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Document type

Postprint (accepted version)

This version is available at

<https://refubium.fu-berlin.de/handle/fub188/25358>

Citation details

Zoellick JC, Kuhlmeier A, Schenk L, Schindel D, Blüher S. Amused, accepted, and used? Attitudes and emotions towards automated vehicles, their relationships, and predictive value for usage intention. *Transportation Research Part F: Traffic Psychology and Behaviour*. [Online] Elsevier BV; 2019;65: 68–78. DOI: 10.1016/j.trf.2019.07.009

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Amused, accepted, and used? Attitudes and emotions towards automated vehicles, their relationships, and predictive value for usage intention.

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Abstract

Automated vehicles (AVs) have left the laboratories and can be experienced in several projects, e.g. at the premises of a clinic in Germany. With this transition, research on AV attitudes no longer needs to rely on questionnaires with hypothetical scenarios and simulations. Previous research – limited by the unavailability of AVs – has provided ambivalent results regarding age and gender differences in attitudes towards AVs. We present research results about the role of age and gender in connection with attitudes such as acceptance, perceived safety, and trust, as well as intention to use. We additionally demonstrate relationships between those constructs and emotions such as amusement, fear, and surprise. Data were collected from participants ($n = 125$) after having experienced an AV ride with level 4 automation on two campuses of a clinic in Berlin, Germany. Results reveal strong correlations between all attitudes ($.55 \leq r \leq .71$; $p < .01$) and show acceptance and perceived safety to be solid predictors of intention to use AVs. We also found age to be a significant predictor for usage intention even when other attitudes are considered ($\beta = -0.22$; $p < .01$). MANOVA results point to gender differences in all constructs, but with limited confidence ($5.40 \leq F \leq 18.34$; $p \leq .02$). However, we reject our hypothesis that young men are highly accepting, trusting, and intending to use AVs compared to other combinations of age and gender. We recommend using a mix of attitude, emotion, and behavioural (intention) measures in future research on AVs together with more transparency regarding construct definitions and study materials.

Keywords: autonomous driving; physical experience of automated vehicles; technology acceptance; trust in automated vehicles; emotions towards automated vehicles

1. Introduction

Automated vehicles (AVs) are the mobility application of digitalisation. We define AVs as shared vehicles that are, electrically powered, and able to perform “all driving functions under certain conditions” (NHTSA, 2017, p. 4). They look unfamiliar being equipped with multiple sensors monitoring their surroundings and without the need for many features of regular cars, e.g. steering wheel or aligned seats (Nordhoff, van Arem, & Happee, 2016). Figure 1 depicts an example of such a vehicle used in the present study. It can transport up to 15 people with a maximum speed of 12 km/h and is electrically powered. It navigates through GPS signals and LIDAR sensors alongside a programmed route. With these features, the behaviour of AVs differs from humans in their communication with passengers, pedestrians, and other road users. Thus, attitudes of road users might be key to understand the prospects of this emerging technology (Nordhoff et al., 2016; Rahman, Lesch, Horrey, & Strawderman, 2017; Van der Laan, Heino, & de Waard, 1997).

The aim of this paper is to understand relationships between attitudes and behavioural intentions towards AVs and their connection with sociodemographic variables. For this purpose, we present research results from a survey following physical experience as users of an AV at the premises of a clinic in Berlin, Germany. With increased validity compared to hypothetical scenarios or simulation studies, we test hypotheses regarding (1) the relationship between acceptance, trust, perceived safety, and behavioural intentions, (2) socio-demographics of users, and (3) a model predicting intention to use AVs in the future.



Figure 1. Navya Arma with level-4 automation at the Charité Virchow Klinikum. By Charité – Universitätsmedizin Berlin, 2018, retrieved from [https://www.wir-fahren-zukunft.de/bilder/#iLightbox\[gallery_image_1\]/34](https://www.wir-fahren-zukunft.de/bilder/#iLightbox[gallery_image_1]/34) Licensed under a CC BY 2.0 license

The remainder of the article is organised as follows. First, we review the literature regarding AV attitudes and behavioural intentions, their results regarding age and gender, and corresponding hypotheses. Second, we define all relevant constructs, describe the procedure in this study, and depict the analysis plan. Third, we provide results of all scales, our power calculation, and the hypothesis testing. Lastly, we discuss all findings amidst relevant limitations and draw conclusions from this study.

2. Literature, Model, and Hypotheses

Models about AV attitudes typically include variables such as social acceptability, willingness to pay, usefulness, or intentions to use as outcomes predicted by pleasure, arousal, socio-demographics, perceived safety, or trust (Nordhoff et al., 2016; Osswald, Wurhofer, Trösterer, Beck, & Tscheligi, 2012). However, as AVs had been unavailable until recently, most studies relied on simulations (Cho, Park, Park, & Jung, 2017; Verberne, Ham, & Midden, 2015) or hypothetical scenarios (Bansal & Kockelman, 2017; Krueger, Rashidi, & Rose, 2016; Nordhoff, de Winter, Kyriakidis, van Arem, & Happee, 2018). This came at the cost of validity. Limitations of many studies include uncertainty about the transferability and applicability of their findings to physical use cases (Bansal & Kockelman, 2017; Fraedrich & Lenz, 2016; Krueger et al., 2016). Method diversity within AV attitude research (Adell, Várhelyi, & Nilsson, 2014) adds to validity concerns and seems to create more uncertainty and confusion as apparent in the ambivalence of results regarding age and gender in connection with AV attitudes and behavioural intentions.

Some studies find older people to be more trusting, accepting, and conscious about benefits of AVs leading them to higher willingness to pay (Regan et al., 2017; Rödel, Stadler, Meschtscherjakov, & Tscheligi, 2014). Others, in contrast, found higher willingness to pay for younger people (Bansal & Kockelman, 2016; Bansal, Kockelman, & Singh, 2016). Similarly, researchers found a positive correlation of age with intention to use AVs (Nordhoff, de Winter, Madigan, et al., 2018) and a negative one with willingness to use AVs (Hohenberger, Spörrle, & Welp, 2017). Older people also decided against both privately owned and shared AVs in favour of regular cars in a stated preference design (Haboucha, Ishaq, & Shiftan, 2017). Payre, Cestac, and Delhomme (2014) did not find age effects on intention to use in three hierarchical regression analyses at all. However, being female was a predictor in their base model. This gender effect was devoured once they introduced acceptability and attitudes to the equation. In contrast, being male predicted willingness to use in Hohenberger et al.'s (2017) regression. Men were more willing to use, derive pleasure from, and less anxious about AVs than women (Hohenberger, Spörrle, & Welp, 2016). Madigan, Louw, Wilbrink, Schieben, and Merat (2017)

and Nordhoff, de Winter, Madigan, et al. (2018) – to our knowledge the only study with participants actually experiencing an AV – did not find gender effects for intention to use. Kyriakidis, Happee, and de Winter (2015) found neither clear age nor gender effects on willingness to pay, comfort, or enjoyment.

In contrast to unclear gender and age effects, relationships between constructs are more evident. Choi and Ji (2015) found trust to be a significant predictor of behavioural intention to use, perceived usefulness of, and perceived risk of AVs in a multiple. Nordhoff, de Winter, Madigan, et al. (2018) found a positive correlation between two principal components reflecting intention to use and the perceived effectiveness of the AV. Rödel et al. (2014) found a correlation between intention to use and attitudes, i.e. evaluations on a favourable/unfavourable dimension. Similarly, Hohenberger et al. (2016) found willingness to use AVs positively correlated with pleasure and negatively with anxiety. Unfortunately, many of the studies reporting age and gender differences either only included one attitude in their otherwise socio-demographic survey (Bansal & Kockelman, 2016, 2017; Bansal et al., 2016) or did not model and test relationships between the attitudes (Kyriakidis et al., 2015; Regan et al., 2017).

This very short overview does not even take into account methodological differences, reliability measures, or validity issues resulting from different study designs. These concerns lead to a chastening conclusion – knowledge about peoples' assessment of AVs might not be as dependable as depicted. It seems the only certainty in acceptance research is the widely held assumption that “acceptance is the precondition that will permit new [...] technologies to achieve their forecasted benefit levels” (Najm, Stearns, Howarth, Koopmann, & Hitz, 2006, p. 5-1).

In our pre-registration, we have formulated the research question “What do participants think of fully automated vehicles and what is their degree of acceptance?” We can specify and translate this into testable hypotheses. Based on previous studies (e.g., Nordhoff et al., 2016; Osswald et al., 2012) we expect to find the following:

Hypothesis 1: The constructs acceptance, trust, perceived safety, and intention to use correlate.

Hypothesis 2: Young men score significantly higher on the scales acceptance, trust, and intention to use than young women, old men, and old women.

Hypothesis 3: Socio-demographic variables (age and gender) lose predictive power for intention to use when adding latent constructs (acceptance, trust, and perceived safety)

Figure 2 portrays the relationship between the variables acceptance, perceived safety, trust, and intention to use with age and gender as socio-demographic variables as described in hypothesis 3. The model depicts a hierarchical regression analysis in which being male and younger predict higher intention to use as a baseline model. We successively add acceptance, trust, and perceived safety as predictors. We expect the explained variance to increase significantly with every step and coefficients for the socio-demographics to become smaller and less or non-significant.

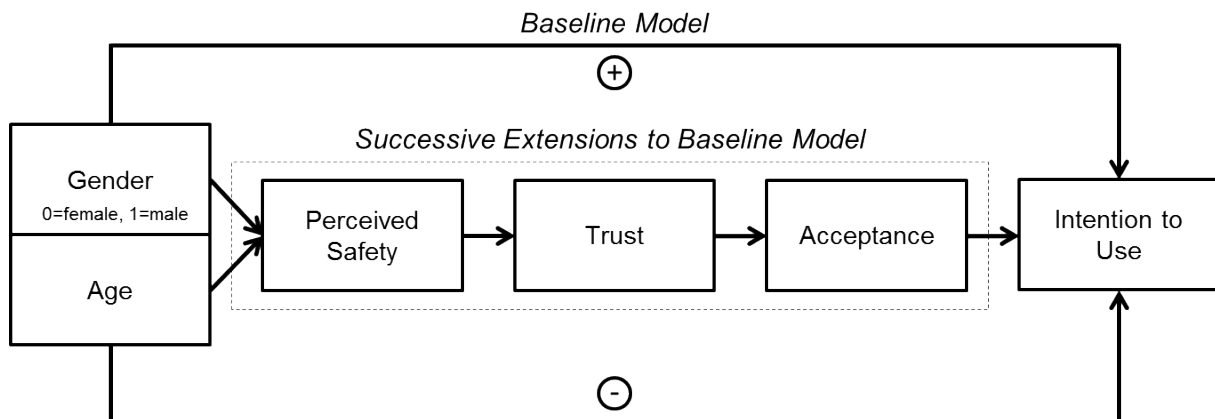


Figure 2. Conceptual model of the relationships between socio-demographics, attitudes, and behavioural outcomes. Hierarchical regression analyses with age and gender predicting intention to use as a baseline model and successive addition of acceptance, trust, and perceived safety.

3. Materials and Methods

3.1 Definitions and Measures

Previous literature has identified a range of variables of interest when considering user experience in AVs. Among them are acceptance, intention to use, perceived safety, and trust as well as emotions varying in their degree of valence and activation. However, construct definitions and the full list and origin of items are absent in many articles on these constructs (e.g., Adell et al., 2014; Nordhoff, de Winter, Madigan, et al., 2018; Schaefer, Chen, Szalma, & Hancock, 2016; Schieben, Griesche, Hesse, Fricke, & Baumann, 2014; Spyropoulou, Karlaftis, & Reed, 2014). To counteract this trend, we provide detailed accounts of all constructs and measures, and refer to our pre-registration for additional information (registration link <https://osf.io/92pv5/>). Our questionnaire contained 36 items and can be found in the supplementary materials in its original German and a translated English version. We asked for age, gender, driver's license, and provided an open item for comments.

3.1.1 Acceptance. In line with Van der Laan et al. (1997, p. 2), we define acceptance as “direct attitudes towards a system, i.e. predispositions to respond, or tendencies in terms of

‘approach/avoidance’ or ‘favourable/unfavourable’”. This definition stands in contrast to behavioural conceptions, e.g. from Adell (2009). Her acceptance definition corresponds to our conception of intention to use, *not acceptance*. Accordingly, we used the five-point semantic differential with attitudes developed by Van der Laan et al. (1997) as operationalisation of acceptance.

3.1.2 Intention to use. We define intention to use as “a person’s location on a subjective probability dimension involving a relation between himself and some action” – in our case taking a ride in an automated vehicle (Fishbein & Ajzen, 1975, p. 288). For measurement, we used three items developed by Osswald et al. (2012) on a five-point Likert scale ranging from *disagree* (1) to *agree* (5).

3.1.3 Perceived safety. In accordance with Osswald et al. (2012, p. 55), perceived safety is defined as “the degree to which an individual believes that using [AVs] will affect his or her well-being”, both generally and with consideration of attention/distraction. We used items 1, 2, 4, and 5 from their six-item scale on a five-point Likert scale ranging from *disagree* (1) to *agree* (5). We excluded items 3 and 6 beforehand, because they could not be adapted to AVs in a sensible way. We added a self-constructed item about general perceptions of safety when thinking of AVs.

3.1.4 Trust. We adapted Pavlou’s (2003, p. 106) definition of trust as “the belief that allows [users] to willingly become vulnerable to [automated vehicles] after having taken [its] characteristics into consideration”. Our operationalisation includes three adapted items from Pavlou (2003) to fit the context of AVs (cf. Choi & Ji, 2015).

3.1.5 Emotions. We understand any emotion as a “complex phenomenon having neurophysiological, motor-expressive, and experiential components” (Izard, 1977, p. 64). However, the experiential component is the only one we measured. The four emotions definitions as conscious experiences can be found in Table 1. For measurement of surprise and fear, we used the DAS (Merten & Krause, 1993), and for boredom and amusement, we used the modified M-DAS (Renaud & Unz, 2006). All emotions were ranked on a five-point Likert scale ranging between *very weak* (1) and *very strong* (5).

Table 1

Definitions of the Emotions Amusement, Fear, Surprise, and Boredom

| Concept | Definition |
|-----------|---|
| Amusement | High arousal and positive valence belonging to the emotional family of joy (Izard, 1977; Scherer, 2005) |

| | |
|----------|--|
| Fear | High arousal and negative valence more activating than but related to distress with the potential to trigger 'fight or flight' behavioural responses (Izard, 1977) |
| Surprise | High arousal sparked by misexpected stimuli (positive or negative) resulting in a short-term behavioural impetus (Izard, 1977) |
| Boredom | Low arousal and slightly negative valence resulting from languidness and indifference (Izard, 1977; Scherer, 2005) |

3.2 Procedure

We collected data at the Long Night of the Sciences – a special event of museums, universities, and other knowledge institutions in Berlin and Potsdam on 9 June 2018. On the two Charité campuses Virchow-Klinikum (CVK) and Mitte (CCM), visitors were invited to ride an AV along round courses with 0.85 km and 1.20 km length, respectively, lasting 10 to 15 minutes. Both courses represented realistic traffic environments with intersections necessitating turns, cycle paths, and crosswalks and with corresponding road users. The model EZ10 from Easymile drove at CCM; the model Arma from Nayva drove at CVK. Both AVs drove a maximum of 12 km/h, navigated through GPS signals and LIDAR sensors, and were electrically powered. They were able to perform all driving functions automatically alongside the programmed routes. The routes are presented in Figure 3 with highlighted routes. A so-called operator for manual control supported each AV if the vehicle was overextended. The Berliner Verkehrsbetriebe (BVG) and the Berlin Senate Department for the Environment, Transport and Climate Protection were involved as project partners.



Figure 3. Maps of the campus areas with AV routes marked in blue. Hop-on-hop-off stations depicted as yellow hearts; wheelchairs symbolise stations equipped for the disabled. (A) Charité Campus Mitte with AVs driving counter clockwise. (B) Charité Virchow Klinikum with AVs driving counter clockwise; route of the AVs used in the pilot study in light blue; route additionally used in the project in dark blue. Originally by Charité – Universitätsmedizin Berlin, 2018, retrieved from <https://www.wir-fahren-zukunft.de/en/the-routes/> Licensed under a CC BY 2.0 license; figure and caption adopted from Zoellick, Kuhlmeier, Schenk, Schindel, and Blüher (2019).

We addressed passengers exiting the AVs at two highly frequented stations on each campus with an invitation to participate in our study. After explicating voluntariness, data processing for scientific purposes, anonymity, etc., and providing a sheet with these information in writing, we handed them the two-page questionnaire. Participants took between 5 and 10 minutes to complete the 36 items and did not receive material compensation. In accordance with our registration, we did not exclude people from participating, i.e. people under the age of 18 or without driver's license were included in the analyses.

3.3 Sample

The 125 participants (50% male) were on average 33.00 years old ($SD = 16.35$ years). 31% of participants did not have a driver's license. 56% of those were under 17 years old, i.e. the age to legally obtain a driver's license in Germany. 39% participated at CVK and 61% at CCM.

3.4 Analysis

As preliminary analyses, we calculated Little's MCAR test and imputed randomly missing data using expectation maximisation in SPSS 25 (IBM Corp., 2017). We then calculated exploratory factor analyses (EFAs) with oblimin rotation as well as reliability analyses on all scales.

Based on these preliminary results, we excluded one item from the perceived safety scale and the emotion boredom from further analyses. We used the acceptance mean, intention to use, trust, and perceived safety factor scores resulting from EFAs, and sum scores for the emotions amusement, fear, and surprise for further analyses. For further insights, we calculated means and other descriptive statistics on the scales intention to use, trust, and perceived safety. For all scales, we tested if they were significantly different from their neutral middle by calculating two-tailed t-tests with one sample setting Bonferroni adjusted alpha levels at $.05 / 8 = .006$ and $.01 / 8 = .001$.

We used G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) to calculate the achieved power of our test. For regressions (fixed model, R^2 deviation from zero), we set the effect size f^2 of .1, alpha-level of .05, sample size of 125, and 5 predictors. For correlations (bivariate normal model, two-tailed), we set ρ H1 of 0.2, alpha-level of .05, sample size of 125, and ρ H0

of 0. We also calculated the effect sizes we were able to identify with a power of .80 *ceteris paribus*. This calculation estimates the robustness of our analyses given a fixed sample size. Thus, we can contextualise and interpret results even from small samples.

We calculated two-tailed parametric (Pearson's r) and non-parametric (Spearman's ρ) correlations between acceptance, perceived safety, intention to use, trust, and those emotion scales providing adequate reliability and factor loadings. With (ordinal) Likert items and non-normally distributed data in the case of fear, we violated often-cited assumptions necessary for using parametric statistics (Norman, 2010). We calculated both for comparative purposes.

For testing our second hypothesis, we split the data set along the median in younger (≤ 33 years) and older (≥ 34 years) participants. We then calculated a one-way MANOVA with age and gender as factors, and acceptance, perceived safety, trust, and intention to use as outcomes.

Approaching the third hypothesis, we calculated the model displayed in Figure 2 as hierarchical regression analyses after testing several assumptions – namely linearity, normal distribution of the outcome, sample size compared to number of predictors, multicollinearity, outliers, and homoscedasticity. Starting with continuous age and dichotomous gender as predictors and intention to use as outcome, we successively added acceptance, trust, and perceived safety as predictors. This resulted in four models for comparison. Violating the assumption of linearity, we introduced quadratic terms for our continuous predictors and compared this fifth model with the results of the previous four.

4. Results

4.1 Preliminary Analyses

With 3% missing data, Little's MCAR test retrieved significant results ($\chi^2 = 573.164$, $df = 496$, $p = .009$). However, upon exploring the data structure, we could not identify systematic missing values. Therefore, we assumed random missing values and imputed data. In factor analyses acceptance, fear, and surprise formed unique factors (Zoellick et al., 2019). All items of the scales trust, intention to use, and amusement loaded on one respective factor, however with cross-loadings from perceived safety and boredom items. Thus, the scales perceived safety and boredom did not form their predicted factors. After excluding the cross-loading item, perceived safety items formed a coherent factor. Descriptive statistics, deviation from the scale's neutral middle, and reliability coefficients for all scales are displayed in Table 2.

Table 2

Descriptive Statistics, Two-tailed t-test Results, and Reliability Coefficients of Attitudes, Behavioural Intention, and Four Emotions.

| Variable | Scale range | Median | Mean (SD) | Skew | KU | <i>t</i> | α |
|----------------------|-------------|--------|-----------------|-------|-------|----------|----------|
| Acceptance | +2 to -2 | 1.22 | 1.18 (0.70) | -0.96 | 0.80 | 18.73** | .91 |
| Perceived safety | 1 to 5 | 3.33 | 3.29 (1.03) | -0.16 | -0.54 | 3.12* | .69 |
| Intention to use | 1 to 5 | 4.00 | 3.68 (1.05) | -0.47 | -0.77 | 7.22** | .83 |
| Trust | 1 to 5 | 3.27 | 3.29 (0.81) | -0.08 | 0.51 | 3.97** | .77 |
| Amusement | 3 to 15 | 12.00 | 11.66 (2.24) | -0.43 | -0.06 | 13.31** | .77 |
| Fear | 3 to 15 | 3.00 | 3.87 (1.72) | 2.39 | 6.86 | -33.40** | .81 |
| Surprise | 3 to 15 | 10.00 | 9.86 (3.08) | -0.16 | -0.54 | 3.12* | .86 |
| Boredom [†] | 3 to 15 | 5.00 | 5.62 (2.49) | 0.76 | 0.17 | -15.18** | .63 |

Note. SD = standard deviation; KU = excess kurtosis; α = Cronbach's alpha. [†] We dropped boredom from further analyses. * $p < .006$. ** $p < .001$. Table based on Tables 9 and 10 in Zoellick et al. (2019).

4.2 Power analysis

We identified actual test power of .77 for regression analyses and .61 for correlations. Effect sizes we could identify with a power of .80 were $f^2 = .11$ for regressions and ρ H1 of .25 for correlations. Even with an arguably small sample size of $n = 125$ we are able to produce robust results with high certainty for correlations $|r| \geq .25$ and regressions $f^2 \geq .11$.

4.3 Hypothesis Testing

Correlation results support our first hypothesis, because all correlations between attitudes and behavioural intentions were significant and $|r| \geq .25$ respective $|\rho| \geq .25$, i.e. the size we could detect with a power of .80 or higher. However, correlations with the emotions were either unintuitive or undependable. Fear correlated neither with acceptance nor with trust, and unconfidently with perceived safety. Despite significance, all correlations between amusement and attitudes ($|r| < .25$ respective $|\rho| < .25$) fell in the range of small certainty. Surprise did not correlate with any of the attitude measures. All correlations are displayed in Tables 3 and 4.

Table 3

Two-tailed Parametric Correlations (Pearson's r) between Seven Latent Constructs and Age

| Measure | ACC | SAFE | I-USE | TRU | AMU | SUR | FEAR | AGE |
|---------|-------|-------|--------|-------|--------|--------|------|-----|
| ACC | - | | | | | | | |
| SAFE | .61** | - | | | | | | |
| I-USE | .60** | .58** | - | | | | | |
| TRU | .56** | .71** | .55** | - | | | | |
| AMU | .18* | .09 | .14 | .17 | - | | | |
| SUR | .11 | -.09 | -.07 | -.03 | .25** | - | | |
| FEAR | -.15 | -.21* | -.26** | -.07 | -.07 | .25** | - | |
| AGE | -.08 | .01 | -.26** | -.21* | -.28** | -.25** | -.12 | - |

Note. $n = 125$. ACC = acceptance; SAFE = perceived safety; I-USE = intention to use; TRU = trust; AMU = amusement; SUR = surprise; FEAR = fear; AGE = age. * $p < .05$. ** $p < .01$.

Table 4

Two-tailed Non-parametric Correlations (Spearman's ρ) between Seven Latent Constructs and Age

| Measure | ACC | SAFE | I-USE | TRU | AMU | SUR | FEAR | AGE |
|---------|-------|-------|--------|-------|--------|--------|------|-----|
| ACC | - | | | | | | | |
| SAFE | .58** | - | | | | | | |
| I-USE | .57** | .58** | - | | | | | |
| TRU | .58** | .67** | .51** | - | | | | |
| AMU | .24* | .09 | .21* | .22* | - | | | |
| SUR | .11 | -.08 | -.06 | -.01 | .25** | - | | |
| FEAR | -.15 | -.20* | -.27** | -.11 | -.09 | .21* | - | |
| AGE | -.04 | .00 | -.26** | -.21* | -.29** | -.28** | -.10 | - |

Note. $n = 125$. ACC = acceptance; SAFE = perceived safety; I-USE = intention to use; TRU = trust; AMU = amusement; SUR = surprise; FEAR = fear; AGE = age. * $p < .05$. ** $p < .01$.

Parametric and non-parametric correlations provided slightly different results. Most obviously, the correlations of amusement with intention to use and with trust were significant at .05-level in Spearman, but not in Pearson. The correlation between surprise and fear was significant at .01-level in Pearson, but at .05-level in Spearman. Both methods provided the same coefficient in 4 out of 15 shared significant correlations with Pearson overestimating four and Spearman overestimating seven correlation coefficients. This stands in contrast to Norman who argues that small sample sizes, non-normally distributed data, and ordinal Likert items do not skew results from parametric statistics, as they "are robust with respect to violations of these assumptions" (Norman, 2010, p. 625). Our data indicates that both

procedures overlap largely regarding significance estimates, but differ in their coefficient estimates.

Group sizes of our MANOVA as a test of our second hypothesis varied between old women ($n = 22$), old men ($n = 25$), young men ($n = 37$), and young women ($n = 41$). We found significant results for Box's test ($F(30, 25693) = 2.38, p < .001$), Levene's tests for acceptance ($F(3, 121) = 7.12, p < .001$) and intention to use ($F(3, 121) = 6.01, p = .001$), and Pillai's traces for age ($F(4, 118) = 3.57, p = .004$) and gender ($F(4, 118) = 2.88, p = .001$). Thus, we rejected the assumption of homogeneous variance-covariance matrices (Huberty & Petoskey, 2000). Consequently, we set stricter alpha levels at $p = .001$ (Allen & Bennett, 2007) when evaluating MANOVA results for acceptance, perceived safety, intention to use, and trust presented in Tables 5 to 8, respectively. None of the investigated groups – particularly the hypothesised young men compared to other combinations of age and gender – differed significantly regarding acceptance, perceived safety, intention to use, and trust in AVs. Thus, we reject our second hypothesis.

Table 5

MANOVA Results for Acceptance

| Predictor | Sum of Squares | df | F | p | η |
|------------|----------------|-----|---------|------|--------|
| Constant | 159.21 | 1 | 337.98* | .000 | .736 |
| Gender | 2.69 | 1 | 5.72 | .018 | .045 |
| Age | 0.60 | 1 | 1.28 | .261 | .010 |
| Gender*Age | 0.52 | 1 | 1.11 | .293 | .041 |
| Error | 57.00 | 121 | | | |

Note. Given non-homogeneous variance-covariance matrices, we set alpha levels at $< .001$ for interpreting significant results. * $p < .001$.

Table 6

MANOVA Results for Perceived Safety

| Predictor | Sum of Squares | df | F | p | η |
|------------|----------------|-----|--------|------|--------|
| Constant | 0.00 | 1 | 0.00 | .981 | .000 |
| Gender | 15.95 | 1 | 18.34* | .000 | .13 |
| Age | 0.13 | 1 | 0.15 | .699 | .001 |
| Gender*Age | 0.40 | 1 | 0.45 | .499 | .004 |
| Error | 105.22 | 121 | | | |

Note. Given non-homogeneous variance-covariance matrices, we set alpha levels at $< .001$ for interpreting significant results. * $p < .001$.

Table 7

MANOVA Results for Intention to Use

| Predictor | Sum of Squares | df | F | p | η |
|------------|----------------|-----|------|------|--------|
| Constant | 0.35 | 1 | 0.40 | .531 | .003 |
| Gender | 5.89 | 1 | 6.72 | .011 | .053 |
| Age | 7.83 | 1 | 8.93 | .003 | .069 |
| Gender*Age | 2.33 | 1 | 2.66 | .106 | .022 |
| Error | 106.12 | 121 | | | |

Note. Given non-homogeneous variance-covariance matrices, we set alpha levels at $< .001$ for interpreting significant results. * $p < .001$.

Table 8

MANOVA Results for Trust

| Predictor | Sum of Squares | df | F | p | η |
|------------|----------------|-----|------|------|--------|
| Constant | 0.20 | 1 | 0.22 | .643 | .002 |
| Gender | 4.95 | 1 | 5.40 | .022 | .043 |
| Age | 4.70 | 1 | 5.12 | .025 | .041 |
| Gender*Age | 1.80 | 1 | 1.96 | .164 | .016 |
| Error | 111.02 | 121 | | | |

Note. Given non-homogeneous variance-covariance matrices, we set alpha levels at $< .001$ for interpreting significant results. * $p < .001$.

Results from our multiple hierarchical regressions as tests for our third hypothesis showed a violation of linearity. The standard deviation of residuals (0.72) exceeded that of the predicted values (0.70) (Garson, 2012, pp. 44-45). Comparing correlation coefficients (Pearson's r) with the correlation ratios (eta), we also found $\eta > r$ for all continuous predictors. Thus, linear regressions might not be the best approximation. Consequently, we introduced quadratic terms for acceptance, perceived safety, trust, and age into a fifth model. All other tested assumptions of regressions applied. Our outcome was normally distributed and we obtained more than 20 participants per predictor. For multicollinearity, no pair of predictors correlated higher than .80, and in collinearity statistics, the minimum tolerance was .37 and the maximum VIF was 2.68 (Garson, 2012). For outliers, Cook's maximum distance was .32, and the range of standardised residuals was between -2.69 and 1.86. For homoscedasticity, we plotted standardized estimates against standardized residuals. All data points laid between -3 and 3 on both axes

with slightly lower variance at high predicted values compared to low predicted values. However, this pattern did not deviate drastically from random distribution. The results of the multiple hierarchical regression are presented in Table 9.

Table 9

Hierarchical Regression Analyses with Intention to Use as Outcome and Age, Gender, Acceptance, Trust, and Perceived Safety as Predictors.

| | B | SE | β | p | ΔF | R^2 | ΔR^2 |
|------------------|-------|------|---------|---------|------------|-------|--------------|
| Model 1 | - | - | - | - | 9.46*** | .13 | .13 |
| Constant | 0.29 | 0.20 | - | .154 | | | |
| Age | -0.02 | 0.01 | -0.27 | .002** | | | |
| Gender | 0.51 | 0.17 | 0.26 | .003** | | | |
| Model 2 | - | - | - | - | 57.61*** | .41 | .28 |
| Constant | -0.60 | 0.21 | - | .004** | | | |
| Age | -0.01 | 0.00 | -0.22 | .002** | | | |
| Gender | 0.25 | 0.14 | 0.13 | .078 | | | |
| Acceptance | 0.78 | 0.10 | 0.55 | .000*** | | | |
| Model 3 | - | - | - | - | 9.17** | .46 | .04 |
| Constant | -0.44 | 0.21 | - | .036* | | | |
| Age | -0.01 | 0.00 | -0.18 | .013* | | | |
| Gender | 0.20 | 0.14 | 0.10 | .160 | | | |
| Acceptance | 0.59 | 0.12 | 0.41 | .000*** | | | |
| Trust | 0.25 | 0.08 | 0.25 | .003** | | | |
| Model 4 | - | - | - | - | 7.21** | .49 | .03 |
| Constant | -0.16 | 0.23 | - | .466 | | | |
| Age | -0.01 | 0.00 | -0.22 | .002** | | | |
| Gender | 0.09 | 0.14 | 0.04 | .537 | | | |
| Acceptance | 0.47 | 0.12 | 0.33 | .000*** | | | |
| Trust | 0.10 | 0.10 | 0.10 | .330 | | | |
| Perceived Safety | 0.29 | 0.11 | 0.29 | .008** | | | |

Note. $n = 125$; gender is coded 0 = female, 1 = male;

* $p < .05$., ** $p < .01$., *** $p < .001$

The fifth model with quadratic terms for age, acceptance, trust, and perceived safety explained less variance ($R^2 = .39$) than the fourth model ($R^2 = .49$). Thus, we assumed a linear regression to be a more fitting approximation of the data set. However, the results only partly supported our third hypothesis. Unexpectedly, age remained a significant predictor even when adding all three latent constructs. Gender, however, lost predictive power once we introduced

acceptance into the regression equation. Perceived safety cannibalised the predictive effect of trust whilst explaining additional variance. Based on our data, the most promising regression equation formed as follows:

$$Y = -.01X_1 + .47X_2 + .29X_3,$$

with Y being intention to use, X_1 being years of age, X_2 being acceptance and X_3 being perceived safety.

5. Discussion

We analysed relationships between socio-demographics, attitudes, behavioural intentions, and emotions towards AVs using realistic traffic settings and in-vivo experience with this emerging technology. Thus, we expect our results to have high external validity – ideal conditions to test ambivalent findings regarding age and gender from previous studies. Our four main findings were (1) close relationships between the constructs acceptance, perceived safety, trust, and intention to use with different results from parametric and non-parametric analyses, (2) age significantly predicting intention to use but being uncorrelated with the other constructs, (3) a tendency for gender differences in all constructs gender slightly outside significance, and (4) acceptance being the strongest predictor for intention to use AVs followed by perceived safety and age – positioning usefulness of, satisfaction with, and feeling safe in at the centre of AV usage. This is particularly important for actors promoting AVs and researchers evaluating them. In the following, we discuss these findings.

Based on our correlation analyses, we can say with high certainty that the concepts acceptance, perceived safety, trust, and intention to use defined and measured as described in the methods section are closely related. This supports our first hypothesis and replicates previous findings (Choi & Ji, 2015; Hohenberger et al., 2016; Rödel et al., 2014). For the first time, we introduced emotions measures to research on AVs. Their results, in contrast, are difficult to interpret. The emerging picture suggests that the positive emotion amusement correlates positively and the negative emotion fear negatively with the measured attitudes and behavioural intentions whereas high, neutral activation (surprise) has no relationship with them at all. This would align with naïve modelling of these constructs. However, we found only small and few significant correlations between the emotions and other constructs with very little certainty particularly given our test power. Thus, a first recommendation is increasing the sample size to boost test power. Apart from this aspect, particularly fear might be inappropriate for the research context characterised by an accompanied, slow ride on private property. Anxiety as a more subtle member of this family of emotions might be a better fit. Lastly, these results could be ascribed to the method employed to measure emotions. All scales consisted of three items representing slightly different facets of the respective emotion. A better way

might be to ask for the overarching emotion directly, e.g. by utilising the Geneva Emotions Wheel (Scherer, 2005; Scherer, Shuman, Fontaine, & Soriano, 2013). Thus, we first encourage further research combining measures of attitudes, behavioural intentions, and emotions. Different methodologies should provide a clearer picture of their connections. Differences between parametric and non-parametric correlations demonstrate the importance of testing their assumptions and applying the appropriate tool for analysis. We thus argue for rigorous assumption testing and result reporting in further research.

For gender and age, results have to be dissected carefully. Indeed, p-values from our MANOVAs regarding age and particularly gender differences in attitudes and behavioural intentions give some indications, but because of strict alpha levels, only one was significant. We could not identify young men to rank higher on any attitude or behavioural intention than old men, young women, and old women. Thus, we reject our second hypothesis and concede that our MANOVAs did not provide much clarity on age and gender effects. However, insignificant findings for age might be a method effect of our median split combined with a remarkably young sample, assigning people as young as 34 years old to the “older” group. Analysing quartiles or applying age cut-offs as group assignment might provide results that are more accurate. Yet, given our sample size ($n = 125$) and age distribution, such a MANOVA would have yielded too few group members for valid comparisons particularly in the oldest group(s). In contrast to the MANOVAs, regression analyses suggest that age has robust predictive power for AV usage intention. With every additional year of age, people intend to use AVs less, even when considering their acceptance, perceived safety, and trust in AVs. Significant predictor abilities of gender were consumed as predicted by adding acceptance as another independent variable. Thus, we found evidence that age plays a role in predicting AV usage intention, but that it does not correlate with other attitudes like acceptance or trust. Gender differences in our four attitudes are likely, given the MANOVA p-values, but need further replication to be definitive. Attitude measures, however, trump the predictive power of gender for explaining usage intention.

We were unable to support our research model (Figure 2) rejecting our third hypothesis. Instead, we identified acceptance as the strongest predictor for intention to use whose predictive power was only partially reduced by adding other attitudes to the equation. This finding though seemingly unsurprising demonstrates the importance of clear conceptualisation. When researchers equate acceptance with usage (intentions) (Adell, 2009), they lose (or rename) a strong predictor. With our correlation and regression analyses, we have shown that coordinated definitions and measurements lead to further understandings of people’s assessment of emerging technologies. We urge researchers to follow this path and help untangle what has been an ambivalent body of research on AV attitudes. We also recommend

researchers to be more rigorous and transparent in their approach by explicitly stating definitions of constructs and by granting full access to all of their methodical materials. This is the only way to make results more comparable and create a reliable body of research on AV attitudes.

5.1 Limitations

Our sample represents a disproportionately young, tech-interested, and rather urban population. Thus, positive assessments across scales are unsurprising. However, a population with these characteristics might not vary so much in key attitudes and emotions towards emerging technologies leading us to underestimate findings such as correlations. These underestimations stand in contrast to possible overestimations of effect sizes because “[v]iolations of data level assumptions mean that actual standard error will be greater than the computed standard error” (Garson, 2012). Thus, we have to await replications with larger sample sizes in further research to estimate effect sizes with more confidence. Nonetheless, results from our power analysis show that we can infer with high confidence any correlations $|r| \geq .25$ and regressions $f^2 \geq .11$. Thus, our study provides a reference point for further research.

Secondly, AVs are still in their experimental phase, driving only accompanied on especially prepared routes with small speed. These conditions make the experience of emotions like fear unlikely and confine attitude research in narrow boundaries. Particularly, the operator compromises the expected level 4 automation and influences user experiences. Even though we collected data in the currently most advanced use cases with higher validity than hypothetical scenarios and simulation studies, we do consider “truly” automated driving to be a topic of the future. Results that are more valid can only be obtained once people can experience AVs regularly and in different scenarios without supervision. For higher internal validity, we refer to simulation studies offering a controlled setting and better oversight.

6. Acknowledgements

The authors thank the four student assistants Bent Fuhlrott, Lina Kluy, Lisa Paduch, and Janek Wilhelm (alphabetical order) for their contributions to this research project.

This work was supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit) under Grant 16EM3157-2. The funders had no role in study design, in the collection, analysis and interpretation of data, in the writing of the report, and in the decision to submit the article for publication.

Declaration of interest: none.

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Questionnaire about driverless busses at the Charité

Thank you very much for participating in this survey!

Please tick the box next to the statement you find most appropriate or make the respective note. Your data will be processed anonymously. Please consult the contact person if you have any questions.

| | | | |
|---|---------------------------------|-------------------------------|--|
| How old are you? | Age: _____ Years | | |
| Please indicate your gender. | <input type="checkbox"/> female | <input type="checkbox"/> male | <input type="checkbox"/> prefer not to say |
| Do you have a driver's license for passenger cars? | <input type="checkbox"/> Yes | | <input type="checkbox"/> No |

| How did you feel on the ride with the electric automated bus? Please give your evaluation for the following terms. | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Very weak | Weak | Neutral | Strong | Very strong |
| Bored | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Silly | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Bored stiff | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Surprised | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Uninvolved | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Scared | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Amused | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Fearful | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Amazed | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Astonished | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Fun-loving | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Afraid | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| How safe did you feel on the ride with the electric automated bus? | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| Very unsafe | Unsafe | Neutral | Safe | Very safe |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

In the following, we are interested in your opinion about automated vehicles in local public transport.

| | Disagree | Some-what disagree | Un-decided | Some-what agree | Agree |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Assuming I had access to an autonomous vehicle, I intend to use it. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I feel safe when using autonomous vehicles. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I trust autonomous vehicles, because they keep my best interests in mind. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| If autonomous vehicles are available, I plan to use one in the next months. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Using autonomous vehicles decreases the accident risk. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Autonomous vehicles keep promises and commitments. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Autonomous vehicles are trustworthy. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I believe using autonomous vehicles is dangerous. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Given I had access to an autonomous vehicle, I predict that I would use it. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Using autonomous vehicles requires increased attention. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| My judgements of automated vehicles are: | | |
|--|--|----------------|
| useful | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | useless |
| pleasant | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | unpleasant |
| bad | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | good |
| nice | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | annoying |
| effective | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | superfluous |
| irritating | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | likeable |
| assisting | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | worthless |
| undesirable | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | desirable |
| raising alertness | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | sleep-inducing |

Did we leave something out? Please give us your comments about the project or the vehicles.

Fragebogen zu fahrerlosen Bussen an der Charité

Vielen Dank für Ihre Teilnahme an dieser Umfrage!

Bitte kreuzen Sie die jeweils zutreffende Angabe an bzw. schreiben die Information auf. Ihre Daten werden anonym verarbeitet. Bei Fragen wenden Sie sich bitte an die Ansprechperson.

| | | | |
|--|-----------------------------------|-----------------------------------|---------------------------------------|
| Wie alt sind Sie? | Alter: _____ Jahre | | |
| Bitte nennen Sie Ihr Geschlecht. | <input type="checkbox"/> weiblich | <input type="checkbox"/> männlich | <input type="checkbox"/> keine Angabe |
| Haben Sie einen PKW-Führerschein? | <input type="checkbox"/> Ja | | <input type="checkbox"/> Nein |

Wie haben Sie sich während der Fahrt mit dem elektrischen, automatisierten Kleinbus gefühlt? Bitte geben Sie Ihre Einschätzung zu den folgenden Begriffen.

| | Sehr schwach | Schwach | Teils/teils | Stark | Sehr stark |
|-------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Gelangweilt | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Vergnügt | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Angeödet | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Überrascht | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Unbeteiligt | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Erschreckt | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Amüsiert | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Furchtsam | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Erstaunt | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Verblüfft | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Erheitert | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Ängstlich | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Wie sicher haben Sie sich bei der Fahrt mit dem elektronischen, automatisierten Kleinbus gefühlt?

| Sehr unsicher | unsicher | neutral | sicher | Sehr sicher |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Im Folgenden interessiert uns Ihre Meinung zu automatisierten Fahrzeuge im öffentlichen Personennahverkehr.

| | Stimme nicht zu | Stimme eher nicht zu | Teils-teils | Stimme eher zu | Stimme zu |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Wenn ich Zugang zu einem automatisierten Fahrzeug hätte, dann würde ich es vermutlich nutzen. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Ich würde mich sicher fühlen, wenn ich automatisierte Fahrzeuge nutze. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Ich vertraue automatisierten Fahrzeugen, weil sie meine Interessen berücksichtigen. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sobald automatisierte Fahrzeuge verfügbar sind, plane ich, eines in den nächsten Monaten zu nutzen. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Automatisierte Fahrzeuge zu nutzen, verringert das Unfallrisiko. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Automatisierte Fahrzeuge halten, was sie versprechen und zusagen. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Automatisierte Fahrzeuge sind vertrauenswürdig. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Ich glaube, dass das Nutzen von automatisierten Fahrzeugen gefährlich ist. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Wenn ich Zugang zu einem automatisierten Fahrzeug hätte, dann würde ich es auf jeden Fall nutzen. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Automatisierte Fahrzeuge zu nutzen, erfordert erhöhte Aufmerksamkeit. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Meine Beurteilung für automatisierte Fahrzeuge lautet:

| | | |
|---------------------|--|---------------|
| nützlich | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | nutzlos |
| angenehm | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | unangenehm |
| schlecht | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | gut |
| erleichternd | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | lästig |
| effektiv | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | überflüssig |
| ärgerlich | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | erfreulich |
| hilfreich | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | wertlos |
| nicht wünschenswert | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | wünschenswert |
| anregend | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | einschläfernd |

Haben wir etwas nicht beachtet? Bitte geben Sie uns Ihre Anmerkungen zum Projekt oder den Fahrzeugen.