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Driver acceptance of truck platooning: state-of-the-art and insights from a field trial on rural roads

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Truck platooning denotes virtually linking two or more trucks by use of communication and sensor technologies. With increasing automation, platoon driver roles and tasks are likely to change. Some drivers may be encouraged by prospects of teamwork and more flexible work schedules. Others may be concerned about safety and monotony, and fear loss of independence. Acceptance from drivers will depend on the perceived benefits and constraints of truck platooning in the context of their work. However, it is difficult to assess impacts of new technology without first-hand experience. The current study investigated acceptance of platooning in a field trial on rural roads. Three professional drivers operated a three-truck platoon along a 380 km route in Northern Norway, subject to large variations in road conditions. The trucks had automated longitudinal control. Although increasing usefulness and satisfaction were reported during the trial, participants appeared undecided or slightly negative towards truck platooning in interviews and in post hoc ratings. The participants stated that platooning may be advantageous on highways while requiring substantial effort from drivers to work on rural roads.

Keywords: automated vehicles, real-world study, technology acceptance model, road geometry, two-lane roads.

1. Introduction

Fig. 1 A truck platoon with a leader and a follower.

Truck platooning is a subset of connected and automated vehicle technology, in which two or more trucks travel together at short following distances to lower fuel consumption and increase traffic throughput (Eitrheim et al, 2022a). A truck platoon consists of a leader and one or more followers that are virtually linked through vehicle-to-vehicle (V2V) communication (see Fig. 1). Truck platooning is currently positioned at automation levels 1-2 (SAE, 2018). Longitudinal and lateral control may be automated, while the driver monitors the surrounding traffic, the platooning system, and the state of the vehicle. This is often described as supervisory control, requiring fully engaged drivers in all trucks. The human driver guides and monitors automation activities, and intervenes in abnormal situations (Sheridan, 2012). Drivers may switch positions in the platoon, i.e., alternate between serving as leader or follower, to distribute workload and better utilize available hours-of-service (Eitrheim et al., 2022a).

At higher levels of automation, platoon driver roles and tasks are likely to change. Prospects of controlling several trucks as platoon leader, resting, or performing non-driving tasks in following trucks while moving, may encourage some drivers. Others may not trust the technology or co-drivers, fear loss of control, surveillance, and boredom. If a single driver can control multiple driverless trucks, drivers may also perceive platooning as a job threat.

In addition to anticipated fuel savings and traffic flow improvements, platooning is often advocated as a solution to the driver shortage in the trucking industry. However, while platooning may be beneficial for trucking companies, its advantages for drivers must be documented. Whether drivers will accept platooning depends on its ability to support their work and well-being. Driver adoption, i.e., the decision to accept and use the technology, may also depend on the context, e.g., under which road conditions and situations platooning is deployed. Even if platooning was to be feasible and permitted from a technical and regulatory standpoint, it may not be desirable from a driver perspective.

Overall, acceptance of any given technology is related to the technology itself, the user, and the context of use. However, contextual and situational factors in automated driving have been investigated only to a limited extent, such as the future intent to use platooning in specific road conditions (Mara & Meyer, 2022). Most previous studies of driver acceptance of truck platooning have assumed ideal highway conditions, and user expectations and preferences have mostly been researched through surveys and simulator studies. The current study investigated driver acceptance of SAE level 1 truck platooning during a field trial on rural roads. The following sections revisit the acceptance concept through a literature review, before presenting findings from the field trial. Acceptance is first explored independent of context, before gradually focusing on the transportation domain and on truck platooning, in particular.

2. Acceptance of new technology

Acceptance theories aim to identify underlying factors behind individuals' decisions to use (or refuse) technological interventions. Unlike adoption and diffusion theories (e.g., Moore & Benbasat, 1991; Rogers, 2003), the focus of acceptance theories is not on the innovation process itself, but rather on *how* and *to what extent* technologies will be used in the long term. Although user acceptance has been a substantial research focus for many years, definitions, theories, and methods vary across disciplines and domains.

2.1. *Acceptance definition*

The terms *acceptance* and *acceptability* have been used interchangeably, as user reactions to technology can be studied at three different phases: (1) prior to any demonstration or exposure to a mock-up or prototype, (2) while being involved in the design and development of the technology, or (3) after using a commercially available system. The mental representation of the technology and its capabilities is likely being moderated during use (e.g., Beggiato & Krems, 2013; Furlough & Gillan, 2018). While acceptance has a behavioural component, i.e., also including the reactions after use (a posteriori), acceptability denotes the beliefs and feeling towards a phenomenon prior to experience (a priori). Liking the system does not mean accepting the system. A driver may use platooning even without supporting it when considered as the best option, e.g., in slow-moving traffic. Adell et al. (2014) suggest avoiding the term acceptability and rather use the term acceptance. The following definition can be used for both intended and actual usage of driving systems: "*Acceptance is the degree to which an individual incorporates the system in his/her driving, or if the system is not available, intends to use it*." (Adell, 2009, p. 31).

2.2. *Theoretical models of acceptance*

In the 1970s, challenges to adopt information technologies in organizations motivated researchers to investigate factors that could predict usage or rejection. The theory of reasoned action (TRA) by Fishbein and Ajzen (1975) became a starting point for subsequent models and theories. TRA aims to explain the relationship between attitudes and behaviors, i.e., predicting how humans will behave based on a causal sequence of beliefs, attitudes, and intentions. If people evaluate behavior as favorable (attitude) and think others want them to perform the behavior (subjective norm), they will have a stronger intention (motivation) and are more likely to perform the behavior. TRA was later extended in the theory of planned behavior (TPB) (Ajzen, 1991), which included the concept of perceived behavioral control (PBC) as an additional determinant of intentions and behavior. PBC refers to "*people's perception of the ease or difficulty of performing the behavior*" (Ajzen, 1991, p. 183). This may depend on the ability to perform a behavior and required resources, e.g., skills, time, and dependence on others.

The technology acceptance model (TAM) by Davis (1989) is based on assumptions made in the TRA and the TPB. According to TAM, the main determinants for user acceptance are perceived usefulness of a system and the perceived ease of use. Usefulness may be conceived of as a specification of attitudes in TRA, i.e., the extent to which they believe that the technology will be beneficial. Ease of use may impact usefulness in a cost-benefit sense, evaluating required efforts to perform the behavior, i.e., use technology to achieve a goal. Thus, ease of use also overlaps with PBC, such as the belief in one's capabilities to use technology. External variables (e.g., job relevance and voluntariness) were included in refined versions of TAM (e.g., TAM 2 by Venkatesh & Davis, 2000), and are highly relevant for studying technology acceptance in the daily work of professional drivers. Other frameworks, such as the Unified Theory of Acceptance and Use of Technology (UTAUT2) have introduced the concept of automaticity, i.e., the degree to which people rely on routines and habits in accepting technology (Venkatesh et al., 2012). This may complement the role of intention as a proxy for behavior.

2.3. *Acceptance in a larger transport context*

User acceptance models have been criticized for being overly simplistic and overemphasizing the rationality of behaviors, providing results that are not falsifiable and lack predictive validity (e.g., Sniehotta et al., 2014). Moreover, the notion of acceptance can be seen as disempowering, perceiving end users as passive receivers of new technology. Still, applied sensibly through the development of new technologies, acceptance theories may enhance the understanding of different stakeholder positions, achieve more accurate user requirements, and increase user satisfaction (e.g., Kujala, 2003). Acceptance theories provide mechanisms for informing public discourse and generating engagement in transport and mobility transitions (e.g., Sopjani et al., 2019). The potential introduction of truck platooning represents one such transition. The field trial reported here aimed at understanding driver acceptance of platooning when using the available system on rural roads. It also explored the extent to which platooning may fulfil the needs and goals of drivers employed in a transport company.

2.4. *Acceptance of truck platooning*

Previous studies investigating driver acceptance of truck platooning range from surveys and interview studies of a priori acceptance factors (e.g., Fröhlich et al., 2018; Neubauer et al., 2019), simulator studies evaluating gap sizes or designs of human system interfaces (e.g., Friedrichs et al., 2016; Hjälmdahl et al., 2017), and on-road tests (e.g., Castritius et al., 2020; Yang et al., 2018) investigating impacts of exposure in real traffic, acceptance of gap sizes and preferences for truck positions (being a leader or follower). Key findings from simulator and on-road studies of truck platooning acceptance are summarized here. Generally, the studies report small sample sizes, which may negatively impact generalizability.

Fröhlich et al. (2018) conducted a survey with 23 truck drivers based on the TAM. The results indicated that many drivers, regardless of age, were skeptical to automated trucks, expressing uncertainty about the performance of the trucks and negative impacts on employment. Prospects of performing other tasks while moving had minor impacts on acceptance, while expectations of being able to relax positively impacted acceptance and trust. The survey neither specified the level of automation, nor the road conditions or other contextual elements.

Hjälmdahl et al. (2017) conducted a truck platooning simulator study where 24 participants were exposed to three conditions: 1) *baseline*, i.e., driving with standard cruise control at a pre-set speed; 2) *partial automation*, i.e., driving with automated longitudinal control and 10-meter headway to the preceding truck; and 3) *full automation*, i.e., driving with both automated longitudinal and lateral control with 10-meter headway. Each condition was simulated in three situations: light traffic, heavy traffic, and heavy traffic plus fog. User acceptance was investigated through the Acceptance Scale for Advanced

Transport Telematics (van der Laan et al., 1997) and five items from the Questionnaire for Interface Satisfaction (Chin et al., 1988). The measures were significantly correlated, indicating the highest acceptance (usefulness and satisfaction) in the baseline condition and no difference between partial and full automation.

Yang et al. (2018) conducted an on-road study of three-truck platoons at SAE level 1, with automated longitudinal control only. Nine participants tested platooning as drivers in the second or third truck on a public highway. The drivers switched positions halfway through the 250-kilometer trip, after which a questionnaire was administered. The participants were satisfied with the platoon driving (mean value 5.6 of 7) but preferred to drive manually in challenging conditions such as heavy traffic, slow speed, and road gradients. Most participants had no preference for being the second or third truck.

Castritius et al. (2020) developed a questionnaire on acceptance of truck platooning based on TAM 2 (Venkatesh & Davis, 2000), adapted through focus group interviews with drivers. Castritius et al. (2020) divided *perceived usefulness* into *personal usefulness* and *general usefulness* and added a *driving safety* construct. Ten test drivers reported their acceptance of platooning on highways in questionnaires and interviews before and after extensive real-world experience (20 h experimental driving and subsequent commercial payload drives for up to three weeks on a German highway). After the experience in real operation, platoon driving was perceived as safer, more useful, and easier to use. Increased safety was found most important among the drivers, while fuel savings and improved traffic flow were perceived as less important. No clear preference for truck position (being a leader or follower) was found, even when considering the possibility of engaging in non-driving activities while moving in a following truck. Most drivers stated that they would use the system if it was available. Currently, the technology requires continuous supervision. Thus, it would need further improvements to achieve more advantages for the driver.

Prior to exposure, the four abovementioned studies generally indicate driver skepticism towards platooning and highly automated trucks. Advantages in terms of fuel savings, increased traffic throughput and capacity to perform non-driving tasks while moving appear less important than improvements in comfort and driver safety. Real-world experience appears to have a positive impact on perceived usefulness and ease of use. However, most studies have focused on ideal highway conditions. Rural roads constitute a large proportion of roads worldwide, but platooning on such roads may be perceived as less advantageous and comfortable for drivers than platooning on high-standard roads. These conditions may affect platoon driver workload (Eitrheim et al., 2022b). The current study is the first to investigate driver acceptance of partially automated truck platooning on rural roads.

3. Method

3.1. *Participants*

Three professional truck drivers participated. All were male, aged 31, 38, and 57 years. The drivers had some experience from truck driving in Norway, and from driving trucks using adaptive cruise control (ACC). They were organized through the same transport company but had no prior experience of driving together until the day before the test, traversing from Finland to Norway. Prior to the test, participants were introduced to the study, signed the consent form, and completed a background questionnaire. The participants are given pseudonyms P1, P2, and P3. Each truck had a passenger to help with data collection. The passengers in two of the trucks were transport company representatives, while a guest researcher with experience from similar field trials was present in the third truck. The study was approved by the Norwegian Centre for Research Data (457013).

3.2. *Vehicles and test route*

Three Scania R500 semi-trucks were operated on a 380-kilometer predefined route in Northern Norway in fall 2020. The trucks were equipped with ACC to accomplish longitudinal distance-keeping and control, allowing for platoon driving. Lateral control was manual. Trucks were numbered 1 (lead), 2 (middle), and 3 (last), according to the positions that they held for most of the trip. Time gaps between the trucks resembled the test set-up described for an earlier Scania-platooning case (Bergenheim et al., 2012), with 2-3 second gaps, i.e., 40-60 meters, at a speed of 80 km/h. Trucks 1 and 2 had equal weights (41 metric tons), whereas truck 3 was lighter (27.5 metric tons). The platoon was accompanied by several escort cars. The test route, driven over two days, traversed a mountainous, coastal region, with roads of varying standard. The trucks traversed very narrow road sections, steep gradients, sharp curves, and tunnels.

3.3. *Evaluation of driver acceptance*

A mixed-methods design was used to investigate driver acceptance, including quantitative ratings, qualitative interviews and communication while driving.

3.3.1. *Platooning acceptance questionnaire*

A questionnaire on acceptance of truck platooning (Castritius et al., 2020) was administrated prior to, and after completing the field trial. In total, 26 items assessed the usefulness of the platooning system (personal benefits and gains for the company or society), ease of use, occupational image, driving safety and intention to use. These were all rated on a 5-point integer scale ranging from completely disagree (-2) to completely agree (+2).

3.3.2. *Acceptance Scale for Advanced Transport Telematics (AATT)*

The Acceptance Scale for Advanced Transport Telematics (AATT) (van der Laan et al., 1997) is a widely used and validated instrument for assessing acceptance, aiming to evaluate the end-user attitudes towards a system. The AATT comprises nine items rated on the same aforementioned 5-point scale, e.g., “I find the system… useless - useful; unpleasant - pleasant”. The items are combined into one usefulness score and one satisfaction score. It was administrated in five breaks during the field trial.

3.3.3. *Interviews and communication while driving*

Semi-structured interviews were conducted prior to the test, and midway, after the first day of driving. The pre-test interviews focused on driver expectations for inventions, in which situations they would occur, and perceived challenges and strategies for platoon driving. The midway interviews encouraged the drivers to reflect on their experiences thus far.

The drivers occasionally commented or made statements regarding their observations and decisions while driving. They did so by talking with their passenger, and by communicating with drivers in the other trucks through radio. Both the interviews and the communication in all trucks were audio recorded and transcribed. Statements made in other languages were translated to English by bilingual speakers. The transcripts were coded and thematically analyzed in the NVivo 12 software (Dhakal, 2022). The analysis was mainly deductive, in which predefined themes, e.g., *acceptance*, *comfort*, and *road conditions* were used to categorize driver utterances.

4. Results

4.1. *Pre-test and post-test ratings of acceptance*

Questionnaire results obtained prior to and after the field trial are shown in Fig. 2. The participants largely agreed about the personal usefulness of truck platooning. While mean ratings (based on 5 items) indicated weak perceived usefulness prior to the trial (0.6 - 0.8), participants appear undecided afterwards (-0.2 - 0.0). Prior to the trial, the participants expressed even higher expectations towards the general usefulness compared to the personal usefulness (6 items, e.g., fuel savings and improved traffic flow). However, also mean ratings of the general usefulness were lower after the trial (0.0 - 0.33 compared to 0.67 - 1.17 before the test).

Ratings on two items assessing perceived ease of use ranged from -1 to +2. The items were rated similarly before and after the field trial. P1, serving as platoon leader for most of the trial, provided the lowest rating (-1), while P3 found the platooning system easy to learn and use (+2). P2 reported slightly lower values on the ease of use after the test (from 0.0 to -0.5).

Prior to the trial, P1 and P2 reported some prestige and status associated with platoon driving in their organization (0.5; 1.5), while P3 was undecided (0.0). However, after the trial, all participants appear undecided or slightly negative (-0.5 - 0.0). A similar pattern was observed for driving safety. P1 and P2 reported some belief in positive safety impacts prior to the trial, while turning undecided afterwards (1.0, 1.2 vs. -0.1, 0.0). P3 indicated sparse or slightly low beliefs in safety improvements both prior to and after the trial (-0.2 and -0.1, respectively). Prior to the trial, P2 and P3 indicated an intention to use the platooning system if available (rated 1 and 2), while P1 was undecided (0). After the trial, only P3 indicated an intention to use platooning, albeit weak (rated 1), while P1 and P2 appear undecided (0).

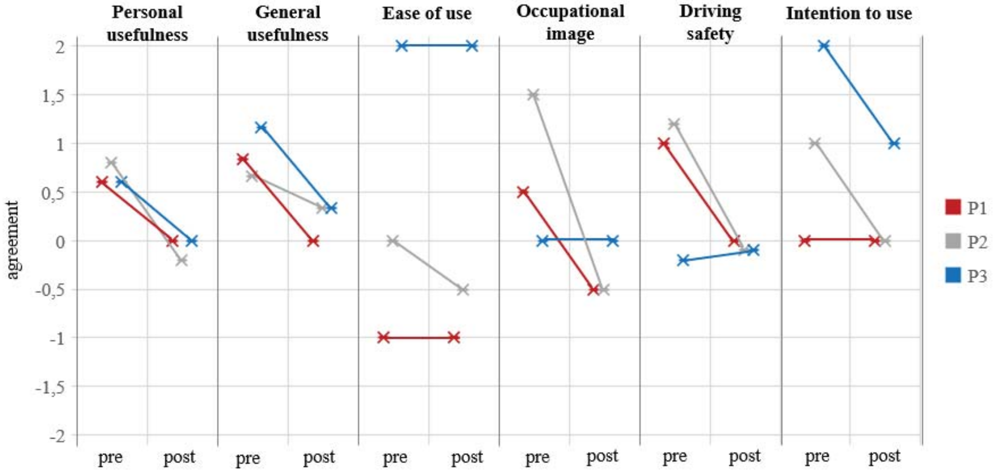

Fig. 2. Acceptance of platoon driving pre and post field trial exposure. Higher values reflect stronger agreement towards perceived usefulness, ease of use, prestige, safety, and the intention to use platooning in the future.

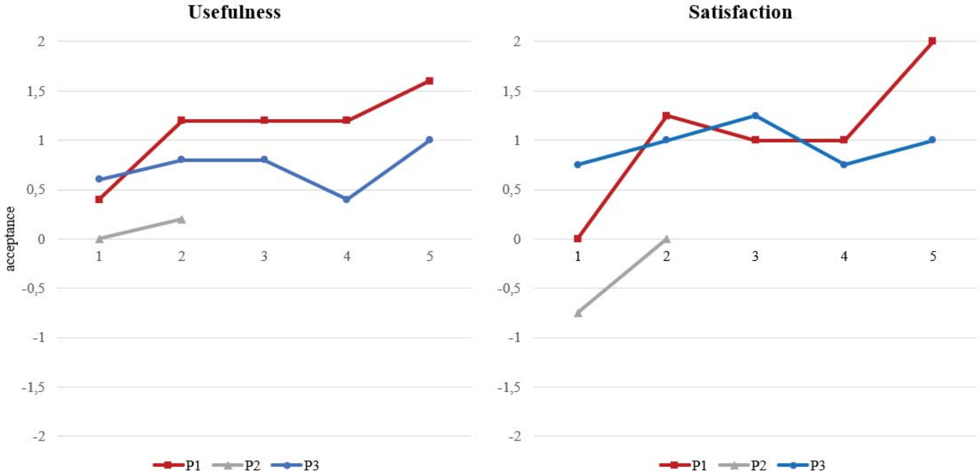

Fig. 3. Acceptance scale for Advanced Transport Telematics (AATT) rated during the field trial.

4.2. *Usefulness and satisfaction during the trial*

Acceptance ratings captured during driving breaks are shown in Fig. 3. P2 reported the lowest ratings of usefulness and satisfaction among the drivers in the first two breaks, before mid-scoring all items in subsequent ratings. These are not included in Fig. 3, nor are they included in further analyses. For P1, usefulness and satisfaction increased after the second driving period and remained stable thereafter. A notable increase in satisfaction and usefulness, was observed from the fourth to the fifth rating. This may be explained by reduced driver demands due to higher road standards than experienced in the preceding rating period. P3 reported gradually increasing usefulness and satisfaction, with the exclusion of the fourth rating, showing a decline. The fourth rating stems from a period with exceptionally challenging road geometry, whereby P3 presumably had to exert increased effort to remain connected to the platoon (Eitrheim et al., 2022b).

4.3. *Acceptance in interviews and during operation*

Initial interviews revealed skepticism towards the feasibility of platooning on the route at hand, due to expectations of challenging road and weather conditions. The field trial was conducted during a period where ice and snow on the roads is to be expected. The drivers already experienced winter conditions when traversing from Finland to Norway. In midway interviews, and orally while driving, drivers expressed feelings of relief and comfort when adverse weather conditions and icy roads did not materialize, after all. "*Because of ice on the road I was a little nervous. But it was strange that when the convoy was connecting… The asphalt was dry, and then it felt very good and very comfortable*." (P3, midway interview)

In the pre-test interview, P2 voiced his expectations to intervene with the platooning system several times: "*I feel more confident and want to do it my way. I don't trust the technology, I trust myself*." When interviewed midway, the same driver explained that his experience with the system changed during the day, him growing more trusting of it. Although he would have preferred earlier braking when approaching the preceding truck, he experienced that the technology worked. P3 stated that he intervened twice during the first day of driving, not due to low trust, but in anticipation of upcoming suboptimal system behavior. Although generally perceiving the platoon driving as "smooth" and "quite satisfying", he occasionally intervened by adjusting system settings and shifting gears according to his personal preferences. P3 justified his interventions as a way of optimizing the platoon driving in terms of driving comfort and fuel savings.

P1 served as platoon leader for most of the field trial. P1 stated that the platoon leader role required less efforts of him as he gained more experience, and that his trust in the follower trucks (and drivers) increased throughout. However, he was anxious when asked to serve as follower: "*I trust the technology, because I know it will brake, and he [the following truck] will not run into me. But I don't trust the technology in the sense that I will drive as the second or third truck*." He did serve as follower for about 20 minutes of driving at nightfall on the first day, with challenging road geometry. He perceived this as stressful and refused to switch position for the remainder of the trial.

In midway interviews, and when encountering sharp curves and steep downhills, the drivers often commented on the shortcomings of the current platooning system. P3 likened platoon driving with using ACC, stating finding no added benefits. "*When I'm on my way down, my car starts speeding up to 85. Suddenly, we reach the distance limit, and the system slows down. This happened many times, especially when it was downhill and then a curve*" (P3, midway interview). P1 commented that the usefulness of platooning depends on road standard and traffic conditions. Specifically, he was unsure whether platoon driving produced fuel savings in the current field study and expected that it would increase traffic jams rather than being advantageous. All drivers stated that platooning may be beneficial on highways, while requiring substantial efforts from drivers to work on low-standard rural roads.

5. Discussion

5.1. *User attitudes towards truck platooning under real conditions*

In the current study, perceived usefulness and satisfaction increased after the first hours of driving and remained stable at a relatively high level in subsequent ratings. Comparable findings were reported in an on-road study of ACC (e.g., Beggiato et al., 2015), indicating that attitudes towards the usefulness and satisfaction of platoon driving are formed in an early phase. Since participants in the current study had used the platooning system while traversing Finland and Sweden prior to the trial, they already had some first-hand experience with the technology, but not in the given test route.

Interview findings suggest that the drivers were nervous during the first part of the field trial, before gradually relaxing as weather conditions improved and they got accustomed with the test regime. Increasing ratings of platooning usefulness and satisfaction may reflect changes in affective responses to participation in the trial, such as feelings of pleasure and well-being (i.e., positive disconfirmation). Another explanation may be that the platooning system performance did not match initial expectations (i.e., negative disconfirmation). To reduce cognitive dissonance (Festinger, 1962) and justify their behavior, participants may thus have reported satisfaction. However, participants appeared undecided or provided low ratings of truck platooning after the trial, reducing the plausibility of this explanation.

Following periods of stable ratings, higher usefulness and satisfaction scores may indicate that drivers considered contextual factors, such as road geometry, when evaluating acceptance. This is supported by previous findings on self-reported workload, which were sensitive to changes in road conditions encountered during the same period (Eitrheim et al., 2022b). Thus, increased usefulness and satisfaction may be associated with reduced driver efforts to operate the platooning trucks as road conditions improved. Future development of the technology to accommodate platoon driving in steep inclines, sharp curves and in combination of these, will likely increase driver acceptance and reduce fuel consumption.

As applied in the current study, the AATT indicated that two of the three drivers found the platooning system somewhat useful and satisfactory. Herein, platooning was not compared against conventional driving. The simulator study by Hjälmdahl et al. (2017), indicated that participants were undecided about the usefulness and satisfaction with partially and fully automated platoon driving, while providing higher acceptance ratings when driving with standard cruise control. Future on-road studies should assess the relative advantages or disadvantages of a platooning system compared to advanced driver assistance systems (e.g., ACC, lane keeping assistance) in a controlled manner, through repeated trials on specific road sections.

5.2. *Future prospects of truck platooning*

Whereas AATT ratings of perceived usefulness and satisfaction showed increasing trends as the field trial progressed, participants appeared undecided or provided low acceptance ratings of truck platooning in the questionnaire administrated after the trial. Thus, any positive attitudes emerging during the field trial did not generalize to post hoc assessments of personal usefulness and ease of use. A comparison of pre- and post-test ratings show the same trend: First-hand experiences seemed to have negatively impacted driver acceptance of platooning. The drivers presumably adjusted initial expectations of performance benefits, constraints, and efforts required to operate platooning trucks in their daily work. Although the experience with the platooning system turned positive in the field trial, the perceived benefits were insufficient to alter driver acceptance of platooning in a broader sense.

The participants in the current study appeared more optimistic towards platoon driving prior to the trial compared to pre-test ratings reported by Castritius et al. (2020). However, after experiencing platooning on rural roads, participants in the current study provided lower ratings and were undecided about its usefulness and safety. Castritius et al. (2020), on the other hand, found higher levels of acceptance after experiencing highway platooning. Conceptual and empirical differences between the studies may explain the contradicting results. The current study tested platooning at automation level 1 (longitudinal control only) and inter-vehicle distances of 40-60 meters in challenging rural road conditions with mostly low traffic densities. Castritius et al. tested platooning at automation level 2 (longitudinal and lateral control), at inter-vehicle distances of 15 and 21 meters on a highway with high traffic densities for parts of the test. These platooning conditions probably alleviated drivers to a larger extent than automated distance-keeping did on rather difficult rural roads.

From personal driving experiences, one may hypothesize that reduced inter-vehicle distances are perceived less favorable than longer distances. However, the results from highway platooning suggested that drivers preferred short gap sizes, reducing the likelihood of intruders, i.e., passenger cars, entering gaps between platooning trucks. Platoon intruders on rural roads would probably be less frequent. On the other hand, risky overtaking maneuvers by passenger cars due to few passing opportunities on rural roads may be more stressful for platoon drivers, versus overtaking behaviors on highways. Future studies may systematically investigate the impacts of traffic flow and road conditions on inter-vehicle preferences and risk perception during platooning.

Finally, participants in the current study experienced platoon driving for only a few days, whereas participants in the study by Castritius et al. (2020) had extensive and realistic exposure through commercial payload drives. Future on-road studies may benefit by having similar or even longer exposure periods, combining continuous self-report data (e.g., driver ratings and observations captured by a smartphone application after each drive), physiological measurements of the driver state (e.g., heart rate variability) and data from fleet management systems (e.g., information about roads, speed and driving distances). This could achieve a better understanding of driver well-being, which is important for improving productivity and safety (Apostolopoulos et al., 2011). The driver shortage is also a strong incentive to identify measures and provide resources to support driver training, well-being, and job satisfaction. Rather than displacing them, platooning technology offers opportunities for drivers to learn new skills and tasks, perhaps taking a similar monitoring role as e.g., pilots in aviation. This may be perceived as attractive by some drivers, while others may be more reluctant to change their way of working.

Herein, interview findings indicated that teaming up with other drivers and aligning preferences and decisions as part of a platoon, could negatively impact the job motivation of truck drivers. Similar concerns were raised by stakeholders in a former study (Eitrheim et al., 2022a), pointing to truck drivers appreciating the independence and freedom of solitary driving. According to self-determination theory (Ryan & Deci, 2000), psychological needs for experiencing autonomy (choose own behaviors), competence (work effectively and master the environment), and relatedness (form relationships with people) must be fulfilled to motivate workers, enhance performance, and promote well-being. Thus, for truck drivers to accept platooning, impacts on multiple levels need to be addressed, from operational platoon system interaction to long-term consequences for job design and job satisfaction.

6. Conclusion

Truck platooning may contribute to improve road freight transport by reducing emissions, increase traffic throughput and enhance safety. The technology provides opportunities also to enhance truck driver working conditions, e.g., team up with other drivers, manage workload and develop new skills. However, truck drivers may also fear reduced autonomy through constraints in choosing how to perform and organize their work. The current field study investigated driver acceptance of real-world platooning on rural roads. Although increasing usefulness and satisfaction were reported, participants appeared undecided or slightly negative towards truck platooning in interviews and post hoc ratings. The participants stated that platooning may be advantageous on highways, while currently requiring substantial driver efforts to work on low-standard rural roads. Further development of the platooning technology is required to accomplish safe and efficient operation in all road conditions and traffic situations. To achieve driver acceptance of truck platooning, the multi-faceted impacts on day-to-day operation and well-being of drivers need to be addressed. Future studies may also investigate impacts of user characteristics such as age, driving experience, road familiarity and technology interaction preferences.

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