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User Acceptance of AI in Transport: The Case of SAE Level 3 Conditional Automated Driving

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ABSTRACT

This study applies an extended version of one of the most popular technology acceptance models, the Unified Theory of Acceptance and Use of Technology (UTAUT2), to predict user acceptance of SAE Level 3 conditional automated driving among more than 9,000 car drivers from nine European and non-European countries. We extend the model by two factors, trust and teaming, that we consider pivotal for user acceptance of conditional automated driving. We also investigate the factors impacting the determinants of acceptance and use of conditional automated driving, addressing a well-known gap in research. In this study we find that 40% of respondents did not intend to buy, and 39% of respondents did not express the intention to use conditional automated driving when available. 71% of respondents indicated a preference to stay engaged in the driving task to respond to requests from the car to resume manual control. The structural equation modeling analysis revealed that performance expectancy is the strongest predictor of driver's behavioral intentions to use conditional automated driving, followed by trust and social influence. Contrary to common beliefs positioning trust as one of the most influential drivers of user acceptance of automated vehicles, the influence of trust on behavioral intention to use conditional automated driving is small. The availability of facilitating conditions supporting the use conditional automated driving (e.g., knowledge, getting help from friends, family, or car dealers) has a small influence on user acceptance. We also found significant effects of the factors impacting the determinants of acceptance and use. The effect of performance expectancy on hedonic motivation is positive, suggesting that the perceived usefulness positively enhances the perceived enjoyment. Similarly, the effect of social influence on performance expectancy and trust is positive, suggesting the social network of the individual plays an important role in promoting positive beliefs about the effectiveness of the technology and trust in the technology. Access to participation in the questionnaire was limited to respondents with access to internet, which is why future research should be performed with respondents without internet accessibility to examine differences in attitudes and acceptance between these internet-affine and less internet-affine groups.

1. Introduction

SAE Level 3 (Conditional Driving Automation), herein referred to as conditional automated driving, can be both a boon or bane for

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public safety given that conditional driving automation may "cause new human-related errors, primarily based on misuse, disuse and abuse of automation" (Gerber et al., 2023, p. 1). Misuse, disuse, and abuse of automation can have a negative effect on the broad uptake of conditional automated driving if drivers do not trust the system, and feel uncomfortable using it. When conditional automated driving is active, human operators are not driving when the automated driving features are engaged - even when seated behind the steering wheel. Yet, they still serve as fallback-ready users and are required to intervene in the vehicle's actions and resume manual control when requested by the vehicle, for instance, in situations in which the vehicle leaves the operational design domain (ODD), or in unexpected situations that exceed the capabilities of the vehicle (e.g., adverse weather conditions, limitations in road design) (Lotz, Russwinkel, & Wohlfarth, 2019; Naujoks, Befelein, Wiedemann, & Neukum, 2017; Radlmayr, 2020; SAE International, 2018; Schrauth, Funk, Maier, & Kraetsch, 2021).

The literature on automated vehicle acceptance has grown in recent years. Establishing user acceptance of conditional automated driving is pivotal to ensure the realization of the benefits of road vehicle automation and a proper return of investment (Van Der Laan, Heino, & De Waard, 1997). User acceptance is a necessary precursor for adoption, and thus critical for the success of this technology. Yet, critical knowledge gaps remain. With this paper, we aim to address these gaps in research.

First, while there is copious literature examining the acceptance of SAE Level 2 and 4 automated passenger vehicles and driverless shuttles (Cai et al., 2023; Kaye et al., 2020; Korkmaz et al., 2022; Madigan et al., 2017; Zhang et al., 2021), far less is known about the acceptance of conditional automated driving. Unlike the other automation levels where the human is required to constantly supervise the system and is thus in principle a constant fall-back ready user (SAE Level 2) or where the human is no longer required to constantly supervise the system but the system is transferred to a minimal risk condition in situations in which the human fails to respond to system take-over requests (SAE Level 4), during conditional automated driving none of this holds: Human drivers are not required to constantly supervise the system but can engage in non-driving related activities (NDRTs) for some time, which can limit drivers' situational awareness and take-over performance (Endsley, 1990; Liang et al., 2021; Miller et al., 2015). For instance, Zeeb et al. (2016) have shown that the take-over quality deteriorated for the distracted drivers, i.e., drivers who read a news text or watched a video, supporting the results of a meta-analysis of 48 articles on the effect of NDRT on take-over performance (Weaver & DeLucia, 2022). In contrast, other studies have shown that the engagement in NDRTs during conditional automated driving did not influence hands-on steering wheel time and take-over performance (Gold et al., 2018; Lin et al., 2021), while the time budget (i.e., the time available to drivers to take over control after a take-over request has been issued) had a strong effect on take-over performance. In Weaver and DeLucia (2022) shorter time budgets had a small effect on drivers' take-over performance, and in Lin et al. (2021) time budget did not influence hands-on steering wheel time. Conditional automated driving combines or blends different automation levels, transitioning from SAE Level 3 to lower automation levels, which can aggravate the issue of mode confusion (Feldhütter et al., 2018; Kim et al., 2025; Lee et al., 2023). Mode confusion occurs when drivers assume the vehicle is operating in a different mode than it actually is (Sarter & Woods, 1995). Mode confusion can have serious implications for public safety if drivers do not monitor the driving task and fail to respond to take-over requests in time (see Kim et al., 2025; Kurpiers et al., 2020). Given the shift in responsibilites of drivers and the capabilities of the conditionally automated vehicle, the safe operation of conditional automated driving depends on the successful teaming between human drivers and the automation (see Carsten & Martens, 2019; Correa-Jullian et al., 2024; Lee et al., 2023). Human-AI teaming is defined as a condition where "one or more people and one or more AI systems requiring collaboration and coordination to achieve successful task completion" (Cuevas et al., 2007) and where "human and autonomous teammates promptly interact with one another in response to information flow from one team member to another, adapt to the dynamic task, and achieve common goals" (Demir et al., 2021, p. 696). Our work contributes to the emerging literature on teaming during conditional automated driving, its operational definition and its direct and indirect effects on the acceptance of conditional automated driving.

Second, most prior literature examining the acceptance and use of automated vehicles has applied established technology acceptance theories, such as the original UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh et al., 2003) and its extended version UTAUT2 (Venkatesh et al., 2012). While this literature stream has considerably advanced our understanding of user acceptance, it fails short in considering the interdisciplinary nature of automated vehicle acceptance research. Most of the technology acceptance theories, including the UTAUT theories, were developed for the Information Systems technology context. These studies do not explicitly establish the connection between automated vehicles and AI. Yet, automated vehicles are not only a vehicle technology, but AI is a major force behind the development and operation of automated vehicles (Sjoberg, 2024). It is not the vehicle that drives it (self), but it is the AI that is driving the vehicle. Here we define AI as the "ability of a computer or computer-controlled robot to perform tasks commonly associated with intelligent beings" (Kavic & Lanzafame, 2024, p. 1). We draw on this literature to inform the development of our hypotheses. This is an attempt to acknowledge the truly interdisciplinary nature of this field, and open the automated vehicle acceptance literature to other disciplines, such as AI and robotics.

Third, most prior research has focused on understanding the direct relationships between the UTAUT independent variables and the behavioral intention to use technology, including automated vehicles and other robots. This literature has shown that the behavioral intention to use is influenced by performance expectancy, social influence, hedonic motivation, and facilitating conditions (Ates & Polat, 2025; Chen et al., 2020; Morrison & Van Belle, 2020; Nordhoff et al., 2020; Panagiotopoulos & Dimitrakopoulos, 2018; Saravanos et al., 2024; Zhang et al., 2019). Little is known about the indirect effects of these UTAUT variables on the behavioral intention to use. The study on examining the indirect effects on technology acceptance and use is not new (Venkatesh & Bala, 2008), yet it has received little attention from the scientific community so far. This is surprising because a more comprehensive understanding of the indirect effects can lead to greater acceptance, helping individuals and society to achieve the many benefits of automated vehicles faster (see Venkatesh & Bala, 2008). There are a few studies that investigated the indirect effects, but the evidence is inconclusive, possibly because these studies do not explicitly consider the nature of the UTAUT constructs. UTAUT assumes that the behavioral intention to use is influenced by both cognitive constructs, such as performance expectancy, and affective constructs, such as hedonic motivation. Though it seems that there are at least two main camps within the cognitive neuroscience literature on the relationship between cognition and emotion, we draw on the literature stream that suggests that cognition precedes emotion (Lazarus, 1982). We posit that cognitive constructs precede the development of affective constructs. We suggest that the automated vehicle and technology acceptance literature take this into account when desiging their research models and formulating their hypotheses.

Fourth, while many prior studies examined the relationships between trust and behavioral intention to use automated vehicles (Benleulmi & Ramdani, 2022; Cai, Yuen, & Wang, 2023; Du, Zhu, & Zheng, 2021; Foroughi et al., 2023; Kaur & Rampersad, 2018; Kenesei et al., 2022; Kettles & Van Belle, 2019; Meyer-Waarden & Cloarec, 2022; Panagiotopoulos & Dimitrakopoulos, 2018; Sakuljao et al., 2023; Waung, McAuslan, & Lakshmanan, 2021; Xu et al., 2018; Zhang et al., 2020), trust is formally not a UTAUT construct. Trust is particularly critical in the context of conditional automated driving. This level of automation is unique because it is the first—automation level that permits drivers to divert their attention from the road and engage in NDRTs while the automated driving system controls the vehicle, until it requests the driver to resume control. The success of this technology therefore hinges on drivers' ability to perform safe takeovers, which in turn depends on their trust in the system (see Wang et al., 2025). In this sense, trust is a necessary condition for users to fully realize the benefits of conditional automated driving. While trust is also treated as multi-layered, dynamic construct (see for instance Hoff & Bashir's (2015) three-layered framework for conceptualizing trust variability), this paper considers trust as uni-dimensional and static construct, mainly because the study has been limited to the collection of cross-sectional data. To formulate hypotheses between trust and our study variables, we draw on the rich and established literature on trust in technology in general and automated vehicles in particular.

1.1. Research objectives

This study addresses these critical knowledge gaps and aims to advance research on the acceptance and use of conditional automated driving. The main objective of the present study is to:

i) Examine the relationships between the UTAUT2 independent variables performance expectancy, social influence, facilitating conditions, hedonic motivation, trust and teaming and their effect on the behavioral intention to use conditional automated driving.

The knowledge obtained in this study provides crucial insights into how conditional automated driving can be effectively marketed to its future customers, informing the development of adequate strategies and interventions to promote acceptance of conditional automated driving.

2. Literature review

In this section, we will report the results from the literature review, with a main focus on the indirect effects of the UTAUT variables.

UTAUT assumes that technology adoption and use are influenced by the behavioral intention to use, which in turn, is determined by performance expectancy, social influence, facilitating conditions, and hedonic motivation. Performance expectancy is defined as the extent to which the technology is perceived to be useful. Effort expectancy is defined as the extent to which using the technology is perceived to be easy. Social influence is defined as the extent to which the use of the technology is supported in the individual's social networks. Facilitating conditions refers to the availability of conditions or resources supporting the use of the technology, such as the knowledge or skills needed to use the technology. Hedonic motivation is defined as the extent to which the use of the technology is perceived to be enjoyable (Venkatesh et al., 2012).

We propose that the effect of facilitating conditions on performance expectancy is positive. Venkatesh and Davis (2000) and Venkatesh and Bala (2008) extended the Technology Acceptance Model (TAM) and proposed TAM2 and TAM3, which theorize that perceptions of control over using a system, which is equivalent to the construct facilitating conditions, influences the perceived ease of use but not perceived usefulness of a system. This aligns with Zefreh et al. (2023) and Li et al. (2022) who did not hypothesize a positive effect of facilitating conditions on performance expectancy. Other empirical automa studies, however, find a link between facilitating conditions and perceived usefulness or performance expectancy, suggesting that the availability of conditions in the environment supporting the use of automated vehicles positively influence the beliefs about the perceived usefulness of automated vehicles (Koh & Yuen, 2023; Man et al., 2025).

In Liu et al. (2019) the effect of positive affect (which is equivalent to our construct hedonic motivation) on performance expectancy is positive, meaning that the perceived enjoyment of automated vehicles can promote the perceived benefits of automated vehicles. Considering performance expectancy as cognitive construct and hedonic motivation as affectve construct, here we propose that performance expectancy positively influences hedonic motivation. We posit that the perceived benefits of using the system provide a basis for forming beliefs about the perceived enjoyment of using the system.

Prior technology acceptance literature (Venkatesh & Davis, 2000; Venkatesh & Bala, 2008) theorizes that social influence has a positive effect on perceived usefulness, which is equivalent to performance expectancy, which is supported by empirical studies (Cai et al., 2023; Koh & Yuen, 2023; Man et al., 2025) in the space. Based on these findings, we hypothesize:

H1: Facilitating conditions will have a positive effect on performance expectancy, such as that respondents providing high scores for facilitating conditions are more likely to provide high scores for performance expectancy than respondents providing low scores.

H2: Performance expectancy willl have a positive effect on hedonic motivation, such as that respondents providing high scores for

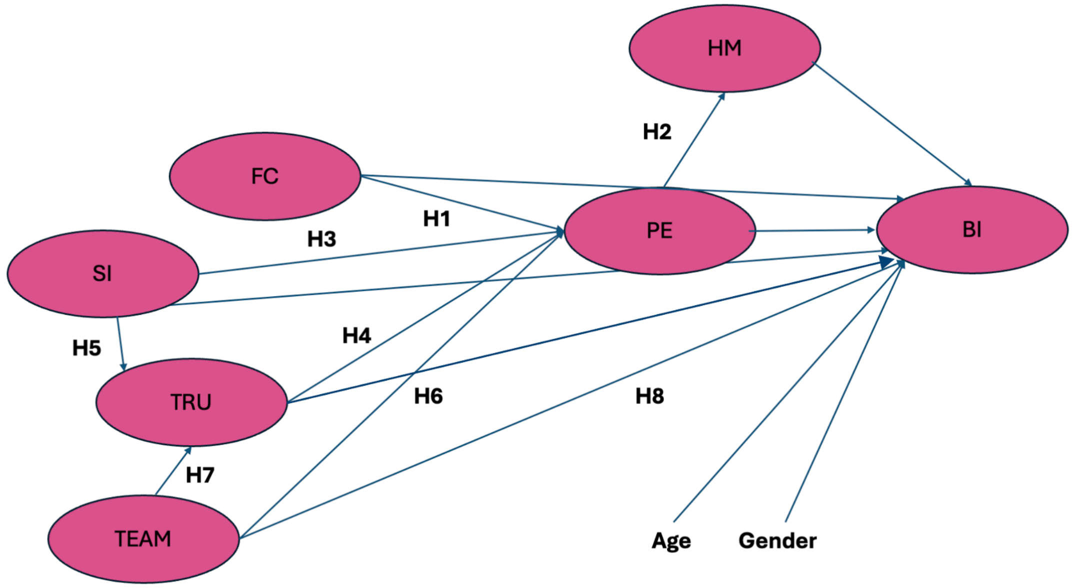

Fig. 1. UTAUT2 model adjusted to the context of our study. FC = facilitating conditions, SI = social influence, TRU = trust, TEAM = teaming, PE = performance expectancy, HM= hedonic motivation, BI = behavioral intention

performance expectancy are more likely to provide high scores for hedonic motivation than respondents providing low scores.

H3: Social influence will have a positive effect on performance expectancy, such as that respondents providing high scores for social influence are more likely to provide higher scores for performance expectancy than respondents providing low scores.

This section will now report the results of the literature about the relationship between trust and performance expectancy. Empirical evidence reports a positive effect of trust on performance expextancy, suggesting that respondents scoring high on trust were more likely to consider automated vehicles useful (Cai et al., 2023; Farmer et al., 2024; Xu et al.; 2018; Zefreh et al., 2023). Other studies found a positive effect of peformance expectancy on trust, suggesting that respondents with higher agreement ratings for performance expectancy were more likely to trust automated vehicles (Kenesei et al., 2025; Koppel et al., 2024). Despite inconclusive evidence about the relationship between trust and performance expectancy, we hypothesize that trust precedes performance expectancy. To motivate this link, we draw on ideas from one of the earlier technology acceptance research, which theorizes relationships between several external variables, including trust, and the key UTAUT variables. For instance, the Automation Acceptance Model (AAM) extends the Technology Acceptance Model (TAM) with trust as an external variable influencing the perceived usefulness of the technology (Ghazizadeh, Lee, & Boyle, 2012).

Kraus et al. (2024) and Zefreh et al. (2023) found a positive effect of social influence on trust, indicating that support for automated vehicles in the important social networks of the individual is positively associated with trust. In contrast, Kenesei et al. (2025) hypothesized a positve effect of social influence on trust and found the effect was not significant. Based on these findings, we hypothesize:

H4: Trust will have a positive effect on performance expectancy, such as that respondents providing high scores for trust are more likely to provide high scores for performance expectancy than respondents providing low scores.

H5: Social influence will have a positive effect on trust, such as that respondents providing high scores for social influence are more likely to provide high scores for trust than respondents providing low scores.

Moreover, we posit that teaming will have a positive effect on performance expectancy, trust and the acceptance of conditional automated driving. The conditional automated driving can back drivers up, for instance, by executing emergency actions to reduce speed or stop the vehicle in situations in which drivers lose their situational awareness, or by reducing their workload controlling the driving task (Kridalukmana et al., 2020). An alternative approach to implementing teaming is the use of driver monitoring systems to promote driver attentiveness and engagement and ensure safety (Correa-Jullian et al., 2024; Fuchs et al., 2023). Monitoring the conditional automated driving system is also an essential task of teaming allocated to humans given that conditional automated driving requires human supervison and appropriate intervention when requested by the system. Given that teaming improves the coordination between drivers and the vehicle and enhance safety and efficiency, it promotes trust in the conditional automated driving system (Doost & Gorman, 2025; Ibrahim et al., 2022). Note that it can also cause trust calibration issues, such as when humans' trust levels exceed the actual technical capabilities of the automated driving system (Kridalukmana et al., 2020). Moreover, poor coordination between humans and the conditional automated driving system – an essential aspect of teaming – can diminish the user experience and compromise safety (Doost & Gorman, 2025), ultimately reducing user acceptance of conditional automated driving. We draw on this literature and formalize the following hypotheses.

H6: Teaming will have a positive effect on performance expectancy, such as that respondents providing high scores for teaming are more likely to provide high scores for performance expectancy than respondents providing low scores.

H7: Teaming will have a positive effect on trust, such as that respondents providing high scores for teaming are more likely to provide high scores for trust than respondents providing low scores.

H8: Teaming will have a positive effect on the behavioral intention to use conditional automated driving, such as that respondents providing high scores for teaming are more likely to provide high scores for behavioral intention than respondents providing low scores.

2.1. Research model

The formulation of the hypotheses leads to the development of the following research model presented in Fig. 1. Fig. 1 shows the relationships between our study variables. UTAUT2 is extended by trust and teaming as individual variables influencing behavioural intention. As there is a wealth of research on the direct effects of the UTAUT variables on behavioral intention to use, we will not explicitly formulate hypotheses for these relationships.

3. Methodology

An online questionnaire was administered to 9,339 car drivers from Brazil, China, France, Germany, Hungary, Japan, Russia, UK, and the U.S. in the L3Pilot project (www.l3pilot.eu). The hypotheses that specify the expectations about the relationships between our study variables as shown in our research model in Fig. 1 are tested using structural equation modelling. A confirmatory factor analysis, representing an inherent part of structural equation modelling, contributes to the operationalization of our study constructs.

3.1. Survey procedure

The questionnaire in this study was conducted by the German market research institute INNOFACT AG (www.innofact.com) using the questionnaire tool EXAVO (https://www.exavo.de/surveytainment/). An certified translation bureau translated the English questionnaire into the different national languages of the countries in which the questionnaire was administered. The countries in which the questionnaire was administrated were selected based on their current and future car market size, geographical representation, and leadership in the development of automated driving technology. From each country, a representative sample of age, gender and income was drawn. Once a representative sample was recruited, participation in the questionnaire was no longer possible. The questionnaire was pre-tested in several iteration rounds with around 30 respondents in total to resolve implementation or wording issues and ensure that respondents had a common understanding of the questionnaire items. Respondents were invited to participate in the questionnaire via email.

To enhance data quality, bots, respondents with suspect proxies or email addresses, and respondents who tried to take the survey more than once were either prohibited from taking part in the questionnaire or excluded from the sample. Respondents received financial compensation for their study: Respondents from Germany received 1€ for completing the questionnaire, and respondents from the remaining countries received points that were worth between 0.80-1.00€, and that could be redeemed as vouchers.

We did not seek ethical approval for this study from the ethics committee as the study-related data processing involved anonymous data. For this reason, regulations on the protection of personal data are not relevant in the context of this study nor are other ethical concerns affected. Moreover, when we invited respondents to the study, we informed them that their participation in the study is voluntary, and that they could withdraw from the study at any time (see also Nordhoff & Lehtonen, 2025). Moreover, when respondents were invited to the study, they were informed that their participation in the study is voluntary, that they have the right to withdraw from the study anytime and that they can refuse to answer questions at any time.

3.2. Survey respondents

After removing respondents whose time to complete the survey was 33% below the median length of their country, and who provided the same response (i.e., strongly disagree, neutral, agree strongly) to the questions q14r.1-q14r.20, 9339 responses remained for further analysis. The responses were collected between February 3rd and 17th, 2021.

Table 1
Relative frequencies of respondent's age and gender distribution between countries (N = total number of respondents)

Country	U.S.	UK	FR	HU	DE	CN	BR	JP	RU
Gender									
Male	50%	48%	48%	47%	50%	49%	49%	49%	46%
Female	50%	52%	52%	53%	50%	51%	51%	51%	53%
Age									
18–29	25%	20%	18%	22%	20%	24%	28%	16%	36%
30–39	19%	21%	24%	21%	18%	34%	34%	21%	25%
40–49	19%	19%	23%	24%	21%	28%	22%	24%	20%
50–59	19%	25%	19%	17%	23%	8%	10%	24%	13%
60–69	18%	15%	17%	17%	18%	7%	7%	16%	6%
N	1009	1038	1011	1042	1054	1059	1061	1006	1059

Note: FR = France, HU = Hungary, DE = Germany, CN = China, BR = Brazil, JP = Japan, RU = Russia

The mean age of respondents is 41.51 years with a standard deviation of 13.84 years. 48% is male, and 52% is female. 29% of respondents reported to have a college degree (no finished studies), and finished studies, respectively. 25% have no college degree, 13% have a high school diploma with apprenticeship / professional training, and 3% have a high school diploma without apprenticeship /professional training. 52% of respondents do not have children, 28% have 1 child, 16% 2, and 4% reported to have 3 children. The cross-country age and gender distributions are presented in Table 1.

3.3. Survey instrument

The questionnaire was divided into several sections (A-F).

Prior to Section A, respondents received the following information about the functionality of conditional automated driving to ensure sufficient understanding.

With this questionnaire, we would like to get your opinion **on conditionally automated cars.** Conditionally automated cars can drive on **motorways, congested motorways, in urban traffic, and parking situations**. These cars still have gas and brake pedals and a steering wheel. You are not driving when the car is in conditionally automated mode - even if you are seated in the driver's seat. This will allow you to engage in other activities except for sleeping. However, the car might ask you to resume control at any time, in which case you will-have to stop what you are doing and resume control of the driving task.

In section A, respondents were asked to provide information about their age, gender, highest level of education completed, number of children in their household below 19 years, access to a valid driving license, and annual mileage.

In section B, respondents had to provide information about their personality and driving profile (personality, attitude towards driving).

In section C, respondents were asked to indicate their awareness of automated vehicles, and how often they read / watch / listen to information about automated vehicles.

In section D, respondents were asked to provide their agreement with questions pertaining to the UTAUT2 factors performance expectancy, social influence, hedonic motivation, facilitating conditions, and behavioral intention, trust, and teaming. The questions were presented in a random order to reduce order effects.

In Section F, respondents were asked to provide their agreement with questions measuring their attitudes towards driving and their experience with driver assistance systems.

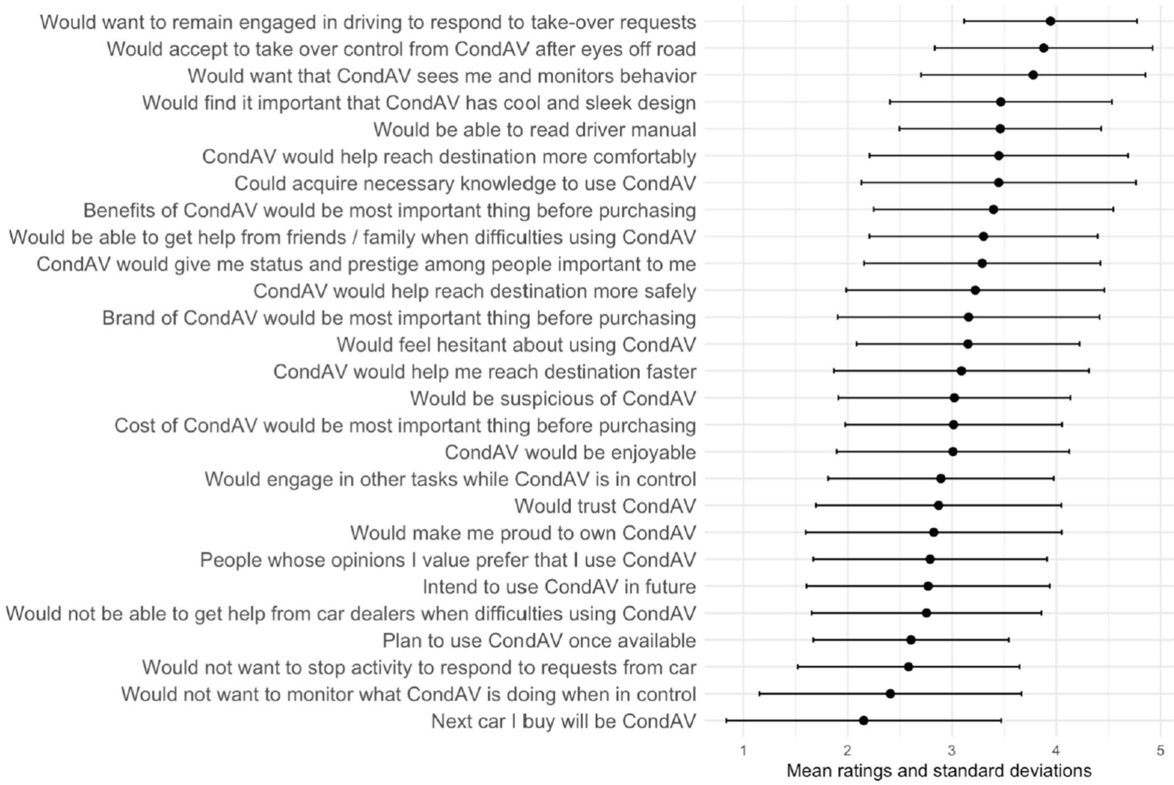

Fig. 2. Boxplots of survey questions sorted by means in descending order from highest to lowest. CondAV = conditionally automated vehicle.

The present study analysed the questions of sections A and D. The responses obtained for the remaining questions are planned to be processed in consecutive studies as it is beyond the scope of the present study to analyze the responses obtained for these questions in sufficient detail. Access to the complete questionnaire is provided in the Appendix in Table A1.

Table 2
Relative frequencies & confirmatory factor analysis results (α = Cronbach's alpha, CR = Composite reliability)

Latent variable	Observed variable	Relative frequencies (%)					Lambda
		1	2	3	4	5	ƛ
Performance expectancy (PE) (α = 0.81, CR = 0.85)	PE1: Using a conditionally automated car would help me reach my destination more safely (q14r.1)	8.41	11.70	37.46	31.91	10.53	0.82
	PE2: Using a conditionally automated car would help me reach my destination more comfortably (q14r.2)	7.28	8.93	28.47	40.48	14.84	0.83***
	PE3: The cost of the conditionally automated car would be the most important thing I would consider before purchasing one (q14r.3)	6.01	9.88	25.56	38	20.55	–
	PE4: The benefits of using a conditionally automated car would be the most important thing I would consider before purchasing one (q14r.4)	7.37	9.25	27.36	40.87	15.15	–
	PE5: Using a conditionally automated car would help me to reach my destination faster (q14r.5)	10.90	18.77	35.91	25.33	9.08	–
Social influence (SI) (α = 0.79, CR = 0.67 = 0.82)	SI1: I assume that people whose opinions I value would prefer that I use a conditionally automated car (q14r.11)	13.85	17.28	38.66	23.15	7.07	–
	SI2: Using a conditionally automated car would give me status and prestige among people important to me (q14r.12)	17.44	17.58	32.81	23.67	8.49	0.73
	SI3: It would make me proud to own a conditionally automated car (q14r.13)	12.44	12.32	31.90	29.78	13.56	0.89***
Facilitating conditions (FC)	FC1: I could acquire the necessary knowledge to use a conditionally automated car (q14r.17)	3.42	5.17	22.78	45.86	22.78	1.00
	FC2: I would be able to get help from my friends and / or family when I have difficulties using a conditionally automated car (q14r.18)	10.71	15.83	32.82	31.91	8.74	–
	FC3: I would not be able to get help from car dealers when I have difficulties using a conditionally automated car (q14r.19)	11.49	24.06	38.39	19.60	6.47	–
	FC4: I would be able to read the driver manual when I have difficulties using a conditionally automated car (q14r.20)	4.12	6.24	24.41	46.49	18.73	–
Hedonic motivation (HM)	HM1: Using a conditionally automated car would be enjoyable (q14r.14)	8.73	10.70	30.26	36.42	13.90	1.00
	HM2: I find it important that the conditionally automated car has a sleek and cool design (q14r.15)	7.56	9.80	33.27	35.95	13.43	–
	HM3: The brand of the conditionally automated car would be the most important thing I would consider before purchasing one (q14r.16)	10.53	16.13	33.40	30.06	9.89	–
Teaming (TEAM) (α = 0.66, CR = 0.67)	TEAM1: I would accept that I might have to take over control from the conditionally automated car after having my eyes off the road for a prolonged period of time (q14r.6)	2.83	6.12	24.47	44.38	22.20	–
	TEAM2: I would not want to monitor what the conditionally automated car is doing when it is in control (reverse-scaled) (q14r.7)	20.90	28.02	25.41	19.28	6.38	0.70
	TEAM3: I would not want to stop the other activity I am doing to respond to requests from the car to take over control (reverse-scaled) (q14r.8)	27.95	24.05	25.09	17.63	5.29	0.70***
	TEAM4: I would want to remain engaged in the driving task, e.g., periodically touch the steering wheel, to be able to respond to requests from the car to take over control (q14r.9)	2.08	5.41	21.85	47.17	23.49	–
	TEAM5: I would want that the conditionally automated car "sees" me and monitors my behaviour to make sure that I am able to respond to requests from the car to take over control (q14r.10)	5.58	8.47	26.71	41.65	17.59	–
Trust (TRU) (α = 0.81,CR = 0.80)	TRU1: I would be suspicious of conditionally automated cars (reverse-scaled) (q12.1)	5.65	20.23	26.07	33.69	14.36	0.82
	TRU2: I would trust conditionally automated cars (q12.2)	9.77	21.67	28.46	30.63	9.47	–
	TRU3: I would engage in other tasks while the conditionally automated car is in control (q12.3)	13.87	25.21	23.03	29.60	8.30	–
	TRU4: I would feel hesitant about using a conditionally automated car (reverse-scaled) (q12.4)	5.99	18.56	22.17	34.44	18.86	0.83***
Behavioral intention (BI) (α = 0.85,CR = 0.90)	BI1: I plan to use a conditionally automated car once it becomes available (q12.5)	18.81	19.92	28.96	22.90	9.40	0.83***
	BI2: I intend to use a conditionally automated car in the future (q15.1)	15.33	11.60	26.73	31.92	14.42	0.89
	BI3: The next car I buy will be a conditionally automated car, if it is available (q15.2)	21.32	18.50	29.26	22.43	8.48	–

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

3.4. Data analysis

A confirmatory factor analysis is conducted to estimate the measurement relations between the latent constructs and underlying questionnaire items by assessing the internal consistency reliability (i.e., Cronbach's alpha), composite reliability, convergent validity, and discriminant validity. Cronbach's alpha and composite reliability are both measures for reliability, but Cronbach's alpha is unweighted and therefore less accurate than composite reliability which is weighted. Cronbach's alpha and composite reliability should exceed 0.70 for a construct to be reliable. Convergent validity is measured by the average variance extracted (AVE), which is computed by averaging the indicator reliabilities of a construct. It is a measure for the average variance that is shared between the construct and its indicator or manifest variables, and should be 0.50 or higher. Discriminant validity measures the distinctivenss of each construct, and is established when the shared variance within a construct is larger than the shared variance between the constructs (Anderson & Gerbing, 1988; Hair, 2009; Hair et al., 2020).

A structural equation modeling analysis is performed based on the measurement model, which is identified in the confirmatory factor analysis. This step involves testing the structural path relationships between the latent constructs in the model, examining the standardized regression coefficients, standard error terms, significance levels, and variance accounted for. The sample size fulfils the "ten times rule of thumb", which requires that the sample size is ten times larger than the number of independent variables in the model (Hair et al., 2011).

4. Results

4.1. Descriptive statistics

The analysis of the means and standard deviations of the questionnaire items representing the UTAUT2 factors, trust, and teaming are presented in Fig. 2. Fig. 2 shows the distributions of the responses obtained for these questions in the form of boxplots sorted by their means in descending order from highest to lowest. The highest mean rating is obtained for wanting to accept to take over control from the conditionally automated vehicle after having the eyes off the road for prolonged periods of time, and for wanting to remain engaged in the driving task to be able to respond to requests from the vehicle to take over control. The lowest mean ratings were obtained for not wanting to monitor what the conditionally automated vehicle is doing when it is in control, for not wanting to stop the activity to respond to requests from the vehicle, and for purchasing a conditionally automated vehicle as a next vehicle.

4.2. Confirmatory factor analysis

A confirmatory factor analysis is conducted to compute the validity and reliability of the measurement model. As mentioned before, the measurement model assesses the relationship between the questionnaire items (observed variables) and their underlying latent constructs. As shown by Table 2, the standardized factor loadings exceed the recommended threshold of 0.60 for all constructs after removing questionnaire items with loadings of < 0.60, and to improve the discriminant validity (uni-dimensionality) of the latent constructs. Consequently, facilitating conditions and hedonic motivation are single-item constructs. Their psychometric properties as single-item constructs can't be computed. The use of single-item constructs in structural equation models is acceptable if their use is limited, and justified (Hair, 2009). The validity and reliability of the items measuring facilitating condition and hedonic motivation are supported in our previous study (Nordhoff et al., 2020). Cronbach's alpha and composite reliability exceed the common threshold of 0.70 for all constructs except for teaming (0.66). This demonstrates that the constructs are largely internally consistent (internal consistency reliability). The fit of the measurement model is acceptable, with most indexes exceeding the recommended thresholds (CFI = 0.98, RMSEA = 0.06). The x^2 test statistic (x^2/df, degrees of freedom) is 36.43, exceeding the recommended threshold of 2.5. It is sensitive to sample size, with larger sample sizes leading to higher values (Hair, 2009; Hu & Bentler, 1999).

The AVE of all constructs meets the recommended threshold of ≥ 0.50 (PE = 0.68, SI = 0.66, DE = 0.50, TRU = 0.68, BI = 0.78). As shown by Table 3, the square root of the AVE of all constructs exceeds the correlation coefficients of all constructs, demonstrating that the latent constructs are sufficiently distinct (discriminant validity).

Table 3
Discriminant validity test; Pearson correlation matrix

Constructs	PE	SI	FC	HM	TEAM	TRU	BI
PE	**0.82**						
SI	0.68***	**0.71**					
FC	0.44***	0.36***	**1**				
HM	0.73***	0.69***	0.45***	**1**			
TEAM	0.44***	0.42***	0.03**	0.30***	**0.81**		
TRU	0.51***	0.43***	0.26***	0.51***	-0.11***	**0.82**	
BI	0.72***	0.71***	0.40***	0.72***	-0.37***	0.59***	**0.88**

Note: The numbers in bold are the square root of the AVE of each construct, and the off-diagonal elements represent the correlation coefficients. *** $p < 0.001$

Table 4
Predicting behavioral intention to use conditional automated driving (direct effects & indirect effects)

Hypotheses	Structural path	Path coefficient
Indirect effects		
H1	FC →PE	0.173***
H2	PE →HM	0.852***
H3	SI →PE	0.657***
H4	TRU →PE	0.227***
H5	SI →TRU	0.674***
H6	TEAM →PE	-0.072***
H7	TEAM →TRU	0.205***
H8	TEAM →BI	-0.084***
Direct effects*		
-	Age →BI	-0.053***
-	Gender_Male →BI	0.053***
-	PE →BI	0.360***
-	TRU →BI	0.245***
-	SI →BI	0.297***
-	HM →BI	0.058***
-	FC →BI	0.031***
-	TEAM →BI	-0.084***

Note: *Note that we did not formalize testable hypotheses for the direct effects given the wealth of research in this area and the focus of the present study on the indirect effects.
*** $p < 0.001$

4.3. Structural equation modeling analysis

We run structural equation modeling analysis to test the structural path relationships between our study variables. The structural equation model investigates the indirect and direct effects of the UTAUT2 variables on behavioral intention. Table 4 presents the results of the structural equation modeling analysis. Most of the hypotheses are supported. The results of the analysis will be discussed in the subsequent section.

5. Discussion

Between 27%–39% of respondents did not intend to use conditional automated driving, while 39% of respondents did not express an intention to purchase conditional automated driving once it is available. This supports our prior research on the user acceptance of conditional automated driving in which the willingness to buy a conditionally automated vehicle was below 30% (Nordhoff et al., 2020). Wang, Tang, and Pan (2018) found that only 18% of respondents expressed a willingness to purchase electric vehicles to replace their conventional vehicles.

The structural equation modeling analysis has shown that performance expectancy is the strongest positive predictor of the behavioral intention to use conditional automated driving, supporting prior research (Kaye et al., 2020; Meyer-Waarden & Cloarec, 2022; Panagiotopoulos & Dimitrakopoulos, 2018). Social influence is the second-strongest predictor of the behavioral intention to use conditional automated driving, followed by trust, a finding which concurs with studies (Park et al., 2021; Zhang et al., 2020). The positive effect of facilitating conditions on behavioral intention is small ($\beta < 0.10$), perhaps because participants consider conditional automated driving easy to use as they expect it doing most of the driving, diminishing the need for driver training and education to operate these systems safely and comfortably (Gopinath & Narayanamurthy, 2022; Zhang et al., 2021). As our participants had no system experience, the effect may become stronger with experience as people may realize the need for infrastructure or other facilities supporting their use of the system (see Gopinath & Narayanamurthy, 2022). Some prior studies reported a non-significant effect of facilitating conditions on behavioral intention (Kaye et al., 2020; Ljubi & Groznik, 2023). In Zefreh, Edries, Esztergár-Kiss, et al. (2023b), the effect of facilitating conditions on behavioral intention is significant in the developed countries, but not significant in the developing countries. Similarly, the positive effect of hedonic motivation on behavioral intention is small ($\beta < 0.10$), which does not align with our previous study where hedonic motivation is the strongest predictor of the user acceptance of conditional automated driving (Nordhoff et al., 2020). This finding is perhaps due to differences in research design, such as the sample population, survey design, and operationalization of our study constructs.

The present study finds a small positive effect of trust on behavioral intention ($\beta < 0.30$), supporting other research (Zefreh, Edries, Esztergár-Kiss, et al., 2023b; Zhang et al., 2020). Yet, these findings stand in contrast to the bulk of research, which has shown that trust is one of the most important drivers influencing acceptance and use (Mir, 2025; Schaefer, 2016; Zhang et al., 2019; Zhang et al., 2021). It is plausible that our finding is due to the measurement of trust, which does not consider the multidimensionality and full scope of trust (see Schaefer, 2016).

Teaming has a small negative effect on behavioral intention. This is counterintuitive and suggests that teaming may not be an important factor explaining the behavioral intention to use conditional automated driving. It does not align with studies reporting a positive link between teaming and behavioral intention (Berretta et al., 2023). It is plausible that this finding is due to the measurement of teaming, which does not comprehensively consider all aspects of teaming (see Lee et al., 2023). Results may also change with actual experience with conditional automated driving, considering that teaming has been associated with issues such as trust calibration (levels of trust not aligned with the actual capabilities of the automation), conflicts of control authority, regaining and maintaining situational awareness, and control transitions (Correa-Julian et al., 2024).

Elderly respondents are less likely to accept conditional automated driving than younger respondents, which mirrors previous findings (Louw et al., 2021; Taniguchi, Enoch, Theofilatos, & Ieromonachou, 2022; Weigl, Nees, Eisele, & Riener, 2022). In the study of Park et al. (2021) the effect of gender on the intention to use automated vehicles was not significant. Males are more willing to use conditional automated driving, supporting prior studies (Wang et al., 2022; Weigl et al., 2022). Modliński et al. (2022) found that religious men were less positive and less trustful of automated vehicles, which could be an interesting avenue for future research.

We also investigated the indirect effects of the UTAUT variables. Performance expectancy has a strong effect on hedonic motivation, which suggests that the perceived benefits of conditional automated driving explain its perceived enjoyment. The positive relationship between performance expectancy and hedonic motivation can be explained with regards to flow theory (Csikszentmihalyi, 1990), which suggests that optimal experiences occur when individuals perceive a balance between the challenges of an activity and their skills, resulting in intrinsic enjoyment. In the context of technology adoption, when users expect a system to be useful and capable of enhancing their performance (high PE), they are more likely to experience mastery, efficiency, and goal attainment while using it, which creates conditions for flow, contributing to an increase in enjoyment.

Similarly, social influence has a strong positive effect on trust and performance expectancy, implying that word-of-mouth and the opinon of the individual's social networks has a strong influence on the decision to adopt conditional automated driving, supporting prior research on technology and automated vehicle acceptance (Baabdullah, 2018; Koh & Yuen, 2023; Liu et al., 2019; Man et al., 2025). This finding can be explained with regards to Social Influence Theory (Kelman, 1958; Cialdini & Goldstein, 2004), which suggests that individual's behavioral intentions are not only shaped by their individual evaluations, but also by the perceptions, expectations and behaviors of others, creating a 'herd effect' where individuals follow prevailing attitudes regardless of their own individual trust levels in the technology. In the case of automated vehicles, high media visibility – whether positive hype about automated vehicles or negative coverage (e.g., Tesla incidents) – can act as positive or negative amplifier of social influence (see Ayoub et al., 2021).

We also found a positive effect of facilitating conditions on performance expectancy. This is in line with prior research (Koh & Yuen, 2023). In Man et al. (2025), however, the effect of facilitating conditions on performance expectancy is negative, albeit small. The direct effect of teaming on trust is positive, supporting prior literature (Berretta et al., 2023).

6. Theoretical and practical contributions

Manufacturers of conditional automated driving should take these study findings into account when designing and marketing conditional automated driving to their prospective consumers.

Given that performance expectancy is the strongest predictor of the behavioral intention to use conditional automated driving, it can be effectively marketed by promoting the expected benefits of conditional automated driving. Future research should investigate whether trust can be improved by communicating the enhanced data-supported safety benefits (Keszey, 2020).

The effect of facilitating conditions on the behavioral intention is small, suggesting that the availability of conditions facilitating the use of conditional automated driving may not be very effective to promote user acceptance. A plausible explanation is that respondents may expect that using conditional automated driving does not require additional knowledge or learning as the driving task is highly automated. A lack of awareness of the necessary resources needed to operate automated vehicles may explain the small effect (see Zefreh, Edries, Esztergár-Kiss, et al., 2023a). We recommend future research to examine to what extent increasing driver awareness of the resources needed to operate conditionally automated vehicles influences the role of facilitating conditions for the acceptance of conditional automated driving.

The construct 'teaming' captures monitoring the road ahead, and being willing to stop a NDRT to respond to take-over requests from the car. Given that the construct is based on self-developed questions, we recommend future research to re-assess its role for the behavioral intention to use conditional automated driving.

It is plausible that the findings obtained on gender and age may be driven by other variables, such as technology interest that have not been controlled for (Wicki, Brückmann, Quoss, & Bernauer, 2023). Future research should examine possible pathways through which gender can affect acceptance, such as travel behavior, environmental preferences, and gender roles (Sovacool, Kester, Noel, & de Rubens, 2018).

Given that the effect of social influence on trust and performance expectancy is positive, we recommend future research to examine the interpersonal communication between consumers, and how it affects trust and the perceived benefits of conditional automated driving (Zhao, Ma, Shao, & Ma, 2022). The positive effect of social influence on performance expectancy suggests that the individual's social networks are pivotal to promoting the perceived benefits of conditional automated driving. We recommend future research to examine how word-of-mouth and the opinon of the individual's social networks influence the decision to adopt conditionally automated vehicles.

We also find a positive effect of facilitating conditions on performance expectancy, suggesting that the availability of conditions in the individual's environment supporting acceptance and use can promote the perceived benefits of this technology. However, the effect is small, implying that there may be other, more effective ways to promote the perceived benefits of conditional automated driving.

Given that teaming affects trust in conditional automated driving, promoting the collaboration between humans and conditionally automated vehicles can be important to build trust in these vehicles. This can be achieved through the explainability of the actions of the conditionally automated driving system, for instance, through textual and/or auditive messages and visualizations on the vehicle's interface (see Zhang et al., 2024). Cognition-aware shared autonomoy systems – driver monitoring systems that detect cognitive impairment of human drivers and restore the human to an optimal cognitive state – can ensure effective collaboration between the human and the conditional automated driving system. However, future research should assess the effectiveness and user acceptance of these systems in measuring human's cognitive state and issuing take-over interventions or by actively disengaging the automation and taking over control. Drivers may worry about privacy and accountability issues because collaboration with the conditional automated driving system may imply that the vehicle gains access to and analyses sensitive information, such as neural brain data, or because drivers will be hold morally accountable for using a system that requires constant vigilance but promotes cognitive impairment (see Suryana et al., 2025). Moreover, the conditional automated driving system should be effectively marketed as teammate, friend or companion whose role is to not only keep the human safe but to make the ride more enjoyable and comfortable, contributing positively to the human's happiness (see Berretta et al., 2025; Lou et al., 2025). Given that there is a lack of a formal definition of teaming in the important context of conditional automated driving, our study contributes to its operationalization, yet invites future researchers to map this construct on other relevant Human Factors constructs that we discussed before (e.g., situational awareness, mode awareness and confusion) (see Kurpiers et al., 2020).

7. Conclusions

This study reports the results of a questionnaire study conducted among a representative sample of more than 9,000 car drivers on their acceptance of conditional automated driving. UTAUT2 is extended by trust and teaming that are considered pivotal for user acceptance of conditional automated driving. Most of our hypotheses are supported. The effect of performance expectancy on behavioral intention is strongest, followed by social influence and trust. The effect of social influence on trust and the effect of performance expectancy on trust are relatively large. Teaming has a small positive effect on trust, which suggests that effective teaming between humans and the conditionally automated vehicle can promote trust.

The study's limitations can provide important avenues for future research. Respondents in the present study did not physically experience conditionally automated vehicles. This 'hypothetical' bias is a well-known limitation of survey research given that conditionally automated vehicles are not yet (widely) available to the public. We recommend future research to perform naturalistic driving studies with respondents physically experiencing conditionally automated vehicles. Moreover, access to participation in the questionnaire was limited to respondents with access to internet. Thus, our sample represents an internet-affine convenience sample, skewing towards tech-savvy individuals from a higher social and economic standing, potentially inflating acceptance estimates. We recommend future research to perform sensitivity analyses or weighting to address this selection bias. Moreover, future research should be performed with respondents without internet accessibility to examine differences in attitudes and acceptance between internet-affine and less internet-affine groups. We also did not examine the effect of effort expectancy for behavioral intention given that previous studies reported ambigious findings about its effect on behavioral intention. Respondents may expect limited human intervention in conditionally automated vehicles, resulting in a diminished role of effort expectancy on behavioral intention (Park et al., 2021). Another limitation pertains to the operationalization of teaming. These questions were self-developed as there has been little knowledge on the exact measurement of this construct for the context of conditional automated driving. We recommend future research to re-assess the operationalization of the construct teaming for conditional automated driving to contribute to scale development and validation. Finally, as hypothetical bias may be present, future studies should assess the reliability and accuracy of willingness-to-pay measures, using more immersive data collection methods, such as driving simulators and on-road studies.

CRediT authorship contribution statement

S. Nordhoff: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **S. Calvert:** Writing – review & editing. **M. Hagenzieker:** Writing – review & editing. **Y. M. Lee:** Conceptualization. **N. Merat:** Writing – review & editing, Funding acquisition.

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.

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Appendix

Table A1

With this questionnaire, we would like to get your opinion **on conditionally automated cars.** Conditionally automated cars can drive on **motorways, congested motorways, in urban traffic, and parking situations.** These cars still have gas and brake pedals and a steering wheel.You are not driving when the car is in conditionally automated mode - even if you are seated in the driver's seat. This will allow you to engage in other activities except for sleeping. However, the car might ask you to resume control at any time, in which case you will have to stop what you are doing and resume control of the driving task.The questionnaire is executed as part of the research project L3Pilot (https://l3pilot.eu/). It will take around 20 minutes and your responses will be treated anonymously.Thank you very much for your participation.

Section A: Personal information (Q1 – Q5)

Question code	Question	Response categories
Section A: Personal information (Q1 – Q5)		
q1_i	How old are you?	
q2_i	What is your gender?	□Male□Female□Other□Prefer not to answer
q3_i	Which of the following groups / categories represents your household income?	UK – annual gross household income□less than 13,000 £□13,000 £ to less than 19,000 £□19,000 £ to less than 26,000 £□26,000 £ to less than 32,000 £□32,000 £ £ to less than 48,000 £□48,000 £ to less than 64,000 £□64,000 £ to less than 96,000 £□More than 96,000 £USA - annual gross household income□Under $15,000□$15,000 to $ 24,999□$ 25,000 to $ 34,999□$ 35,000 to $ 49,999□$ 50,000 to $ 74,999□$ 75,000 to $ 99,999□$ 100,000 to $ 149,999□$ 150,000 to $ 199,999□$ 200,000 and overFR - monthly household net income□Moins de 999 Euro□1000 Euro - 1999 Euro□2000 Euro - 2499 Euro□2500 Euro - 2999 Euro□3000 Euro - 3499 Euro□3500 Euro - 3999 Euro□4000 Euro ou plusHU - monthly household net income□100.000 Ft alatt□100.000-150.000 Ft□150.000-200.000 Ft□200.000-250.000 Ft□250.000-300.000 Ft□350.000-400.000 Ft□400.000-500.000 Ft□500.000 Ft és többDE - monthly household net income□Unter 1.000 Euro□ 1.000 bis unter 1.500 Euro□ 1.500 bis unter 2.000 Euro□ 2.000 bis unter 2.500 Euro□ 2.500 bis unter 3.000 Euro□ 3.500 bis unter 4.000 Euro□ 4.000 bis unter 5.000 Euro□ 5.000 Euro oder mehrCN - monthly household net income□ 4.000 RMB 或以下□ 4.001 - 6.000 RMB□ 6.001 - 8.000 RMB□ 8.001 - 10.000 RMB□ 10.001 - 15.000 RMB□ 15.001 - 20.000 RMB□ 20.001 - 40.000 RMB□ 40.001 - 60.000 RMB□ 60.001 - 80.000 RMB□ 80.001 RMB 以上BR - annual gross household income□ Menos de R$ 9.000□ De R$ 9.000 a R$ 17.999□ De R$ 18.000 a R$ 26.999□ De R$ 27.000 a R$ 35.999□ De R$ 36.000 a R$ 44.999□De R$ 45.000 a R$ 53.999□De R$ 54.000 a R$ 63.999□Mais de R$ 64.000JP - annual gross household income□< 1,000,000円□ 1,000,000-1,999,999円□ 2,000,000-2,999,999円□ 3,000,000-3,999,999円□ 4,000,000-4,999,999円□ 5,000,000-5,999,999円□ 6,000,000-7,999,999円□ ≥ 8,000,000円RU - annual gross household income□ Менее 150 000 руб.□ От 150 000 до 299 999 руб□ От 300 000 до 449 999 руб.□ От 450 000 до 599 999 руб.□ От 600 000 до 749 999 руб□ От 750 000 до 899 999 руб.□ От 900 000 до 1 049 999 руб□ 1 050 000 руб. или больше
q4_i	What is the highest educational level you have completed or you are about to complete?	□ University degree□ Trade/technical/vocational training□ None of those
q5	How many children under 19 years old live in your household?	□ None□ 1□ 2□ 3□ 4□ More than 4
Section B: Personality and driving profile (Q6-Q20)		
q6	Do you have a valid driving license?	□ Yes (please, move to Q5, please)□ No (move to end of questionnaire)
q7	Approximately how many kilometres/miles did you drive in the last 12 months?	In kilometers□ Less than 2,000 km□ 2,000–5,000 km□ 5,000–10,000 km□ 10,000–15,000 km□ 15,000–20,000 km□ 20,000–50,000 km□ More than 50,000 kmIn miles□ Less than 1,000 miles□ 1,000–3,000 miles□ 3,000–6,000 miles□ 6,000–9,000 miles□ 9,000–12,000 miles□12,000–30,000 miles□ More than 30,000 miles
Here are a number of characteristics that may or may not apply to you. Please indicate your level of agreement with the following statements.		
8.1	I see myself as someone who is reserved	□ Strongly disagree□ Disagree□ Neutral□ Agree□ Strongly agree
8.2	I see myself as someone who is generally trusting	
8.3	I see myself as someone who tends to be lazy	
8.4	I see myself as someone who is relaxed, and handles stress well	
8.5	I see myself as someone who has few artistic interests	
8.6	I see myself as someone who is outgoing, sociable	
8.7	I see myself as someone who tends to find fault with others	
8.8	I see myself as someone who does a thorough job	
8.9	I see myself as someone who gets nervous easily	
8.10	I see myself as someone who has an active imagination	
Please indicate your level of agreement with the following statements.		
q9.1	I love driving	□ Strongly disagree□ Disagree□ Neutral□ Agree□ Strongly agree
q9.2	I like to drive just for the fun	
q9.3	I feel free and independent if I drive	
q9.4	My own risky driving behavior could cause an accident.	

(*continued on next page*)

Table A1 (*continued*)

q9.5	The high speed I drive at can be the cause of a car accident	
q9.6	My lack of driving skills could produce an accident.	
q9.7	The risky overtaking maneuvers that I initiate may lead to accidents	
q9.8	Traffic accidents can result from my own driving errors.	
Section C: Awareness of automated vehicles (Q21-Q22)		
q10.	Have you ever heard of automated vehicles or driverless cars?	☐ Yes (please, move to Q22, please)☐ No (move to Q23, please)
q11	If yes, how often do you read / watch / listen to information about automated vehicles?	☐ Never☐ Rarely☐ Occasionally☐ Often
Section D: Attitudes towards conditionally automated cars (Q23-Q60).Now please indicate your level of agreement with the following items.		
q12.1	I would be suspicious of conditionally automated cars	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q12.2	I would trust conditionallyautomated cars	
q12.3	I would engage in other tasks while the conditionally automated car is in control	
q12.4	I would feel hesitant about using aconditionally automated car	
q12.5	I plan to use a conditionallyautomated car once it becomes available	
When driving in automated mode, you can engage in other activities. The car may ask you to take back control if needed. How often would you engage in the following activities while the system is active?		
q13.1	Spending time with my fellow passengers (e.g., talking, playing games)	☐ Always☐ Very often☐ Sometimes☐ Rarely☐ Never☐ Not relevant to me
q13.2	Entertaining/ taking care of children	
q13.3	Messaging/calling friends or family	
q13.4	Listening to music, radio, or audio books	
q13.5	Using digital media (e.g., browsing, watching videos, playing games)	
q13.6	Reading a book or magazine	
q13.7	Eating or drinking	
q13.8	Monitoring how the car is functioning	
q13.9	Observing the landscape or road ahead	
q13.10	Relaxing and/or resting	
q13.11	Working (e.g., phone calls, meeting s, emails)	
Now please rate the level of agreement with the following aspects pertaining to the use of a conditionally automated car.		
q14.1	Using a conditionally automated car would help me reach my destination more safely	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q14.2	Using a conditionally automated car would help me reach my destination more comfortably	
q14.3	The cost of the conditionally automated car would be the most important thing I would consider before purchasing one	
q14.4	The benefits of using a conditionally automated car would be the most important thing I would consider before purchasing one	
q14.5	Using a conditionally automated car would help me to reach my destination faster	
q14.6	I would accept that I might have to take over control from the conditionally automated car after having my eyes off the road for a prolonged period of time.	
q14.7	I would not want to monitor what the conditionally automated car is doing when it is in control	
q14.8	I would not want to stop the other activity I am doing to respond to requests from the car to take over control	
q14.9	I would want to remain engaged in the driving task, e.g., periodically touch the steering wheel, to be able to respond to requests from the car to take over control	
q14.10	I would want that the conditionally automated car “sees” me and monitors my behaviour to make sure that I am able to respond to requests from the car to take over control	
q14.11	I assume that people whose opinions I value would prefer that I use a conditionally automated car	
q14.12	Using a conditionally automated car would give me status and prestige among people important to me	

(*continued on next page*)

Table A1 (*continued*)

q14.13	It would make me proud to own a conditionally automated car	
q14.14	Using a conditionally automated car would be enjoyable	
q14.15	I find it important that the conditionally automated car has a sleek and cool design	
q14.16	The brand of the conditionally automated car would be the most important thing I would consider before purchasing one	
q14.17	I could acquire the necessary knowledge to use a conditionally automated car	
q14.18	I would be able to get help from my friends and/or family when I have difficulties using a conditionally automated car	
q14.19	I would not be able to get help from car dealers when I have difficulties using a conditionally automated car	
q14.20	I would be able to read the driver manual when I have difficulties using a conditionally automated car	
Now, we would like to know whether you are planning to use conditionally automated cars once they are on the market.		
q15.1	I intend to use a conditionally automated car in the future	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q15.2	The next car I buy will be a conditionally automated car, if it is available	
Section E: Attitudes towards using different conditionally automated car systems (Q61-Q80).		
STREAM 1:The next section will provide a list of statements about the different conditionally automated car systems. You are asked to read each of these statements and to answer some questions on whether you would use each of the systems.**System A: The Motorway System** can be activated by the driver on free-flowing motorways **up to 130 km/h**. When it is on, the car will do **all of the steering, accelerating and braking,** and you will not be required to monitor the road ahead. It will **maintain a safe distance** to the vehicle in front, **changing lane** to overtake traffic if required. To what extent do you agree or disagree with the following statements?		
q16i.1	I would be suspicious of the motorway system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q16i.2	I would trust the motorway system	
q16i.3	I would engage in other tasks while the motorway system is turned on	
q16i.4	I would feel hesitant about using the motorway system	
q16i.5	I plan to use a motorway system once it becomes available	
System B: The Traffic jam system is designed to deal with slow or stationary traffic in motorway environments, up to a speed of 60 km/h. It can be activated by the driver on the approach to a traffic build-up on open roads. The car will do all of the steering, accelerating and braking for as long as and you will not be required to monitor the road ahead. To what extent do you agree or disagree with the following statements?		
q17i.1	I would be suspicious of the traffic jam system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q17i.2	I would trust the traffic jam system	
q17i.3	I would engage in other tasks while the traffic jam system is turned on	
q17i.4	I would feel hesitant about using the traffic jam system	
q17i.5	I plan to use a traffic jam system once it becomes available	
System C: The Urban System can be activated on urban roads up to a speed of 50 km/h. When the system is activated, the car will do all of the steering, accelerating and braking, and you will not be required to monitor the road ahead. It can drive in signalized and unsignalized intersections, along with simple roundabouts. To what extent do you agree or disagree with the following statements?		
q18i.1	I would be suspicious of the urban system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q18i.2	I would trust the urban system	
q18i.3	I would engage in other tasks while the urban system is on	
q18i.4	I would feel hesitant about using the urban system	
q18i.5	I plan to use an urban system once it becomes available	
System D: The **Parking System** can be activated to complete **parallel and perpendicular parking** manoeuvres for parking into and out of a parking space, **both on-street and in parking lots.** The system can detect non-motorized road users including pedestrians and cyclists.		
q19i.1	I would be suspicious of the parking system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q19i.2	I would trust the parking system	
q19i.3	I would engage in other tasks while the parking system is on	
q19i.4	I would feel hesitant about using the parking system	

(*continued on next page*)

Table A1 (*continued*)

q19i.5	I plan to use a parking system once it becomes available	
Section F: Attitudes towards driving & experience with driver assistance systems (Q81-Q91)With the last questions, we would like to ask you to provide some information on your previous experience with road vehicle automation.		
Have you ever experienced the following systems in any car you have travelled in?		
q21.1	Lane Keeping Assistance (LKA) helps the driver to avoid inadvertently moving out of the lane by controlling the steering	
q21.2	Adaptive Cruise Control (ACC) maintains speed, but automatically slows down or speeds up to keep a pre- selected distance from a car ahead	
q21.3	Self-parking Assist System controls the car for parallel or reverse parking. The system may control both steering and the throttle, or only control the steering (the driver presses the brake and throttle) during the parking maneuver. The driver is in the car during the parking maneuver	
How often do you activate the following systems in your car?		
q22.1	Lane Keeping Assistance (LKA) helps the driver to avoid inadvertently moving out of the lane by controlling the steering	☐ Not applicable☐ Never☐ Rarely☐ Occasionally☐ Frequently☐ Always
q22.2	Adaptive Cruise Control (ACC) maintains speed, but automatically slows down or speeds up to keep a pre-selected distance from a car ahead	
q22.3	Self-parking Assist System controls the car for parallel or reverse parking. The system may control both steering and the throttle, or only control the steering (the driver presses the brake and throttle) during the parking maneuver. The driver is in the car during the parking maneuver	
STREAM 2:The next section will provide a list of statements about the different conditionally automated car systems. You are asked to read each of these statements and to answer some questions on whether you would use each of the systems.**System A: The Motorway System** can be activated by the driver on free-flowing motorways **up to 130 km/h**. When it is on, the car will do **all of the steering, accelerating and braking,** and you will not be required to monitor the road ahead. It will **maintain a safe distance** to the vehicle in front, **changing lane** to overtake traffic if required.The car requires visible lanes and road markings, so may ask the driver to re-take control if, for example, there are roadworks where lane markings have been removed, or a situation where there is poor weather conditions, including heavy rain, snow, or surface water. The driver will also be asked to re-take control when the vehicle is leaving the motorway. To what extent do you agree or disagree with following statements?		
q23i.1	I would be suspicious of the motorway system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q23i.2	I would trust the motorway system	
q23i.3	I would engage in other tasks while the motorway system is turned on	
q23i.4	I would feel hesitant about using the motorway chauffeur system	
q23i.5	I plan to use a motorway chauffeur system once it becomes available	
System B: The Traffic jam system is designed to deal with slow or stationary traffic in motorway environments, up to a speed of 60 km/h. It can be activated by the driver on the approach to a traffic build-up on open roads. The car will do all of the steering, accelerating and braking for as long as the traffic jam persists, and you will not be required to monitor the road ahead.The car **requires visible lanes and road markings** so may ask the driver to re-take control if, for example, there are roadworks where lane markings have been removed, or a situation where there is **poor weather conditions, including heavy rain, snow, or surface water**. The driver will also be asked to re-take control when the vehicle is **leaving the motorway,** and if there is no longer a **vehicle in the lane ahead**.		
q24i.1	I would be suspicious of the traffic jam system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q24i.2	I would trust the traffic jam system	
q24i.3	I would engage in other tasks while the traffic jam system is turned on	
q24i.4	I would feel hesitant about using a traffic jam system	
q24i.5	I plan to use a traffic jam system once it becomes available	
System C: The Urban System can be activated on urban roads up to a speed of 50 km/h. When the system is activated, the car will do all of the steering, accelerating and braking, and you will not be required to monitor the road ahead. It can drive in signalized and unsignalized intersections, along with simple roundabouts. The car **requires visible lane and road markings, along with markings of street parking and cycle lanes,** so may ask the driver to re-take control if these are not present. Drivers will also be asked to take control in **poor weather such as rain or snow, or situations where there is surface water.** Finally, the driver will also be asked to re-take control **to deal with complex roundabouts, junctions, or railway / tram crossings.**To what extent do you agree or disagree with following statements?		
q25i.1	I would be suspicious of the urban system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q25i.2	I would trust the urban system	
q25i.3	I would engage in other tasks while the urban system is on.	
q25i.4	I would feel hesitant about using an urban system	
q25i.5	I plan to use an urban system once it becomes available	

(*continued on next page*)

Table A1 (*continued*)

System D: The **Parking System** can be activated to complete **parallel and perpendicular parking** manoeuvres for parking into and out of a parking space, **both on-street and in parking lots.** The system can detect non-motorized road users including pedestrians and cyclists. The car **requires visible markings or parked cars to indicate the parking space,** and the driver **must monitor** the parking manoeuvre. To what extent do you agree or disagree with following statements?		
q26i.1	I would be suspicious of the parking system	☐ Strongly disagree☐ Disagree☐ Neutral☐ Agree☐ Strongly agree
q26i.2	I would trust the parking system	
q26i.3	I would engage in other tasks while the parking system is on	
q26i.4	I would feel hesitant about using a parking system	
q26i.5	I plan to use a parking chauffeur system once it becomes available	
Have you ever experienced the following systems in any car you have travelled in?		
q28.1	Lane Keeping Assistance (LKA) helps the driver to avoid inadvertently moving out of the lane by controlling the steering	☐ Yes☐ No
q28.2	Adaptive Cruise Control (ACC) maintains speed, but automatically slows down or speeds up to keep a pre- selected distance from a car ahead	
q28.3	Self-parking Assist System controls the car for parallel or reverse parking. The system may control both steering and the throttle, or only control the steering (the driver presses the brake and throttle) during the parking maneuver. The driver is in the car during the parking maneuver	
How often do you activate the following systems in your car.		
q29.1	Lane Keeping Assistance (LKA) helps the driver to avoid inadvertently moving out of the lane by controlling the steering	☐ Not applicable to me☐ Never☐ Rarely☐ Occasionally
q29.2	Adaptive Cruise Control (ACC) maintains speed, but automatically slows down or speeds up to keep a pre-selected distance from a car ahead	
q29.3	Self-parking Assist System controls the car for parallel or reverse parking. The system may control both steering and the throttle, or only control the steering (the driver presses the brake and throttle) during the parking maneuver. The driver is in the car during the parking maneuver	

Table A2
Results of confirmatory factor analysis, all countries

Latent variable	**Observed variable**	**λ**								
	Country	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
	Item									
PE	q14r.1	0.88	0.82	0.83	0.81	0.83	0.65	0.746	0.761	0.801
	q14r.2	0.851***	0.832***	0.829***	0.750***	0.763***	0.692***	0.804***	0.746***	0.832***
	α	0.79	0.81	0.83	0.71	0.77	0.62	0.75	0.72	0.80
SI	q14r.12	0.770	0.777	0.772	0.627	0.626	0.661	0.598	0.764	0.724
	q14r.13	0.902***	0.870***	0.908***	0.874***	0.906***	0.736***	0.882***	0.849***	0.880***
	α	0.82	0.81	0.82	0.71	0.72	0.71	0.68	0.79	0.78
FC	q14r.17	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HM	q14r.14	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DE	q14r.7	0.784	0.665	0.737	0.757	0.666	0.590	0.723	0.665	0.426
	q14r.8	0.752***	0.756***	0.667***	0.558***	0.589***	0.647***	0.618***	0.673***	0.696***
	α	0.74	0.67	0.66	0.59	0.56	0.59	0.62	0.62	0.46
TRU	q12.1	0.789	0.823	0.825	0.678	0.835	0.863	0.759	0.781	0.825
	q12.4	0.828***	0.767***	0.799***	0.892***	0.866***	0.786***	0.848***	0.799***	0.782***
	α	0.79	0.77	0.79	0.75	0.84	0.75	0.77	0.77	0.78
BI	q12.5	0.873***	0.853***	0.847***	0.763***	0.839***	0.767***	0.759***	0.847***	0.781***
	q15.1	0.902	0.869	0.895	0.842	0.873	0.723	0.848	0.840	0.853
	α	0.88	0.85	0.86	0.78	0.84	0.78	0.77	0.83	0.80
Model fit parameters	CFI	0.985	0.973	0.981	0.968	0.966	0.966	0.972	0.984	0.975
	RMSEA	0.057	0.070	0.063	0.068	0.075	0.061	0.063	0.047	0.063
	SRMR	0.027	0.033	0.027	0.039	0.045	0.037	0.039	0.026	0.029
	x^2 teststatistic	4.246	6.119	4.96	5.774	6.919	4.910	5.263	3.228	5.205

Note: Items with factor loadings < 0.60 are highlighted in red; α = Cronbach alpha. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table A3
Discriminant validity test; Pearson correlation matrix for all countries

U.S.	PE	SI	FC	HM	DE	TRU	BI
PE	**0.88**						
SI	0.75***	**0.84**					
FC	0.46***	0.37***	**1**				
HM	0.79***	0.76***	0.45***	**1**			
DE	-0.46***	-0.52***	-0.10***	-0.40***	**0.78**		
TRU	0.44***	0.37**	0.19***	0.46***	-0.04***	**0.81**	
BI	0.78***	0.79***	0.42***	0.79***	-0.44***	0.49***	**0.91**
UK	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.83**						
SI	0.73***	**0.82**					
FC	0.31***	0.23***	**1**				
HM	0.75***	0.70***	0.30***	**1**			
DE	-0.42***	-0.49***	0.04	-0.40***	**0.78**		
TRU	0.49***	0.43***	0.13***	0.49***	0.20***	**0.80**	
BI	0.73***	0.70***	0.31***	0.72***	0.41***	0.60***	**0.87**
FR	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.80**						
SI	0.74***	**0.84**					
FC	0.57***	0.49***	**1**				
HM	0.78***	0.73***	0.57***	**1**			
DE	-0.40***	-0.46***	-0.20***	-0.37***	**0.71**		
TRU	0.54***	0.48***	0.34***	0.52***	-0.19***	**0.81**	
BI	0.75***	0.74***	0.52***	0.74***	0.42***	0.62***	**0.92**
HU	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.78**						
SI	0.60***	**0.76**					
FC	0.31***	0.25***	**1**				
HM	0.60***	0.55***	0.37***	**1**			
DE	-0.28***	-0.31***	0.13***	-0.20***	**0.71**		
TRU	0.48***	0.42***	0.17***	0.45***	-0.19***	**0.80**	
BI	0.62***	0.61***	0.27***	0.59***	-0.31***	0.66***	**0.88**
DE	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.79**						
SI	0.57***	**0.70**					
FC	0.37***	0.16***					
HM	0.67***	0.65***	0.37***	**1**			
DE	-0.23***	0.41***	0.08*	-0.24***	**1**		
TRU	0.54***	0.43***	0.24***	0.62***	0.19***	**0.82**	
BI	0.62***	0.63***	0.30***	0.59***	-0.31***	0.66***	**0.91**
CN	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.67**						
SI	0.48***	**0.70**					
FC	0.45***	0.35***	**1**				
HM	0.57***	0.45***	0.44***	**1**			
DE	-0.23***	-0.43***	0.18***	-0.19***	**0.71**		
TRU	0.17***	0.03	0.09**	0.15***	0.25***	**0.82**	
BI	0.59***	0.52***	0.42***	0.51***	-0.33***	0.18***	**0.66**
BR	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.77**						
SI	0.62***	**0.72**					
FC	0.44***	0.37***	**1**				
HM	0.69***	0.61***	0.47***	**1**			
DE	-0.12***	-0.13**	0.14***	-0.03	**0.68**		
TRU	0.47***	0.38***	0.27***	0.46***	-0.09**	**0.79**	
BI	0.67***	0.61***	0.39***	0.64***	-0.07**	0.57***	**0.72**
JP	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.75**						
SI	0.52***	**0.81**					
FC	0.44***	0.32***	**1**				
HM	0.61***	0.58***	0.37***	**1**			
DE	-0.15***	-0.36***	0.01	-0.15***	**0.65**		
TRU	0.49***	0.37***	0.26***	0.47***	-0.11***	**0.79**	
BI	0.60***	0.59***	0.38***	0.61***	-0.18***	0.60***	**0.89**
RU	**PE**	**SI**	**FC**	**HM**	**DE**	**TRU**	**BI**
PE	**0.82**						
SI	0.68***	**0.81**					
FC	0.47***	0.44***	**1**				
HM	0.75***	0.66***	0.46***	**1**			

(*continued on next page*)

Table A3 (*continued*)

U.S.	PE	SI	FC	HM	DE	TRU	BI
DE	-0.27***	-0.27***	-0.11**	-0.24***	**0.77**		
TRU	0.53***	0.44***	0.26***	0.49***	-0.13***	**0.79**	
BI	0.69***	0.63***	0.43***	0.66***	-0.23***	0.60***	**0.89**

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Data availability

Data will be made available on request.

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