Driving without the brain? Effects of value predispositions, media attention, and science knowledge on public willingness to use driverless cars in Singapore

Ho, Shirley Soo Yee; Leow, Vetra Jing Xuan; Leung, Yan Wah

2020

Ho, S. S., Leow, V. J. X., & Leung, Y. W. (2020). Driving without the brain? Effects of value predispositions, media attention, and science knowledge on public willingness to use driverless cars in Singapore. Transportation Research Part F: Traffic Psychology and Behaviour, 71, 49-61. doi:10.1016/j.trf.2020.03.019

https://hdl.handle.net/10356/139508

https://doi.org/10.1016/j.trf.2020.03.019

Driving Without the Brain? Effects of Value Predispositions, Media Attention, and Science Knowledge on Public Willingness to Use Driverless Cars in Singapore

Shirley S. Ho[1]
tsyho@ntu.edu.sg

Vetra Jing Xuan Leow[1]
C160117@e.ntu.edu.sg

Yan Wah Leung[2]
yanwah.leung@outlook.com

[1]Wee Kim Wee School of Communication and Information
Nanyang Technological University, Singapore
31 Nanyang Link
Singapore 637718

[2]Ministry of Communications and Information
140 Hill Street, Old Hill Street Police Station, Singapore
Singapore 179369

Author Note
Correspondence concerning this article should be addressed to Shirley S. Ho, Wee Kim Wee School of Communications and Information, Nanyang Technological University, Singapore 637718. Email: tsyho@ntu.edu.sg.

This is the final version of a manuscript that appears in *Transportation Research Part F: Traffic Psychology and Behaviour.* The APA citation for the published article is:

Ho, S. S., Leow, V. J. X., & Leung, Y. W. (2020). Driving without the brain? Effects of value predispositions, media attention, and science knowledge on public willingness to use driverless cars in Singapore. *Transportation Research Part F: Traffic Psychology and Behaviour*, *71*, 49-61.

Acknowledgement
The authors wish to acknowledge the funding support for this project from the Singapore Ministry of Education Tier 1 Grant (Grant Number: M4011932).

Abstract

This study employs the cognitive miser model and science literacy model as theoretical frameworks to investigate motivations behind public willingness to use driverless cars in Singapore. Findings from a large-scale survey of 1,006 adult Singaporeans indicate that public willingness to use driverless cars was strongly related to value predispositions, especially affect. Aside from having a direct relationship with willingness to use driverless cars, this study found that affect also had an indirect relationship with willingness to use driverless cars via benefit perceptions. Meanwhile, findings failed to reveal significant relationships between two types of science knowledge and willingness to use driverless cars. The findings shed light on the current public opinion on driverless cars in Singapore and lend support to the cognitive miser model over the scientific literacy model. Theoretical and practical implications are discussed.

Keywords: driverless cars; autonomous vehicles; cognitive miser model; science literacy model; media attention

Driving Without the Brain? Effects of Value Predispositions, Media Attention, and Science Knowledge on Public Willingness to Use Driverless Cars in Singapore

1. Introduction

The widespread use of driverless vehicles can yield multiple benefits to society, including drastically reducing the number of accidents on the road (Benleulmi & Blecker, 2017). Road traffic injuries are a leading cause of death globally, and the number of deaths caused by road traffic injuries continue to rise every year (World Health Organisation, 2015). Human errors account for 94% of road traffic accidents (Singh, 2015). Driverless cars eliminate the element of human error, including recognition, decision, and performance errors, thus potentially lowering the number of road traffic accidents significantly (Singh, 2015). Furthermore, driverless cars can reduce road congestion, improve time and fuel efficiency, and make commuting a more enjoyable experience overall (Howard & Dai, 2014; König & Neumayr, 2017; Lipson & Kurman, 2016).

Nonetheless, driverless cars bring about certain risks. While the widespread use of driverless cars can increase road safety, scholars have contended that driverless cars are unable to predict human behavior and may cause an increase in traffic accidents when used alongside human-driven vehicles on the roads (Nyholm & Smids, 2018; Rasouli, Kotseruba, & Tsotsos, 2017). There may also be privacy issues as driverless cars can store users' data even when the cars may not be secure from hackers (König & Neumayr, 2017; Lipson & Kurman, 2016). Besides, driverless cars may bring about social and economic consequences by displacing millions of drivers from their jobs (Lipson & Kurman, 2016; Thierer & Hagemann, 2015).

Many vehicles already incorporate some autonomous elements in the form of computer-operated safety functions that perform independently of drivers (Thierer & Hagemann, 2015). The Society of Automotive Engineers (2018) categorized driverless technologies into five automation levels, with increasing degrees of automation. The first three levels still require drivers to have a degree of control over the car. This study is concerned with vehicles that are level four and above, where little to no driver intervention is required to operate the vehicle.

As with other emerging technologies, public support is critical for the success of driverless cars (Nees, 2016; Panagiotopoulos & Dimitrakopoulos, 2018). Hence, it is timely to examine public opinion of driverless cars and the motivations to use driverless cars. This study employs the cognitive miser model and the science literacy model to investigate the motivations behind public willingness to use driverless cars. These models have been useful in explaining public acceptance of other emerging technologies, such as nanotechnology, agricultural biotechnology, and stem cell research (e.g., Brossard & Nisbet, 2006; Ho, Brossard & Scheufele, 2008; Ho, Scheufele, & Corley, 2010; Liang et al., 2015). This study further examines the mediating roles of risk and benefit perceptions on the relationship between affect and willingness to use driverless cars. The findings of this study can potentially guide policy implementations and communication strategies.

1.1. Driverless cars in Singapore

Singapore is one of the most prepared countries to integrate driverless cars into society. According to a study that examined countries' readiness for driverless cars by comparing consumer acceptance, policies and legislations, infrastructure, and technology and innovation, Singapore came in second among 25 countries in terms of overall readiness for driverless cars (KPMG, 2019).

The Singapore government has been actively incorporating driverless cars into the country's transport plans. The Smart Nation plan[1] features the use of driverless vehicles to

[1] The Smart Nation plan was launched by the Singapore government in 2014. It reflects the government's goal to empower the people with technological tools to improve their lives and drives the Singapore economy. Smart Nation initiatives fall into six categories: strategic national projects, transport, start-ups and businesses, urban living, health, and digital government services. Driverless cars are described as the future of Singapore's transport system and are a key component within the transport initiatives (Smart Nation Singapore, n.d.).

resolve Singapore's transportation problems (Smart Nation Singapore, n.d.). The Singapore Autonomous Vehicle Initiative was set up in 2014 to oversee the development and facilitate the testing of driverless vehicles in Singapore (Land Transport Authority, 2018). In 2017, the Ministry of Transport introduced a set of legislation in preparation for the widespread use of driverless vehicles. Starting from 2022, three areas in Singapore will be ready to incorporate driverless vehicles as a daily commuting option (Lim, 2017). Additionally, autonomous ride-sharing services hold great promise in Singapore as it is the most expensive city to own and use a car (Batarags, 2019).

Despite the imminent introduction of driverless cars in Singapore, there is a lack of understanding about the state of public acceptance of driverless cars in the city-state. Studies on public perception of driverless cars have been conducted in Western nations, such as the United States, the United Kingdom, and the Netherlands (e.g., Bansal, Kockelman, & Singh, 2016; Blythe & Curtis, 2004; Howard & Dai, 2014; Kyriakidis, Happee, & de Winter, 2015). However, none of such studies have been based in Asian nations. When forming judgments about driverless cars, different motivations may be activated by individuals from nations with varying values and cultures. This study thus establishes a timely foundation for understanding public support for driverless cars in Singapore.

1.2. Willingness to use driverless cars

Acceptance of a technology exists in varying degrees. Adell, Várhelyi, and Nilsson (2014) classified acceptance into five categories. The first degree encompasses a general, heuristic acceptance of a technology. The second degree considers whether individuals' needs are satisfied through the technology, referring to the perceived usefulness of the technology. The third degree requires affective evaluations of the technology in addition to objective evaluations of the technology's usefulness. The fourth degree considers users' willingness to engage with the technology, in addition to holistic evaluations of the technology. The fifth and highest degree of acceptance refers to actual use of the technology.

This study examines consumers' willingness to use driverless cars (i.e., the fourth degree of acceptance). It is difficult to measure the current use of driverless cars in Singapore, as this technology is not yet widely available to the public. Willingness to use serves as an indicator of future actual usage of driverless cars (Ajzen, 1985).

2. Theoretical approach

This study applies two socio-psychological models — the cognitive miser model (Fiske & Taylor, 1991) and the science literacy model (Miller, Pardo, & Niwa, 1997) — as theoretical frameworks to investigate the motivators of public willingness to use driverless cars. The science literacy model posits that improving science knowledge will enhance public support for science and technologies (Miller et al., 1997). In other words, this theory argues that the public forms opinions about science and technologies rationally, using the science knowledge they have. However, the cognitive miser model posits that people do not wish to utilize too much effort to make decisions (Fiske & Taylor, 1991). Hence, people rely on mental shortcuts rather than knowledge to form opinions about complex issues such as science and technologies (Chuah, Leong, Cummings, & Ho, 2018; Scheufele & Lewenstein, 2005). This study applies both competing perspectives to examine the indicators of public acceptance of driverless cars.

2.1. Value predispositions

One school of thought asserts that individuals are cognitive misers who use a minimal amount of effort to form opinions (Fiske & Taylor, 1991). Faced with the demands of daily life, individuals prefer to simplify decision-making and opinion formation processes. Thus, they form judgements based on heuristic cues such as value predispositions.

A growing body of literature shows that value predispositions significantly influence public support for emerging technologies (Chuah et al., 2018; Ho et al., 2010; Liang et al., 2015; Scheufele & Lewenstein, 2005). Some value predispositions include religiosity, deference to scientific authority, affect, risk perceptions, and benefit perceptions. Since the public has limited experience and knowledge about emerging technologies such as driverless cars, value predispositions are an efficient and simple basis that they can rely on to form judgements of driverless cars.

2.1.1. Deference to scientific authority

When people find it difficult to understand information surrounding a complex issue, they often accept experts' judgements. For complex science issues, scientists are often regarded as the experts of the topic. Deference to scientific authority refers to the degree in which individuals trust scientists to make decisions that are beneficial to society (Brossard & Nisbet, 2006). Anderson, Scheufele, Brossard, and Corley (2011) posit that deference to scientific authority is developed from the early stages of life and serve as an enduring basis for forming opinions. It is a personal attribute that shapes opinion formation towards controversial technologies (Brossard & Nisbet, 2006).

Individuals with a strong deference to scientific authority believe that scientists have more knowledge about all scientific issues than the public, and that public opinion should not influence matters about science (Anderson et al., 2011). Consequently, they are more likely to trust scientists' judgments, and be supportive of emerging technologies that scientists claim to be beneficial to society. This relationship is supported by previous research where deference to scientific authority was found to have a positive relationship with support for embryonic stem cell research, nanotechnology and agricultural biotechnology (Brossard & Nisbet, 2006; Ho et al., 2008; Ho et al., 2010; Liang et al., 2015). Thus, we hypothesize that:

H1: *Deference to scientific authority is positively associated with willingness to use driverless cars.*

2.1.2. Religiosity

The extent to which individuals rely on religion in their daily lives influences their decision-making process, especially when it comes to science and technology. Science and religion frequently provide contrasting explanations about the world (Brossard, Scheufele, Kim, & Lewenstein, 2009). Highly religious individuals may find science to be "playing God," disrupting the order of nature, and being risky and immoral (Sjöberg, 2004). Highly religious individuals may have more concerns regarding the ethical implications of new technologies, and what new technologies mean for humankind as a whole (Brossard et al., 2009). Highly religious individuals are more likely to perceive new technologies as challenging their moral and religious beliefs, and hence are more resistant to novel technologies. Thus, we posit:

H2: *Religiosity is negatively associated with willingness to use driverless cars.*

2.1.3. Risk and benefit perceptions

Instinctive and intuitive feelings about the potential dangers and rewards of a certain technology act as heuristics used in opinion formation. These instinctive responses are termed as risk and benefit perceptions. Individuals rely on such feelings for most tasks in their daily lives (Slovic & Peters, 2006). Risk and benefit perceptions are based on other pre-existing value predispositions, the external environment, and media messages (Anderson et al., 2011).

As fully driverless technologies are not yet widely adopted by the public, individuals may lack a thorough understanding of the real risks and benefits of driverless cars. Instead, their *interpretation* and perceptions of potential negative and positive outcomes may heavily influence their opinion towards driverless cars (Sjöberg, 2004). Individuals with greater risk perceptions tend to view technology as being more dangerous for human health, society, and the environment, resulting in greater resistance against the technology (Sjöberg, 2004). There are five risks salient in the context of driverless cars — privacy risk, performance risk, safety risk, financial risk, and socio-psychological risk (Benleulmi & Blecker, 2017).

Fewer studies have examined the relationship between benefit perception and technology acceptance. However, risk and benefit perceptions are negatively correlated (Alhakami & Slovic, 1994; Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). While perceived risks may deter individuals from accepting a technology, perceived benefits provide incentives for them to accept the technology. In the case of genetically-modified products, perceived benefits were found to be the main factor determining acceptance of the products (Siegist, 2000). For driverless cars, perceived benefits include fewer crashes and greater safety, greater driving ease, and driving comfort (Bansal et al., 2016; Blythe & Curtis, 2004). Hence, we posit:

H3: *Risk perception is negatively associated with willingness to use driverless cars.*

H4: *Benefit perception is positively associated with willingness to use driverless cars.*

2.1.4. Affect

Humans are often irrational (De Martino, Kumaran, Seymour, & Dolan, 2006), and rely heavily on their feelings when making decisions (Alhakami & Slovic, 1994). The first reaction invoked toward any issue is often an emotional reaction, which we term affect. Affect refers to the conscious or non-conscious experiences of positive or negative emotions that serve as signals on whether something is good or bad (Zajonc, 1980). Affective responses, which can be either positive or negative in valence, occur automatically and promptly when individuals encounter a stimulus (Peters & Slovic, 1996; Siegrist & Sütterlin, 2016; Slovic & Peters, 2006).

Affective reactions serve as a guide for performing complicated tasks such as opinion formation (Zajonc, 1980). Indeed, studies found intuitive affective responses to form the basis for opinion formation (King & Slovic, 2014; Zajonc, 1980). Slovic, Finucane, Peters, and

MacGregor (2004) found that affect influences the recall and impressions of past experiences, which in turn shape judgements about a technology. Thus, we hypothesize:

H5: *Positive affect is positively associated with willingness to use driverless cars.*

H6: *Negative affect is negatively associated with willingness to use driverless cars.*

2.1.5. Risk and benefit perceptions as a mediator for affect

In addition to the straightforward role in shaping opinions, affect can also exert an indirect effect by shaping risk and benefit perceptions, which then shape opinions. Numerous studies show that affect guides judgements of risk and benefit (Finucane, Alhakami, Slovic, & Johnson, 2000; Keller, Siegrist, & Gutscher, 2006; Siegrist & Sütterlin, 2016; Siegrist, Cousin, Kastenholz, & Wiek, 2007; Slovic et al., 2004).

People with positive affective evaluations about solar power and nuclear energy perceived such technologies to have greater benefits and lesser risks, while negative affect caused people to perceive such technologies to have fewer benefits and greater risks (Alhakami & Slovic, 1994; Bourassa, Doraty, Berdahl, Fried, & Bell, 2016). This implies that risk and benefit perceptions are potential mediators for the relationship between affect and willingness to use driverless cars (refer to Fig. 1). To investigate this mediation model, we hypothesize:

H7: *Negative affect is (a) positively associated with risk perception and (b) negatively associated with benefit perception.*

H8: *Positive affect is (a) negatively associated with risk perception and (b) positively associated with benefit perception.*

H9: *The relationship between negative affect and willingness to use driverless cars is mediated by (a) risk perception and (b) benefit perception.*

H10: *The relationship between positive affect and willingness to use driverless cars is mediated by (a) risk perception and (b) benefit perception.*

[Insert Figure 1 about here.]

2.2. Media attention

In addition to value predispositions, people utilize information they gather from the media to form opinions. Traditionally, mass media outlets such as news, movies, and magazines are used to disseminate information from gatekeepers to the public (Viswanath, Ramanadhan, & Kontos, 2007). Similarly, the media disseminates information about emerging technologies (McCluskey, Kalaitzandonakes, & Swinnen, 2015) and serves as the public's main source of information for science and technology (Brossard, 2013). The media can highlight specific aspects about an issue and influence what aspects of an issue are more salient to the public (Entman, 1993; Scheufele & Iyengar, 2012). By determining the aspects that people think about in relation to an issue, the media can shape what is discussed, and subsequently influence opinions on an issue (Scheufele & Iyengar, 2012). The influence of the media is especially significant when the public has little knowledge of the technology (Chuah et al., 2018), such as for driverless cars.

Further, between 2010 and 2019, 88% of news reports on driverless cars on Singapore's leading and highest circulated news publisher, *The Straits Times*, have been favorable or neutral in tone[2], potentially suggesting that there is no significant opposition against the use of driverless cars in Singapore. When the media portrays a technology in a positive light, greater attention paid to the media is associated with greater support for the technology (Brossard & Nisbet, 2006;

[2] Due to the absence of content analysis on driverless cars in Singapore, we conducted a simple content analysis for this study. First, we extracted all the news articles on driverless cars reported by *The Straits Times*, Singapore's leading news publisher, between 1 January 2010 to 30 November 2019 from Factiva. The search terms include *"driverless cars," "driverless vehicles," "autonomous cars,"* and *"autonomous vehicles."* This resulted in 268 news reports. Two coders analysed the tone of the articles (intercoder reliability: r = 0.81).

Cummings, Chuah, & Ho, 2018; Ho, Brossard, & Scheufele, 2008; Liang et al., 2015). Given that most news articles on driverless cars in Singapore are positive or neutral in tone, we posit:

H11: *Attention to mass media is positively associated with willingness to use driverless cars.*

Since the advent of the Internet, people have sought information from not only the mass media, but also online sources and social media (Westerman, Spence, & Van Der Heide, 2014). User-generated content differs vastly from mass media. The former blurs the line between the audience and the content generator, due to a lack of formal gatekeeping processes. With user-generated media, people who were traditionally passive audiences can go beyond consuming information to producing content on their own initiative (Jönsson & Öernebring, 2011; Örnebring, 2008). Furthermore, user-generated content allows for two-way user-to-user interaction (Shao, 2009), compared to the traditional one-way user-to-content interaction.

With such differences, the effects of attention paid to mass media potentially differ from that of user-generated content. While mass media generally portrays driverless cars positively, user-generated content might be less positive as critics are free to voice their opinions. With the increase in popularity of user-generated content over the last decade, it is highly relevant to investigate its relationship with user acceptance of emerging technologies like driverless cars.

RQ1: *How will attention to user-generated media affect willingness to use driverless cars?*

2.3. Scientific knowledge

In contrast to media effects and the cognitive miser model, the science literacy model proposes that people require some understanding of science to make decisions about science-related matters (Miller et al., 1997). As people amass scientific knowledge, their judgements become more accurate and align with experts', which improves their opinion of emerging technologies (Cacciatore, Scheufele, & Corley, 2011).

Factual scientific knowledge refers to accurate understanding of scientific information (Ho, Looi, Leong, & Leung, 2019). There are two types of factual scientific knowledge: (1) general science knowledge and (2) domain-specific knowledge. Applying the science literacy model to the context of driverless cars, a greater possession of general science knowledge can be associated with greater support for driverless cars. This claim is corroborated by past research (Brossard & Nisbet, 2006; Ho et al., 2010, 2019; Liang et al., 2015). Additionally, domain-specific knowledge can sway public acceptance in the same direction; people who hold more knowledge on driverless cars should have greater support for driverless cars. A study by Lee and Scheufele (2006) revealed that domain-specific knowledge had a positive influence on support for nanotechnology. Following this train of thought, we hypothesize:

> ***H12:*** *(a) General science knowledge and (b) domain-specific knowledge are positively associated with willingness to use driverless cars.*

3. Method

We hired Qualtrics, an online survey company, to disseminate the questionnaire to their online panel from 13 August 2018 to 31 October 2018. Respondents who successfully completed the survey received points that could be accumulated to exchange for gifts. We attained a response rate[3] of 37.5%.

3.1. Sampling procedure and sample

[3] The response rate was calculated by dividing the number of completed surveys by the number of eligible panellists invited to participate.

We collected data from 1,006 Singaporeans and Singapore permanent residents. We imposed quotas on gender, age, and ethnicity to increase representativeness of the sample[4]. The sample comprised 50.0% male and 50.0% female respondents. Their age ranged from 21 to 81 (*M* = 41.61, *SD* = 12.84). Participants comprised 88.3% Chinese, 5.9% Malay, 3.9% Indian, 0.7% Eurasian, and 1.4% from other ethnicities. The median household income was S$6,000 - S$6,999, and median education level was holding a Bachelor's degree or equivalent. Finally, 75.3% of respondents owned a driver's license, while 45.1% owned a car.

3.2. Measurements

All items were measured using a 5-point Likert scale, unless otherwise mentioned. We created a composite index for each variable after ensuring acceptable internal reliability. Table 1 presents exact item wordings and descriptive statistics.

[Insert Table 1 about here.]

3.2.1. Willingness to use driverless cars

Respondents answered three items adapted from König and Neumayr (2017) on their willingness to use driverless cars when driverless cars become available in Singapore. A higher score indicates greater willingness to use driverless cars (*M* = 3.26, *SD* = 1.00, *Cronbach's α = 0*.89).

3.2.2. Deference to scientific authority

Two items adapted from Cacciatore et al. (2016) were used to measure respondents' deference to scientific authority. A higher score indicates greater deference to scientific authority (*M* = 3.08, *SD* = 0.86, *Spearman's r* = 0.68).

[4] According to census data, the Singapore population consists 48.0% male and 52.0% female residents, as well as 76.1% Chinese, 15.0% Malays, 7.5% Indians, and 1.5% other ethnicities. The median age is 40.8 (Department of Statistics Singapore, 2018).

3.2.3. Religiosity

A single item was used to measure respondents' reliance on religion in their daily lives. A higher score indicates greater religiosity (*M* = 3.03, *SD* = 1.40).

3.2.4. Risk perception

Respondents answered five items adapted from König and Neumayr (2017) to measure their risk perception. Higher scores indicate greater perception of risks (*M* = 3.99, *SD* = 0.54, *Cronbach's α = 0*.69).

3.2.5. Benefit perception

Respondents answered five items regarding their benefit perception. The items were adapted from Schoettle and Sivak (2014) and Bell (n.d.). Higher scores indicate greater perception of benefits (*M* = 3.39, *SD* = 0.80, *Cronbach's α* = 0.85).

3.2.6. Positive affect

Respondents answered two items to indicate the degree of their positive affect. We adapted these items from Bourassa et al. (2016) and Smith and Anderson (2017). Higher scores indicate greater positive affect (*M* = 2.85, *SD* = 1.10, *Spearman's r* = 0.91).

3.2.7. Negative affect

Respondents answered three items to indicate the degree of their negative affect. We adapted these items from Bourassa et al. (2016) and Smith and Anderson (2017). Higher scores indicate greater negative affect (*M* = 2.13, *SD* = 0.80, *Cronbach's α* = 0.79).

3.2.8. Attention to mass media

Respondents answered four items on how much attention they paid to messages related to driverless cars on mass media. Higher scores indicate greater amount of attention paid to mass media (*M* = 2.66, *SD* = 0.89, *Cronbach's α* = 0.84).

3.2.9. Attention to user-generated content

Respondents answered three items on the amount of attention they paid to messages related to driverless cars on user-generated media. Higher scores indicate greater amount of attention paid to user-generated media (*M* = 2.35, *SD* = 0.90, *Cronbach's α* = 0.82).

3.2.10. General science knowledge

Respondents answered five true-false items to gauge their level of general science knowledge. We adapted the items from Chuah et al. (2018). Correct answers each earned respondents one point, and incorrect answers were scored zero. We summed the scores of the five items, with higher scores indicating a higher level of general science knowledge (*M* = 3.25, *SD* = 1.37, *KR-20* = 0.56).

3.2.11. Domain-specific knowledge

Due to the lack of prior studies on knowledge about driverless cars, we consulted with three experts (two scientists and one policymaker) to craft five items to measure domain-specific knowledge. Five true-false items were used to measure respondents' level of domain-specific knowledge. Correct answers each earned respondents one point, while each incorrect answer earned respondents zero points. We summed the scores of the five items, with higher scores indicating a higher level of domain-specific knowledge (*M* = 3.03, *SD* = 1.33, *KR-20* = 0.49).

3.2.12. Control variables

We included standard demographic variables as control variables. Specifically, we controlled for respondents' gender, age, education level, marital status, monthly household income, ownership of driver's license, and ownership of car.

3.3. Analytical approach

We used *SPSS version 25* to conduct hierarchical regression analysis to test the hypothesized main effects. We entered the variables into the regression model based on their assumed causal order, similar to how past studies have ordered the variables (e.g., Anderson, Brossard, Scheufele, Xenos, & Ladwig, 2014; Cacciatore, Scheufele, & Corley, 2011; Ho, Brossard, & Scheufele, 2008; Ho, Scheufele, & Corley, 2011; Kim, Yeo, Brossard, Scheufele, & Xenos, 2014). Control variables were entered into the first block; value predisposition variables were entered in the second block; media attention variables were entered into the third block; knowledge variables were entered in the fourth block; and risk perception and benefit perception were entered in the fifth block[5].

Furthermore, we conducted structural equation modelling using *Amos 18* to test how risk and benefit perceptions mediate the relationship between affect and willingness to use driverless cars. We evaluated the model fit based on five criteria: the maximum likelihood chi-square (χ^2) value should be non-significant ($p > 0.05$); the relative chi-square ratio (χ^2/df) should not exceed 5.00; the root mean square error of approximation (RMSEA) value should be less than 0.05; the comparative fit index (CFI) and Tucker-Lewis Index (TLI) should exceed 0.95 (Hu & Bentler, 1999; Wheaton, Muthen, Alwin, & Summers, 1977).

4. Results

4.1. Main effects

The regression model accounted for 64.7% of the variance in public willingness to use driverless cars. Table 2 presents the standardized regression coefficients.

[5] As an additional analysis, we entered the blocks in different orders to observe whether the trends in results differ based on the order in which the variables were entered. Even after differing the order in which we entered the variables into the regression models, the general observation remained the same – the value predispositions block accounted for the highest amount of variance in public willingness to use driverless cars.

[Insert Table 2 about here.]

Value predisposition variables accounted for 59.5% of variance in willingness to use driverless cars. Deference to scientific authority and positive affect were positively related to willingness to use driverless cars, supporting *H1* and *H5*. Negative affect was negatively associated with willingness to use driverless cars, supporting *H6*. However, religiosity was not significantly related to willingness to use driverless cars. Thus, *H2* was not supported.

Risk perception and benefit perception accounted for 0.19% of variance in willingness to use driverless cars. Risk perception was negatively associated with willingness to use driverless cars, while benefit perception was positively associated with willingness to use driverless cars. Thus, *H3* and *H4* were supported.

Media attention variables accounted for 2.50% of the variance in willingness to use driverless cars. Attention to mass media was positively related to willingness to use driverless cars, supporting *H11*. Regarding *RQ1*, attention to user-generated media was not significantly associated with willingness to use driverless cars.

Scientific knowledge accounted for 0.01% of the variance in willingness to use driverless cars. Neither general science knowledge nor domain-specific knowledge was found to be significantly related to willingness to use driverless cars, thus *H12a* and *H12b* were not supported.

The demographic block accounted for 2.50% of the variance in willingness to use driverless cars. Age was negatively associated with willingness to use driverless cars ($\beta = -0.06$, $p < 0.01$). Gender, education, income, driver license ownership, car ownership, and marital status were not significantly related to willingness to use driverless cars.

4.2. Mediation analysis

Overall, the model achieved good statistical fit (χ^2/df = 2.65, $p < 0.001$, CFI = 0.96, TLI = 0.95, RMSEA = 0.04) (see Fig. 2). After controlling for gender, income, age, and whether participants had a driver's license, the proposed model accounted for 85.4% of the variance in willingness to use driverless cars. The relationship between risk perception and willingness to use driverless cars was not significant. The findings supported all other hypothesized relationships.

[Insert Figure 2 about here.]

The results revealed that negative affect had a significant positive relationship with risk perception ($\beta = 0.34$, $p < 0.001$) and a significant negative relationship with benefit perception ($\beta = -0.41$, $p < 0.001$), thus supporting *H7a* and *H7b*. Positive affect had a significant negative association with risk perception ($\beta = -0.23$, $p < 0.001$) and a significant positive association with benefit perception ($\beta = 0.75$, $p < 0.001$), thus supporting *H8a* and *H8b*. Risk perception had a non-significant negative association with willingness to use driverless cars ($\beta = -0.04$, $p < 0.05$), while benefit perception had a significant positive association with the dependent variable ($\beta = 0.91$, $p < 0.001$). Thus, the results do not support *H9a* and *H10a*, but support *H9b* and *H10b*.

5. Discussion

Overall, the current state of public willingness to use driverless cars in Singapore is marginally positive ($M = 3.26$). This finding suggests that even after the introduction of driverless cars into Singapore, driverless cars might not achieve widespread usage if there are no efforts to promote it, limiting the degree to which the society can reap the technology's benefits. Further, younger people indicated that they were more willing to use driverless cars than older people. The finding that younger people tend to be more receptive than older people to emerging technologies is consistent across socio-psychological studies (Ho, Scheufele, & Corley, 2013; Nisbet, 2005).

5.1. The role of value predispositions

The findings corroborate past studies in affirming the importance of the cognitive miser model over the science literary model. Compared to knowledge and media attention variables, value predispositions accounted for the largest amount of variance in willingness to use driverless cars. Specifically, affect had a very strong relationship with willingness to use driverless cars.

Popular socio-psychological theories such as the theory of planned behavior (Ajzen, 1985) are often criticized for failing to consider irrational motivators of behaviors (Bechara, 2004; Lemerise & Arsenio, 2000; Perugini & Bagozzi, 2001). The strong relationships between both positive and negative affect and willingness to use driverless cars support this criticism, highlighting the importance of examining non-rational motivators of behavior. Affect not only motivates willingness to use driverless cars directly, but also shapes benefit perceptions, which subsequently influence willingness to use driverless cars. The emphasis on affect is not unique to this study. Other studies have found that emotions motivate consumer behavior (Laros & Steenkamp, 2005), environmental behaviors (Carmi, Arnon, & Orion, 2015), and even voting behaviors (Panagopoulos, 2010).

While positive and negative affect were important motivators of willingness to use driverless cars, the results failed to find such notable relationships between traditional value predispositions and willingness to use driverless cars. Religiosity was not significantly associated with willingness to use driverless cars. This contradicts past literature which revealed religiosity to be negatively associated with acceptance of emerging technologies. A possible explanation is that driverless technology does not involve salient morality concerns, rendering religious concerns irrelevant.

5.2. The negligible role of knowledge

While the science literacy model posits that improving science literacy will help to improve public support for science and technology issues, the findings from this study did not support this claim. Considering that knowledge is a multifaceted concept (Hwang & Jeong, 2009), this study explicated factual science knowledge into general science knowledge and domain-specific knowledge to examine if different dimensions of knowledge is related to public acceptance differently. Neither general science knowledge nor domain-specific knowledge were significantly related to willingness to use driverless cars. The findings suggest that factual science knowledge played a negligible role in predicting willingness to use driverless cars. This finding is in line with that of past studies. Past studies examining public acceptance of emerging technologies also found that general science knowledge was not a significant predictor of public acceptance of novel technologies (Brossard & Nisbet, 2006; Ho et al., 2008, 2010).

5.3. Attention to media

The findings revealed that attention to mass media had a significant relationship with willingness to use driverless cars. However, attention to user-generated media did not have a significant relationship with willingness to use driverless cars. The discrepancies could be attributed to two reasons.

First, the content analysis conducted on the main news publisher in Singapore suggests that there are very few negative articles on driverless cars in the country. Hence, in the Singapore context, attention to mass media might improve public acceptance of driverless cars. Discussions on driverless cars might not be so positive on user-generated media. However, this explanation can only be verified through an extensive content analysis on driverless cars on such media platforms in future studies.

Second, the presence of gatekeeping for mass media could cause people to perceive it as a more reliable source of information (Infocomm Media Development Authority, 2016) than user-generated media. Therefore, people might be more willing to rely on the information presented on mass media to make decisions compared to the information presented on user-generated media.

5.4. Theoretical and practical implications

Overall, the findings indicate that people tend to rely on their value predispositions, especially affect, to form opinions on their willingness to use driverless cars. Since fake news capitalizes on emotions, people are made vulnerable to fake news regarding driverless cars (Peters, 2018; Rochlin, 2017).

This research highlights several practical implications for messaging strategies to change the people's willingness to use driverless cars. Communication practitioners can consider using positive emotional appeals (i.e., feel good messages) to increase public willingness to use driverless cars. Further, they should focus on enhancing benefit perceptions and reducing risk perceptions about driverless cars. A post-hoc paired-samples t-test suggests that risk perceptions are significantly higher ($M = 3.99$, $SD = 0.54$) than benefit perceptions ($M = 3.39$, $SD = 0.80$) in Singapore $t(1005) = 17.9$, $p < 0.001$. This indicates that further steps should be taken to assure the public that relevant risks are mitigated and remind them that there is a plethora of benefits that could be reaped from driverless cars. As legislation on driverless cars is already rather substantial in Singapore, the government should promulgate these regulations to reduce the public's risk perceptions.

5.5. Limitations and directions for future research

This study utilized cross-sectional data, which prevents us from establishing causality. Future studies can use longitudinal data collection methods to mitigate this limitation. Further, this study did not involve a content analysis of the information available about driverless cars on the entire mass media landscape and user-generated media landscape. To address this limitation, future studies can conduct a content analysis for both mass media and user-generated media to shed greater clarity on their relationships with public acceptance of driverless cars in Singapore. Based on a preliminary content analysis conducted for this study, we assumed that mass media portrayal of driverless cars in Singapore is positive, and a rigorous content analysis can help to test this assumption.

Future studies could examine the influence of social conformity and social norms on people's perceptions of driverless cars. Relatedly, future studies could conduct a cross-cultural comparison of public acceptance of driverless cars, preferably between cultures with differing levels of social conformity and social norms. Finally, this study measured risk perceptions and benefit perceptions to the society. Future studies can compare whether risk and benefit perceptions at different levels of social distance – family, friends, and general society – can have differing relationships with public willingness to use driverless cars.

References

Adell, E., Várhelyi, A., & Nilsson, L. (2014). The definition of acceptance and acceptability. *Driver Acceptance of New Technology. Theory, Measurement and Optimisation*, 11–21.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11–39). Berlin, Heidelberg: Springer.

Alhakami, A. S., & Slovic, P. (1994). A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis, 14*(6), 1085–1096.

Anderson, A. A., Brossard, D., Scheufele, D. A., Xenos, M. A., & Ladwig, P. (2014). The ‘‘nasty effect:” Online incivility and risk perceptions of emerging technologies. *Journal of Computer-Mediated Communication, 19*(3), 373–387.

Anderson, A. A., Scheufele, D. A., Brossard, D., & Corley, E. A. (2011). The role of media and deference to scientific authority in cultivating trust in sources of information about emerging technologies. *International Journal of Public Opinion Research, 24*(2), 225–237.

Bansal, P., Kockelman, K. M., & Singh, A. (2016). Assessing public opinions of and interest in new vehicle technologies: An Austin perspective. *Transportation Research Part C: Emerging Technologies, 67*, 1–14.

Bechara, A. (2004). The role of emotion in decision-making: evidence from neurological patients with orbitofrontal damage. *Brain and Cognition, 55*(1), 30–40.

Batarags, L. (2019). The same city has been ranked the most expensive city in the world for 5 years running, and it’s partially because of the cost of buying a car. Business Insider Singapore. Retrieved from https://www.businessinsider.sg/most-expensive-city-in-the-world-singapore-2019-1/.

Bechara, A. (2004). The role of emotion in decision-making: Evidence from neurological patients with orbitofrontal damage. *Brain and Cognition, 55*(1), 30–40.

Bell, L. (n.d.). 10 benefits of self-driving cars. Retrieved from https://www.autobytel.com/car-ownership/advice/10-benefits-of-self-driving-cars-121032/.

Benleulmi, A. Z., & Blecker, T. (2017). Investigating the factors influencing the acceptance of fully autonomous cars. In *Proceedings of the Hamburg international conference of logistics (HICL)* (pp. 99–115).

Blythe, P. T., & Curtis, A. M. (2004). Advanced driver assistance systems: Gimmick or reality. 11th world congress on ITS, Nagoya.

Bourassa, M., Doraty, K., Berdahl, L., Fried, J., & Bell, S. (2016). Support, opposition, emotion and contentious issue risk perception. *International Journal of Public Sector Management, 29*(2), 201–216.

Brossard, D. (2013). New media landscapes and the science information consumer. *Proceedings of the National Academy of Sciences, 110*(Supplement 3), 14096–14101.

Brossard, D., & Nisbet, M. C. (2006). Deference to scientific authority among a low information public: Understanding US opinion on agricultural biotechnology. *International Journal of Public Opinion Research, 19*(1), 24–52.

Brossard, D., Scheufele, D. A., Kim, E., & Lewenstein, B. V. (2009). Religiosity as a perceptual filter: Examining processes of opinion formation about nanotechnology. *Public Understanding of Science, 18*(5), 546–558.

Cacciatore, M. A., Browning, N., Scheufele, D. A., Brossard, D., Xenos, M. A., & Corley, E. A. (2016). Opposing ends of the spectrum: Exploring trust in scientific and religious authorities. *Public Understanding of Science, 1*, 18.

Cacciatore, M. A., Scheufele, D. A., & Corley, E. A. (2011). From enabling technology to applications: The evolution of risk perceptions about nanotechnology. *Public Understanding of Science, 20*(3), 385–404.

Carmi, N., Arnon, S., & Orion, N. (2015). Transforming environmental knowledge into behavior: The mediating role of environmental emotions. *The Journal of Environmental Education, 46*(3), 183–201.

Chuah, A. S., Leong, A. D., Cummings, C. L., & Ho, S. S. (2018). Label it or ban it? Public perceptions of nano-food labels and propositions for banning nano-food applications. *Journal of Nanoparticle Research, 20*(2), 36.

Cummings, C., Chuah, A. S. F., & Ho, S. S. (2018). Protection motivation and communication through nano-food labels: Improving predictive capabilities of attitudes and purchase intentions toward nano-food. *Science, Technology, & Human Values, 43*(5), 900–902.

De Martino, B., Kumaran, D., Seymour, B., & Dolan, R. J. (2006). Frames, biases, and rational decision-making in the human brain. *Science, 313*(5787), 684–687.

Department of Statistics Singapore. (2018). Population trends, 2018. Retrieved from https://www.singstat.gov.sg/-/media/files/publications/population/ population2018.pdf.

Entman, R. M. (1993). Framing: Toward clarification of a fractured paradigm. *Journal of Communication, 43*(4), 51–58.

Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making, 13*(1), 1–17.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. *Policy Sciences, 9*(2), 127–152.

Fiske, S. T., & Taylor, S. E. (1991). *Social cognition* (2nd ed.). New York, NY: McGraw-Hill.

Ho, S. S., Looi, J., Leong, A. D., & Leung, Y. W. (2019). Explicating factual and subjective science knowledge: Knowledge as a mediator of news attention and attitudes. *Asian Journal of Communication, 29*(1), 73–91.

Ho, S. S., Brossard, D., & Scheufele, D. A. (2008). Effects of value predispositions, mass media use, and knowledge on public attitudes toward embryonic stem cell research. *International Journal of Public Opinion Research, 20*(2), 171–192.

Ho, S. S., Leong, A. D., Looi, J., Chen, L., Pang, N., & Tandoc, E. Jr, (2019). Science literacy or value predisposition? A meta-analysis of factors predicting public perceptions of benefits, risks, and acceptance of nuclear energy. *Environmental Communication, 13*(4), 457–471.

Ho, S. S., Scheufele, D. A., & Corley, E. A. (2010). Making sense of policy choices: Understanding the roles of value predispositions, mass media, and cognitive processing in public attitudes toward nanotechnology. *Journal of Nanoparticle Research, 12*(8), 2703–2715.

Ho, S. S., Scheufele, D. A., & Corley, E. A. (2011). Value predispositions, mass media, and attitudes toward nanotechnology: The interplay of public and experts. *Science Communication, 33*(2), 167–200.

Ho, S. S., Scheufele, D. A., & Corley, E. A. (2013). Factors influencing public risk–benefit considerations of nanotechnology: Assessing the effects of mass media, interpersonal communication, and elaborative processing. *Public Understanding of Science, 22*(5), 606–62.3

Howard, D., & Dai, D. (2014). Public perceptions of self-driving cars: The case of Berkeley, California. Transportation Research Board 93rd Annual Meeting, 14(4502), 1-16.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Hwang, Y., & Jeong, S. H. (2009). Revisiting the knowledge gap hypothesis: A meta-analysis of thirty-five years of research. *Journalism & Mass Communication Quarterly*, *86*(3), 513–532.

Infocomm Media Development Authority. (2016). Media consumer experience and zero to fourteen consumer experience study 2016. Retrieved from https://www.imda.gov.sg/-/media/imda/files/industry-development/fact-and-figures/mces–cs-2016_public_final.pdf?la=en.

Jönsson, A. M., & Öernebring, H. (2011). User-generated content and the news. *Journalism Practice*, *5*(2), 127. https://doi.org/10.1080/ 17512786.2010.501155.

Keller, C., Siegrist, M., & Gutscher, H. (2006). The role of the affect and availability heuristics in risk communication. *Risk Analysis*, *26*(3), 631–639.

Kim, J., Yeo, S. K., Brossard, D., Scheufele, D. A., & Xenos, M. A. (2014). Disentangling the influence of value predispositions and risk/benefit perceptions on support for nanotechnology among the American public. *Risk Analysis*, *34*(5), 965–980.

King, J., & Slovic, P. (2014). The affect heuristic in early judgments of product innovations. *Journal of Consumer Behaviour*, *13*(6), 411–428.

König, M., & Neumayr, L. (2017). Users' resistance towards radical innovations: The case of the self-driving car. *Transportation Research Part F: Traffic Psychology and Behaviour*, *44*, 42–52.

KPMG (2019). Autonomous vehicles readiness index. Retrieved from https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/2019-autonomous-vehicles-readiness-index.pdf.

Kyriakidis, M., Happee, R., & de Winter, J. C. (2015). Public opinion on automated driving: Results of an international questionnaire among 5000 respondents. *Transportation Research Part F: Traffic Psychology and Behaviour, 32*, 127–140.

Land Transport Authority. (2018). Singapore autonomous vehicle initiative. Retrieved from https://www.lta.gov.sg/content/ltaweb/en/roads-and-motoring/managing-traffic-and-congestion/intelligent-transport-systems/savi.html.

Laros, F. J., & Steenkamp, J. B. E. (2005). Emotions in consumer behavior: A hierarchical approach. *Journal of Business Research, 58*(10), 1437–1445.

Lee, C. J., & Scheufele, D. A. (2006). The influence of knowledge and deference toward scientific authority: A media effects model for public attitudes toward nanotechnology. *Journalism & Mass Communication Quarterly, 83*(4), 819–834.

Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Development, 71*(1), 107–118.

Liang, X., Ho, S. S., Brossard, D., Xenos, M. A., Scheufele, D. A., Anderson, A. A., ... He, X. (2015). Value predispositions as perceptual filters: Comparing of public attitudes toward nanotechnology in the United States and Singapore. *Public Understanding of Science, 24*(5), 582–600.

Lim, A. (2017). Driverless vehicle rides in three new towns from 2022. Retrieved from https://www.straitstimes.com/singapore/transport/driverless- vehicle-rides-in-three-new-towns-from-2022.

Lipson, H., & Kurman, M. (2016). *Driverless: Intelligent cars and the road ahead*. London: The MIT Press.

McCluskey, J. J., Kalaitzandonakes, N., & Swinnen, J. (2015). Media coverage, public perceptions, and consumer behavior: Insights from new food technologies. *Ann Rev Resour Econ, 7*, 19–111.

Miller, J. D., Pardo, R., & Niwa, F. (1997). Public perceptions of science and technology. A comparative study of the European Union, the United States, Japan, and Canada. Fundación BBV-Chicago Academy of Sciences, Bilbao.

Nees, M. A. (2016). Acceptance of self-driving cars: An examination of idealized versus realistic portrayals with a self-driving car acceptance scale.

Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 60(1), 1449–1453.

Nisbet, M. C. (2005). The competition for worldviews: Values, information, and public support for stem cell research. *International Journal of Public Opinion Research, 17*(1), 90–112.

Nyholm, S., & Smids, J. (2018). Automated cars meet human drivers: Responsible human-robot coordination and the ethics of mixed traffic. *Ethics and Information Technology*, 1–10.

Örnebring, H. (2008). The consumer as producer—of what? User-generated tabloid content in The Sun (UK) and Aftonbladet (Sweden). *Journalism Studies, 9*(5), 771–785.

Panagiotopoulos, I., & Dimitrakopoulos, G. (2018). An empirical investigation on consumers' intentions towards autonomous driving. *Transportation Research Part C: Emerging Technologies*, *95*, 773–784.

Panagopoulos, C. (2010). Affect, social pressure and prosocial motivation: Field experimental evidence of the mobilizing effects of pride, shame and publicizing voting behavior. *Political Behavior, 32*(3), 369–386.

Perugini, M., & Bagozzi, R. P. (2001). The role of desires and anticipated emotions in goal-directed behaviours: Broadening and deepening the theory of planned behaviour. *British Journal of Social Psychology, 40*(1), 79–98.

Peters, M. A. (2018). *Education in a post-truth world* (pp. 145–150). Fake News: Post-Truth.

Peters, E., & Slovic, P. (1996). The role of affect and worldviews as orienting dispositions in the perception and acceptance of nuclear power 1. *Journal of Applied Social Psychology, 26*(16), 1427–1453.

Rasouli, A., Kotseruba, I., & Tsotsos, J. K. (2017). Understanding pedestrian behavior in complex traffic scenes. *IEEE Transactions on Intelligent Vehicles, 3*(1), 61–70.

Rochlin, N. (2017). Fake news: Belief in post-truth. *Library Hi Tech, 35*(3), 386–392.

Scheufele, D. A., & Iyengar, S. (2012). The state of framing research: A call for new directions. In *The Oxford Handbook of Political Communication Theories* (pp. 1–26). New York: Oxford University Press.

Scheufele, D. A., & Lewenstein, B. V. (2005). The public and nanotechnology: How citizens make sense of emerging technologies. *Journal of Nanoparticle Research*, 7(6), 659–667. *Pragmatics, 59*, 210–220.

Schoettle, B., & Sivak, M. (2014). Public opinion about self-driving vehicles in China, India, Japan, the US, the UK, and Australia. Ann Arbor, MI: The University of Michigan Transportation Research Institute, 1–31.

Shao, G. (2009). Understanding the appeal of user-generated media: A uses and gratification perspective. *Internet Research, 19*(1), 7–25.

Siegrist, M. (2000). The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk Analysis, 20*(2), 195–204.

Siegrist, M., & Sütterlin, B. (2016). People's reliance on the affect heuristic may result in a biased perception of gene technology. *Food Quality and Preference, 54*, 137–140.

Siegrist, M., Cousin, M. E., Kastenholz, H., & Wiek, A. (2007). Public acceptance of nanotechnology foods and food packaging: The influence of affect and trust. *Appetite, 49*(2), 459–466.

Singh, S. (2015). Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey. Traffic Safety Facts Crash Stats. Report No. DOT HS 812 115. Washington, DC: National Highway Traffic Safety Administration.

Sjöberg, L. (2004). Principles of risk perception applied to gene technology: To overcome the resistance to applications of biotechnology, research on risk perception must take a closer look at the public's reasons for rejecting this technology. *EMBO Reports, 5*(1S), S47–S51.

Slovic, P., & Peters, E. (2006). Risk perception and affect. *Current Directions in Psychological Science, 15*(6), 322–325.

Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis: An International Journal, 24*(2), 311–322.

Smart Nation Singapore. (n.d.). Autonomous vehicles. Retrieved from https://www.smartnation.sg/what-is-smart-nation/initiatives/Transport/autonomous-vehicles.

Smith, A., & Anderson, M. (2017). Americans' attitudes toward driverless vehicles. Retrieved from http://www.pewinternet.org/2017/10/04/americans- attitudes-toward-driverless-vehicles/.

Society of Automotive Engineers. (2018). Taxonomy and definitions for terms related to on-road motor vehicle automated driving systems. SAE International.

Thierer, A., & Hagemann, R. (2015). Removing roadblocks to intelligent vehicles and driverless cars. *Wake Forest Journal of Law & Policy, 5*, 339–392.

Viswanath, K., Ramanadhan, S., & Kontos, E. Z. (2007). Mass media. In *Macrosocial Determinants of Population Health* (pp. 275–294). New York, NY: Springer.

Westerman, D., Spence, P. R., & Van Der Heide, B. (2014). Social media as information source: Recency of updates and credibility of information. *Journal of Computer-Mediated Communication, 19*(2), 171–183.

Wheaton, B., Muthen, B., Alwin, D. F., & Summers, G. F. (1977). Assessing reliability and stability in panel models. *Sociological Methodology, 8,* 84–136. World Health Organization. (2015). Global status report on road safety 2015. World Health Organization.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35*(2), 151.

Tables and Figures

Figure 1. *Proposed mediation model.*

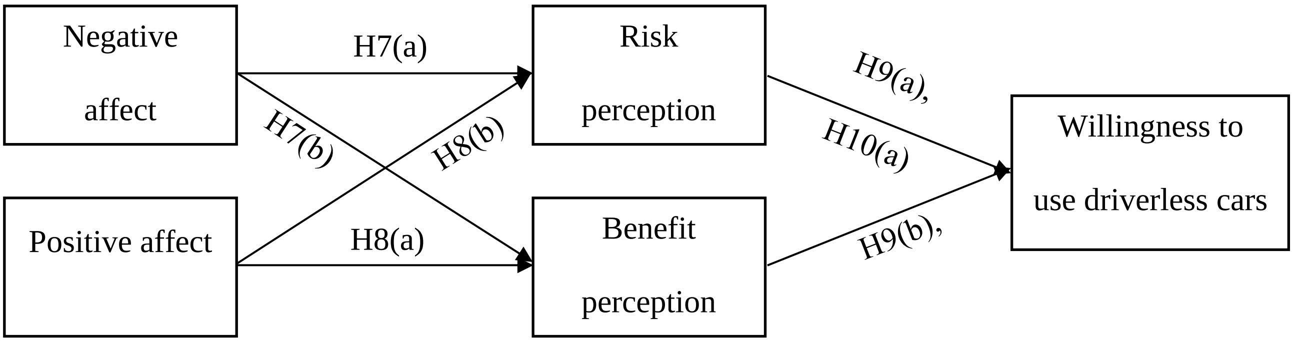
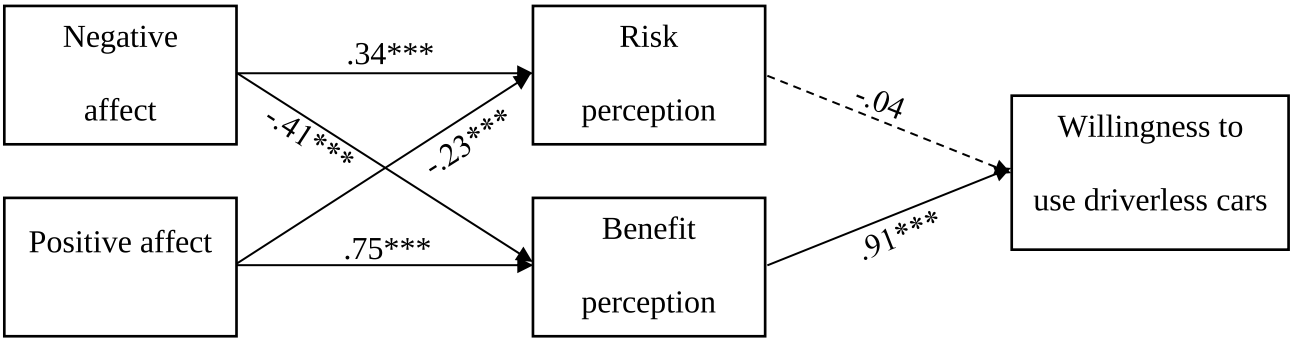


Figure 2. *Results of mediation analysis.*



Note. ****p* < *.001*

Table 1. *Exact item wording and descriptive statistics*

Items	*M*	*SD*
Deference to scientific authority		
On a scale of 1 – 5 (1 = strongly disagree; 5 = strongly agree), how much do you agree with the following statements?		
Scientists know best what is good for the public.	2.77	0.99
Scientists should do what they think is best for the society, even if they have to persuade people that it is right.	3.38	0.98
Religiosity		
On a scale of 1 – 5 (1 = no guidance at all; 5 = a lot of guidance), how much guidance does religion provide in your everyday life?	3.03	1.4
Risk perception		
On a scale of 1 – 5 (1 = strongly disagree; 5 = strongly agree), how much do you agree or disagree with the following statements?		
Driverless cars may cause safety consequences triggered by technical error.	4.14	0.64
Driverless cars may not be secure from hackers.	4.12	0.74
Driverless cars may lead to privacy issues caused by steady tracking of exact location.	3.99	0.77
Driverless cars may lead to job losses.	3.79	0.98
Driverless cars may pose a risk to safety when there are also human-operated cars on the road.	3.93	0.86
Benefit perception		
On a scale of 1 – 5 (1 = strongly disagree; 5 = strongly agree), how much do you agree with the following statements?		
Driverless cars may lead to fewer crashes.	3.11	0.95
Driverless cars may reduce traffic congestion.	3.09	1.12
Driverless cars may lead to lower fuel consumption.	3.42	1.03
Driverless cars may help to increase human productivity.	3.5	0.97
Driverless cars may help elderly and disabled be more independent.	3.84	0.98
Positive affect		
On a scale of 1 – 5 (1 = not at all; 5 = extremely), to what extent does the development of driverless cars makes you feel:		
Enthusiastic	2.84	1.13
Excited	2.85	1.13
Negative affect		
On a scale of 1 – 5 (1 = not at all; 5 = extremely), to what extent does the development of driverless cars makes you feel:		
Worried	2.62	0.96
Frightened	2.3	1.01
Angry	1.46	0.87
Attention to mass media		

On a scale of 1 – 5 (1 = No attention at all, 5 = A lot of attention), how much attention do you pay to messages related to driverless cars from the online and offline versions of the following sources?		
Science magazine	2.25	1.07
Science-themed movies	2.51	1.11
Science-themed documentaries	2.67	1.14
News	3.22	1.01
Attention to user-generated content		
On a scale of 1 – 5 (1 = No attention at all, 5 = A lot of attention), how much attention do you pay to messages related to driverless cars from the online and offline versions of the following sources?		
Blogs (e.g., BlogSpot, WordPress)	2.06	0.97
Wikis (e.g., Wikipedia, Wiktionary)	2.38	1.06
Social networking sites (e.g., Facebook, Twitter, YouTube)	2.61	1.10
General science knowledge		
For each of the following statements, please indicate whether it is true or false.		
Lasers work by focusing sound waves. (F)	0.56	0.50
The center of the Earth is very hot. (T)	0.88	0.32
Antibiotics kill viruses as well as bacteria. (F)	0.48	0.50
Electrons are smaller than atoms. (T)	0.62	0.48
All radioactivity is man-made. (F)	0.7	0.46
(Statements that are true are indicated with (T); Statements that are false are indicated with (F))		
Domain specific knowledge		
For each of the following statements, please indicate whether it is true or false.		
Driverless cars have only one level of automation. (F)	0.55	0.50
Artificial intelligence is key for the development of driverless cars. (T)	0.86	0.35
Driverless cars can drive in complete darkness without the need of headlights. (T)	0.51	0.50
Most driverless car-related accidents that have happened have been due to human error. (T)	0.43	0.50
Fully driverless cars can guide themselves without human intervention. (T)	0.68	0.47
(Statements that are true are indicated with (T); Statements that are false are indicated with (F))		

Table 2. *Stepwise hierarchical regression model for factors predicting public willingness to use driverless cars*

Variables	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β
Block 1: Demographics					
Gender	0.14***	0.01	0.00	-0.01	-0.01
Education	0.06	0.00	0.00	0.00	-0.01
Income	0.03	-0.01	-0.01	-0.02	-0.03
Age	-0.09*	-0.06**	-0.07**	-0.07**	-0.06**
Driver License Ownership	-0.01	0.01	0.01	0.01	0.01
Car Ownership	-0.01	-0.02	-0.02	-0.02	-0.01
Marital Status	-0.03	0.02	0.01	0.01	0.01
Incremental R^2 (%)	2.50***				
Block 2: Value predispositions					
Deference to scientific authority		0.12***	0.12***	0.12***	0.06*
Religiosity		0.01	0.00	0.00	0.01
Positive affect		0.60***	0.58***	0.58***	0.49***
Negative affect		-0.30***	-0.30***	-0.29***	-0.23***
Incremental R^2 (%)		59.50***			
Block 3: Media attention					
Attention to mass media			0.10***	0.09**	0.09**
Attention to user-generated media			-0.06*	-0.06*	-0.04
Incremental R^2 (%)			2.50**		
Block 4: Scientific knowledge					
General science knowledge				0.01	-0.01
Domain specific knowledge				0.04	0.04
Incremental R^2 (%)				0.01	
Block 5: Perceptions					
Risk perception					-0.06**
Benefit perception					0.19***
Incremental R^2 (%)					0.19**
Total R^2 (%)					64.70***

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