TRUST IN SELF-DRIVING TECHNOLOGY

Jovana Jovanovic

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> *„If I had asked people what they wanted, they would have said faster horses." – Henry Ford*

1 Automotive Transformation

Driving revolution is happening. Autonomous vehicles aim to eliminate the primary cause of accidents on the roads caused by human error. It is expected that autonomous vehicles will contribute to a better environment, better traffic flow, reduce accidents, decrease traffic congestion and increase highway capacity, enhance human productivity and improve mobility of elderly and disabled. The list of benefits is long. However, society still is skeptical about vehicles that drive themselves. Although automation technology is replacing humans in complex tasks' performance, eliminating human intervention from driving may imply significant safety and trust-related concerns. Many question are still seeking answers.

If we take a look at the history of the automobiles, we should not forget their antecedents. It all began with the horsepower. People used to live more locally than they do now, and if they needed to move things they would drag them by sledge or float them down the river. Many times, horses would have brought a carriage home safely, even if the driver was no longer completely fit for the journey. However, horsepower was not the long-term solution. One of the greatest inventions of prehistoric times was certainly the wheel. It provided a possibility for people and animals to pull heavier loads further and faster. After Greeks gave us gears and Romans gave us roads, the only missing part was the engine to get a modern car of today.

Furthermore, when Karl Friedrich Benz (1844-1929), German mechanical engineer, designed and built the world's first practical automobile with an engine in 1885, a three-wheeled carriage became the world's first practical gas-powered car. The successful introduction of a four-wheel car by the start of the 20th century made him the world's leading car maker. However, this car was not accepted immediately, because people did not trust them.

It took some time until Henry Ford (1863-1947), who knew how to sell the product efficiently and to leave the rest of the work to the engineers, created his first automobile in 1896, a gasoline powered car he called "Quadricycle". And later the famous Model T became America's only affordable car for the middle-class citizens.

"*I will build a motor car for the great multitude. It will be so low in price that no man will be unable to own one.*" – Henry Ford

Ultimately, people did choose cars as they were quite realistically to maintain and served the purpose of a living animal, even though it was challenging to trust a machine. When we fast-forward to the present time, it is notable that the biggest change in car evolution since that time is happening right now by bringing an autonomous vehicle to the roads.

The following table presents some automobile firsts, compiled from the book, *Science and Technology Firsts and Thought Co.'s History of the Automobile* (Bruno & Olendorf, 1997; *Science and Technology Firsts* is a comprehensive source for information about major events in the history of science and technology).

AUTOMOBILE FIRSTS			
Inventor	**Date**	**Type/Description**	**Country**
Nicolas-Joseph Cugnot (1725-1804)	**1769**	STEAM / Built the first self-propelled road vehicle (military tractor) for the French army: three wheeled, 2.5 mph.	France
Robert Anderson	**1832-1839**	ELECTRIC / Electric carriage.	Scotland
Karl Friedrich Benz (1844-1929)	**1885/86**	GASOLINE / First true automobile. Gasoline automobile powered by an internal combustion engine: three wheeled, four cycle, engine and chassis form a single unit.	Germany
Gottlieb Wilhelm Daimler (1834-1900) and Wilhelm Maybach (1846-1929)	**1886**	GASOLINE / First four wheeled, four-stroke engines-known as the "Cannstatt-Daimler."	Germany

George Baldwin Selden (1846-1922)	**1876/95**	GASOLINE / Combined internal combustion engine with a carriage: patent no: 549,160 (1895). Never manufactured -- Selden collected royalties.	United States
Charles Edgar Duryea (1862-1938) and his brother Frank (1870-1967)	**1893**	GASOLINE / First successful gas powered car: 4hp, two-stroke motor. The Duryea brothers set up first American car manufacturing company.	United States

Table 2-1: Automobile firsts

If we glance at the current public debate on autonomous driving, we can see that there is no universal consensus on terminology. The formulation of the word "automobile" combines the Greek autòs (meaning self, personal independent) and Latin mobilis (meaning mobile), and clearly shows that automobile can be interpreted as "self-mobile". But what exactly is an autonomous vehicle and how can we build trust toward this technology and something that is brand new? The following section explains self-driving vehicle technology and the most commonly used terminology among researchers and practitioners when it comes to describing vehicles that drive themselves.

1.1 Self-Driving Vehicle Technology

Self-driving vehicle technology has the potential to be a great changer on our roads by making driving easier and give people an increase in productivity and mobility.

These vehicles are connected and present the most visible and familiar example of Internet of Things technology. Vehicles equipped with automated driving systems are described in the literature under different names such autonomous, self-driving, driverless, or automated vehicles. For many people, finding consensus on these names is still confusing. SAE International (formerly the Society of Automotive Engineers) specifies 5 levels of automation, and the US National Highway Traffic Safety Administration (www.nhtsa.gov) recently adopted this taxonomy. This includes the full range from no automation to full autonomy. Before explaining levels of automation, it is necessary to clarify how a self-driving car is defined. According to the National Highway Traffic Safety Administration, self-driving vehicles are defined as vehicles in which operation occurs without direct driver input to control the steering, acceleration, and braking (U.S. Department of Transportation, 2016). The driver is not expected to constantly monitor the roadway while operating in self-driving mode. This kind of vehicle is often defined as a vehicle that can guide itself without human conduction by using various kinds of technologies.

NHTSA formalized levels to describe the degree of automation:

- Level 0 or entirely manual car with zero automation where driver performs all driving tasks.
- Level 1 refers to cars that use automation to operate a single control only when needed and the vehicle is controlled by the driver.

- Level 2 is partial automation or combined function automation where the driver continues to closely monitor the environment all the time, even though some functions like acceleration and steering are automated.
- Level 3 or conditional automation does not require the driver's constant attention to environment. The driver must be ready to take control and intervene when needed, but an automated system can both conduct some parts of the driving task, and monitor the driving environment.
- Level 4 refers to an automated system that can operate only in certain environments under certain conditions without driving assistance.
- Level 5 is full automation where the car is completely automatic. The vehicle is capable of performing all driving functions under all conditions, but the driver may have the option to control the vehicle.

Levels 1, 2 and 3 are considered semi-autonomous vehicles, whereas levels 4 and 5 are considered fully autonomous vehicles but still are not permitted on the market for selling.

All levels are permitted to be tested on public roads as long as they are retrofitted in a way that allows for a back-up human driver. (California Department of Motor Vehicles (CA DMV), 2016)

Endsley (Endsley, 1987) specified a hierarchy of levels of autonomy, saying that a task could be performed using:

- Manual control – with no assistance from the system
- Decision support – by the operator with input in the form of recommendations provided by the system
- Consensual artificial intelligence – by the system to be automatically implemented unless refused by the operator; and
- Full automation with no operator interaction

However, a distinction must be made between the different levels of automation in driving. A key distinction is that in SAE levels 1 and 2, a human driver monitors the driving environment, whereas in higher levels, under certain conditions, the driver can transfer control, and the driving system will continue monitoring the driving environment. SAE Level 3 vehicles are more advanced compared to level 2 vehicles, as they are actually capable of taking control and responsibility for the driving task on specific parts of a journey. For example, Google achieved Level 3 autonomy back in 2012 with its test vehicles, but drivers were too trusting and reacted too slow in situations of trouble where the control should have been taken from the driver. Other examples of level 3 autonomy would be Audi A8 luxury saloon and Tesla Autopilot.

Just like human drivers, autonomous driving systems also need information to operate. These systems take sensor data from the cameras, LiDAR (Rasshofer & Gresser, 2005: Lidar - Light Detection and Ranging is a high-precision sensor that measures distance to objects using pulses of laser light to create 3D visualization/maps including 3600 of visibility) and radars to monitor the environment around the vehicle by observing other road participants, such as other vehicles, pedestrians and bicyclists, noticing how they move and what their likely intended actions are. Achieving human level perception is a great challenge, and at the core of self-driving is decision making. An important part of earning public trust is certainly driving the vehicle in a way which other road users expect.

However, consumers are still concerned about autonomous vehicles and these concerns are manifold. It is expected that autonomous vehicles will be adopted only if users believe them to be safe and trustworthy. If we are able to understand what triggers users' trust toward autonomous driving technology, we can better understand the users' attitude and willingness to accept and use these intelligent vehicles. Various factors will promote users' trust toward this technology that allows different types of vehicles to drive themselves.

On the other hand, there will be various factors that will cause the opposite effect, in other words, factors that will undermine and compromise users' trust toward autonomous driving technology. To be human is to fear the unknown and most people still fear this technology since they have never had the experience of riding in a self-driving vehicle. Therefore, trust is a crucial element toward autonomous vehicle adoption.

2 The Importance of Trust

-Trust in Technology-

> *"There is one thing which, if removed, will destroy the most powerful government, the most successful business, the most thriving economy, the most influential leadership, the greatest friendship, the strongest character, the deepest love... That one thing is trust." Stephen M. R. Covey, The Speed of Trust*

Digital technology is rapidly changing the world. Over the years, technology has revolutionized our perspective of the world, it has made our lives easier, faster, better and many would say more fun. This digital explosion is still transforming literally every aspect of the way businesses operate and never before in history the change occurred as fast as today. From mobile solutions, cloud computing, connectivity and social impact, right up to sights of automobiles that drive themselves. Technology continues to develop at a rapid pace with faster and more secure innovations but what about the public appetite for all this innovative technological solution?

In order to be used, any technological novelty has to earn consumer's trust. Building trust in new technology takes time, familiarity with a technological solution and repeated results, preferably positive results. Lack of trust has been identified as one of the most alarming barriers for people to become involved with technology. Without trust and understanding, the adoption of new technologies is holding back. Different disciplines such as sociology, organizational psychology, human factors, management, political science etc. are all dealing with the concept of trust and this topic generates great interest among researchers and practitioners.

As McKnight and Chervany (McKnight & Chervany, 2001) point out, *"There are literally dozens of definitions of trust. Some researchers find them contradictory and confusing; others conclude that the concept is almost (impossible) or elusive to define, and still others choose not to define it"* (37).

Since trust is a broad concept, it seems difficult – if not impossible – to define it in a simple and precise way. It is a multidimensional concept comprising a variety of different facets, but it can be a single, unitary concept affected by different precursors (Mayer, et al., 1995).

Most trust researchers have not yet come to a consensus on the fine points of the structure of trust (Lewicki, et al., 2006), although they do agree on some basics. Defining trust and the ambiguity of its fundamental concepts are a challenge not only to academic researchers but also to organizations and professionals. Moreover, there is a scarcity of robust scientific evidence about which elements and indicators of trust are the most relevant depending on the context and how they change, due to a variety of both human and environmental factors and about the best way (if there is any) of measuring them.

In one study, in which a meta-analysis has been conducted (Sandro, 2007), 72 different published definitions of trust have been pulled together from a variety of academic disciplines to examine what they have in common and what the differences among them were. Most of the definitions showed elements that referred to:

- a subject
- an action or behaviour
- a future action like intention or expectation/belief

It has been shown that a critical feature of trust is the 'future' element, which involves predicting or anticipating another one's actions. However, trust involves present decisions often based on past experience or another person's past behaviour that require anticipating some action that hasn't happened yet (Borum, 2010). Most researchers agree that trust is driven mainly by a combination of cognitive (deliberative) and affective (emotional) factors. Social psychologists see trust as a cognitive process and suggest that different cognitive cues and impressions have an effect on how people form trust, meaning that when people lack direct information or experience with the trustee, they will probably establish a cognitive familiarity based on previous knowledge, impressions, cognitive cues and processes.

The following aspects present the most commonly used definitions of trust chronologically:

- "the confidence that one will find what is desired from another, rather than what is feared." Deutsch, M. 1973
- "willingness to arrange and repose his or her activates on other because of confidence that the other will provide expected gratifications." Scanzoni, J. 1979
- "expectancy held by an individual that the word, promise, oral or written statement of another individual or group can be relied on" Rotter, J.B. 1980
- "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." Mayer, John D. 1995
- "the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another." McAllister, II J.P. 1995
- "expectations, assumptions or beliefs about the likelihood that another's future actions will be beneficial, favourable or at least not detrimental." Robinson, Sandra L. 1996

- "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another." Rousseau, Denise M. 1998

As mentioned before, each of these definitions suggest that trust is a multidimensional construct, and the definitions have several things in common. Firstly, trust is described as an expectation of, or confidence in another and it can be toward another person but also toward a machine. Secondly, the definitions suggest that interpersonal trust operates under conditions of acknowledged interdependence and it is identified by a willingness to accept vulnerability and also a certain risk.

Even though trust and trustworthiness are related, they are not the same concept. While trust is commonly described as a person's willingness to accept vulnerability to another, trustworthiness, on the other hand, comprises the characteristics of the thing or person being trusted, commonly named trustee. Therefore, trustworthiness may be seen as the key antecedent, driver or determinant of trust rather than as synonymous with the behaviour of trust itself.

Ability, benevolence, and integrity are three determinants of trustworthiness (Caldwell & Hayes, 2007). Ability refers to skills or competencies that enable an individual to have influence in a certain area. Benevolence is the expectation that others will have a positive orientation or a desire to do good to the trustee and integrity is the expectation that another will act in accordance with socially accepted standards of honesty, providing reasonably verified information.

Besides a great deal of interest in trust research, it has remained a challenging research topic for several reasons. Firstly, the problem with the definition itself, confusion between trust and its antecedents and outcomes, lack of clarity between trust and trustworthiness, trust and risk and many other terms frequently used to explain trust.

Furthermore, in the book *Trust in Organizations: Frontiers of Theory and Research*, two components of trust are explained (Kramer & Tyler, 1996). The first component concerns how we feel about being trusted, meaning that we are able to manage resources that other people value. The second component of trust concerns how we feel about having to trust others. Trust arises out of our dependency on others, meaning that when we trust, we have to give the trustee power over us.

Three predictors in trustworthiness research, as mentioned above, are a) ability, defined as perceptions of a trustee's competence and consistency, b) benevolence, defined as perceptions of the trustee's caring, empathy, goodwill and commitment, and c) integrity, defined as perceptions of the trustee's objectivity, fairness, honesty and dedication. The propensity to trust varies among people and situations and it is influenced by a considerable number of factors such as past experience, personality characteristics, cultural norms amongst others.

It is already shown that trust may be that crucial factor for the successful introduction of new products or services to the market, including computer technology. Even though interpersonal trust cannot be completely separated from trust in technology, differences between trust in persons and trust in machines exist. However, trust in technology is built the same way as trust in people. When users experience a certain technology for the first time, signals of well-designed user interfaces and good vendor reputation will build trust (Li et al., 2008).

When a new technology is introduced, the importance of trust becomes apparent as the primary predictor of technology usage and understanding user's perception of it. The adoption of a new technology requires previous trust in the technology itself. Trust evolves over time, and at different stages trust is formed based on different factors and processes (McKnight et al., 1998).

The importance of trust has been shown in different domains, especially in the adoption of new technologies (Gefen et al., 2003; Pavlou, 2001). It has also been shown in numerous studies on automation, that trust is a major determinant of acceptance of automation (Lee & See, 2004; Parasuraman, et al., 2008). In addition, many researchers have called for insights on factors that build trust in order to accomplish a better understanding of trust (Leimeister, 2005). According to Lee and Moray (1992) there are three general bases of trust: **performance, process and purpose**.

- Performance refers to the current and past operation of the automation where reliability, predictability, and ability describe what the automation does. More precisely, performance is specified as the competency or expertise as demonstrated by its ability to achieve the operator's goals.
- Process is basically the degree to which the automation's algorithms are appropriate for the given situation and also able to achieve the operator's goal. Finally, process information describes how the automation operates.
- Purpose refers to the degree to which the automation is being used within the realm of the designer's intent. Purpose describes why the automation was developed.

As mentioned before, many researchers have argued that trust has three dimensions and each of them corresponds to an interpersonal trusting belief, that is to say: belief that the system is predictable and understandable, belief that the system performs tasks accurately and correctly and belief that the system provides adequate, effective, and responsive assistance. In other words, the three dimensions for trust in an autonomous vehicle, according to (Choi & Ji, 2015), would be: system transparency, technical competence and situation management. System transparency refers to the degree to which users can predict and understand the operating of an autonomous vehicles. Technical competence is the degree of user perception on the performance of the autonomous vehicle and last but not the least, situation management refers to the users' belief that they can regain control in a situation whenever desired.

3 Can Self-Driving Vehicles Earn Our Trust?

-Key Factors Influencing Trust in Self-Driving Vehicles-

Self-driving vehicles are seen as one of the key disruptors of the next technology revolution. Automated and connected vehicle technologies are among the most heavily researched automotive technologies (CAAT, 2020). Vehicular automation as a topic, has been experimented with and explored for almost a century and as time passed, the degree of automation has increased. Today, the phase of the automation industry has reached a turning point with the inception of self-driving vehicles, where the driver can sit in his car and go to work while the car is driving itself. Automated driving technologies are mostly mature and some autonomous driving is already here, available today and deployed in commercially available vehicles. This technology in the transportation industry has advanced rapidly, both in the private and public sector. However, consumer perception about automated systems' functioning safety capabilities is still hesitant and uncertain. Soon, human operators will share the roads with driverless automobiles and it is critical that we understand users' perceptions of these vehicles.

Automation has been defined as the replacement of a human operator by a machine agent that performs various work-related tasks (Keller & Rice, 2009; Parasuraman & Riley, 1997). Simply said, it is the replacement of human activities by machine activities. The importance of trust between human and machine is vital because an automated system must be seen as an operator's partner in overall system control efforts. Therefore, automation is typically described in terms of levels, ranging from no automation to full automation that has been discussed in section 1.1. (Self-driving technology), and the more trust humans have in machines, the greater the extent of independence they will pass over to the machine. It is important to understand that automation is not all or none, but it can vary across a continuum of levels, from fully manual performance to the fully automated level.

Fully automated vehicles means self-driving vehicles in which operation of the vehicle occurs without direct driver input to control neither steering, acceleration, nor braking, designed so that the driver is not expected to constantly monitor the roadway while operating in self-driving mode (U.S. Department of Transportation, 2016: National Highway Traffic Safety Administration). In general, the difference between automated and autonomous vehicle is the degree of human intervention or better said the level of independence. According to Professor David Levinson, a truly autonomous car is a vehicle that would decide on destination and route as well as control within the lanes and an automated car would follow orders about destination and route (Garrison & Levinson, 2014: Professor David Matthew Levinson, University of Minnesota www.transportist.org). Nevertheless, as reported in a 2015 article of The Economist (https://www.economist.com/the-economist-explains/2015/07/01/why-autonomous-and-self-driving-cars-are-not-the-same), the difference between autonomous and self-driving vehicles is in design. Autonomous cars will look like the vehicles we drive today and will take over from the driver under certain circumstances, whereas self-driving cars are a stage further where the steering wheel will disappear completely and the vehicle will do all the driving. Contrary to autonomous vehicles, automated driving still requires a driver, but allows the driver to take his eyes off the road and engage in NDRTs (non-driving-related task) and the act of this reliance is performed only if the driver trusts the driving automation enough to hand over the driving task. However, these terms, autonomous vehicle and self-driving vehicle, are used interchangeably.

The basic goal of self-driving movement is to make roads safer by reducing errors made by humans. Autonomous vehicles could improve safety, efficiency and mobility by taking the driver out of the loop and relying on the vehicle to navigate itself through traffic (Beiker, 2012). The scientific community predicts that vehicular automation could prevent 75-90% of the vehicular accidents we suffer each year. Most crashes involve human error and by eliminating these errors, benefits for road safety may be substantial. This seems to be a big step in terms of reducing the consequences of human errors.

Before tackling the question of self-driving benefits, we should consider the arguments for autonomous over manually driven cars where three main points in favour of autonomous cars, could be defined as (Fagnant & Kockelman, 2015):

- Less accidents. A significant proportion of accidents and loss of life on the roads are due to driver errors. Lives saved is the measure that will conclusively show the advantages of autonomous over driven cars.
- More productive commutes. A significant percentage of the population in developed, car-rich economies spend considerable time commuting to work. Driverless cars would convert these unproductive hours and minutes into productive work and/or leisure time.
- Less traffic jams. Driverless cars would be better suited for higher volumes of traffic, as they would be able to travel at higher speeds while keeping shorter distances between vehicles.

Nevertheless, for some people who would not take a driverless trip, the biggest fears concern a general lack of trust in the technology, especially safety concerns. According to prior studies, once a person has doubts about the safety of a technology, the person tends to avoid using it (König & Neumayr, 2017).

3.1 Factors influencing trust toward autonomous vehicles

> *"If you think the car likes you, you think it's going to try harder to do well, and that's terribly worrisome."* – Wendy Ju, Stanford University

Autonomous driving promises to become the most far-reaching advance in mobility since the invention of the automobile itself (Lang et al., 2016: Anthropomorphism – attribution of human traits and human-like qualities to non-human entities). As this technology slowly changes how people live, work, and travel, a potential barrier to autonomous driving turns out to be consumer's trust toward this technology and their acceptance. Research on consumer's willingness to ride in an automated vehicle is important in order to fully understand the influence automation has on future users.

This section reveals the most important factors that influence users' trust toward autonomous driving. As mentioned before, some of them have positive impact and they can foster users' trust toward self-driving vehicles, while others can undermine and compromise it. Research has shown not only that individuals are less willing to ride in autonomous ambulances, but gender, nationality and length of time in the vehicle all have an influence on a person's willingness to ride in autonomous vehicles (Winter et al., 2018).

In a study by Nicholas Epley et al. (Waytz et al., 2014) published in the *Journal of Experimental Social Psychology*, it was found that by giving a driverless car human-like qualities, people were more likely trusting the car. In their experiment, it has been shown that people trusted anthropomorphized (see also Large & Burnett, 2018) vehicles more than two other kinds of cars (regular and technically sound autonomous vehicle). People showed more willingness to trust vehicles that possess a name, voice and gender. In a recent Science article (Hutson, 2017), the executive director of Stanford's Center For Design Research pointed out, that when we trust a car with a human interface to a point where we think it likes us, we might assume it will try harder to save us in the event of an imminent crash.

Starting from very basic variables, culture is one particularly important trust determinant in every sphere. In the interpersonal sphere, research has shown that trust varies across countries, religions, and races; the same goes with technology and automation. People with different national cultures and personalities respond differently to the autonomous vehicle technology. Wenderoth recently wrote an article explaining that Chinese drivers are nearly twice as trusting of autonomous cars then peers in Germany and the U.S. (Wenderoth, 2018). Age differences in trust in automation is also a significant variable. The level of trust is directly linked to the level of interest in new technologies among drivers. Younger generations demonstrated greater interest and levels of trust toward self-driving vehicles. Across different studies, results have shown that young people valued driverless cars considerably more than old people, and males were more open towards driverless cars than females (König & Neumayr, 2017). Thus, gender plays an important role concerning trust in technology. Through different studies it has been shown that males and females respond differently to an automated system's communication style and appearance. In one study (Fu & Juan, 2017) published in *Transportation Research Part A*, it was shown that the effects of perceived car control on habit, satisfaction, and intention in the male group were greater compared to those of the female sample, as men have a stronger desire for control, flexibility, privacy, etc. On the other hand, differences in gender have been shown to influence risk-taking behaviours as well, where females are usually less willing to take risks. One prior study has investigated gender differences in the willingness to use a driverless vehicle, finding that within a sample of 1603 Germans, females showed significantly more anxiety regarding the use of driverless vehicles than males (Hohenberger & Spörrle, 2016). Finally, men are more inclined to use technology in general and according to research (Payre et al., 2014) published in *Transport Research Part F*, men have more positive attitudes toward fully autonomous driving and a higher desire to both buying such a vehicle and using it.

Lack of trust can also be related to the fear of possible attacks by hackers. As the autonomous driving technology develops, it is becoming more evident that cyber security is an equally critical subject that impacts public trust and acceptance toward self-driving vehicles (Yağdereli et al., 2015; Schoitsch et al., 2015). People were found to be reluctant to hand over control to machines because of their safety concerns caused by the fear of potential hackers' attacks and system failure (Hulse et al., 2018). As these vehicles used a number of sensors and advanced technology, it has been shown that people already using automated features and advanced technology have less concerns regarding technical issues in general. Prior experience with automated features could influence drivers' trust in automation; a positive previous experience will raise the drivers' trust, whereas a negative past experience will lower and reduce it. Therefore, past experience with an automated system, or a similar technology, can significantly influence the trust formation process; likewise does past knowledge. System transparency, technical competence and situation management are factors with significant effects on trust according to research by Choi & Ji (2015). They examined users' adoption of autonomous vehicles by extending the TAM model (Venkatesh et al., 2003: Technology Acceptance Model – an information systems theory that models how users come to accept and use a technology) and adding 10 new constructs of trust distributed among three second-level constructs: system transparency, technical competence, and situation management. The findings showed the importance of providing functions that allow drivers to recover control in situations whenever they desire. This is particularly important for car manufacturers when designing an autonomous vehicle. On the other hand, they have identified that trust has a negative effect on perceived risk and that the individual locus of control significantly influenced behaviour. Locus of control is defined as a personality trait that echoes the extent to which a person believes he or she can control events that affect him/her (Rotter, 1996). It is a significant personality variable in psychology and it has been shown that it influences the users' decision making process. Locus of control describes people's propensity to blame external or internal factors when some event occurs. Internal locus of control refers to people's belief that things that happen are their own fault, while people with higher external locus of control have a hard time accepting blame but instead believe in environmental reasons. In an abovementioned study (König & Neumayr, 2017), results confirmed that giving the driver the possibility to take over control whenever desired, is the most effective option to increase trust toward self-driving cars. Participants aged 60 or older, as well as female respondents, showed the highest agreement to this statement.

One potential approach to improve trust is designing automated vehicle control systems, such as speed and lateral distance. In one MIT study (Abraham et al., 2017) with 3.000 participants, 48% said they would never purchase a car that completely drives itself. Respondents said they are uncomfortable with the loss of control and they cannot completely rely on technology, but also that they do not perceive self-driving cars as safe as their current vehicle.

In order for automation technology to be widely accepted and successfully commercialized, new investments are needed in the "soft side" of high tech to address consumers concerns. Slowly but surely, it seems that private car ownership will also become a thing of the past and we can expect that automotive companies will become more and more information technology based.

Many factors influencing trust towards autonomous vehicles can be observed in scientific literature, and to some extent they are presented in this chapter. Further analysis and synthesis and validation of previous and new research is needed in this research area. Car manufacturers could use such results in future strategic decisions and to improve their market approach with the aim of better acceptance of autonomous vehicles technology.

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