciting prospect for the future. This is highlighted by the high number of people willing to use the buses when they become available. Previous research has found that people may be particularly prone to want to use SASs in areas where public transport is currently infrequent (Mouratidis & Serrano, 2021). This can be seen in conjunction with our finding that many participants worry about availability in their residential area. Content analysis of respondents' text answers suggest excitement and trust in the governments' implementation of such novel technology. Trust and safety has long been noted as key factors in public acceptance of autonomous vehicles, and it seems to hold true for the implementation of SASs as well (Adnan et al., 2018; Choi & Ji, 2015; Nordhoff, Stapel, et al., 2020; Salonen & Haavisto, 2019). However, for many people, this trust is dependent on proper testing of a technology that many think of as immature. Safe implementation thus seems a key strategy for keeping potential riders excited about this future bus service (Mouratidis & Serrano, 2021). Recent research into the piloting of SASs in Norway, suggest that having an immature version of the technology driving in ones' neighborhood may be detrimental to this optimism (Aasvik et al., 2024). Other research have found that interactions with different types of AVs may help improve perceptions of it, so continued testing in a safe fashion may also be beneficial to the public perception of SAS (Eden et al., 2017; Salonen & Haavisto, 2019; Tennant et al., 2016).

Like with other Nordic pilots, respondents are concerned with effectiveness of such a shuttle service (Lundgren et al., 2020). How efficiently this shuttle will be able to transport passengers with different destinations will be a key challenge. In fact, some suggest that this increased travel time may be a greater barrier than the presence of a stranger (Lavieri & Bhat, 2019). While the optimistic and trusting attitude found in our study may be fragile, it is a great place to build from to create good impressions on a larger population. Because social influence seems an important factor when people decide whether to use the service in the future, having a positive tech-savvy group could be a great asset. According to our results, transport providers could capitalize on this by emphasizing the rigorous testing and safety measures. Transparency in implementation has been mentioned as an key factor, and transport providers should seek to be open about their issues and tests (Iclodean et al., 2020). Trust seems to be a key factor, both in terms of technology and regulation. This is in line with previous research on automated vehicles in general (Choi & Ji, 2015; Korkmaz et al., 2021; Paddeu et al., 2020).

The social situation seems to be an important difference between SASs implemented into public transport and AVs in general. Willingness to share has SASs has been under-studied (Dolins, 2021; Sanguinetti et al., 2019). Most of our respondents do not find this to be an issue, even with the small bus sizes. However, about a third of the sample would dislike this proximity, and most would prefer the seats oriented towards the direction of travel. Research suggests that providing information about the passengers in ridesharing can help overcome a potential barrier to acceptance, and impact willingness to pay for the service (Kearney & De Young, 1995; König et al., 2021). Rudimentary information about co-passengers could help people overcome discriminatory attitudes in sharing rides (Sarriera et al., 2017). Rider-to-rider discrimination could emerge as a critical issue in the future (Middleton & Zhao, 2019), and our sample seem to reflect that this holds true for a significant portion of potential riders. We know that perceptions of safety and fear of harassment is dependent on factors such as gender, also in egalitarian countries like Norway (Backer-Grøndahl et al., 2007; Ceccato, 2017). These issues should be explored further, as SASs without a steward may represent a unique case in which social security becomes crucial. Going forwards, studies investigating SASs should consider focusing on norms, such as whether friends would use, usefulness, hedonic motivation, and trust, as well as social security. One should also take care to clarify the nature of the AVs investigated, particularly with regards to potential availability, travel cost, and technical capability.

4.1. Strengths & limitations

This is the first paper to investigate intentions to use SAS using open-ended questions based on MAVA factors. Our results indicated that there are some differences in which factors people deem important when deciding to use SAS, as compared to AVs in general. These are factors concerning availability, trust, and the social situation on-board.

There are some notable limitations in the current study. The dichotomous nature of the quantitative variables limits the variance that is subject to our analysis. This could inhibit some relationships from emerging. The nature of our variables also inhibited us from doing any multivariate analyses. The selection of factors from the MAVA or UTAUT frameworks may also be subject to some bias, as we did not aim to develop a conceptual model to be tested in this paper. Additionally, forcing respondents to take a binary approach to a subject may be a poor representation of their perceptions. Future research should follow up our quantitative findings using questionnaires that offer better psychometric properties.

Using a deductive qualitative approach could restrict the way in which data is generated, encoded, and analyzed. It puts a certain set of lenses on the data that may occlude other important factors. However, technology acceptance and use is a long researched area with a well-established theoretical framework. While it is justified to use this approach, a more open inquisition into people's lived reality of interpreting new transport services may yield novel ideas. We are confident that our questions and study design facilitated incorporation of the main concerns and ideas from our participants.

Another important limitation is the generalizability of our samples. They were either very interested in technology or a sample of people visiting a busy tourist shopping street. These results can therefore not be considered generalizable to the entire population of Norway or abroad. However, the trends uncovered here could be applicable to other samples, particularly because we controlled for tech-savviness in our regression model. We also find that MAVA-factors do not capture all concerns related to the potential use of SAS. Interrelationships between MAVA-factors, and other extraneous factors such as those regarding the social situation, should be investigated in future research in order to build a better framework for understanding and influencing people's willingness to use SAS in the future.

4.2. Conclusion and future research

In this study, we pioneered the use of open-ended questions to explore the role of MAVA-factors in acceptance of SAS in public transport. We found that people have positive perceptions about SAS, and their intentions to use share a linear relationship with perceived usefulness, hedonic motivation, trust and the social influence of their friends. Directed content analysis suggest that availability, efficiency, and travel cost are important factors that respondents keep mentioning. The social situation may also be an important unique factor to the SASs as compared to AVs in general. The intimate nature of the service could preclude certain groups from engaging with this novel service, due to lack of social security. It seems that people's optimism about SASs is hinged on proper testing of the service and that people keep an optimistic attitude. The recent sub-optimal tests in Norway may be detrimental to keeping this high intention to use. Transit agencies should take note of this and only launch experimental pilots where they will not harm public perception. Furthermore, focusing on building trust, improving usefulness, and keeping a positive social norm about the service, may be of great importance to maximize SAS acceptability.

Future research should continue to improve the ways in which we can measure and predict intentions to use SASs. Specifically, doing a large-scale investigation of how the identified factors work differently in public transport than for AVs in general. Such an investigation should examine the psychometric properties of MAVA-factors and help develop a more standardized way of measuring intentions to use SASs, considering the novel findings about the social situation. Research could also use other theoretical approaches such as personality and individual difference variables to see whether these can improve the efficacy of prediction, also including perceptions of social security in SASs. These findings and future directions could be critical for integration of SAS into the public transport system.

CRediT authorship contribution statement

Ole Aasvik: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Software, Writing – original draft. **Marjan Hagenzieker:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing. **Pål Ulleberg:** Formal analysis, Methodology, Supervision, Writing – review & editing.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.trip.2025.101414.

Data availability

Data will be made available on request.

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