Master Thesis

Trust in Automated Cars within Eastern and Western Societies: A Case Study on Indonesia and the Netherlands

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Abstract

Most of the previous studies investigate the effect of cultural orientations on trust toward automation at the national level by adopting Hofstede's perspective. Only two studies which discuss this topic at the individual level by adopting Triandis' perspective. Within this perspective, everyone has both collectivism and individualism values within himself (vertical collectivism, horizontal collectivism, vertical individualism and horizontal individualism). The results lead to the inconsistent conclusion about whether collectivists or individualists can trust automation more. Our PRISMA review suggests that it might be caused by several factors e.g., the use of different approaches in measuring participants' cultural orientation. However, there was no study which directly compared the use of both approaches in their studies. Thus, we would like to investigate whether the use of both approaches would lead to the same conclusion. The data in this study were analysed by using two different methods: (1) Comparing the trust level at the national level; (2) Considering individual differences by using Triandis' perspective. In total, 123 participants from Indonesia and the Netherlands participated in this study. All participants completed an online experiment where they were asked to watch both positive and negative videos of automated cars. Results showed that Indonesian participants exhibited higher trust in automated cars than Dutch participants. However, it is unlikely that the difference was caused by the cultural orientations. Only the trust level of Dutch participants was affected by the level of horizontal individualism value in addition to the negative video. Therefore, our study confirms that the use of different approaches in studying cultural orientation may lead to the different conclusion. Moreover, combining both approaches in studying cultural effect on trust toward automated cars may result in broader practical benefits.

Introduction

An automated vehicle can be described as a "robotic" vehicle that works with no or less human intervention (Kaur & Rampersad, 2018). In the past several years, car manufacturers, as well as technology companies such as Tesla, Volvo and Google-Waymo are investing an increasing amount of effort in developing automated cars (Noah et al., 2017). The ultimate goal of the current industrial research is to achieve a fully automated driving as it is predicted to bring the broader benefits to the society, ranging from the safety perspective to the perspective of environmental sustainability. For instance, automated cars are expected to have higher safety level than the manual cars since most of the accidents on the streets are caused by human errors (Khastgir et al., 2018; Piao et al., 2016; Choi & Ji, 2015). Researchers also suggest that automation system improves the driving comfort as people can be more relaxed and do the other activities while driving in automation mode (Payre, Cestac, & Delhomme, 2016; Hergeth et al., 2016). Moreover, as less efforts are required to drive an automated car, this innovation is more accessible to people with disabilities and special needs (Molnar et al., 2018; Piao et al., 2016; Hergeth, Lorenz, Vilimek, & Krems, 2016). In addition, automated cars are considered more environmentally friendly (Piao et al., 2016).

All of the benefits mentioned above can only be obtained by the presence of Automated Driving System (ADS) in the car designs. This system is designed to help the car to (semi-) independently select the driving information, transform it and make its own decision based on that information (Walker et al., 2018; Hoff & Bashir, 2015). The ability of ADS-featured cars in acting automatically depends on their automation level. There are six levels of automation according to the Society of Automotive Engineers (SAE) which range from 0 (no automation) to 5 (full automation) (SAE, 2014). In level 1, ADS can partially take over the steering wheel from the human drivers. However, the responsibilities for monitoring and controlling the dynamic driving tasks are fully on the drivers' side. The main distinction is between level 2 (partial automation) and level 3 (conditional automation). In level 2, the drivers are still fully responsible for everything

related to the driving process, from monitoring the driving environment to handling the fallback occurrence. However, ADS can fully take over the steering wheel. Whereas in level 3, ADS is capable of monitoring the driving environment. Still, once any fallback occurs, the human drivers should fully take over the responsibility in handling the problems. Nevertheless, SAE (2014) also emphasises that this level of categorisation cannot be used as an absolute basis on how ADS work. The human drivers are then expected to always monitor the dynamic process of the driving tasks and be fully responsible for it. Table 1 summarises the ADS function presenting a comparison between each automation level.

Table 1

Comparison of each automation level (SAE, 2014)

Level	Name	Narrative Definition	Execution of Steering	*Monitoring*	Fallback Performance	System Capability *(Driving Modes)*
***Human driver* monitors the driving environment**						
0	No Automation	The full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	The *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* performs all remaining aspects of the *dynamic driving task*	Human driver, system	Human driver	Human driver	Some driving modes
2	Partial Automation	The *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/ deceleration using information about the driving environment and with the expectation that the *human driver* performs all remaining aspects of the *dynamic driving task*	System	Human driver	Human driver	Some driving modes
Automated driving system monitors the driving environment						

3	Conditional Automation	The *driving mode*-specific performance by an *automated driving system* of all aspects of the dynamic driving task with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	System	Human driver	Some driving modes
4	High Automation	The *driving mode*-specific performance by an automated driving system of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	System	Some driving modes
5	Full Automation	The full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	All driving modes

The introduction of ADS system has gained many positive responses from the potential users. They cannot wait to take the advantages of using automation features which allow them to do non-driving-related tasks such as sending text messages, eating and drinking (Pfleging, Rang & Broy, 2016). However, previous studies (Kundinger, Wintersberger & Riener, 2019; Kundinger, Riener, Sofra & Weigl, 2018) also point out that the application of ADS system can lead to the drivers' drowsiness. Whilst the currently marketed ADS are mainly using level 2 system which needs the human drivers to fully monitor the driving environment. Even if the cars use ADS level 3 or higher, the human drivers are still expected to frequently monitor the driving environment as they are still responsible for the driving safety. Thus, wrong expectation and improper trust calibration of the potential users may lead to the serious safety issues. Moreover, it is also important to note that the main market of ADS is the typical drivers, not someone with certain domain expertise and experience such as pilots (Kundinger et al., 2019). Therefore, the trust level and expectations of the potential users may vary widely. In the next section, we are going to look at the safety issues with ADS and its connection with the sense of trust toward these systems.

1.1. Automated cars and safety issues

In recent years, fatal accidents involving automated cars raised concerns about the functioning of ADS. Jenssen, Moen and Johnsen (2019) mention that there was a fatal accident that occurred involving SAE level 3 Volvo XC90 Uber Self-Driving which killed a pedestrian in Arizona. National Transportation Safety Board (NTSB) (2018) reports that the car should have slowed down or commanded the driver to brake the car when recognising the pedestrian crossed the street at six seconds before the collision. However, the car did deliver the need of an emergency brake at 1.3 seconds before the collision. Moreover, the sign that the ADS sent was also not so clear causing the driver to hit the brake at less than a second before the collision. It was too late since the car was at high speed. Even though SAE (2014) mentions that in the automation level 3, the human drivers are still responsible for any fallback, ADS in this case failed at giving proper information and recommendation regarding the driving environment which results in a fatal accident.

There are also other accidents involving higher automation level where any fallback is supposed to be handled by the ADS (SAE, 2014). As of June 2019, California DMV reports there are 167 automated vehicle collisions of Google-Waymo cars SAE level 4 (Jenssen et al., 2017). Some studies (Teoh & Kidd, 2017; Favaro et al., 2017) suggested that 19 out of the 21 accidents of Google Waymo were caused by wrong expectations of the drivers due to drivers' over-trust toward the system. It has been previously explained that automated vehicles are not always reliable and are not error-free. Still, in most of the cases, people, in general, tend to over-trust automation system and directly blame the sharp-end sides when any accident occurs (Awad et al., 2020). Certainly, safety and trust toward automated vehicles are connected, and several researchers are investigating this relationship to better understand which factors may affect people trust toward ADS (Wintersberger & Riener, 2016; Kundinger et al., 2019; Koo et al., 2015; Kundinger et al., 2018; Kunze, Summerskill, Marshal & Filtness, 2017)

1.2. Definition of trust in automation, types and factors affecting it

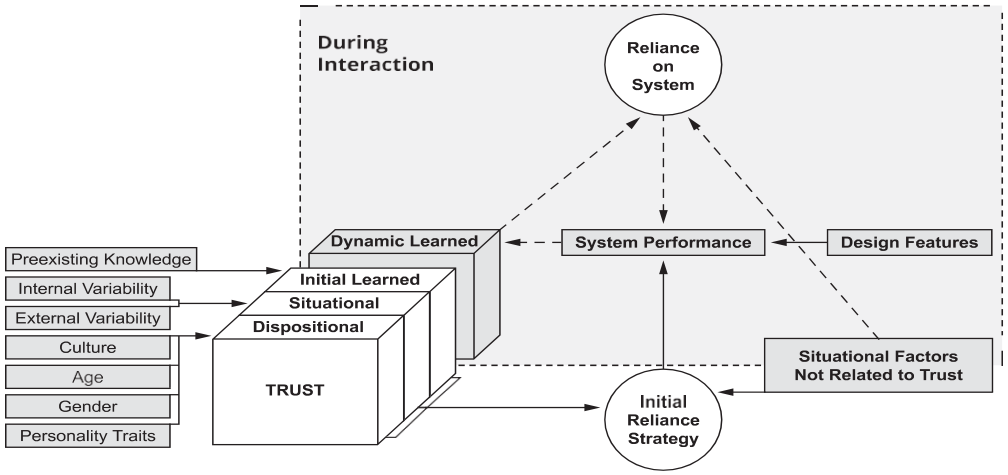
Trust in automation can be defined as the willingness of the trustors to use the automation as a helper in achieving their goals in an uncertain and vulnerable situation (Lee & See, 2004; Lazányi

& Maráczi, 2017). According to Lazanyi & Maraczi (2017), there are two types of trust in automation. The first is dispositional trust. Dispositional trust can be described as someone's trust in automation before having actual experience and interaction with the system (Merritt & Ilgen, 2008; Lazányi & Maráczi, 2017). It is more likely affected by the trustors' characteristics such as personality, self-confidence (de Vries, Midden & Bouwhuis, 2003; Lazányi & Maráczi, 2017), age (Wiegmann, McCarley, Kramer & Wickens, 2006), and culture (Ferronato & Bashir, 2020; Mehta, Rice, Winter & Oyman, 2014; Rice et al., 2018; Mehta, Rice, Winter & Eudy, 2017; Winter et al., 2015; Ragbir, Baugh, Rice & Winter, 2018). However, dispositional trust in automation can also be affected by the visible features of the cars or other automated machines (Merrit & Ilgen, 2008).

The next type of trust in automation is history-based trust. In contrast to the dispositional trust, history-based trust is heavily influenced by users' perception of the machine's performance (Lazányi & Maráczi, 2017). In other words, history-based trust in automation is someone's trust in an automation system after having actual interactions with the system. However, the number of trust types also depend on the authors of the studies. For example, Hoff and Bashir (2015) indicate that there are four types of trust in automation. In addition to dispositional trust, there are: (1) Situational trust which is affected by internal and external variability; (2) Initial learned trust which is affected by pre-existing knowledge of the users; (3) Dynamic learned trust which is affected by the interaction of users with the system. The illustration of how these types of trust in automation are affected by various factors can be seen in Figure 1.

Figure 1.

Full model of factors influencing trust in automation (Hoff & Bashir, 2015)



Note: Besides dividing the types of trust based on whether there is any interaction with the system i.e., initial trust (pre-interaction) and dynamic learned trust (during the interaction), Hoff and Bashir (2015) also categorise the trust type based on the influencing factors of trust i.e., dispositional trust (affected by the demographic factors and personality traits of the operators), situational trust (affected by the external environment and how the operators react to their environment) and initial learned trust (affected by the formed knowledge obtained from operators' experience and previous interactions with the system).

1.3.Dispositional trust in automation

This study will not discuss all of the types of trust in automation and their factors since it will result in a too broad discussion. This study will only focus on the dispositional trust toward automation, specifically toward automated cars. The definition of dispositional trust that will be used in this study is the one which has been used by Merritt and Ilgen (2008), as well as Lazányi and Maráczi (2017) which is the trust before having any direct interaction with the system. Studying dispositional trust in automated cars is important since there is a huge assumption that automation can substitute humans in daily life, which may result in overreliance to the system (Rice et al., 2014; Wintersberger & Riener, 2016). Such assumption is dangerous as both humans and automation have different kinds of ability that the other has not. For example, automation is better

than humans in performance efficiency and processing large amount of information, while humans are better in making judgement and decision (Choi & Ji, 2015).

By studying dispositional trust in automated cars, the tendency of the potential drivers to become over-reliant on the system can be predicted. Thus, fatal crashes can be prevented. Previous studies related to dispositional trust in automation show inconsistent results about the current level of trust among potential users. Some studies (Lazanyi & Maraczi, 2017; Myounghoon et al., 2017) suggest that the level of dispositional trust among potential users is very low which leads to disuse –the use of automation features below its real capability (Parasuraman & Riley, 1997; Wintersberger & Riener, 2016). However, there are also some studies which find that potential users have high dispositional trust in automation (Chien, Sycara & Liu, 2016; Chien et al., 2018a; Chien et al., 2018b). In some cases, potential users may also over-trust the system which leads to misuse –the use of automation features more than its real capability (Parasuraman & Riley, 1997; Wintersberger & Riener, 2016).

1.4. Studies about dispositional trust in automation across the East and the West

Most of studies about dispositional trust in automation only involved participants from industrialised western countries. There is still a limited number of studies that involved participants from eastern countries. Even when people from eastern countries are involved, they come from developed eastern countries such as China (Chien et al., 2016; Chien et al., 2018a; Chien et al., 2018b), Korea (Myounghoon et al., 2017) and India (Rice et al., 2014; Mehta, Rice, Winter & Oyman, 2014; Rice et al., 2018; Mehta, Rice, Winter & Eudy, 2017; Winter et al., 2015; Ragbir, Baugh, Rice & Winter, 2018).

Similar to the findings from industrialised western countries, there is an inconsistency in their findings. Some studies suggest that people from eastern countries have higher dispositional trust in automation (Rice et al., 2014; Mehta, Rice, Winter & Oyman, 2014; Rice et al., 2018; Mehta, Rice, Winter & Eudy, 2017; Winter et al., 2015; Ragbir, Baugh, Rice & Winter, 2018). While the other suggest that those from eastern countries have lower trust in automation (Chien et

al., 2016; Chien et al., 2018a; Chien et al., 2018b). Most of studies assume that the difference in trust level between eastern and western countries can be explained by the difference in their cultural orientations (Rice et al., 2014; Mehta, Rice, Winter & Oyman, 2014; Rice et al., 2018; Mehta, Rice, Winter & Eudy, 2017; Winter et al., 2015; Ragbir, Baugh, Rice & Winter, 2018). However, there is still a limited number of studies that involve participants from developing eastern countries to compare the perspective of people from such areas of the world to the perspective of people living in western societies. Since automated cars are expected to be globally marketed, it is important to also study the level of dispositional trust of people from developing countries toward automated cars.

2. Intercultural aspects of dispositional trust towards automation

2.1. Collectivism versus individualism cultures and propensity to trust

Culture can be defined as the shared norms, values and practices within a profession, an organisation or even a nation (Rice et al., 2014; Helmreich, 2000). One of the well-known approaches in cultural studies is to compare collectivism versus individualism values in societies. In daily life, people tend to link the individualistic culture with western countries and the collectivistic culture with eastern countries such as Indonesia, China or other Asian countries. However, collectivism-oriented societies can also be found in the Middle East, Africa, Latin America and a small part of Europe such as Greece, Portugal and Croatia (Huang & Bashir, 2017; Jiang, 2016; Ilies & Zahid, 2019).

People from collectivistic societies seeing themselves as interdependent to other people within their society, where family, work and society, in general, are placed as their priority of life (Huang & Bashir, 2017; Rice et al., 2014; Matsumoto et al., 1997). Therefore, their attitudes, decisions and behaviours tend to be derived from their social norms. They also put the norms above their own needs and personal opinion. On the other hand, those from individualistic societies tend

to behave based on their own personal attitudes and values, where the societal responsibilities are not viewed as their main concern in life (Huang & Bashir, 2017; Triandis, 1995).

Previous studies found that the collectivism-individualism culture affects the propensity of interpersonal trust (Huang & Bashir, 2017; Rice et al., 2014; Yamagishi, Cook, & Watabe, 1998; Hofstede, 1980). However, the conclusion about whether collectivists or individualists are willing to trust others more remains unclear. Rice et al. (2014) mention that those from collectivistic societies are taught to trust something without the need of asking further questions from an early age. Asking questions about why certain social norms or rules are made, especially when they are made by the government or elder people is considered as a rebellious and impolite action. This is also how Indonesians are raised. In Indonesia, being critical by asking about certain opinions or decisions of their parents, professors or authority are considered as inconsiderate. Thus, they tend to easily trust something. On the other hand, in individualistic societies such as the Netherlands, it is common to disagree or to have a different point of view with parents, professors or authority since the interaction style is less hierarchical (ten Dam, 2011; Joy & Kolb, 2009; House, Hanges, Javidan, Dorfman & Gupta, 2004). However, some studies suggest that people from individualistic societies tend to have higher trust in others than those from collectivistic societies (Ferronato & Bashir, 2020; Huang & Bashir, 2017; van Hoorn, 2015). It shows us that the relationship between culture and propensity to trust is complicated. It may also be affected by personal characteristics such as generations and some other factors (Huang & Bashir, 2020).

2.2.Collectivism and individualism and trust toward automation

There is a difference in the process of trust development between interpersonal trust or trust towards people and trust in automation (Lee & See, 2004; Hoff & Bashir, 2015). Hoff and Bashir (2015) mention that the initial level of interpersonal trust depends on the predictability level of trustees. Once the trustor thinks that trustees' actions are predictable, the trust starts to be measured by the trustees' dependability and integrity. Then finally, the trust is strengthened by faith. On the other hands, initial trust in automation is based on faith. Its dependability and predictability will then define the level of trust after users' interaction with the automation system (Hoff & Bashir,

2015; Lazányi & Maráczi, 2017). Although formed by different attributes, some studies suggest that both interpersonal trust and trust in automation are affected by collectivism-individualism culture.

Similar to the interpersonal trust, the conclusion about which culture can trust automation more remains inconsistent. Madhavan and Wiegmann (2007) mention that individualistic societies have higher general trust toward automation than collectivistic ones. However, interestingly some other studies find that collectivistic culture leads to higher trust in automation (Huerta, Glandon, & Petrides, 2012; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Huerta et al., 2012). This is probably due to the use of different research methods in those studies. Most of the studies which mention that individualistic societies have higher trust in automation use surveys as their data collection method (Chien et al., 2016a), while studies that suggest collectivistic societies have a higher level of trust in automation use experiments as their method (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Huerta et al., 2012). The result of those experiments shows us that people from collectivistic societies are more receptive toward the idea of automation technology development. The possible explanation of it is they see the company that develop automation technology as a party with authority. Thus, their level of trust in automation is relatively stable and high even after the failure occurrence compared to those from individualistic societies (Rice et al., 2018).

However, some studies (Ferronato & Bashir, 2020; Huang & Bashir, 2017) also mention that the collectivism-individualism culture alone does not significantly define the level of trust in automation. Those studies adopt Triandis' (1995) perspective in studying the level of trust in automation in both cultures. Within their perspectives, the level of trust in automation more likely depends on the dimensions within the collectivism-individualism culture, which in this case is vertical-horizontal values. People with horizontal values regardless of whether they are collectivists or individualists are inclined to have higher trust in automation (Ferronato & Bashir, 2020; Huang & Bashir, 2017). People with horizontal values are those who emphasise equality

within the society, whereas those with vertical values emphasise hierarchy (Triandis & Suh, 2002). However, they only use a survey as their data collection method. It is still unknown whether the result is still consistent with these findings when the experimental method is used to investigate this topic.

Moreover, in which tool where the automation is applied such as robot or automated vehicles may also affect the result (Ferronato & Bashir, 2020). Both studies do not specify which type of tools they use in their study. Thus, this study aims to study the level of dispositional trust in automated cars in Indonesia and the Netherlands by not only considering the collectivism-individualism perspective, but also vertical-horizontal values. Therefore, cultural orientation in this study is divided into four categories, namely vertical collectivism, vertical individualism, horizontal collectivism and horizontal individualism.

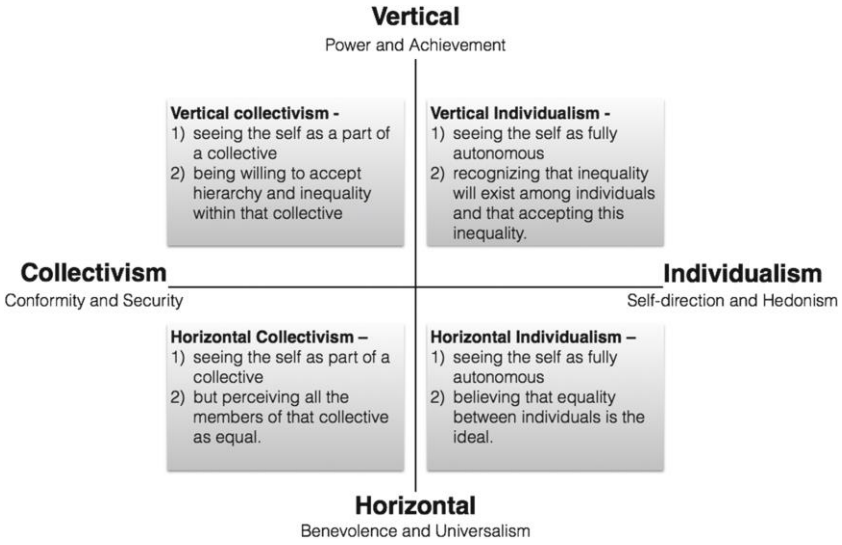
As mentioned before, vertical-oriented societies emphasise hierarchy such as power and achievement (Triandis & Suh, 2002; Triandis 1995). The difference between vertical-collectivism-oriented and vertical-individualism-oriented societies lies in the different purpose of using power and achievement in their environment. In the vertical-collectivism-oriented societies, people use power and achievement to gain more conformity and security, since people with higher social staus is more likely to be heard, accepted and respected in their society. While in the vertical-individualism-oriented societies, the use of power and achievement is more likely driven by people's hedonism values such as for increasing their own prestige in the society.

Furthermore, the horizontal-oriented societies emphasise societal equality (Triandis & Suh, 2002; Triandis 1995). The difference between horizontal-collectivism-oriented and horizontal-individualism-oriented societies is that those from horizontal-collectivism-oriented societies still prioritise the societal conformity in their life. While in the horizontal-individualism-oriented societies, people's actions are not based on the societal conformity, since they tend to see themselves as a fully autonomous human being. The differences between these four categories can be seen in Figure 2. The hypothesis is Indonesians as people from collectivistic culture, especially

those with higher vertical values, tend to be more forgiving toward automation failure than the Dutch.

Figure 2

The differences between each cultural orientation (Triandis, 1995)



Note: Vertical-oriented societies emphasise power and achievement. The difference between vertical-collectivism-oriented and vertical-individualism-oriented societies lies in the different purpose of using power and achievement in their environment. Whereas horizontal-oriented societies emphasise benevolence and universalism, where everyone in the society is equal. The difference between horizontal-collectivism-oriented and horizontal-individualism-oriented societies lies in the difference in prioritising societal conformity and responsibilities.

2.3.Other personal factors which may affect dispositional trust in automation

2.3.1. Age or generation

There are some conflicting studies about how age relates to trust in automation. Payre et al. (2014) find that older people tend to rely on automated cars more and have a higher tendency of over-trusting automated cars. However, Deb et al. (2017) mention that younger people are more receptive towards the idea of automated car technology development. Ferronato and Bashir (2020) propose that this is due to the age-related cognition changes in working memory where older people

are less sensitive to any fault in the automation system. Therefore, the hypothesis in the current study is that younger people tend to trust automated car technology more.

2.3.2. Gender

Previous studies uniformly mention that men show more positive attitudes towards automated cars than women. Kyriakidis, Happee and de Winter (2015) mention that the higher level of automation in automated cars creates a more comfortable driving sensation for men. Men are also relatively less concerned about the possibility of system failure (Hulse, Xie & Galea, 2018; Deb et al., 2017; Hillesheim, Rusnock, Bindewald & Miller, 2017; Kyriakidis et al., 2015). Thus, following the same pattern, the hypothesis in this study is men have higher dispositional trust in automated cars than women.

2.3.3. Experience of living abroad or being raised in a contrasting culture

Triandis and Suh (2002) mention that everyone has access to both collectivism and individualism cognitive structure. However, in the end, their cognitive structure depends on which one they have more access to. Those who originally come from collectivistic society may have individualism cognitive structure if they have lived in individualistic society for a certain period of time and vice versa. Moreover, this variable has never been studied before. Hence, in this study, we would like to test whether having experience of living abroad and/or being raised in a family with different culture background have an impact on cultural orientation which in turn may affect their level of dispositional trust in automation. In addition, those who have abroad experience have higher sense of critical thinking which makes them become more sceptical toward something (Roberts, Raulerson, Telg, Harder & Stedman, 2018). Thus, we expect that abroad experience would negatively influence people's trust toward automated cars.

2.3.4. Education level

Becirovic, Hodzic and Brdarevic-Celjo (2019) find that the higher individual's education level, the higher his critical thinking skill is. Critical thinking defines someone's willingness to do or to

believe something (Facione, 2000). Someone who has a higher critical thinking skill does not easily believe in something. Hence, the expected result is the higher the education level of the participants, the lesser dispositional trust in automation they have.

2.3.5. Experience in the engineering field

Harapan et al. (2020) find that people with higher experience in a topic tend to have higher trust in that topic-related products. Therefore, the hypothesis in this study is people with engineering experience would have higher trust in automated cars.

2.4. Direct and indirect experience with automated cars

Direct experience of driving with automated cars has not been available in many countries such as Indonesia. Moreover, the use of automated cars simulator also needs a lot of expense and may cause a bias since the participants will not experience any real danger (Gold, Körber, Hohenberger, Lechner & Bengler, 2015; Payre et al., 2016; Walker et al., 2018). Thus, we expect that the video of automated cars can be used as a medium to study the trust in automated cars as it provides a vicarious experience to the potential users. Previous studies (Smith, Johnston & Howard, 2005; Jain, Rakesh & Chaturvedi, 2018; Miller & Washington, 2012; Parker, 2011) suggest that advertisement video may increase consumers' trust level as it gives a vicarious experience to them. Therefore, it is expected that the negative video of automated cars such as a fatal crash video may decrease the trust level in automated cars.

Aims of this study

The present study has two main aims. The first aim is to explore and systematise the intercultural factors that affect dispositional trust toward automation by using a PRISMA approach (Moher et al., 2009). The second aim is to empirically explore the effect of cultural orientation on dispositional trust toward automation, specifically toward automated cars. In this work, we will involve Indonesian and Dutch participants as a case study to represent respectively collectivistic and individualistic societies (Hofstede, 2020). Section 3 presents a systematic literature review. We will discuss the results of this systematic review and use the information from the literature to set up the case study. Section 4 presents the research questions that we intend to explore and discusses the methods. The results of the current case study will be discussed in section 5.

3. PRISMA: Intercultural Trust in Automation

This systematic review was conducted from November 2020 to January 2021 by using PRISMA checklist and PRISMA flow diagram proposed by Moher et al. (2009). The results of this systematic review would be used in the discussion for the experimental part of this study.

3.1.Criteria and article selection

The following criteria were set up at the beginning of the study:

1. The articles should be all in English.
2. The articles should be longer than 2 pages.
3. The articles should be published in 2000-2020.
4. The articles should discuss the effect of culture on trust in automation (not vice versa).
5. The articles should provide clear measurements and methods that were used in their study.

3.2.Information sources

Online databases with large academic repositories including Elsevier (SCOPUS), ScienceDirect, IEEE Xplore, Research Gate, Proquest, Wiley Online Library were used as information sources in this study. Furthermore, Google Scholar was also included for additional source.

3.3. Study selection

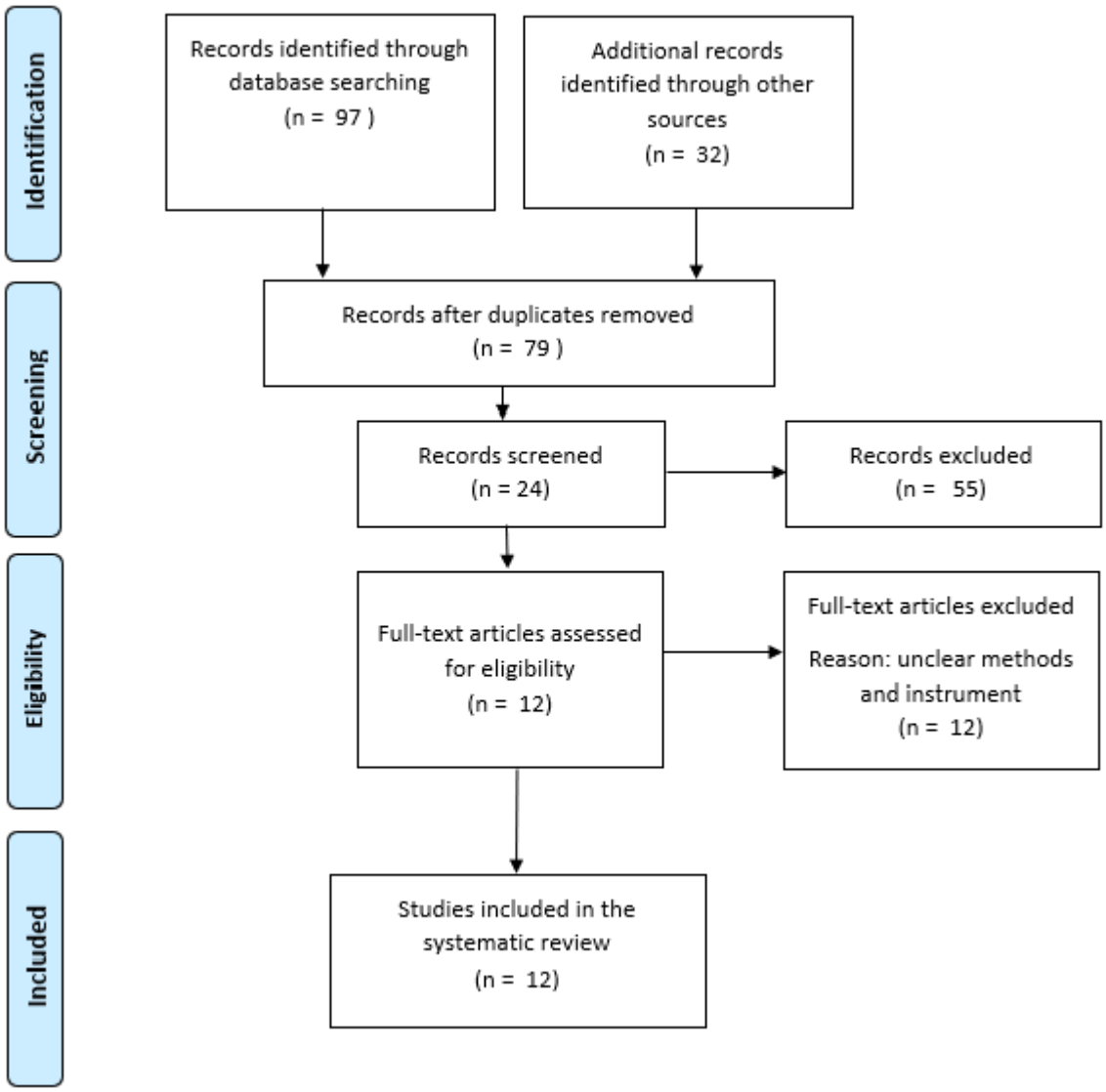
The study selection was done in the following phases:

1. Keyword search. “intercultural trust in automation” was used as the main keywords in this study. However, other words related to cultural orientation such as “collectivism” and “individualism” were also used. Furthermore, “automated vehicle” was also used as a keyword in this study in addition to “automation”. Therefore, in addition to “intercultural trust in automation”, we also used “collectivism and trust in automation”, “collectivism and trust in automated vehicle”, “individualism and trust in automation” and “individualism and trust in automated vehicle”

2. Removing duplicates from various sources.
3. Eliminating articles based on its title, abstract and keywords.
4. A complete or partial reading on selected articles to determine whether they met the eligibility criteria and should be included in the review or not.

Figure 3

PRISMA flow diagram



3.4. PRISMA Result

All the twelve selected studies that have been fully reviewed are reported in Table 2. In the last ten years, an average of 1.1 articles are published each year on the topic of cultural differences in trust toward automation systems. In 2018, the number of publications reached its highest rate, where only three articles published regarding this topic. It shows that the level of researchers' interest in this topic is relatively low compared to the interest in studying trust toward automation in general. In addition to the number of published researches each year, we have summarised the tools of automation which attract the researchers' interest within this last decade (see Figure 4). It can be seen from Figure 4 that automated vehicle is the most researched automation tool (Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018). In addition, it can also be seen in Figure 5 that around 67% (n = 8) of studies that included in the present review were focused on dispositional trust (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Huerta et al., 2012; Ferronato & Bashir, 2020; Huang & Bashir, 2017; Chien et al., 2016).

Table 2

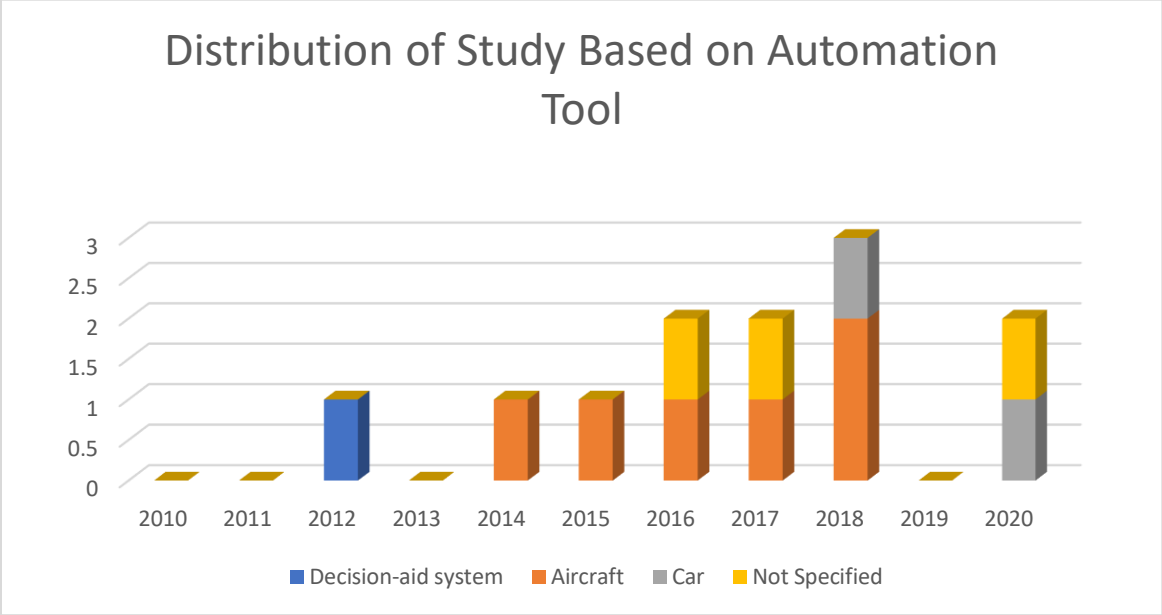
Articles used in this study

No.	Year	Author(s)	Article
1	2012	Huerta et al.	Framing, Decision-Aid Systems, and Culture: Exploring Influences on Fraud Investigations
2	2014	Mehta et al.	Consumers' Perceptions About Autopilots and Remote-Controlled Commercial Aircraft
3	2015	Winter et al.	Indian and American Consumer Perceptions of Cockpit Configuration Policy
4	2016	Chien et al.	Relation between Trust Attitudes Toward Automation, Hofstede's Cultural Dimensions, and Big Five Personality Traits
5	2016	Chien et al.	The Effect of Culture on Trust in Automation: Reliability and Workload
6	2017	Mehta et al.	Perceptions of Cockpit Configurations: A Culture and Gender Analysis

7	2017	Huang & Bashir	Users' Trust in Automation: A Cultural Perspective
8	2018	Chien et al.	Influence of Culture, Transparency, Trust, and Degree of Automation on Automation Use
9	2018	Rice et al.	Does Length of Ride, Gender or Nationality Affect Willingness to Ride in a Driverless Ambulance?
10	2018	Ragbir et al.	How Nationality, Weather, Wind, and Distance Affect Consumer Willingness to Fly in Autonomous Airplanes
11	2020	Lanzer et al.	Designing Communication Strategies of Autonomous Vehicles
12	2020	Ferronato & Bashir	An Examination of Dispositional Trust in Human and Autonomous System Interactions

Figure 4

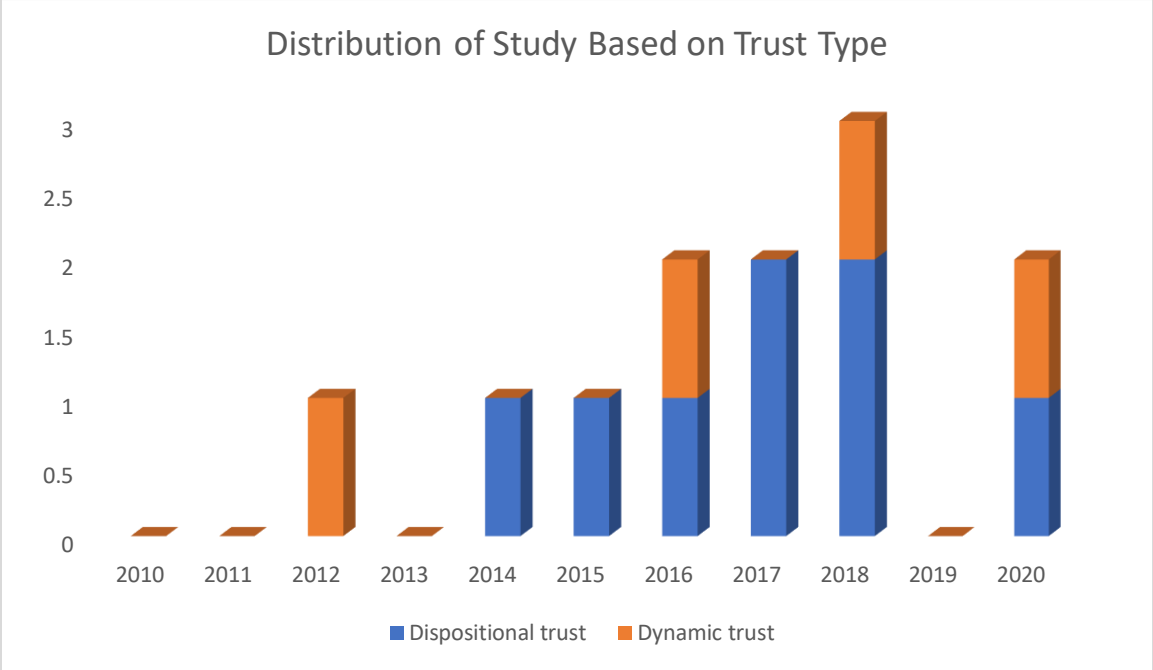
Distribution of study based on automation tool



Note: The graph presents the distribution of researches about trust toward automation based on the type of automation tool used in the previous studies. It is shown that automated vehicles, especially automated aircrafts are the most researched tools within the last decade.

Figure 5

Distribution of study based on trust type



Note: The graph presents the distribution of researches about trust toward automation based on the type of trust in automation. It indicates that 8 out of 12 researches in these past ten years were focused on the dispositional trust toward automation.

Most of the articles in this study (n = 8, 67%) involving people from developed countries, where US is the most researched country in this past ten years (n = 11, 92%) (see Table 3) (Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Ferronato & Bashir, 2020; Huang & Bashir, 2017; Chien et al., 2016). US participants represent people with individualism values. India which represents people with collectivism values placed as the second most researched country in the present review (n = 6, 50%) (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018). Other collectivistic countries involved in the currently reviewed studies were China (Lanzer et al., 2020), Taiwan (Chien et al., 2016b; Chien et al., 2018; Chien et al., 2016), Turkey (Chien et

al., 2016b; Chien et al., 2018; Chien et al., 2016), Sri Lanka (Huang & Bashir, 2017) and Mexico (Huerta et al., 2012).

In addition to the collectivism-individualism approach, 9 out of 12 articles in this study also included other sub-cultural approaches in their studies such as Hofstede's cultural syndrome and Triandis' vertical-horizontal approach. Hofstede's cultural syndrome was the most used cultural sub-approach in previous studies (n = 7, 58%) (Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Chien et al., 2016). The information about sub-cultural approach distribution can be seen in Figure 6.

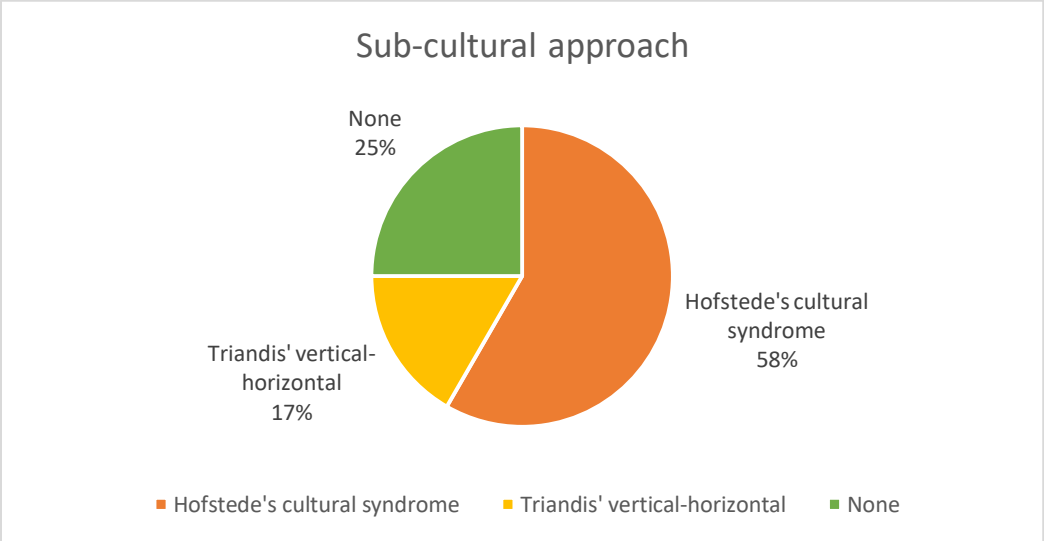
Table 3

List of countries involved in the study

Category	Country	Number of Publication
Developed Country	US	11
	India	6
	Taiwan	3
	China	1
	Germany	1
Developing Country	Turkey	3
	Sri Lanka	1
	Mexico	1

Figure 6

Sub-cultural approaches used in the studies included in the PRISMA review



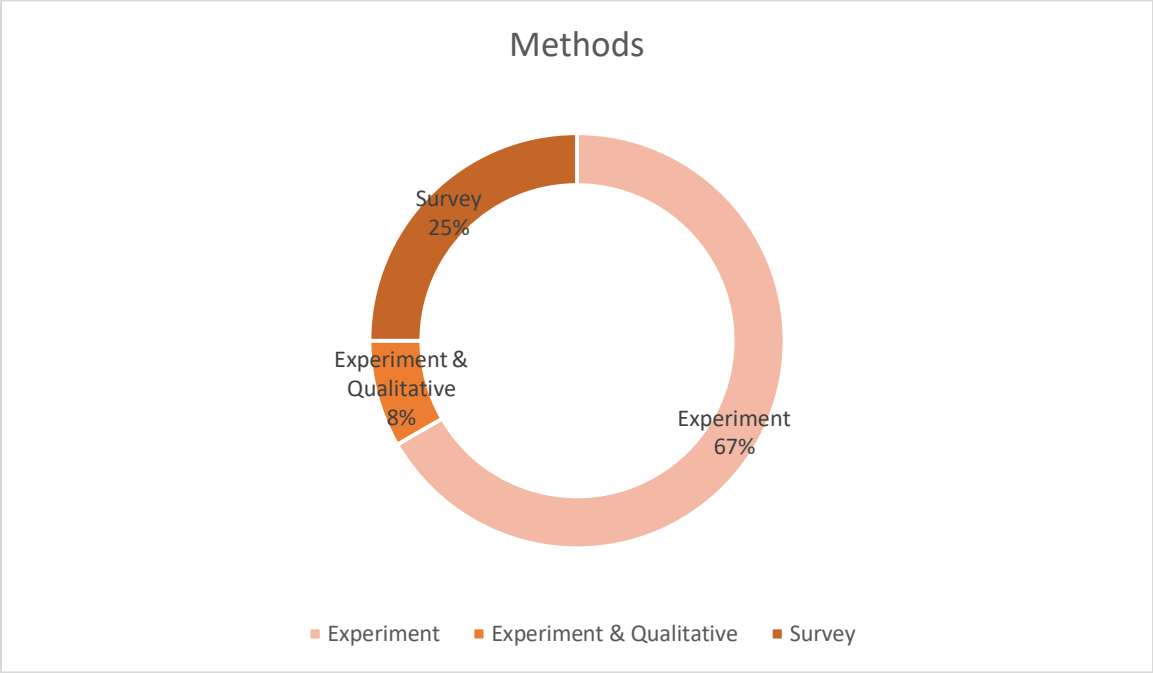
Note: The graph presents the distribution of researches about trust toward automation based on the type of sub-cultural approaches used in the previous studies. It is known that around 53% of the previous studies measured the participants cultural orientations at the national level by using Hofstede's approach. 17% of the studies used Triandis' approach, where they measured the participants' cultural orientations individually. Whereas 25% of the studies did not use any specific cultural approach and directly compared the trust level between eastern and western countries.

The methods and the experimental media used in the previous studies were also reviewed in the current study. Most of the studies (n = 8, 67%) adopted an empirical research approach by performing an experiment to investigate the cultural effect on the level of trust in automation (Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Chien et al., 2016). Ragbir et al. (2018) even included a qualitative approach in addition to the experimental approach. A more detailed overview can be seen in Figure 7. Furthermore, the most used experiment media in the currently reviewed articles is imagination (n = 5, 56%) (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018). The participants were asked to imagine themselves, their colleagues and

their family flying or driving with automated vehicles. More information about the distribution of experimental media used in the articles reviewed in this study can be seen in Figure 8.

Figure 7

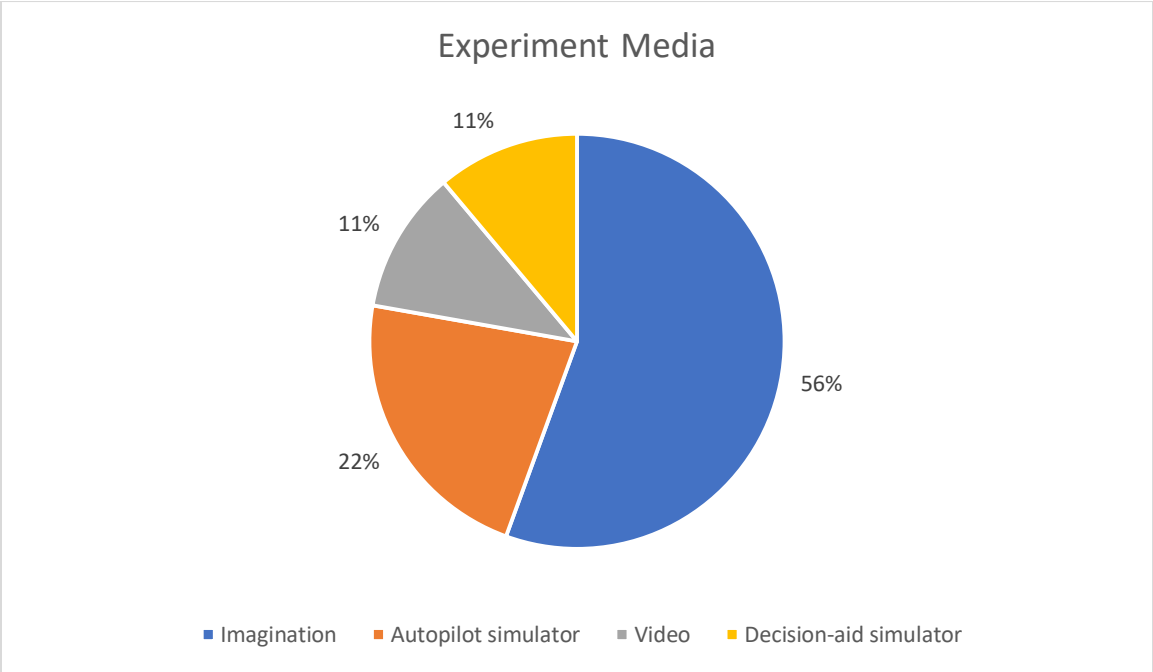
Methods used in the study



Note: The graph presents the distribution of researches about trust toward automation based on the type of methods used in the previous studies. It suggests that experiment is the most preferred way in studying this topic. However, there is still a limited number of studies which consider the importance of qualitative values in studying this topic.

Figure 8

Experiment media used in the study



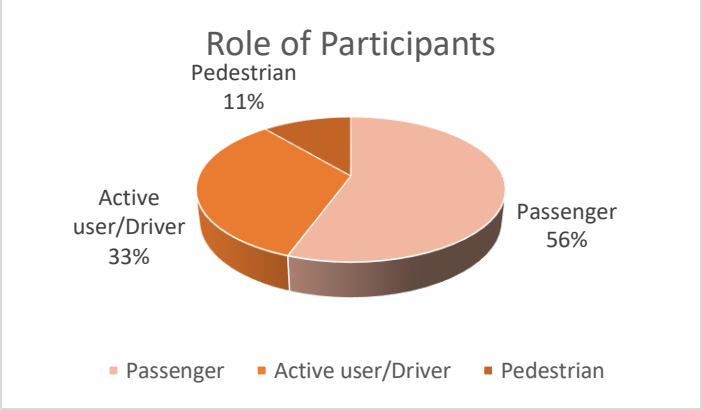
Note: The graph presents the distribution of researches about trust toward automation based on the type of experimental media used in the previous studies. Around 56% of researches used imagination as their experimental media. It also indicates that most of the researches were focused on the dispositional trust toward automation.

Furthermore, most of the experimental studies in the current review (n = 5, 56%) studied potential passive users' trust toward automation systems (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir, 2018). Contrarily, three of the reviewed experimental studies were focused on the trust level of potential active users (Chien et al., 2016b; Chien et al., 2018; Huerta et al., 2012). Finally, only one study investigated the pedestrians' perceptions toward automated cars (Lanzer et al., 2020). More detailed overview can be seen in Figure 9. Besides measuring the effect of culture on automation, articles in this review also examined the other factors affecting the level of trust toward automation such as gender (Mehta et al., 2014), degree of automation (Chien et al., 2018) and distance (Rice te al., 2018; Ragbir et al., 2018). The detail of the factors can be found in Table 4.

Regarding the instruments used in the previous studies, a questionnaire developed by Chien et al. (2014) was the most used questionnaire for measuring the participants' trust level toward automation system (Chien et al., 2016b; Chien et al., 2018; Chien et al., 2016). Some other studies (25%, n = 3) even only using a single-item questionnaire to measure the level of participants' trust (Mehta et al., 2014; Winter et al., 2015; Ragbir et al., 2018). No any additional objective measurement such as eye-tracking and EEG was used to measure this variable. While for measuring the level of participants' cultural orientation, most of the studies (50%, n = 6) used Hofstede's approach (Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Winter et al., 2015; Ragbir et al., 2018). With this approach, the researchers did not actually use questionnaires to individually measure participants' cultural orientation. They went to Hofstede's website to know the level of individualism values of certain nations. Two studies even did not go to the Hofstede's website, they just compared the level of trust between countries by assuming that the involved countries were collectivistic and individualistic (Lanzer et al., 2018; Mehta et al., 2017). Finally, only two studies measured participants' cultural orientation at the individual level by using Triandis' approach (Ferronato & Bashir, 2020; Huang & Bashir, 2017).

Figure 9

Role of participants in the study



Note: The graph presents the distribution of researches about trust toward automation based on the role of participants in the previous studies. It suggests that the researchers are mostly interested in studying the perceptions of potential passengers (passive users) of automation.

Table 4

Factors researched in the study besides culture

Factor	Author(s)
Communication style	Lanzer et al. (2020)
Transparency	Chien et al. (2018)
Degree of automation	Chien et al. (2018)
Gender	Mehta et al. (2014)
Distance	Rice et al. (2018); Ragbir et al (2018)
Length of journey	Rice et al. (2018)
Type of aircraft	Winter et al. (2015)
Relation with the person who will use the vehicle	Winter et al. (2015)
Weather	Ragbir et al. (2018)
Wind	Ragbir et al. (2018)
Framing	Huerta et al. (2012)
Age	Ferronato &Bashir (2020)
Education	Ferronato & Bashir (2020)
Personality traits	Chien et al. (2016a)

3.5. PRISMA Discussion

Researchers are widely investigating the human interaction with automated vehicles. However, only a limited number of studies focused on the cultural aspects associated with the trust toward automation (Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018). By reviewing the articles which considered the cultural effect on trust toward automation, we expected to get more insight about the limitations of the previous studies. Hence, we could conduct a better approach for doing an empirical study by using an experimental approach to this topic. Moreover, the findings from this review will be used in the discussion of the experimental results.

From the previous studies, it is known that dispositional trust toward automated vehicles raised the highest concern among the researchers (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Ferronato & Bashir, 2020; Huang & Bashir, 2017; Chien et al., 2016). Dispositional trust toward automated vehicles can be described as the trust of the potential users before having any direct interaction with the vehicles. It raised the highest concern because automated vehicles are used by more and more common users than the other automation systems. Thus, their safety level becomes the biggest issue among the researchers and technology developers as it may cause a fatal danger (Lazányi et al., 2017, Jenssen et al., 2019; Hergeth et al., 2016; Rice et al., 2014).

Most of the studies included in this review (91.67%, n = 11) are done by involving participants from developed countries such as US (Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018; Ferronato & Bashir, 2020; Huang & Bashir, 2017; Chien et al., 2016), Germany (Lanzer et al., 2020), and India (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018). The possible explanation is the automated vehicle technology is mostly developed and/or already marketed in developed countries. Thus, the interest in studying this topic in these countries is high since there is already a problem to analyse such as a self-driving car crash in Arizona.

Nevertheless, studying this topic in developing countries with a high economic gap within their countries such as Indonesia (de Silva & Sumarto, 2014), where the rich can buy such advanced technology like automated cars is also important. This could help minimising the automation-related problems in the early stage.

In order to study the cultural effect on trust toward automation, 53% (n = 7) of the previous studies used the Hofstede's approach in measuring participants' cultural orientation. In this approach, the researchers did not actually measure the cultural orientation of their participants. They went to Hofstede's website to know the individualism level of the involved countries and directly compare the trust level between the countries (Chien et al., 2016a; Chien et al., 2016b; Chien et al., 2018; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018). Three of the previous studies even did not use any specific cultural approach and directly compared the trust between eastern and western countries. Only two studies (Huang & Bashir, 2017; Ferronato & Bashir, 2020) measured the participants' cultural orientation at the individual level.

As stated earlier in the beginning of this study, the results of the previous studies lead to an inconsistent conclusion regarding the effect of cultural orientation on trust toward automation system. In this study, we find that this inconsistency might be caused by the use of different approaches in measuring participants' cultural orientations. For example, a survey study by Chien et al. (2016a) which used the Hofstede's approach found that individualists had higher trust toward automation system than collectivists. On the other hands, previous survey studies which measured participants' cultural orientation at the individual level by adopting Triandis' perspective found that individualism-collectivism alone did not predict the level of trust toward automation (Huang & Bashir, 2017; Ferronato & Bashir, 2020). In their finding, the trust level in automation was more likely affected by the horizontal values. Therefore, both collectivists and individualists with horizontal values had higher general trust toward automation than those with vertical values (Huang & Bashir, 2017; Ferronato, 2020).

These conflicting results might also be caused by the use of different experimental media used in the previous studies. For instance, experiment studies which asked the participants to imagine themselves flying or driving with autonomous vehicles found that collectivists had higher trust in automation (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018). While experimental studies which used autopilot simulators as their experiment media found that individualists had higher trust in automation (Chien et al., 2018; Chien et al., 2018). Thus, it could be said that collectivistic participants have higher dispositional trust in automation. Whilst individualistic participants have higher dynamic and history-based trust in automation. However, in accordance with Ferronato and Bashir (2020), the system in which the automation is applied also affects the result of the study. Huerta et al. (2012) also used an automation simulator in their study, yet the result was that collectivists had higher trust in automation than individualists. This was because they used an automation simulator for a decision-aid system for managerial position, not for an automated vehicle, which has higher risk.

It was still unclear whether the use of different methods (e.g., experiment or survey) might lead to the different results if we measure participants' cultural orientation at the individual level by adopting Triandis' approach. It was because both studies which adopted Triandis' approach (Huang & Bashir, 2017; Ferronato, 2020) only used survey to collect the data. There was no experimental study which measured this variable at the individual level. In addition, it was still unclear if studying the participants' cultural orientation at both the national and individual level might result in the same finding since there was no study which used both approaches in their study, then compared the results of both approaches. That is why an experimental procedure was used for it in the current study. The result of this experimental study will be discussed in section 5.

Furthermore, most of the studies in this review (75%, n = 8) used an experimental approach as their method. Around 56% (n = 5) of them investigated the trust level of potential passive users of automation (e.g., passengers of automated ambulance) (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir, 2018). Contrariwise, three of the reviewed experimental studies were focused on the trust level of potential active users (e.g., pilots and drivers

of automated cars) (Chien et al., 2016b; Chien et al., 2018; Huerta et al., 2012). While only one study investigated the pedestrians' perceptions toward automated cars (Lanzer et al., 2020). Since the automated cars are expected to be marketed broadly and not limited to public transportation, it is important to do more studies on the perceptions of potential drivers and pedestrians on automated cars. This could help the government to create a comprehensive rule about automated cars and prevent over-blaming at the sharp-end side. In addition, the automated car developers could predict the tendency of over-reliance to the system by the potential drivers. In this way, they could modify the systems and help the potential drivers to do a proper trust calibration.

In order to measure the participants' trust in automation, all of the previous studies used questionnaires without the use of any additional objective measure such as eye tracking and EEG. There is not yet any theoretically validated questionnaire to measure this variable. Moreover, the use of only questionnaires is sometimes not enough to get the illustration of trust level in automation (Noah et al., 2017; Walker et al., 2018). Besides, 25% (n = 3) of the included studies (Mehta et al., 2014; Winter et al., 2015; Ragbir et al., 2018) only used a single-item questionnaire to measure the trust in automation. It should be avoided as a single-item questionnaire less likely explains the complex relationship between humans and automation system (Schrum, Johnson, Ghuy & Gombolay, 2020).

4. Experimental Study: Comparison between Indonesia and the Netherlands

4.1. Aims of the experiment

Based on our findings in PRISMA review, we conducted an empirical study to investigate the effect of cultural orientation on dispositional trust toward automated cars. From now on, the word "trust" in this study refers to "dispositional trust in automated cars". The current study builds on the previous research in these following ways:

1. 83.33% of the previous studies measured participants' cultural orientations at the national level. Although Huang and Bashir (2017), as well as Ferronato and Bashir (2020) measured participants' cultural orientation individually by using Triandis' approach, they did not compare their results with the frequently used approach. Thus, we did not know whether the use of both approaches would result in the same finding. This study aimed to fill this gap by using both approaches in studying the effect of cultural orientations on trust toward automated cars and comparing the results. Thus, we could examine if both approaches would result in consistent findings.

2. 25% of the previous studies stated that personal characteristics such as age (Ferronato & Bashir, 2020) and personality traits (Chien et al., 2016a) affect the trust toward automation. Thus, we would like to investigate the effects of the other personal characteristics such as abroad experience and engineering experience on trust toward automated cars.

3. There was no experimental study which adopted Triandis' approach in studying the cultural effect on trust toward automation. Moreover, previous experimental studies in this topic either used imagination or automation simulators as their experimental media. There was no study which investigated if the presentation of a negative video highlighting a fatal failure of automated cars in reality would affect people's trust toward ADS. In addition, it

was still unknown whether the presentation of a positive video (e.g., advertisement video) of automated cars prior to the negative video would be able to prevent potential users from having a significant drop in trust after watching the negative video. This study addresses this gap by presenting the positive video of automated cars prior to the negative one. Furthermore, we also aimed to investigate if the effect of both videos on trust was moderated by the participants' personal characteristics.

4.2. Research Questions

In order to accomplish our research goals mentioned in the previous section, we specifically investigated the following three aspects, presented as research questions:

1. ***Will the nationality of the participants affect the trust reported by participants after seeing a positive and negative video regarding automated cars?***

Based on the previous finding (Smith et al., 2005; Jain et al., 2018; Smith et al., 2005; Miller & Washington, 2012; Parker, 2011), we expected that the participants level of trust would be affected by the video exposures. Their trust level would be significantly higher after seeing the positive video, then conversely, would be decreased significantly after seeing the negative video of automated cars. We also expected that the effect of the video exposures on trust toward automated cars was moderated by the participants' nationality. Moreover, it was predicted that the participants' nationality would affect their trust level across the experimental conditions, where Indonesian participants as the participants from a collectivistic country would have higher trust toward automated cars than the Dutch participants after seeing both positive and negative videos (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018).

2. ***Will cultural orientations (e.g., vertical collectivism, horizontal collectivism, vertical individualism and horizontal individualism) of the participants affect their level of trust toward automated cars after seeing a positive and negative video regarding automated cars?***

As indicated by the previous studies (Rice et al., 2014; Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018), people with collectivism values have higher trust toward automation. Although we expected the same result, we were still unsure if the use of both the national and individual approaches in measuring participants' cultural orientations would result in consistent results. It was because Triandis and Suh (2002) suggest that everyone has access to both collectivism and individualism cognitive structures. In the era of globalization, there is a possibility that people from collectivistic countries get the exposures from individualistic countries which makes them become individualistic persons instead of collectivistic persons and vice versa. Therefore, we decided to also measure the cultural orientations of the participants at the individual level to investigate the cultural effect on trust toward automation.

In addition, previous studies (Huang & Bashir, 2017; Ferronato & Bashir, 2018) found that collectivism-individualism values alone did not really predict the level of trust toward automation. According to them, horizontal values (regardless of collectivism or individualism) more likely predict the level of trust toward automation. People with horizontal values emphasise benevolence and universalism, where everyone in the society is equal (Triandis, 1995). The difference between horizontal-collectivism-oriented and horizontal-individualism-oriented people is that people with higher horizontal collectivism values still prioritise the societal responsibilities and conformity in their life. Therefore, they tend to trust innovation which enables them to bring broader benefits to their society (Shavitt, Johnson & Zhang, 2011; Shavitt, Lalwani, Zhang & Torelli, 2006).

While for people with higher horizontal individualism values, their actions are not based on the societal responsibilities and conformity since they tend to see themselves as a fully autonomous human being (Triandis, 1995). Thus, they tend to trust products which enhance their self-reliance in their society (Shavitt et al., 2011; Shavitt et al., 2006). Still, we were also sceptical that these results would be consistent with the current study since the previous studies did not specifically discuss automated cars. Moreover, the participants of these studies were not exposed to the presentation of automation failure.

However, Huang and Bashir (2018) also mention that vertical collectivism values predict the level of trust in automation since people with vertical values tend to regard the automation company as a party with higher expertise. Thus, they believe that automation system is less error. Therefore, we expected that vertical collectivism would have the most significant regression weight on trust toward automated cars across the experimental conditions compared to the other cultural orientations.

3. ***Will the personal characteristics of the participants affect their level trust in automated cars after seeing a positive and negative video regarding automated cars?***

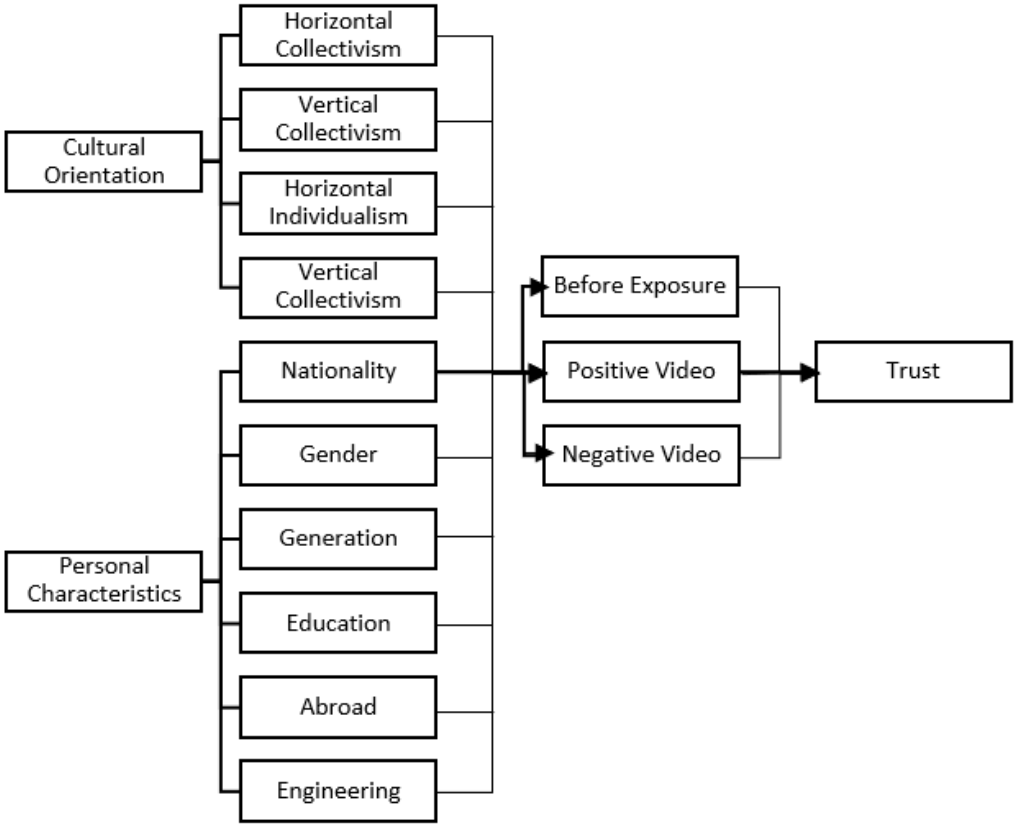
For the last research question, we expected that the effect of video exposures on trust toward automated cars was also moderated by the participants' other personal characteristics. Moreover, we proposed these following hypotheses: (1) Generation would have a significant effect on trust in automated cars, where participants from Gen Z would have the highest trust across the experimental conditions (Deb et al., 2017; Ferronato & Bashir, 2020); (2) Gender would have a significant effect on trust in automated cars, where male participants would have higher trust across the experimental conditions (Hulse, Xie & Galea, 2018; Deb et al., 2017; Hillesheim et al., 2017; Kyriakidis et al., 2015); (3) Education would have a significant effect on trust in automated cars, where participants with high school background would have highest trust across the experimental conditions (Becirovic et al., 2019); (4) Abroad experience would have a significant effect on trust in automated cars, where participants with no abroad experience would have higher trust across the experimental conditions (Roberts, Raulerson, Telg, Harder & Stedman, 2018); (5) Engineering experience would have a significant effect on trust in automated cars, where participants with engineering experience would have higher trust across the experimental conditions (Harapan et al., 2020).

4.3. Research Model

Based on the hypothesised relationships between participants' cultural orientations, personal characteristics and trust toward automated cars discussed in the previous section, we made a visual representation of the current proposed research model in Figure 10. In this model, we proposed that the videos of automated cars, participants' cultural orientations and personal characteristics (e.g., nationality, generation, gender, education, abroad experience, engineering experience) significantly influence participants' trust toward automated cars. Moreover, we also expected that the effect of both videos on trust was moderated by the participants' personal characteristics.

Figure 10

Proposed research model



Note: We proposed that participants' cultural orientations and personal characteristics, as well as video exposures would significantly affect the trust toward automated cars. Moreover, the effect of video exposures would be moderated by the participants' personal characteristics.

4.4.Design

We used the type of video exposure as the manipulated variable in this study. We presented a positive video and a negative video of automated cars by using a within-subject design. Thus, all of the participants should watch both types of video and follow the same procedure throughout the study. By adopting this approach, it was expected that the treatment effect of the manipulation could be explained better than if it were positioned as the between-subject factor (Charness, Gneezy & Kuhn, 2012; Greenwald, 1976). It was also expected to result in better internal validity (Charness et al., 2012). However, we also aimed to investigate if the effect of both videos on trust toward automated cars was moderated by the participants' personal characteristics. Therefore, the personal characteristic variables (e.g., nationality, gender, generation, education, abroad experience and engineering experience) would be used as the between-subject factors in explaining the effect of both videos on trust toward automated cars.

4.5. Participants

At first, participants in this study were recruited from the researcher's colleagues and friends. Then, the researcher with the help of her colleagues and friends also did some advertisements through Whatsapp and Facebook groups to get more participants. The groups that the researcher used for advertising were:

1. UT Muslim Community (Whatsapp group)
2. Psikologi 13 (Whatsapp group)
3. Indonesians Living in Holland (Facebook group)
4. Dutch Expats in Indonesia (Facebook group)

In those groups, the researcher also asked the potential participants to spread the information to their Indonesian and Dutch friends, family and/or colleagues. One of the participants helped the researcher to spread the information to the Delft alumni group. Therefore, it helped the researcher to get more Dutch participants.

A total of 213 participants took part in this study. The participants did not get any incentive for joining this study. They were all volunteers. However, only 123 participants completed the procedures correctly and included for further analysis. All of the participants had no experience in driving with automated cars and/or automated car simulators. They already reached legal age requirement to have a driving license. Therefore, they were expected to have enough understanding of driving safety. The participants also reported having no trauma related to fatal accident. The majority of the participants were Indonesian (n = 70, 56.9%). Most of the participants had bachelor degree (n = 63, 51.2%). Around 52% of the participants had experience in living abroad with different culture from their own. More than half of the participants were female (n = 72, 58.5%). Most of the participants were millennials or aged between 23 to 38 years old at the time of study (n = 82, 66.7%). The majority of the participants had never studied and/or worked in the engineering field (n = 88, 71.5%). Further demographic information can be seen in Table 5.

Table 5

Demographic data

Category	Frequency	Percentage
Nationality		
Indonesian	70	56.9%
Dutch	53	43.1%
Education		
High School	12	9.8%
Bachelor	63	51.2%
Master	48	39%
Experience in Living Abroad		
Yes	64	52%
No	59	48%
Gender		
Female	72	58.5%
Male	51	41.5%
Generation		
Gen Z (up to 22 years old)	17	13.8%
Millennials (23-38 years old)	82	66.7%
Gen X (39-54 years old)	24	19.5%
Engineering Experience		
Yes	35	28.5%
No	88	71.5%

4.6. Location of the study

This study was conducted online. The participants followed the experiment via Qualtrics. This method was chosen since it was more applicable and safer during this Covid-19 pandemic. Therefore, the risk for being infected could be minimized for both researcher and participants. By doing this way, the researcher and the institution also complied with the Dutch and Indonesian government regulation to minimise physical contact as much as possible.

4.7. Materials and instruments

We used two videos related to automated cars in this study. One video highlighting the positive aspects of autonomous cars composed of the advertisement of Volvo XC90 which has SAE level 3 automation feature (www.youtube.com/watch?v=p3AGRSPolgQ). The other video presented cases of autonomous driving failure, specifically news about a fatal Volvo XC90 Uber self-driving crash in Arizona (www.youtube.com/watch?v=ufNNuafuU7M).

Moreover, we collected data by using a demographic questionnaire (Appendix 1), the Horizontal-Vertical Individualism and Collectivism Scale (HVS - Appendix 2), and the Scale of Trust between People and Automation (SCT- Appendix 3). The details of the scales will be explained further below:

1. The demographic questionnaire consisted of 6 questions related to the personal characteristics of the participants. They were nationality, generation, gender, education, abroad experience and engineering experience.

2. The HVS scale (Triandis & Gelfland, 1998) aims to assess the participants' cultural orientations. It is comprised of sixteen items which are divided into four categories of cultural orientation: (1) The first four items measure the participants level of horizontal individualism orientation; (2) The second four items measure the level of vertical individualism orientation; (3) The third four items measure the level of horizontal collectivism orientation; (4) The last four items measure the vertical collectivism orientation. Participants rated the items on a seven-

point Likert rating which ranges from 1 (strongly disagree) to 7 (strongly agree). The total score for each cultural orientation is obtained by summing the scores for all items within each category. The higher scores representing a greater level of certain cultural orientation. Thus, the scores range from 4 to 28 for each cultural orientation. The HVS scale has been found to be reliable to measure the participants' cultural orientations (Cronbach's alpha = .82).

3. The SCT scale (Jian, Bisantz & Drury 2000) consists of 12 items which measure the participants' trust toward automated cars. This questionnaire was chosen because it has been empirically validated to measure the trust toward automation. It is broadly used by researchers as it provides empirical information about dispositional trust in automation (Walker, Verwey & Martens, 2018). In addition, this scale has been developed carefully through three phases of development. It results in the high-level assurance of content validity (Johnston, 2012). This instrument was used three times in this study as the pre-test and post-tests for each manipulation. Participants rated the items on a seven-point Likert rating which ranges from 1 (strongly disagree) to 7 (strongly agree). Hence, the scores range from 12 to 84, where the higher scores representing the higher trust in automated cars. The first five items are non-favourable items. Therefore, the scoring methods should be reversed for these items. For instance, when the participants rate 1 for the first item, the participants will get 7 for that item. This scale is also known to be reliable to measure the trust toward automated cars (Cronbach's alpha = .79)

4.8. Procedure

The participants used their own laptops or mobile phones to participate in this study. A laptop or a mobile phone was needed to deliver the experimental procedure via Qualtrics. In this study, the participants performed the following seven steps:

1. The researcher providing a written disclosure (Appendix 4)

   The information about the research goal and procedure was provided in this section. It was also explained that any participants' contribution in this study would be voluntary and they had the right to stop their participation at any time they want.

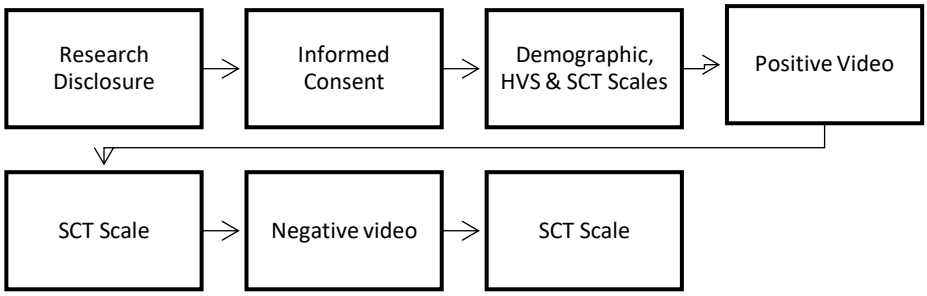
2. Signing a digital informed consent (Appendix 5).

   It was mentioned in this section that all of the data in this study would be used for scientific purposes only and might be published. However, participants' identities and responses would be treated confidentially. Once agreeing to participate, the participants should firstly give their sign this section.
3. Filling in the three instruments (including the first SCT Scale as their pre-test).
4. Presentation of the positive video (a time setting was used for making sure that the participants did not skip the video)
5. Filling in the SCT Scale again as their first post-test
6. Presentation of the negative video.
7. Filling in the SCT Scale as their final post-test.

The summary of the procedure can be found in Figure 11. The order of the video presentations was not randomised. Thus, all of the participants should firstly watch the positive video before the negative video. The idea behind this decision was that people tend to have broader access to the positive information of automated cars than the negative ones prior to the launching of the technology. This assumption was based on the fact that the companies will always do a massive promotion before the official launching of the high-technology products such as automated cars (Baccarella, Gerhard & Voigt, 2010; Burmester, Becker, van Heerde & Clement, 2015). Kim, Choi and Waslak (2019) mention that advertisement videos may lead to an unrealistic expectation of potential users. Therefore, from the practical point of view, we would like to help the government in finding the type of advertisement which will not result in overreliance on the system. Thus, this order seemed to be more appropriate to use in order to help us in accomplishing our goal than the use of randomised order.

Figure 11

Summary of the experimental procedure



4.9. Ethical approval

This study has been approved by the ethical committee of the faculty of Behavioural, Management and Social Sciences (BMS) of the University of Twente on November 3rd 2020 with the request number of 201290.

4.10. Results of HVS questionnaire

According to the commonly used literature in studying cultural orientations, people in the Netherlands are much more individualistic than Indonesians (Hofstede, 2020). The national individualism scores of both countries are respectively 80 and 14. Interestingly, Dutch participants (M_{VI} = 17.075, SD_{VI} = 5.664; M_{HI} = 21.698, SD_{HI} = 2.814) in this study had slightly lower level of individualism than Indonesian participants (M_{VI} = 17.257, SD_{VI} = 4.722; M_{HI} = 22.129, SD_{HI} = 3.586) (see Table 6). However, the results for collectivism values were in line with the previous literature. Indonesian participants had a higher level of collectivism values than the Dutch participants.

Table 6

Participants' level of cultural orientations based on their nationality

Cultural Orientation	M		SD	
	Indonesian	**Dutch**	**Indonesian**	**Dutch**
1. Vertical Individualism	17.257	17.075	4.722	5.664
2. Horizontal Individualism	22.129	21.698	3.586	2.814
3. Vertical Collectivism	21.914	15.811	3.994	5.597
4. Horizontal Collectivism	22.171	19.736	3.237	4.116

4.11. Analysis

The data in this study was analysed by using Rstudio. The syntax can be found in Appendix 6. Before doing any hypothesis testing, we investigated if the data met the assumptions for doing the parametric tests which were normality test, homogeneity of variance and outliers check. There are some controversies whether Likert data can be analysed with parametric approaches or not (Schrum et al., 2020; Vickers, 2019; Pimentel, 2019; Wu & Leung, 2017; Glass, Peckham & Sanders, 1972). However, although Likert data is basically ordinal, some studies (Schrum et al., 2020; Vickers, 2019; Pimentel, 2019; Wu & Leung, 2017) suggest that data from a Likert scale can be treated as interval.

According to Wu and Leung (2017), the more points on a Likert scale will result in a closer approach to the interval scale. Moreover, Pimentel (2019) find that 7-Likert point produces very similar differences between points which makes it possible to be treated as an interval data. Therefore, as long as the data meet the three assumptions for doing a parametric test, Likert scale data can be analysed with a parametric approach without giving any significant negative impact to the Type I and Type II error (Schrum et al., 2020; Glass et al., 1972).

After knowing that the data met these three assumptions, a descriptive statistic has been extracted to get the general information of the results. Subsequently, we did a linear model test to investigate what factors had significant effects on trust toward automated cars and whether the effect of both videos on trust level was moderated by the participants' personal characteristics. In addition, our investigation would be focused on what factors affecting the trust toward automated

cars in each experimental condition. Furthermore, t-tests have also been conducted for the significant factors to obtain more information about the mean comparison between sub-groups.

4.12.Experimental Results

The hypotheses testing began by investigating the mean values of trust toward automation across the experimental conditions based on participants' personal characteristics. However, it is important to note that these results cannot be used as a basis to decide whether certain variables had significant effects on trust toward automation or not. In general, we find the following results: (1) Indonesian participants had higher trust than Dutch; (2) Those with a master degree had the highest trust compared to those with lower degree; (3) Participants who had abroad experience had lower trust than those who did not; (4) Male participants had higher trust than female; (5) Those from Generation Z (aged up to 22 years in the time of the study) had the highest trust; (6) Those with engineering experience had higher trust than those who did not. Table 7 summarises the results.

Table 7

Descriptive statistics for trust toward automation based on participants' personal characteristics

Category	Before Exposure		Positive		Negative	
	M	**SD**	**M**	**SD**	**M**	**SD**
Nationality						
Indonesian	55.143	11.391	56.814	12.175	49.371	12.844
Dutch	52.528	9.609	55.453	9.458	41.925	10.949
Education						
High School	53.250	7.677	53.333	8.659	39.583	9.986
Bachelor	53.095	12.083	55.778	12.784	45.746	13.135
Master	55.417	9.346	57.542	8.970	48.354	11.971
Abroad Experience						
Yes	52.661	10.869	52.983	10.946	44.915	11.645
No	55.266	10.466	59.219	10.384	47.312	13.362
Gender						
Female	53.319	11.391	54.653	12.175	45.097	12.844
Male	55.000	9.867	58.451	9.708	47.667	11.923
Generation						
Gen Z (up to 22 years old)	55.824	9.876	60.412	8.973	45.567	10.988
Millennials (23-38 years old)	52.915	11.152	55.463	11.904	46.195	12.624
Gen X (39-54 years old)	56.500	9.376	55.875	8.897	46.417	13.897
Engineering						
Yes	57.661	8.567	61.257	8.922	48.657	12.630
No	52.386	11.060	54.227	12.240	45.170	12.485

To further investigate if the mean differences in trust toward automated cars between sub-groups were really caused by the participants' personal characteristic differences and the types of video presented in this study, a linear model test has been conducted. The result shows that only the negative video, nationality, engineering and abroad experience affecting the participants' trust level toward automated cars. A more detailed overview can be seen in Table 8.

The estimate for the "intercepts" means the average trust level of the female Dutch participants who had non-engineering bachelor degree, had no experience in living abroad and aged between 39-54 years old before the exposures to the videos which was 54.856. The participants' trust only slightly increased after watching the positive video. After watching the negative video, their trust level became 13.840 points lower than the moment before the video exposure ($p < .001$). In addition, there was a significant effect of the nationality variable, where Indonesian participants' trust before the video exposures was 3.211 points higher than the Dutch ($p < .05$). Those with engineering background on average also had 7.266 points higher than those who did not ($p < .001$). While those who had abroad experience had 3.484 points lower trust than those who did not ($p < .01$). However, the effect of both positive and negative videos on trust toward automated cars was not moderated by these variables since there was no interaction effect between the videos and participants' personal characteristics.

Table 8

Linear model for factors affecting trust toward automated cars

Variable	Estimate	Std. Error	t-value	Pr(> |t|)
Trust Before Exposure (intercept)	54.856	6.543	8.357	**$< 2 \times 10^{-15}$ *****
Negative Video	-13.840	5.075	-2.727	0.00673*******
Positive Video	1.935	5.075	.381	0.703
Engineering: Yes	7.266	2.737	2.654	**.000859 *****
Abroad: Yes	-3.484	2.111	-2.179	**.00998****
Education: HS	1.906	4.097	.465	.64204
Education: Master	1.324	2.233	.593	.55368
Gender: Male	-.062	1.421	-.044	.71576
Generation: Z	1.435	3.938	-.364	.56291
Generation: Millennials	-2.827	2.734	-1.034	.30187
Horizontal Individualism	-.102	.192	-.531	.59611

Vertical Individualism	.066	.117	.564	.57342
Horizontal Collectivism	-.087	.191	-.413	.67965
Vertical Collectivism	.134	.150	.896	.36701
Nationality: Indonesia	3.211	1.416	2.265	**.03651***
TaskNegative:EngineeringYes	-5.288	3.817	-1.386	.16681
TaskPositive:EngineeringYes	0.181	3.817	0.047	.96216
TaskNegative:AbroadYes	1.895	2.980	0.636	.52516
TaskPositive:AbroadYes	-3.076	2.980	-1.032	.30271
TaskNegative:EducationHS	-7.074	5.786	-1.223	.22232
TaskPositive:EducationHS	-3.971	5.786	-0.686	.49296
TaskNegative:EducationMaster	0.318	3.113	0.102	.91866
TaskPositive:EducationMaster	0.095	3.113	0.031	.97544
TaskNegative:GenderMale	4.704	3.411	1.379	.16873
TaskPositive:GenderMale	1.110	3.411	0.326	.74486
TaskNegative:GenerationZ	3.404	5.508	0.618	.53692
TaskPositive:GenerationZ	4.921	5.508	0.894	.37220
TaskNegative:GenerationMillennials	2.898	3.811	0.761	.44748
TaskPositive:GenerationMillennials	2.491	3.811	0.654	.51375
TaskNegative:NationalityIndonesian	4.909	2.944	1.667	.09637
TaskPositive:NationalityIndonesian	-1.321	2.944	-0.449	.65399

*Note. *p < 0.05; **p < 0.01, ***p < 0.001*

We further investigated if the participants' nationality, engineering experience and abroad experience gave significant effects on the participants' trust during each experimental condition by doing the linear model tests (see Appendix 7). The results show that these three variables affecting the participants' trust during the different conditions. Before the video exposures, the participants' trust was only defined by their engineering experience, where the participants with engineering experience exhibited 6.747 points higher trust than the participants who did not ($t = 2.495$, $p < .05$). Whereas their trust level during the positive condition was defined by their experience in the engineering field and living abroad. Participants with engineering experience had 7.512 points higher trust than those who did not ($t = .006$, $p < .01$). Contrarily, those with abroad experience exhibited 6.546 points lower trust than those who did not ($t = 0.00148$, $p < .01$). Finally, the effect of nationality was found in the negative video condition, where Indonesian participants had 6.451 points higher trust than the Dutch ($t = .02$, $p < .05$).

Moreover, t-tests were also performed to investigate whether during the negative condition, Indonesian participants who reported having abroad experience or engineering experience had higher trust than the Dutch participants who also had both experiences. The results show that

Indonesian participants who had abroad experience (M = 49.781, SD = 10.002) exhibited significantly higher trust than the Dutch participants with abroad experience (M = 39.148, SD = 10.932) ($t = -3.899$, $p < .001$) in the negative condition. However, the trust level of Indonesian participants with engineering experience (M = 51.722, SD = 14.249) did not significantly differ from Dutch participants with engineering experience (M = 45.412, SD = 10.075) ($t = -1.505$, $p = .142$) during the negative condition. Moreover, there was no trust difference between Indonesian and Dutch participants who reported having both experiences during the positive condition, since nationality did not significantly affect the participants' trust level during this condition, as indicated in the previous paragraph.

Additionally, we specifically investigated what factors affecting the trust level of Indonesian and Dutch participants in this study by using linear model tests. Both Indonesian and Dutch participants' trust was affected by the negative video. However, the Dutch participants' reaction toward the negative video ($p <.001$) was more extreme compared to Indonesian participants ($p < .01$) (see Table 9 and Table 10). The Dutch participants' trust became 10.604 points lower after watching the negative video. While Indonesian trust only decreased 5.771 points after watching the negative video. The result also show that the trust level of Indonesian participants was only affected by the negative video ($p < .01$) (see Table 9). While the trust level of Dutch participants was also affected by their engineering experience ($p <.001$), abroad experience ($p < .001$) and horizontal individualism value ($p < .05$) in addition to the negative video ($p < .001$) (see Table 10). Dutch participants who had engineering experience had 7.582 points higher trust than those who did not. In contrast, Dutch participants who had abroad experience had 6.877 lower trust than those who did not. Moreover, the higher horizontal individualism values that the Dutch participants had, the higher their trust toward automation.

Table 9

Linear model for factors affecting trust toward automated cars in Indonesian participants

Variable	Estimate	Std. Error	t-value	Pr(> |t|)
Trust Before Exposure (intercept)	53.360	9.572	5.365	**< 2.27 x 10^{-07} *****
Negative Video	-5.771	2.034	-2.838	**.005020 ****
Positive Video	1.671	2.034	.822	.412215
Engineering: Yes	4.988	2.633	1.894	.059726
Abroad: Yes	-3.877	1.219	-3.179	.001607
Education: HS	-4.775	2.365	-.751	.453272
Education: Master	1.461	1.320	1.107	.269102
Gender: Male	-1.062	1.421	-.044	.965202
Generation: Z	1.340	2.314	.579	.562919
Generation: Millennials	-1.030	1.617	-.637	.524580
Horizontal Individualism	.198	.285	.695	.487920
Vertical Individualism	.048	.202	.239	.811380
Horizontal Collectivism	-.378	.335	-1.129	.260190
Vertical Collectivism	.299	.287	1.043	.298150

*Note. *p < 0.05; **p < 0.01, ***p < 0.001*

Table 10

Linear model for factors affecting trust toward automated cars in Dutch participants

Variable	Estimate	Std. Error	t-value	Pr(> |t|)
Trust Before Exposure (intercept)	51.140	9.182	6.005	**1.47 x 10^{-08} *****
Negative Video	-10.604	1.742	-6.088	**9.71 x 10^{-09} *****
Positive Video	2.923	1.742	1.679	.095254
Engineering: Yes	7.582	2.020	3.754	**.000251 *****
Abroad: Yes	-6.877	1.837	-3.179	**.000259 *****
Education: HS	1.775	3.365	.534	.593272
Education: Master	-.275	1.720	-.160	.873102
Gender: Male	-1.062	1.421	-.044	.965202
Generation: Z	1.340	2.314	.579	.562919
Generation: Millennials	-1.030	1.617	-.637	.524580
Horizontal Individualism	.620	.272	2.695	**.024654 ***
Vertical Individualism	.176	.143	1.234	.219235
Horizontal Collectivism	.259	.227	1.138	.257086
Vertical Collectivism	.274	.179	1.529	.128388

*Note. *p < 0.05; **p < 0.01, ***p < 0.001*

5. General Discussion

The aim of this study was to investigate the effect of cultural orientations on dispositional trust toward automated cars. However, differently from most of the previous studies, we also measured the participants' cultural orientations at the individual level. We would like to investigate whether the use of both the national and individual approaches would lead to the same conclusion. Thus, the results of both approaches are compared in this study. In order to accomplish our goal, we conducted an experiment by presenting both positive and negative video regarding automated cars. We expected that the participants' cultural orientations and personal characteristics significantly influence participants' trust toward automated cars. In addition, it was also predicted that the effect of both videos on trust was moderated by the participants' personal characteristics.

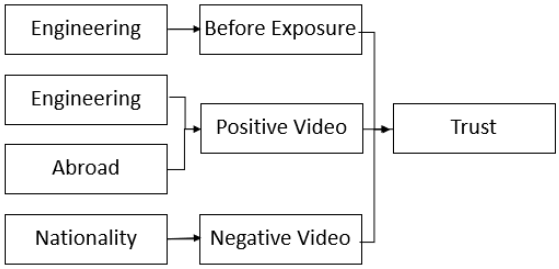
This study suggests that the participants' trust is affected by the negative video of automated cars. This is partially in line with our expectations that both the positive and negative videos would significantly affect the participants' trust. The participants' trust was slightly but not significantly increased after watching the positive video. These results somehow conflict with the previous studies which suggested that watching a video that highlights the positive aspects of a product significantly increases people's trust toward it (Smith et al., 2005; Jain et al., 2018; Smith et al., 2005; Miller & Washington, 2012; Parker, 2011).

Conversely, the trust level of our participants significantly dropped after watching negative video. Accordingly, this study suggests that being previously exposed to the positive video of automated cars cannot prevent the participants from having a significant drop in their trust level after seeing the negative video presenting a fatal failure of automated cars in reality. The possible explanation is that automated cars are high-risk products and the positive video alone cannot significantly increase the participants' trust toward automated cars. However, qualitative studies need to be done to understand how the participants perceive the positive and negative video of automated cars. Moreover, the order of the videos in this study was not randomised. Thus, we do not know if the result would be consistent if the negative video was presented first.

In addition, this study also suggests that the effect of both videos on trust toward automated cars was not moderated by the participants' personal characteristics. However, our analyses per condition suggests that the participants' nationality, engineering and abroad experience did affect their trust toward automated cars in the different experimental conditions. For example, participants' nationality only significantly affected their trust toward automated cars after the negative video was presented. While during the positive condition, participants' trust was defined by their engineering and abroad experience. A more detailed overview can be seen in Figure 12.

Figure 12

Factors affecting trust toward automated cars during each condition



Note: Although the effect of both videos on trust toward automated cars was not moderated by the participants' personal characteristics, analysis per condition shows that the nationality, engineering and abroad experience affecting the trust toward automated cars at the different conditions.

Regarding the research questions, our first question was *"Will the nationality of the participants affect the trust reported by participants after seeing a positive and negative video regarding automated cars?"*. Our hypothesis is only partially confirmed since there was no significant effect of nationality during the positive video condition. In contrast, after watching the negative video, Dutch participants exhibited more extreme reaction than Indonesian. Thus, their trust level became significantly lower than Indonesian participants. This result is in line with the previous studies (Mehta et al., 2014; Rice et al., 2018; Mehta et al., 2017; Winter et al., 2015; Ragbir et al., 2018) which suggested that those from collectivistic countries show less extreme reaction towards automation technology than those from individualistic countries. Moreover, we

also find that Indonesian participants who reported having abroad experience exhibited higher trust than Dutch participants with abroad experience. It suggests that once any fatal accident involving the automated cars occurs in the Netherlands, extra effort will be needed to rebuild people's trust toward automated cars in this country compared to Indonesia.

Our second research question was *"Will cultural orientations (e.g., vertical collectivism, horizontal collectivism, vertical individualism and horizontal individualism) of the participants affect their level of trust after seeing a positive and negative video regarding automated cars?"*. We did not find any direct effect of cultural orientations on trust toward automated cars. Therefore, it can be said that studying the intercultural trust toward automated cars at the national and individual approaches may lead to the different conclusion. Moreover, there is an interesting finding in our study. We found that the trust level of Indonesian and Dutch participants was affected by different factors.

Indonesian participants' trust in this study was only affected by the negative video. While for Dutch participants, their trust level was also defined by their engineering experience, abroad experience and horizontal individualism value in addition to the negative video. Dutch who had engineering and/or no abroad experience had higher trust toward automated cars than Dutch without both experiences. Moreover, the higher horizontal individualism values that the Dutch participants had, the higher their trust toward automated cars. This finding suggests that Dutch participants' trust is more likely affected by the promised functionality of automated cars rather than the prestige value of the cars. Previous studies state that those with higher horizontal individualism values tend to trust the product which can help them to be self-reliant and are less concerned about the social status benefit of it (Shavitt et al., 2011; Shavitt et al., 2006). This is also in line with Huang and Bashir's (2017) finding which suggests that people with higher horizontal individualism regard the automation as a system which can enhance their autonomy. However, further qualitative studies need to be conducted to explain why cultural orientation (in this case is horizontal individualism) only affect the Dutch participants' trust.

Our last research question was "*Will personal characteristics (e.g., gender, generation, educational background, engineering experience and abroad experience) of the participants affect their level of trust in automated cars across the conditions?"*. Our expectations are only partially confirmed in this study. Gender, generation and education level of the participants did not have any significant effect on trust toward automation. Only engineering experience and abroad experience significantly defined the trust level toward automated cars.

Our result related to the engineering experience is in line with the finding of Harapan et al. (2020) which suggests that people with certain expertise tend to have higher trust towards their expertise-related products. Automation technology is basically developed by engineers. Therefore, their trust levels tend to be higher than people in general, especially after watching the positive video of automated cars. Thus, it suggests that those with engineering experience are more receptive toward the idea of automated car technology development and perceive the advertisement video of automated cars more positively compared to those who do not. Unfortunately, we did not include any qualitative values in our study. Hence, we cannot explain why the trust level of those with engineering experience did not significantly differ from those who had not during the negative video condition.

Furthermore, we find that abroad experience had significant effect on trust toward automated cars. However, our hypothesis regarding the abroad experience variable is again only partially supported. Those with abroad experience only had significantly lower trust than those who did not after watching the positive video of automated cars. Thus, this study suggests that they tend to perceive the advertisement video of automated cars more negatively compared to those who do not have abroad experience. Roberts et al. (2018) state that those with abroad experience have a higher sense of critical thinking than those who do not. Therefore, they become more sceptical in perceiving the advertisement video of a relatively new invented product such as automated cars.

5.1. Theoretical and practical implications of this study

It has been previously explained that we did not find any direct effect of culture on trust toward automated cars. Although it has been confirmed that the Dutch participants as the representatives of people from individualistic countries have significantly lower trust than Indonesian participants, it is unlikely that the higher individualism values will lead to the lesser trust toward automated cars. In fact, Dutch participants in our study had slightly lower level of individualism values than Indonesian participants. Moreover, we found that only Dutch participants' trust was affected by the horizontal individualism values. Thus, from the theoretical point of view, our study suggests that studying the cultural effect on trust toward automated cars at the individual level may lead to different conclusion from studying this topic at the national level.

Moreover, the absence of cultural effect on trust prior to the video exposure in our study (which is similar to a survey study since there was no manipulation given) provides two possible explanations of why the previous researches produce inconsistent conclusion about which cultural orientations can predict the trust toward automation more. Firstly, it confirms the assumptions of Ferronato and Bashir (2020) which states that in which tool the automation is being studied such as robot or automated vehicles may affect the result. This study, which specifically discusses the trust toward automated cars finds no cultural effect on trust. On the other hands, the previous survey studies (Ferronato & Bashir, 2020; Huang & Bashir, 2017) which discuss the general trust toward automation find that horizontal values predict the trust.

Secondly, it suggests that the inconsistent conclusion might be caused by the use of different sample of countries in the previous researches. Ferronato and Bashir (2020), as well as Huang and Bashir (2017) mostly involved participants from the US in their study. Whilst the current work involved Indonesian and Dutch samples. As explained before, the cultural effect on trust was only found in the Dutch participants. Thus, future studies should investigate it further by exactly replicating the previous studies (Ferronato & Bashir, 2020; Huang & Bashir, 2017) but using the different sample of countries from theirs, in order to re-confirm the correctness of our finding. Moreover, our study suggests that there is no effect of culture on trust toward automation during

the experimental conditions. It suggests that the use of different research methods in studying intercultural trust toward automation may also result in the different finding.

In addition, this study suggests that the negative video which presents a fatal failure of automated cars in reality can be used as an experimental medium in studying dispositional trust toward automated vehicles. The previous experimental studies which also focus on the pre-interaction trust toward automated vehicles only used imagination as their experimental medium. Using imagination as the experimental medium in studying this topic has several limitations e.g., it cannot give a concrete illustration of how automated vehicles work in reality. Thus, the studies cannot predict the trust of the potential users once they see or experience a fatal failure of automation.

Furthermore, we find that the use of video in studying trust toward automated cars is more cost-friendly compared to the use of automated car simulators. Therefore, it can target broader participants than the automated car simulators. However, it is important to note that unlike the automated car simulators, the videos of automated cars cannot predict the dynamic trust toward automated cars –trust during direct interactions with automated cars. Studying dynamic trust, especially how the potential users interact with the system during the presence of a fatal system failures is important to predict how potential users handle such situations to prevent any fatal crash.

Nevertheless, the use of automated car simulators may cause a bias since the participants will not experience any real danger (Gold et al., 2015; Payre et al., 2016; Walker et al., 2018). Current study suggests that watching a real case of fatal failures significantly affect the participants' trust. Thus, it may be more beneficial to design the automated car simulators to be able to provide participants with more realistic driving sensations. For instance, by presenting as if other people are seriously injured on the simulators' screen and providing more realistic vibrating effect, every time the participants failed at handling the fatal system failures. Yet, it is also important to emphasise that this approach may result in a severe trauma for several participants. Thus, it is important to carefully select the participants prior to the study and provide psychological guidance if needed.

From the regulatory point of view, our study suggests that the positive video (advertisement) used in our study did not alter the trust of the participants by causing any unrealistic belief that the automated cars are totally flawless and error-free. Hence, the government may safely allow the companies to use this kind of advertisement in promoting their automated cars. However, it is important to note that the order of the videos was not randomised in the current study. Thus, we do not know whether the effect of the positive video would be consistent if it were presented last.

In addition, most of the participants in this study holding a bachelor degree or higher. Therefore, it can be said that the participants of this study were highly educated. Whilst the market of the automated cars not only target the highly educated potential users (Kundinger et al., 2019). Thus, it could be important to test the effect of advertisement video on the trust toward automated cars among the less educated participants before claiming that the current advertising style can be safely used in the society, without increasing the tendency of potential users being over-reliant to the automated driving system.

Moreover, we find that this kind of advertisement did not significantly increase the trust level of the potential users in both Indonesia and the Netherlands. As indicated in the previous section, the possible reason is that automated cars are high-risk products. Thus, commercial-wise, it is important to create more convincing advertisement in promoting automated cars.

From the industrial point of view, studying trust toward automated cars at the national level may be beneficial in predicting the general acceptance of the system within a country. However, studying this topic at both the national and individual level may give better information on how we can optimise the design for countries with certain cultural orientations. For example, this study suggests that the trust level of Dutch participants is more likely affected by the horizontal individualism values.

Those with horizontal individualism values are less concerned about the status benefits of a product and tend to trust product which can reduce their level of dependence on others (Shavitt

et al., 2011; Shavitt et al., 2006). Therefore, we can further reduce the production cost by setting aside the prestige values of the automated cars' design for the Dutch market, and instead, emphasising the functionality of features which enhance the drivers' self-reliance in their society. For instance, in order to increase their self-reliance during a fatal crash, the future cars can be designed to directly alert the nearest hospital and police station, as well as to inform the drivers' family and insurance company. Thus, the help will immediately come and the needed documents will be efficiently prepared, without the need of interrupting other people's time when the drivers cannot independently manage everything by themselves.

5.2. Limitations and recommendations for future studies

This study has some limitations which might affect its internal validity (Flanelly, Flanelly & Jankowski, 2018). First, there was lack of control during the process of this study. This study was conducted online without any recording provided to control the participants' activities during its process. Therefore, there is a possibility that the participants were not fully focused on the experimental procedure. Future studies should provide video recording during the process to control the activities of the participants. Thus, the participants' chance for being distracted can be reduced and the result of the study can have better internal validity.

The next limitation is the use of the same 12-item questionnaires for repeated measures might cause a learning effect to the participants that might also affect the internal validity of this study (Flanelly et al., 2018; Taylor & Asmundson, 2008). In addition, it might cause tiredness and boredom to the participants. Moreover, participants did not get any incentive for joining in this study. Therefore, instead of using 12-item questionnaire as pre-test and post-test, it is better to use the shorter questionnaire to prevent boredom and tiredness of the participants since online experiment is less interactive compared to person-to-person experiment.

The next weakness of this study is the validity of our scale for measuring trust in automation. Although Johnston (2012) state that this scale has high level of content validity and it has been used by many researchers due to the fact that it has been empirically validated, some

studies (Spain, Bustamante & Bliss, 2008; McKnight & Chervany, 2001) argue that putting the trust and distrust as a single continuum factor may not valid according to the theoretical point of view. However, we kept using this scale as it has been validated for the empirical purpose and there is not yet any theoretically validated scale for measuring the trust in automation. Therefore, future studies should be aimed to develop both empirically and theoretically validated scale for measuring this variable.

Moreover, this study did not use any qualitative method. Thus, this study cannot explain any causal relationship between variables. For example, we cannot properly explain why horizontal individualism value only affected the trust level of Dutch participants. Future studies should include qualitative approach to investigate the cultural differences in trust toward automation since the relationship between culture and trust toward automation is complicated. The other limitation is the order of the videos in this study was not randomised. Hence, we do not know if the effect of videos on trust was also affected by their order. In addition, the analyses in this study have low statistical power since the number of participants in each sub-group was not equal (Rusticus & Lovato, 2014). Future studies should consider the equality of size between sub-groups.

This study also has a limitation in regards to its external validity. The samples of this study were only chosen from a developing collectivistic country and a developed individualistic country. It is still unclear if the result is consistent if any developed collectivistic country and developing individualistic country included (Taylor & Asmundson, 2008; Slack & Draugalis, 2001). In regards to the sampling, it would be better if the future studies involve participants from both developing and developed countries for each cultural orientation.

It is also important to note that there are some variances in cultural values within a country depending on in which region the people live and/or what ethnicity they belong to. For example, Indonesia is known to be a large multi-cultural and multi-ethnic country. Badan Pusat Statistik (BPS) or the Central Bureau of Statistics of the Republic of Indonesia (2020) mention that Indonesian population is around 273 million people with the number of ethnicities is 633. Although generally most of the ethnicities in Indonesia are collectivistic, their collectivism level and how it

affects their trust toward innovation may largely differ between ethnicities. Some ethnicities in Indonesia are resistant towards certain technology innovation since it can destroy their existing cultural structure (Mulyadi & Iyai, 2016). Even if people come from the same ethnicity, for example Javanese, those who live in Surakarta and those who live in Banjarnegara may differ significantly in how they perceive an innovation technology. This study has not taken this consideration into account. Therefore, this is still unclear whether the results of the current study can be generalized to every ethnicity in Indonesia or not.

6. Conclusion

There is still a limited number of researches which study the effect of cultural orientation on trust toward automation. Moreover, the previous studies show inconsistent results about which culture can trust automation more. Our study suggests that it might be caused by several factors such as the use of different approach in measuring participants cultural orientations, the use of different research methods, the use of different experimental media, the use of different sample of countries and the use of different automation tool discussed in the previous studies. In addition, most of studies in this topic only involving samples from developed countries. Therefore, a lot more studies need to be done for developing countries. Furthermore, we previously found that only two studies considering the individual differences in cultural orientation within a country. The current study is the first experimental study which compares the trust level in automation between eastern and western countries by also measuring the participants' cultural orientations at the individual level. This study reveals that the trust toward automation among participants from an eastern country is higher than those from a western country. However, in contrast to the previous studies, this difference was not caused by the differences in their cultural orientations. The trust of Indonesian participants in this study was only affected by the negative video. Whereas the Dutch trust was also affected by engineering experience, abroad experience and horizontal individualism value.

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Appendices

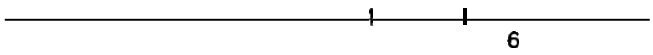
Appendix 1. Demographic Questions

1. What is your gender?
   - ☐ Male
   - ☐ Female
2. What is your nationality?
   - ☐ Indonesian
   - ☐ Dutch
3. How old are you?
   - ☐ years old
4. Have you ever lived or currently living in a country with different culture with you? (Example: You are Dutch currently living in Eastern countries and vice versa)
   - ☐ Yes
   - ☐ No
5. What is your educational background?
   - ☐ High school (SMA)
   - ☐ Bachelor (S1)
   - ☐ Master (S2)
   - ☐ Doctorate (S3)
6. Have you studied or worked in engineering field?
   - ☐ Yes
   - ☐ No

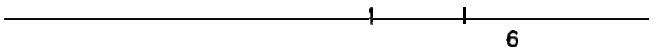
Appendix 2. Cultural Dimensions of Collectivism and Individualism Triandis and Gelfland (1998)

Now, think about yourself and your relation with people around you and then please rate this following items.
Note: the scale ranges from 1 (strongly disagree) to 7 (strongly agree)

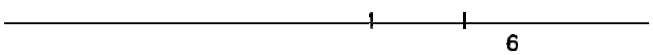
1. I'd rather depend on myself than others.



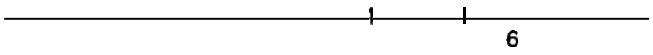
2. I rely on myself most of the time; I rarely rely on others.



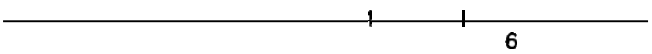
3. I often do "my own thing."



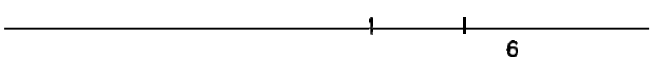
4. My personal identity, independent of others, is very important to me.



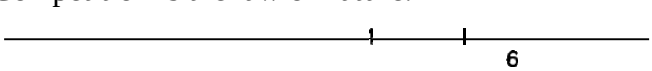
5. It is important that I do my job better than others.



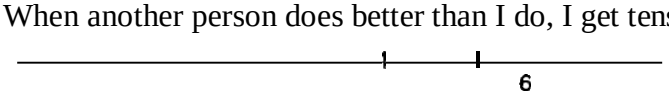
6. Winning is everything.



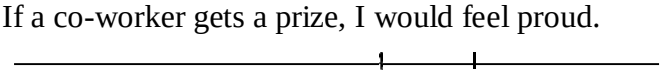
7. Competition is the law of nature.



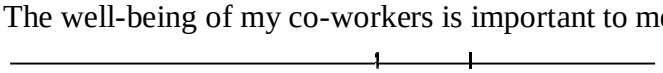
8. When another person does better than I do, I get tense and aroused.



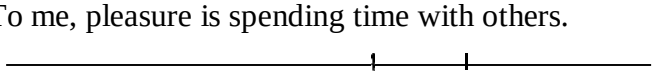
9. If a co-worker gets a prize, I would feel proud.



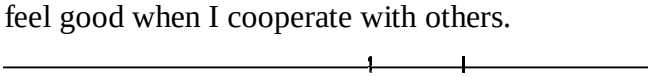
10. The well-being of my co-workers is important to me.



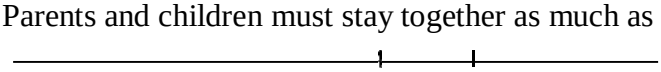
11. To me, pleasure is spending time with others.



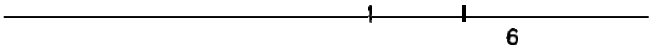
12. I feel good when I cooperate with others.



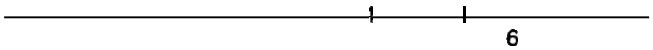
13. Parents and children must stay together as much as possible.



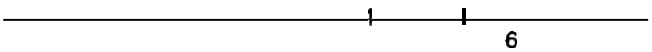
14. It is my duty to take care of my family, even when I have to sacrifice what I want.



15. Family members should stick together, no matter what sacrifices are required.



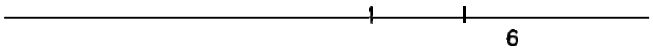
16. It is important to me that I respect the decisions made by my groups.



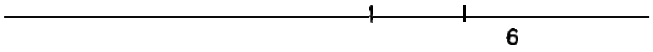
Appendix 3. Trust in Automation Scale (Jian, Bisantz and Drury, 2000)

Below is a list of statements for evaluating trust between people and automation. There are several items for you to rate which explain your intensity of trust in automated cars.
Note: the scale ranges from 1 (strongly disagree) to 7 (strongly agree)

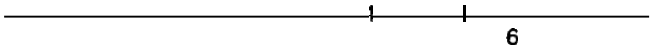
1. The system is deceptive.



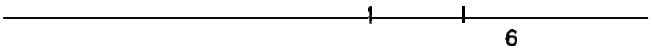
2. The system behaves in underhanded manner.



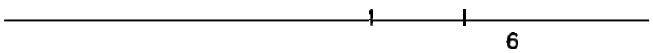
3. I am suspicious of the system's intent, action or outputs.



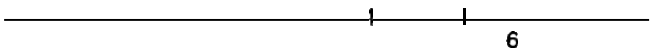
4. I am wary of the system



5. The system's action will have a harmful or injurious outcome.

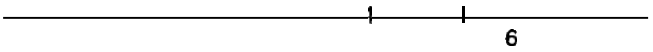


6. I am confident in the system.

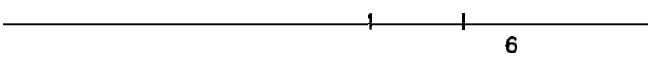


7. The system provides security.

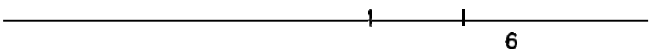
8. The system has integrity.



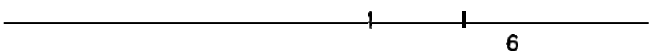
9. The system is dependable.



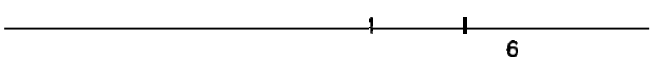
10. The system is reliable.



11. I can trust the system.



12. I am familiar with the system.



Appendix 4. Research Disclosure

Dear Everyone,

Thank you so much for your willingness to take a part on my master thesis study. Recently, the interest of developing automated cars has been rising. Automated cars is a technology where a car can drive itself with less or even no human intervention. However, the safety issue of it still become a huge debate. In this study, I would like to compare the level of trust in automated cars between Indonesians and Dutch. For being able to participate in this study, you must be at least 17 years old, have no experience in driving automated cars or trying automated cars simulators and have no trauma related to accidents.

It will only take about 15 minutes to finish the study. The results of this study can be useful to the development of automated cars's design and increase its safety level. In this study, you will watch 2 videos about automated cars. The first video is an advertisement video and the second one is a news about fatal automated cars crash. You have the right to quit your participation at any time you want. However, I really hope that you will follow the steps until the last.

If you agree to participate in this study, you have to sign a digital informed consent by clicking "I have read all of the explanation and I agree to participate". Then, before you watch the videos, you have to answer some demographic questions and fill in 2 questionnaires. After each time you finish watching a video, you will again fill in a questionnaire.

All of the data in this study will only be used for scientific purposes and your data will be handled confidentially.

For further questions, you can contact me on gandesnawangsari@student.utwente.nl.

Thank you,
Gandes Nawangsari

Appendix 5. Informed Consent

Informed Consent

On a voluntarily basis, I decided to participate in an online experiment in which my culture orientation and dispositional trust in automation will be measured to provide information on the differences between Indonesian and Dutch in trusting automated cars.

After having finished the experiment, I have the right to ask further questions by contacting Gandes Nawangsari, a master student at the department Cognitive Psychology and Ergonomics at the University of Twente (email: gandesnawangsari@student.utwente.nl).

During the experiment, I have the right to quit my participation at any time.

I understand that the data in this study might be used for scientific publications and will be handled confidentially. In addition, my anonymity is assured.

☐ I have read all of the explanation and I agree to participate

Appendix 6. R Syntax

Thesis
Gandes Nawangsari
1/1/2021

```
DT <- read_xlsx("TrustGandesFix.xlsx") %>%
  mutate(HI = as.integer(HI),
         VI = as.integer(VI),
         HC = as.integer(HC),
         VC = as.integer(VC),
         Part = as.factor(Part),
         Gender = as.factor(Gender),
         Trust = as.integer(Trust),
         Nationality = as.factor(Nationality),
         Generation = as.factor(Generation),
         Education = as.factor(Education),
         Engineering = as.factor(Engineering),
         Culture = as.factor(Culture),
         Task = as.factor(Task),
         Abroad = as.factor(Abroad))

summary(DT)
DT %>%
  group_by(Nationality, Task) %>%
  get_summary_stats(Trust, type = "mean_sd")
DT %>%
  group_by(Engineering, Task) %>%
  get_summary_stats(Trust, type = "mean_sd")
DT %>%
  group_by(Abroad, Task) %>%
  get_summary_stats(Trust, type = "mean_sd")
DT %>%
  group_by(Education, Task) %>%
  get_summary_stats(Trust, type = "mean_sd")
```

```r
DT %>%
  group_by(Gender, Task) %>%
  get_summary_stats(Trust, type = "mean_sd")
DT %>%
  group_by(Generation, Task) %>%
  get_summary_stats(Trust, type = "mean_sd")
DT %>%
  group_by(Culture, Task) %>%
  get_summary_stats(Trust, type = "mean_sd")
lm(Trust ~ Task + Engineering + Abroad + Education + Gender + Generation +
+ HI + VI + HC + VC + Nationality, DT)%>%

summary()
DT %>%
 filter(Task == "Negative") %>%
  lm(Trust ~ Engineering + Abroad + Education + Gender + Generation + HI +
VI + HC + VC + Nationality, data =.) %>%
  summary()
test_Task <- t.test(Trust ~ Nationality,
              data = DT %>% filter(Task == "Negative"),
              var.equal = TRUE)
test_Task
DT %>%
 filter(Task == "Positive") %>%
  lm(Trust ~ Engineering + Abroad + Education + Gender + Generation + HI +
VI + HC + VC + Nationality, data =.) %>%
  summary()
test_Task <- t.test(Trust ~ Engineering,
              data = DT %>% filter(Task == "Positive"),
              var.equal = TRUE)
test_Task
test_Task <- t.test(Trust ~ Abroad,
              data = DT %>% filter(Task == "Positive"),
              var.equal = TRUE)
test_Task
DT %>%
 filter(Task == "Control") %>%
  lm(Trust ~ Engineering + Abroad + Education + Gender + Generation + HI +
VI + HC + VC + Nationality, data =.) %>%
  summary()
test_Task <- t.test(Trust ~ Engineering,
              data = DT %>% filter(Task == "Control"),
              var.equal = TRUE)
test_Task
DT %>%
 filter(Nationality == "Indonesian") %>%
  lm(Trust ~ Task + Engineering + Education + Abroad + Gender + Generation
+ HI + VI + HC + VC , data =.) %>%
  summary()
```

```
DT %>%
 filter(Nationality == "Dutch") %>%
  lm(Trust ~ Task + Engineering + Education + Abroad + Gender + Generation
+ HI + VI + HC + VC , data =.) %>%
  summary()
```

Appendix 7. Factors Affecting Trust Toward Automation based on the Conditions

a. factors affecting trust before the video exposure

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -25.0625  -5.8735   0.3487   4.9566  23.6674
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 53.05324    9.78086   5.424 3.49e-07 ***
## EngineeringYes               6.74691    2.70366   2.495   0.0141 *
## AbroadYes                   -3.33406    2.03702  -1.637   0.1045
## EducationHigh School (SMA)   1.86429    3.94990   0.472   0.6379
## EducationMaster (S2)         1.76166    2.20539   0.799   0.4261
## GenderMale                  -1.68279    2.37349  -0.709   0.4798
## GenerationGen Z             -1.28337    3.86620  -0.332   0.7406
## GenerationMillenials        -2.63893    2.70117  -0.977   0.3307
## HI                           0.09013    0.31910   0.282   0.7781
## VI                           0.03823    0.19483   0.196   0.8448
## HC                          -0.15139    0.31738  -0.477   0.6343
## VC                           0.08327    0.24985   0.333   0.7396
## NationalityIndonesian        2.39817    2.36330   1.015   0.3124
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.54 on 110 degrees of freedom
## Multiple R-squared:  0.1241, Adjusted R-squared:  0.02852
## F-statistic: 1.299 on 12 and 110 DF,  p-value: 0.2296
```

b. factors affecting trust during the positive condition

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -27.4865  -6.2833  -0.5133   5.3709  21.2881
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 60.22851    9.64008   6.248 8.07e-09 ***
## EngineeringYes               7.51152    2.66475   2.819  0.00572 **
## AbroadYes                   -6.54644    2.00770  -3.261  0.00148 **
## EducationHigh School (SMA) -2.04261    3.89304  -0.525  0.60086
## EducationMaster (S2)         1.52766    2.17365   0.703  0.48366
## GenderMale                  -0.96462    2.33933  -0.412  0.68089
## GenerationGen Z              3.58481    3.81055   0.941  0.34889
## GenerationMillenials        -0.11208    2.66229  -0.042  0.96649
## HI                          -0.14730    0.31451  -0.468  0.64046
## VI                           0.07693    0.19203   0.401  0.68947
## HC                          -0.27194    0.31281  -0.869  0.38656
## VC                           0.19737    0.24625   0.802  0.42457
## NationalityIndonesian        0.75993    2.32929   0.326  0.74485
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.39 on 110 degrees of freedom
## Multiple R-squared:  0.2047, Adjusted R-squared:  0.1179
## F-statistic: 2.359 on 12 and 110 DF,  p-value: 0.009716
```

c. factors affecting trust during the negative condition

```
## Residuals:
##     Min      1Q  Median      3Q     Max
## -32.182  -6.660   0.286   7.409  26.592
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 39.38025   11.30100   3.485 0.000709 ***
## EngineeringYes               2.43204    3.12386   0.779 0.437925
## AbroadYes                   -1.75217    2.35361  -0.744 0.458186
## EducationHigh School (SMA) -5.14871    4.56379  -1.128 0.261705
## EducationMaster (S2)         1.09555    2.54815   0.430 0.668080
## GenderMale                   2.46128    2.74238   0.897 0.371413
## GenerationGen Z              1.71999    4.46708   0.385 0.700954
## GenerationMillenials        -0.33942    3.12098  -0.109 0.913595
## HI                          -0.24783    0.36870  -0.672 0.502883
## VI                           0.08267    0.22511   0.367 0.714159
## HC                           0.18722    0.36671   0.511 0.610692
## VC                           0.12269    0.28868   0.425 0.671659
## NationalityIndonesian        6.45052    2.73060   2.362 0.019919 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.18 on 110 degrees of freedom
## Multiple R-squared:  0.1537, Adjusted R-squared:  0.06138
## F-statistic: 1.665 on 12 and 110 DF,  p-value: 0.08448
```