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Designing trust in Shared Autonomous Vehicles: trusting the vehicle and fellow passengers: A exploratory review

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Abstract

Shared autonomous vehicles (SAVs) combine the benefits of connected, automated, ride-shared, and electrified vehicles, with the potential for widespread adoption worldwide. However, one aspect of SAV adoption that is often overlooked amidst the hyperbole surrounding this emerging technology is the need for in-depth investigation into how SAVs can engender trust in their safe utility and overcome distrust among passengers who may be in relatively close proximities. Much of the research conducted in the SAV space focuses on the efficacy of driving technology and is often shrouded in commercial confidentiality. Trust in SAVs can be influenced by various factors, particularly in the aesthetics of the vehicular exterior and interior. Yet, there is limited literature that investigates the aspects of industrial design in SAVs that might mitigate a lack of confidence in the vehicle and among fellow passengers.

To address this research gap, the authors conducted an exploratory review of the literature. The findings demonstrated a scarcity of research that addresses trust issues through the form language and orchestration of the different structural elements that make up a vehicle interior and exterior. However, there is a substantial body of literature concerned with understanding trust in the broader context of human experience. Therefore, the authors speculate that exploring the industrial design research and delving into theoretical approaches to understanding the levels of trust that can be stimulated by various traits and triggers could inform a design response to better engender feelings of confidence between passengers and the vehicle, as well as among passengers themselves.

1. Introduction

Autonomous vehicles (AVs) are one of the dominant topics in transportation research. Both industry and academic organisations are investing resources to research future AVs. The Society of Automotive Engineers (SAE) has defined five levels of vehicle automation, from level 1 to level 5 (SAE, 2016). Level 0 represents no automation. Levels 1 to 3 are where the driver has main control over the vehicle and automation is partially used. Level 4 means the vehicle can be controlled by the system, and Level 5 refers to the vehicle being controlled entirely autonomously. Because of the advancement in fully autonomous technology (Level 5), shared automated vehicles (SAVs) are expected to become a reality when fully autonomous driving technology (Level 5) is combined with on-demand shared mobility (e.g., Uber, Didi) (Golbabaei, Yigitcanlar, and Bunker, 2021). SAVs have been trialled in hundreds of cities around the world in recent years, but they are only provided on a commercial basis in certain areas, such as Google Waymo One (USA) and EasyMile's EZ10 (France) (Tian, Sheu, and Huang, 2019).

SAVs have received considerable attention with the potential to reduce pollution, improve road safety, and provide a cost-saving service to end users (Narayanan, Chaniotakis, and Antoniou, 2020). It is worth noting that the development of SAVs may increase the number of vehicles. The increasing demand for SAVs may result in a higher service wait time (Kim et al., 2020). Due to the fact that the real-world deployment of SAVs has been extremely limited, the impact of SAVs on transportation systems is still difficult to predict, but SAVs do represent a potential means of improving transportation if those disadvantages can be reduced. To achieve this, though, it is essential that the SAVs be shared synchronously. This distinction is important as the term "SAVs" is currently used in the literature to refer to both (i) a vehicle exclusively used by an individual or group for travel and (ii) a vehicle used by more than one individual or group who may or may not know each other in parallel (Paddeu, Parkhurst, and Shergold, 2020). This review refers to the latter definition.

Given the implementation of AV technology and ride-sharing schemes, we currently know little about whether passengers still prefer to ride in such a vehicle on their own or with those they do not know in close proximity. Since SAVs haven't been extensively used in the market, they appear to offer advantages that exist already and are not taken up widely, for example carpooling. Many academic studies have stated that distrust in automated technology and distrust in strangers in such a vehicle devoid of an authority figure could be important barriers to the successful implementation of SAVs (Paddeu, Parkhurst, and Shergold, 2020; Merat, Madigan, and Nordhoff, 2017; Sarriera et al., 2017). A long history of industrial design has sought to build consumer/user confidence in objects and underpin social norms where expectations of behaviour are required. However, the practical implications of trust in the machine and trust with fellow passengers have been less well documented. As automotive design creates a milieu of functional, aesthetic, and haptic experiences (Coxon, Napper, and Allen, 2007), a deep understanding of trust theory is important to examine how design could improve passenger trust in SAVs. Therefore, there is a need for the designer to analyse this problem in order to point out future vehicle design guidance for SAVs.

The overall aim of this paper is to conduct an exploratory review to help understand the topics mentioned thus far more broadly and will seek to assess the opportunities and uncertainties presented by the trust design issues in SAVs. There has been limited practise research addressing trust issues for SAVs, and as such, additional industry research and resources will be covered in this review. Specifically, in this review, a designer’s lens will be used to explore this problem to elicit new design information to complement the design efforts to improve passengers' trust in the vehicle and fellow passengers' trust in the SAV interior. Accordingly, the remainder of this review is organised as follows: Section 2 explains the terminology of trust and the trust definition in this review. Section 3 reviews the literature on the issues relating to passengers' trust in the vehicle. Section 4 analyses the issues of trust between fellow passengers in SAVs. Then in Section 5, the findings will be synthesised based on the review of current literature and will outline the current knowledge gap and promising directions for further research in this field.

2. Trust theory review

2.1. Defining trust

So far, there has been no universal definition of trust as it varies across different areas and depends on the context, such as economics, psychology, and political science. Despite those differences in trust definitions, there are some commonalities across domains. Lee and See (2004) proposed that trust involves three main components: the individuals who can build and receive trust, an incentive for the trust to exist, and the possibility of a potential failure. In simple terms, trust is like a relationship where one-person places trust in another, and there's something important at stake between them. The person who is trusted must also have a reason or motivation to fulfil their responsibilities in that relationship. Also, there is the possibility of failure that would invoke a certain amount of risk and uncertainty when engaging in the task (Hoff and Bashir, 2015).

Along with trust, distrust is frequently linked to trust and used in conjunction with it. While distrust was traditionally regarded as the opposite of trust, with distrust being described as an absence of trust (Bigley and Pearce, 1998), trust and distrust may coexist at the same time (Lewic, Mcallister, and Bies, 1998), as there is sometimes no clear boundary between trust and distrust. More recent research considers them as different concepts (Bigley and Pearce, 1998; Liu and Wang, 2010). For instance, when an actor cannot take a risk (e.g., a leap), it is not automatically distrust but a relatively low level of trust (Van De Walle and Six, 2014). In contrast, in the 2012 Costa Concordia cruise ship disaster, 32 passengers were killed when the ship's skipper decided to use manual control instead of the ship's computerised navigation systems, which is a case of high distrust (Lyons and Guznov, 2019). On the other hand, if I do not know you, I may neither trust nor distrust you (Hardin, 2002).

Thus, distrust should not be viewed merely as the absence of trust but rather as an independent attitude. It represents an actual expectation that another actor cannot be relied upon and may engage in harmful behaviour, whereas trust is defined as confident positive expectations regarding other objects (Lewic, Mcallister, and Bies, 1998; Van De Walle and Six, 2020).

2.2. Interpersonal trust and human-machine trust in SAVs

In the context of SAVs, trust will not only affect how passengers feel about the absence of an authority figure but also influence their concerns about in-vehicle safety with other strangers (Salonen, 2018). Consequently, two domains applicable to describe the trust issues in SAVs' relationships between passengers and the vehicles are interpersonal trust and human-machine trust.

Interpersonal trust is a significant factor that impacts people's behaviour in various types of interactions, including those between governments, minorities and majorities, buyers and sellers, patients and therapists, parents and children, and others (Rotter, 1980). This aspect of trust is prevalent among different individuals. For instance, when someone is sitting next to a stranger in a shared vehicle, especially in the evening, they may experience a low level of trust during the journey. This low level of trust manifests as a state of vigilance and tension, as they are unsure of the unfamiliar person's intentions or behaviour. In that case, interpersonal trust can be influenced by the perceived ability, benevolence, and integrity of the other person in the interaction (Colquitt, Scott, and Lepine, 2007). In the context of SAVs, interpersonal trust could be affected based on a fear of strangers and the potential absence of authority a SAVs presented (Dolins et al., 2021). Similarly, another definition that would be relevant for trust in strangers is swift trust. According to Meyerson, Weick, and Kramer (1996), the term "swift trust" is used to describe temporary systems; it refers to "a set of organisational actors working together on a complex task during a limited period of time." Specifically, as required in temporary systems, they describe "swift trust" as "familiarity, shared experience, reciprocal disclosure, threats and deterrents, fulfilled promises, and demonstrations of non-exploitation of vulnerability." That is, the shared space In the SAVs, it could be regarded as a temporary system to move strangers to a different or the same destination. Hence, to form trust between strangers in SAVs means individuals' willingness to make themselves vulnerable to the actions of another party (Mayer, Davis, and Schoorman, 1995).

Human-machine trust refers to the confidence that humans place in automation systems or technology (Lee and See, 2004). It is considered a critical factor that can either enable or hinder the adoption and continued use of new automation technology (Morgan et al., 2019).

Although some passengers may perceive SAVs as safe on the road due to their trust in government agencies and safety standards, others may still harbor low trust when using SAVs. This lack of trust can be attributed to the similarities in the relationship between humans, computers, and robots (Nass, Fogg, and Moon, 1996; Reeves and Nass, 1996). Humans tend to commit the fundamental attribution error when assigning responsibility while interacting with machines, similar to how they do with other humans. Users often prefer to attribute errors and mistakes to technology or machines rather than accepting their own responsibility (Madhavan and Wiegmann, 2007). For instance, despite the ability of aircraft to operate autonomously during the journey, many people still think it is safer when human pilots to control the aircraft. As a result, when SAVs were initially commercialised, some of the passengers may have low confidence in the vehicles themselves due to their have a low trust in on automation technology.

Despite the differences between interpersonal trust and human-machine trust, trust issues in SAVs could be viewed as feelings of future anticipatory sensations towards the vehicle and other strangers, as the issue of trust in SAVs can occur both concerning the trust in the vehicles themselves and the trust in SAVs when operated by strangers, given the absence of an authority figure. Hence, the trust issues of SAVs can be considered as a single system. The following sections of this review will focus on analysing passengers' trust issues in the vehicle and the trust issues between strangers when passengers use SAVs.

3. Trust in vehicle when using SAVs

Human-machine trust is important in the field of AVs because, in the absence of a visible operator or control element, people will consider whether AVs are safe or controllable during the travel experience (Bass, 2018). This is because, during their daily travels, passengers' trust in the vehicle can be built through communication with the driver of the vehicle (Payre et al., 2017). It is clear that a SAVs without an operator will reduce passengers' trust level. While there has been limited research specifically on SAVs, trust in machines has been recognised as a key issue for AV acceptance (Zhang et al., 2015). It refers to a user's confidence in the automated system's reliability or ability (Parasuraman, Sheridan, and Wickens, 2008). Research interests in human trust in machines and SAVs have found strong relevance regarding the different impact factors, and it is worth noting that building trust between machines and humans could be considered a dynamic process that impacts each stage of the interaction experience, from intention to execution (Marsh and Dibben, 2003).

Marsh and Dibben (2003) presented three layers of trust to illustrate the factors that impact trust in machines in dynamic processes. This model was further developed by Hoff and Bashir (2015). They present a summary of the main factors influencing formation before and during an interaction. As shown in Figure 1, it includes dispositional, situational, and learned trust. Dispositional trust represents an individual's enduring tendency to trust automation; situational trust depends on the context of the user experience taking place and the human relationship to the context influencing the experience; and learned trust refers to expectations and earlier experiences relevant to the current system of use (Lundquist, 2018). The definition of those is more specific as follows:

(1) Dispositional trust is affected by personal characteristics such as culture, age, gender, and personality. These factors align with human traits from the three factors of trust (Schaefer and Straub, 2016) and have been mentioned a lot for trust in automation and AVs within Human-Computer Interaction (HCI) research. As trust is a subjective factor, it is influenced not only by rational issues (e.g., usability and perceived use) but also by how people feel through experience (Raats, Fors, and Pink, 2020).

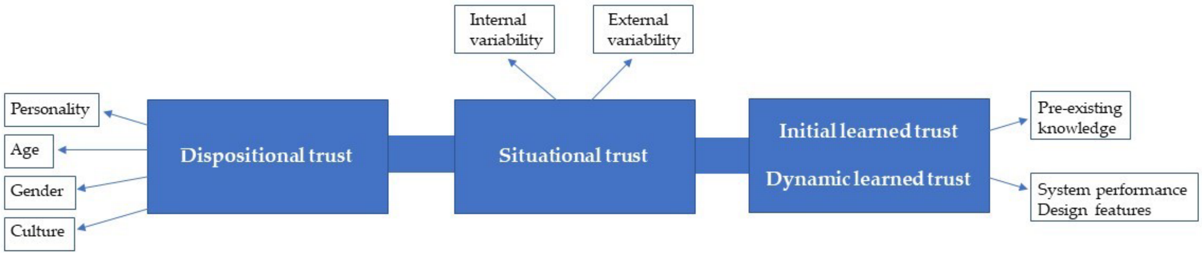
(2) Situational trust includes two ingredients: internal and external variability. Internal variability can be mainly described as the individual's confidence when it comes to a certain task. Mood, expertise, and attention are important factors for internal variability. These factors also influence dispositional trust. For example, the utilisation of automation may be higher when a person's confidence is low but trust in automation is high (De Vries, Midden, and Bouwhuis, 2003). For external variability, trust largely depends on the complexity and difficulty of the task and the type of system for which it is used. For instance, the operator tends to use automation more frequently during a heavy workload when there is a lot of work to be done, which also increases trust in the automation (Lavieri et al., 2017). This finding illustrates the importance of external context during the interaction process.

(3) Learned trust can be divided into two categories: initial learned trust and dynamic learned trust. The initial learned trust represents the trust that existed prior to interaction with the system. For example, unfamiliarity with AV technology might have a negative impact on trust (Dong, DiScenna, and Guerra, 2019). This is supported by Hartwich, Beggiato, and Krems (2018), who found that participants' trust in AVs increased after experiencing AVs driving across experimental runs in a simulation trial. Dynamic learned trust is about the current state of the system performance and design elements that impact how easy the system is to use (Coxon, Napper, and Allen, 2007). For example, the test SAVs in Kista have tried to build initial trust through their reputation, service, and understanding of the vehicle during the pilot phase, because it can shape human-automation relationships for people who have had no experience with SAVs yet (Hoff and Bashir, 2015). So, in the future, passengers could feel familiar with the SAVs while travelling in the SAVs. Taking this into account, the external factors of dynamic learned trust and situational trust play a crucial role in building trust, including the capability of ease-of-use and design features of the product (e.g., aesthetics, functionality).

Learned trust is closely related to situational trust because both are guided by previous experience (Marsh and Dibben, 2003). The distinction between these two depends on whether the trust-guiding past experience is relevant to the environment (situational trust) or to an automated system (learned trust) (Hoff and Bashir, 2015). Thus, this framework could serve as a useful guide for future research into the complexities of automation trust, and it can also help researchers assess the appropriate level of trust during the trust-building process.

The model demonstrated the importance of external variability in the trust-building process, as the design features of the vehicle have a direct influence on situational trust and learned trust. In the design sphere, the combination of existing design methods for addressing trust issues in machines and AVs is worth exploring to address trust issues in the vehicle of SAVs. Discussed here will be definitions within system transparency, anthropomorphic features, and personalisation design.

Figure 1：Three layers of trust. Elaborated by the authors based on Hoff and Bashir (2015)



3.1. System transparency

Increased information about AVs has the potential to reduce users' anxiety and improve their trust in AVs, resulting in positive attitudes towards SAVs (Dong, DiScenna, and Guerra, 2019). Prior research on this is mainly through the use of displays from the HMI field (Pu and Chen, 2006), because an interface could allow the passenger to know what the car is doing, what it will do, and whether or not the procedure is going well and smoothly. In particular, maintaining high levels of system transparency through feedback as well as developing and implementing a meaningful HMI are critical in interface design (Choi and Ji, 2015). These ideas have been employed in different transport modes, such as buses and trains, which provide an interface to show the time, speed, and next stop location. Likewise, Olli 2.0, a SAVs made by Local Motor, provides a large HMI that resembles the bus station's screen so that passengers can easily touch it and communicate with it. What's more interesting is that the passenger can ask this vehicle questions regarding commute routes or vehicle function. As auditory technology advances, it has been widely utilised in different types of vehicles. For example, Waymo uses the visual and auditory modalities for passengers to keep them updated on their journey. The same approach has been used by Uber in the past. In essence, those designs try to improve trust by improving system transparency.

On the other hand, Haeuslschmid et al. (2016) argue that system transparency will become less important in fully automated vehicles. In their study for the private AV, the driver will not be required to control the vehicle and be disengaged from the driving tasks, so they may not need to be aware of potential hazards in the AVs. And when the trust level is high, passengers would like to focus on other activities. However, their research is based on the information requirements of drivers in different autonomous environments. In the context of SAVs, people's roles will switch from driver to passenger, so it is not clear whether the perception of information is still similar to that of a driver.

3.2. Anthropomorphic features

Vehicle appearance and communication style are also likely to have an influence on the development of user trust in SAVs. In this regard, employing anthropomorphic features has been found to increase trust in automation (Roesler, Onnasch, and Majer, 2020). Anthropomorphism, which can be broadly defined as the human tendency to transfer humanlike characteristics to non-human entities, can appear in a robot's appearance, movements, style of communication, as well as context (Onnasch and Roesler, 2021).

According to Epley, Waytz, and Cacioppo (2007), when the conversational agents look more humanlike through embodiment or visual representation, it can increase people's trust with the agent. Similarly, the anthropomorphic form also has the same impact on trust. For example, prototyping animated eyes on a vehicle may increase passenger trust towards SAVs, as these elements could make people feel affinity towards the vehicle. Currently, there are a variety of concepts within the car industry that provide anthropomorphic design features, especially on the vehicle exterior. The Sedric concept car is an example of implementing an anthropomorphic feature on the vehicle. It has a digital anthropomorphic face on the front face to let people have a sense of affinity before using the vehicle. A similar idea is the Semcon smiling car, which uses an LED display representing a smile on the front grill of the car to improve pedestrian trust when crossing. This design element has been represented across different design concepts, and they try to build trust by improving people's understanding of the vehicle and making them feel like it is easy to use.

However, the anthropomorphic features may be insufficient to improve trust because these anthropomorphic elements (e.g., animated eyes and animated smiles) may have negative effects on the interaction because of the "uncanny valley" phenomenon (MacDorman and Kageki, 2012). The uncanny valley phenomenon indicates that the acceptability of the robot would first rise as the robot became more human-like, but as it got closer to a human state, there would be a dramatic decline in acceptance (Mori, 1970). This phenomenon may have a negative effect on emotional reactions and make users feel uncomfortable. Nowadays, many manufacturers try to make robots' appearances more human-looking. As a result, it represents a sense of affinity, which could attract our interest. However, because of the advances in fabrication technology, some robots can also simulate human skin, veins, fingernails, and even fingerprints to look like real people. When we realise the robot that looked real at first sight is actually artificial, we may experience an eerie sensation and feel less affinity, which is the "uncanny valley" phenomenon (MacDorman and Kageki, 2012). So, when designing SAVs, there is a need to consider the appropriate anthropomorphic features of the SAVs. Moreover, in addition to the aesthetics of the vehicle's exterior and interface, there has been little actual research into the effects of vehicle interior design on users' trust in SAVs. Thus, more work needs to be done within this area to fully understand how the aesthetics of interior design impact passengers' trust.

3.3. Personalisation design

Personalisation has been identified as an effective way of enhancing user trust (Butakov and Ioannou, 2014). It can be achieved by focusing on users' needs, preferences, interests, and characteristics, and then creating a more engaging user experience by designing information and images that they find useful or pleasing (Sun, May, and Wang, 2016). As a result, it fosters a sense of belonging and identity as well as a desire to express personality in public spaces (Blom and Monk, 2003). In current vehicle design, personalisation is mainly used for interface design and driver assistance systems (Hartwich, Beggiato, and Krems, 2018; Hasenjäger and Wersing, 2017). Within this design, the display and automation settings can be configurable based on the operator's preference, thus resulting in a sense of control (Saffarian, De Winter, and Happee, 2012). However, this insight is mainly focused on private AVs, and little has been explored for SAVs. Due to the character of public use in ride-sharing schemes in SAVs, the diversity and personalisation of automated systems will cause challenges with interoperability. It is still unclear how personalisation could be designed in the context of SAVs.

Through a review of the trust-building process and relevant design methods, this helps provide a potential design research direction to explore in the context of SAVs. As discussed earlier, in addition to distrust in the vehicle, distrust in strangers is another important part of trust issue in SAVs. This is discussed in the next section, with the aim of better understanding the ways comprehensive trust issues in SAVs.

4. Trust in strangers when using SAVs

Trust in strangers has been found to be an important influencing factor on passengers' willingness to use ride-sharing services (Amirkiaee and Evangelopoulos, 2018). Particularly in the context of SAVs, because of the ride-sharing schemes, small groups of mutual strangers travelling together in such vehicles devoid of an authority figure could increase their distrust in strangers when using SAVs (Paddeu, Parkhurst, and Shergold, 2020; Sanguinetti, Kurani, and Ferguson, 2019). A study by Dong, DiScenna, and Guerra (2019) demonstrated that two-thirds of people were willing to use an autonomous bus when there was a conductor on board, and the result dropped to just 13% when there was no "authority figure" presence in this vehicle. As well, in the United States, fear of travelling with an unpleasant passenger is the main reason for passengers' unwillingness to share trips (Sarriera et al., 2017). Apparently, sharing a ride with a stranger in SAVs could raise users' concerns about their personal physical and safety (Paddeu et al., 2021). This may result in a low tolerance of close proximity and a Low sense of security with strangers to strangers in the SAVs.

Trust issues in self-driving autonomous vehicles (SAVs) are complex and can be influenced by various factors when passengers share space with strangers. This section explores two critical aspects affecting passengers' trust: proximity and the sense of security.

4.1. Proximity and low trust

The concept of proximity has received considerable attention in academic research, covering geographical, organisational, and technological proximity (Knoben and Oerlemans, 2006). In the context of transportation, geographical proximity refers to the physical distance between passengers. Hall et al.'s proxemics theory (1968) indicates that strangers often feel psychological discomfort when forced into an intimate social distance (between 0-0.45 m) in a public transport situation. Passengers prefer to avoid eye contact, touch, and tense muscles to remain immobile, thus preventing intimate contact (Hirsch and Thompson, 2011). This situation results in low privacy and usually occurs in crowded spaces that create close proximity between passengers.

Crowding is defined in the literature as personal space being violated, which produces the sensation of crowding (Evans and Wener, 2007). Beaulieu (2004) emphasizes that a lack of private space means an individual's privacy or interactions with others are intruded upon by those surrounding them. Low trust may be a result of passengers sharing space in SAVs, and reducing the perception of crowding has the potential to increase trust in strangers within SAVs (Li and Hensher, 2013; Thompson et al., 2012).

4.2. Security concerns and low sense of safety

Security concern is a psychological manifestation of distrust in passengers when using ride-sharing services, including SAVs (Chaudhry, EI-Amine, and Shakshuki, 2018). In the context of SAVs, the absence of a human driver could reduce trust in other passengers about their behaviour when sharing space, particularly during night-time trips (Nahavandi, 2017). Women may have lower trust levels with strangers due to safety concerns (Salonen, 2018).

Improving passengers' perception of in-vehicle safety plays a significant role in enhancing trust with strangers in SAVs (Sarriera et al., 2017; Dichabeng, Merat, and Markkula, 2021). Implementing the defensible space theory, which emphasises perceived control and ownership of a space, can enhance passengers' sense of security (Newman, 1996). Features like human remote control, video surveillance, and emergency stop buttons are effective methods for crime prevention and safety assurance (Ong et al., 2019). Private and shared service options in SAVs, allowing passengers to choose their comfort level, may also increase their trust and sense of safety (Seymour Powel; IDEO).

Creating low-density interiors and designing SAVs with openness and safety in mind are additional considerations to address security concerns (Lundquist, 2018; Kvarnefalk, 2021). Nonetheless, while certain design solutions can improve trust, it's crucial to find a balance between personal comfort and space utilisation in SAVs.

Through the understanding of the issue of trust in strangers in shared vehicles, the literature has concluded that improving the perception of private space and emotional security could reduce passengers' concerns with other strangers and, in turn, increase trust when sharing a vehicle with strangers. While many solutions have been mentioned to address these issues from certain perspectives, there are limitations that need to be considered, including space flexibility, convenience, and passenger capacity of SAVs, as they are critical factors in representing the advantages of ideal SAVs. In summary, by creating a sense of space, security, and comfort, SAVs can enhance passengers' trust and pave the way for widespread adoption.

5. Discussion and conclusions

This paper has examined the current academic research on trust in the vehicle and trust in strangers within the context of future SAVs (Level 5 autonomy). The study identifies existing design challenges and proposes potential research opportunities to address these problems. Three central themes are emphasised: the theory of trust, trust issues related to the vehicle in SAVs, and trust issues concerning interactions with strangers in SAVs.

Many studies have highlighted that people tend to exhibit low levels of trust in SAVs, primarily due to the absence of a human driver within the vehicle. The lack of perceived control and distrust in the autonomous technology are identified as essential factors contributing to this issue. Existing literature suggests that enhancing the feeling of control can effectively improve trust. Several strategies are proposed to boost passengers' trust in the vehicle, such as implementing Human-Machine Interface (HMI) to provide clear insights into the vehicle's operations, incorporating anthropomorphic features for a more aesthetically compatible SAV function, and fostering a sense of identity and hedonic motive through personalised or enjoyable design elements. However, it is essential to note that the literature mainly focuses on the traditional or private autonomous vehicles. Little research has been conducted on how these design theories can be explored and adapted to address trust issues in the specific context of SAVs. Understanding these factors is crucial for designing shared spaces that promote trust in the vehicle.

Regarding trust in strangers when using SAVs, the review primarily focuses on the issues surrounding passengers' trust in sharing a vehicle with strangers, especially in the absence of an authority figure. It is observed that sharing a vehicle with strangers may decrease passengers' trust in unfamiliar individuals, leading to reduced tolerance of close proximity in a crowded shared space and consequently lowering the perceived security with strangers. Existing solutions from academia and industry have mainly focused on creating personal space and implementing monitoring mechanisms in the vehicle to improve trust in strangers. However, these approaches might not adequately address the unique challenges posed by the ride-sharing scheme of SAVs, which calls for a better trade-off design between enhancing feelings of privacy, security perception, space convenience, flexibility, and passenger capacity. Therefore, further research, particularly through design practise, is essential to develop more suitable solutions that effectively address the trust-related issues associated with sharing vehicles with strangers in SAVs.

In conclusion, from this literature review, it becomes evident that the existing knowledge is primarily derived from ethnography and behavioural studies, using traditional design elements (e.g., buses, trains) and design theories (System transparency, anthropomorphic features, personalisation design) to explore and address trust issues in the context of SAVs. The research reveals a clear and interrelated relationship between trust in the vehicle and trust in strangers, jointly shaping the quality of a trustworthy environment for SAVs. However, the existing research also points to a significant research gap that requires attention. To address trust issues comprehensively in SAVs, a holistic approach is necessary, considering both trust in the vehicle itself and trust in strangers as interconnected systems. Exploring the successful orchestration of design elements to achieve this is vitally important. This could include investigating the implementation of anthropomorphic features in the interior and exterior to improve passengers' trust, identifying additional physical elements to enhance feelings of safety, and designing the interior configuration to mitigate privacy concerns between strangers. As the development of SAVs progresses, conducting more design research on trust in SAVs holds the potential to significantly benefit the overall design of autonomous vehicles. The successful implementation of such research findings in SAVs can ultimately lead to greater public acceptance and adoption of autonomous transportation in the future.

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