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COMPARING THE INTENT TO USE AUTONOMOUS VEHICLES BETWEEN RURAL AND URBAN AREAS

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ABSTRACT

Objective: Autonomous vehicles have the potential to change mobility as we know it. And with many major car manufacturers and tech giants developing and testing autonomous vehicles, it may seem like we will see widespread use on our roads soon. However, prediction about when and if autonomous vehicles will be adopted differs greatly from a few years to over seventy years. To determine whether or how adoption will occur, it is vital to determine why and how people will embrace autonomous vehicle technology and are intended to use it. Most research is currently focused on urban areas with tech hubs like cities and universities at the forefront of testing, leaving other potential beneficial areas like rural ones out of the equation. These areas stand to gain a lot from autonomous vehicles as they could improve mobility and accessibility. In that way, rural areas are often seen as the biggest beneficiaries of autonomous vehicles. Additionally, researchers are in consensus that it is crucial to investigate new populations to determine when and how widespread adoption of driverless technology will occur.

This research compares rural and urban populations to identify the different factors that lead to intent and, ultimately, the adoption of autonomous vehicles—using the most current multi-level model for adopting autonomous vehicles (e.g. MAVA) developed by Nordhoff et al. in 2019. With this information, legislation makers, tech developers and researchers can develop new strategies and theories or change their focus related to the intention to use of autonomous vehicles for the broad public.

Method: Using an online survey to compare rural (N=62) and urban (N=139) populations by examining the intent to use autonomous vehicles and the specific factors affecting both populations. This evaluation was done by operationalising the MAVA model from Nordhoff et al. (2019), which consists of nine main acceptance classes for technology: (1) performance expectancy, (2) effort expectancy, (3) facilitating conditions, (4) safety, (3) service and vehicle characteristics, (6) social influence, (7) hedonic motivation, (8) perceived benefits and (9) perceived risks. Additionally, it uses the micro factors of initial exposure, tech attitude and travel behaviour (e.g. mobility) to predict the intent to use autonomous vehicles.

Results: The results displays that rural respondents are just as tech-savvy as urban respondents. Both are positive towards the intent of using an autonomous vehicle for various reasons. Even more so, 64,6% of rural respondents indicated that they would use autonomous vehicles compared to 64,0% of urban respondents. Rural respondents seem to base their choice on intent to use more on practical factors like how ‘will autonomous vehicles perform’ (vehicle performance) or ‘are they available to me’ (facilitating conditions, whilst urban respondents base their choice based on factors like ‘will it decrease my travelling time’ (vehicle characteristics), how hard is it to use one (effort expectancy) and is it safe to use an autonomous vehicle (safety), that have a more direct gratification and self-gain aspect to it. This research also found subfactors for performance expectancy, social Influence and perceived benefits. The only significant factors for both populations are user benefits and hedonic motivation.

Conclusion: The results of this study confirm that society needs to broaden the scope of development for autonomous vehicles. It identifies that in contrast to only testing in urban areas, policymakers, car manufacturers, and researchers also need to focus on rural areas. Rural respondents are just as tech-savvy and enthusiastic about the prospect of autonomous vehicles as their urban counterparts. Additionally, this research found subfactors within Performance expectancy, Social Influence and Perceived benefits showing that there is still much to be explored regarding the intention to use autonomous vehicles.

KEYWORDS:
Autonomous Vehicles; Rural Areas; Urban Areas; Technology Acceptance; Comparing intent to use

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INTRODUCTION

Our society is getting more and more driven by technology. The technical revolution has changed industries and the way we communicate. We even have technology assisting us in everyday chores like robots vacuum cleaning our house or serving us food in restaurants. However, when it comes to mobility, specific steps of automation have not been taken yet. Whilst autopilot has become the standard in air-, boat- or train traffic with autonomous vehicles, this consensus has not been reached (Fortunati, Lugano & Manganelli, 2019; International Transport Forum, 2015; Nordhoff, Kyriakidis, Arem & Happee, 2019). This is interesting because the concept of autonomous vehicles is not new. It was first introduced at the world fair of 1939 in Chicago by General Motors and designer Norman Bel Geddes. This, however, was still an assisted driving vehicle that used wires on the road to follow a route, in contrast to a fully autonomous vehicle. It would not be until 2014 that the first autonomous vehicles truly capable of driving without a specific infrastructure became available on the road in silicon valley.

Early research in the field of autonomous vehicles was not as optimistic either. In 1992 Underwood even stated that market share would be around 5% in 2075 and would never even reach 50%. More recent predictions for the widespread use of autonomous technology are more positive and range from 2025 to 2050 (Benenson, Petti, Fraichard & Parent, 2008; Chottani, Hastings, Murnane & Neuhaus, 2018; Godoy, Pérez, Onieva, Villagrá, Milané & Haber, 2015; McKinsey & Company, 2016). Making it hard to say when autonomous vehicles will be fully adapted on a broad scale. Bekiaris, Petica, Vicens, Portouli, Papakonstantinou, Peters, & Damiani (1996) studied the acceptance of systems that could assist impaired drivers in nine European countries. At this point, most respondents rejected the notion of using automated driving technology.

Whilst the first studies about autonomous driving mainly focused on the feasibility of the technology; lately, an interest in the social science field can also be seen. Power (2012) is one of the first to conduct a large-scale research surveying 17,400 respondents in the USA. During the research, Power (2012) found that 37% of respondents would be interested in autonomous vehicles, mostly males aged 18 to 37 living in an urban area. In 2013 Sommer carried out similar research in Germany, China, Japan and the USA that yielded a more negative response, with 31% of respondents expressing fear of driving in an autonomous vehicle and 54% indicating they think that the technology would not be reliable. Lee, Ward, Raue, D'Ambrosio and Coughlin (2017) researched attitude toward autonomous vehicles for different age groups by comparing the acceptance of self-driving vehicles between Millennials, Generation X, Baby Boomers and the Silent Generation. They found that age negatively affects the perception of autonomous vehicles and the intention to use them. The older their respondents were, the less interest they showed in autonomous vehicles. Additionally, their data showed that factors like trust in technology and age significantly impact how respondents feel about autonomous vehicles.

In 2019 Gkartzonikas and Gkritza reviewed 43 studies focusing on preference/choice experiments to examine potential user preferences/behaviours towards autonomous vehicles. All of these studies were done after 2012, highlighting how young the field of behavioural research within the domain of autonomous vehicles is. In their review, Gkartzonikas and Gkritza (2019) categorized the studies into eight objectives ranging from the level of awareness to the likelihood of adopting autonomous vehicles. Even more so, Gkartzonikas and Gkritza (2019) defined nine antecedents for the willingness to use or adopt autonomous vehicles being (1) awareness of autonomous vehicles, (2) consumer innovativeness; (3) safety; (4) trust of strangers; (5) environmental concerns; (6) relative advantage, compatibility, complexity; (7) subjective norms, which reflect external social pressures; (8) self-efficacy, (9) driving-related seeking scale. These antecedents can be related to constructs used in most general technology adoption theories like the Technology acceptance model (Davis, 1985) and Motivation model (Davis et al., 1992) and UTUAT (Venkatesh et al. 2003). By doing so, Gkartzonikas and Gkritza (2019) provide a much-needed baseline for future researchers in the field.

Nordhoff et al. (2019) use similar antecedents and theories to theorise a comprehensive multi-level model on automated vehicle acceptance (e.g. MAVA-model) to explain the willingness to use autonomous vehicles. In their model, they used four stages and the nine predictors (1) Performance Expectancy, (2) Effort Expectancy, (3) Facilitating conditions, (4) Safety, (5) Vehicle Characteristics, (6) Social Influence, (7) Hedonic motivation, (8) Perceived Benefits and (9)Perceived Risks examining what factors play a role in the intent to use autonomous vehicles. Using the MAVA model, researchers can now start looking at how and for what reasons the general public will intent to use autonomous technology, which is seen as one critical factor for the adoption of autonomous vehicles by many researchers (Bansal, Kockelman & Singh, 2016; Fortunati et al., 2019; Kyriakidis, Happee, & De Winter, 2015; Kaur & Rampersad, 2018; Nordhoff, De Winter, Kyriakidis, Van Arem, & Happee, 2018).

Till now, like with most technology and that of autonomous vehicles is no exemption. Many researchers see the possible adoption of autonomous vehicles happening in smart cities and tech hubs like universities or Silicon Valley. Research has focused chiefly on specialists' opinions or early adapters like students or car owners in urban areas (Fortunati et al., 2019; Gkartzonikas & Gkritza, 2019; Nordhoff et al., 2019). Meanwhile, the possibilities for other demographical groups are not explored. A deficit that researchers like Raj, Kumar & Bansal (2020), Fortunati et al. (2019) and Nordhoff et al. (2016) acknowledge. Because for an entire society to embrace autonomous vehicles, it is essential to research different geographical groups and their barriers to the intent to use and adopt the technology. This paper addresses this deficit by comparing the intent to use autonomous vehicles in different areas. More specifically, that of rural areas versus urban areas.

As is often seen with newer technology, rural areas as a demographic group are often overlooked (Chmielewski, 2018; Eurofond, 2019; Vitale Brovarone & Cotella, 2020). This is likely because most new technology is developed in urban areas before being introduced into rural areas. On the other side, it has to do with the demographics and cognitive beliefs of the population in rural areas concerning new technology, also known as the digital divide. The digital divide describes how gaps between digital skills and trust exist within certain societal groups. It stipulates that urban groups usually are better at using technology and, therefore, have higher trust and confidence in it. Rural populations are often mentioned on the other side of the spectrum (Cullen, 2001; Vanan & Subramani, 2015), having lower digital skills and less trust in new technology.

Additionally, declining mobility, connectivity, and a dwindling younger population in rural areas are problems that do not help achieve social and economic growth (Chmielewski, 2018; Eurofond, 2019; European Commission, 2020). Studies like Meyer, Becker, Bösch, & Axhausen (2017) and Chmielewski (2018) point out that autonomous vehicles can help with the various social and economic issues that threaten rural areas by improving accessibility and mobility. Additionally, living standards for the current, growing elderly population could see drastic improvements when introducing autonomous vehicles. However, with little known about the preferences of the rural population when it comes to the intent of using autonomous vehicles, developers and policymakers alike cannot move forward. Therefore it is essential to research and compare the intent to use autonomous vehicles between various geographical groups like urban and rural. That is why the main research question this study is seeking to answer is:

In what way does the intent to use autonomous vehicles as a mode of transport, and the factors that are crucial to do so, differ between rural and urban areas?

This research will give insight into how different geographical groups intend to use autonomous vehicles—using the MAVA model from Nordhoff et al. (2019) in cross-sectional analysis to identify and compare the intent to use autonomous vehicles between rural and urban areas. By researching which factors are crucial for the intent to use autonomous vehicles, academics, policymakers, and technology companies will have more insight into the adoption process of autonomous vehicle technology by the general public.

THEORETICAL FRAMEWORK

The definition of autonomous vehicles

Self-driving cars, otherwise known as autonomous vehicles, are seen as one of the new disruptive technologies in the 21st century. They can revolutionise how we travel due to their ability to move without human drivers (Knight, 2016; Meyer et al., 2019). That is why it is no wonder that there is an interest in the domain of social, political, and business environments, with researchers from technical and social science being curious about the attitudes, perceptions, views, and emotions our society has towards Autonomous vehicles (Gkartzonikas & Gkritza 2019).

The first attempt at an autonomous vehicle stems back to October 1957, when General Motors and Radio Corporation of America showcased their first concept of a self-driving car that could maintain course on a specially designed track with embedded wires. After that, it was not sooner than 2005 that the world would see the first successful attempts at autonomous vehicles during a Defense Advanced Research Projects Agency staged self-driving car race (Baker, 2017). Out of the five vehicles to finish the 132-mile race, a modified Volkswagen Touareg from Stanford University was the first to cross the line. By doing so, the team of researchers showed the world that the technology was becoming feasible. In 2014 the first autonomous vehicles from Google came available on the road in silicon valley. In the meantime, many other car manufacturers and technology-driven companies have shown interest in creating autonomous vehicles to provide future mobility.

Even with research rapidly increasing over the last decade, most cars on the road are still not truly autonomous vehicles. Nonetheless, car manufacturers use the term self-driving car or autonomous vehicles loosely. Many car brands present these semi-autonomous vehicles to the market, calling them self-driving cars. Nordhoff, Arem & Happee (2016) mentions that most of these are driver-assisted rather than replacing the driver. To fully understand the spectrum of Autonomous vehicles, one should be aware that there are six levels of car automation. These range from level 0 semi-automated vehicles with functions like blind-spot warning up to level 5, a fully automated vehicle that functions in all conditions (SEA International, 2018). Research on the general opinions, concerns and acceptance of assisted driving features by the likes of Kyriakidis et al. (2014), Schoettle & Sivak (2015) and Power (2016) largely neglected systems at levels 4 and 5. Therefore it is essential to distinguish between partial and fully automated vehicles (Fortunati & Manganelli, 2019). Since one can assume that a higher level of automation will result in a more significant impact on society and the way people travel, this paper will always refer to level 5 autonomous vehicles.

Adoption of autonomous vehicle technology

Global use of autonomous driving technology remains an often-discussed topic, and there is much uncertainty regarding when this will be realised (Fortunati & Manganelli, 2019; Litman, 2017; International Transport Forum, 2015). Google, a pioneer in Autonomous vehicles, predicted that its first fully autonomous car would be in operation by 2020. The company has indeed been testing such vehicles in designated areas and cities adapted to host them. However, it is not yet ready for widespread consumer use, showing how hard it is to predict accurate technology adoption. Researchers like Benenson et al. (2008) and Godoy et al. (2015) acknowledge this. They believe that driverless cars will not become mainstream on most roads globally in the immediate future. This seems to be the case, with the latest predictions about the adoption of autonomous vehicles ranging from 2025 to 2050 (Chottani et al. 2018; McKinsey & Company 2016). It is, however, more likely that adoption will first take place in a closed environment such as a university campus, airport, golf course, holiday park, retirement homes (Miralles-Guasch & Domene, 2010) or public transport (Nordhoff et al., 2016).

A crucial factor affecting autonomous vehicle success is whether and how people will find the idea and technology of autonomous vehicles and its technology (Bansal et al., 2016; Fortunati et al., 2019; Kaur & Rampersad, 2018; Kyriakidis et al., 2015; Nordhoff et al., 2018). Like many other technological innovations before it, Raj et al. (2020) and Bagloee, Tavana, Asadi & Oliver (2016) stipulate that there are physical (e.g. infrastructure, policy and regulation development) and psychological barriers (e.g. public perception, security, trust, privacy, reliability) to the adoption of autonomous vehicles. They state that with many physical barriers slowly breaking down because the technology is maturing and policymakers recognising the potential for society, research should focus more on psychological barriers.

Shabanpour, Golshani, Shamshiripour, & Mohammadian (2018) also mention that the adoption behaviour of autonomous vehicles is expected to be subject to a considerable degree of heterogeneity. Meaning, that groups and people have different sensitivity toward various attributes, making adaption a complex equation. A majority (71%) of the researcher's attention has been devoted to technological, particularly engineering and computer science, and economic aspects of autonomous vehicles (Cavoli, Phillips, Cohen & Jones, 2017), leaving research in social science (less than 6%) in the background.

Cavoli et al. (2017) point out, "With the pace that autonomous vehicle technology is developing, there is an urge to understand the associated social, behavioural and societal issues." In autonomous vehicles' adoption behaviour research (Fortunati et al., 2019; Shabanpour et al., 2018), only 3% of the studies contribute to the social aspect of adoption (Gkartzonikas & Gkritza, 2019). Even more so, early studies in this area used simplistic descriptive analyses to investigate the associations between individuals' demographic characteristics and their opinions about autonomous vehicles (Kyriakidis et al., 2015; Payre, Cestac & Delhomme, 2014; Schoettle & Sivak, 2014). Nonetheless, this research has already given valuable insight into all the variables that could be important for adopting autonomous vehicles.

Mobility & Accessibility in urban vs rural settings

Most research focuses on closed environments or heavily populated areas like cities (e.g. urban areas), whilst rural areas' possible benefits, or negative impacts, are often neglected. However, shifting focus might be needed to address one major issue in rural areas: low accessibility and lacking mobility.

First introduced by Hansen in 1959, accessibility describes the interaction between the geographical characteristics, socio-economics and mobility within a region. Later research has well established that if accessibility in an area is good, people are more likely to populate such an area. Hansen's theory seems true regarding how the world population is divided. Most people live in urban areas like cities with high accessibility. Vice versa, areas with low accessibility, like rural areas, have a lower population density. A factor that strongly influences accessibility is mobility. It significantly impacts the level of accessibility in a region (Vitale et al., 2020). Additionally, it connects areas and their population, leading to an increase in socio-economics.

The gap between accessibility and mobility in rural and urban areas is becoming bigger and bigger. Whereas urban areas are highly connected with good accessibility, rural connectivity has become a political and social problem worldwide (Chmielewski, 2018; European Commission, 2020; Vitale et al., 2020). In the last decade, public transport has become less connected in rural areas; therefore, people are very dependent on the use of cars (Alessandrini, Cattivera, Holguin, & Stam, 2014; Regan, Horberry & Stevens, 2014; Vitale et al. 2020). This difference can lead to mobility exclusion for people who do not have access to a car or cannot drive one.

Mobility Exclusion, or Mobility Inclusion, is essential for the living standards of an area. When mobility inclusion is reached, these areas become more attractive and achieve higher socio-economic standards, as reflected when looking at urban areas. They are all highly populated economic hubs with solid connectivity and mobility. Due to this, urban areas have all the positive precursors to become the first choice when developing and implementing new technology. In contrast, the opposite is happening to rural areas, resulting in less investment and dwindling living standards due to mobility exclusion. Mobility exclusion in rural areas is a result of the following five factors: (1) Rural areas usually have less connection to the public transport system when compared to urban areas; (2) Traveling distances and the time needed to travel somewhere tends to be longer compared to urban areas; (3) Rural areas can be harder to reach due to conditions like bad roads; (4) There are lesser taxi's or Ubers available (5) travelling is more expensive due to all the previously mentioned reasons (Chmielewski, 2018; Vitale et al. 2020).

Shabanpour et al. (2018) states that automation technology can profoundly impact mobility and transportation systems. Hence, it can solve the mobility exclusion of rural areas. It is also believed to have the potential to improve and change people's lifestyles (Fagnant, Kockelman & Bansal, 2015; Harper, Hendrickson, Mangones & Samaras, 2016; Shabanpour et al., 2018). An example of this is that of older people and those with disabilities who cannot drive. By introducing autonomous vehicles, they can access transport, increasing their mobility. In a highly connected environment (e.g. urban areas), this group would not be hit as hard by mobility exclusion compared to the lesser connected environments (e.g. rural areas). Meyer et al. (2017) confirms this when exploring the increase in mobility that autonomous vehicles can bring to Switzerland. The most substantial increases were seen in rural areas, while urban areas even got negatively impacted.

With younger people being drivers for socio-economic improvements and increasing accessibility, having them depart from rural areas due to a lack of mobility significantly impacts the area. To counter the lack of mobility, it is crucial to look for ways to improve mobility in rural areas (Vitale et al., 2020). Some researchers have also compared the intent to use autonomous vehicles between groups that use different modes of transport. Bansal, Kockelman, and Singh (2016) and Zmud, Sener and Wagner (2016) found that people commuting by car were less likely to use shared autonomous vehicles than public transport users.

With mobility potentially having such a high impact on increasing living standards for rural areas compared to urban areas, and therefore state that:

H1: Mobility will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.

Technology acceptance of autonomous driving

Research about how and why individuals adopt new information technology is by no means new in social research. Over the past decades, various theoretical models, like the Theory of reasoned action (Fishbein & Ajzen, 1977) and the Technology acceptance model (Davis, 1985), have been proposed to explain how individuals adopt and use new technologies. These models are primarily rooted in the psychological and sociological field, going back to the basics of the uses and gratifications theory (Lasswell, 1948) states that people actively seek out specific experiences to satisfy their needs.

With society becoming more technology-driven, most policymakers and researchers have been looking toward new technology to improve living standards, making technology acceptance an even more important field for social research. With this importance, more comprehensive models for technology acceptance have been developed. In 2003 Venkatesh, Morris, Davis, & Davis proposed the Unified Theory of Acceptance and Use of Technology (UTAUT) after a comprehensive review of the eight most significant acceptance models.

The models Venkatesh et al. (2003) reviewed were: (1) Personal Computer Usage Model (Thompson, Higgins & Howell, 1994), (2) Innovation Diffusion Theory (Rogers, 1995), (3) Technology Acceptance Model (Davis, 1985), (4) Theory of Reasoned Action (Fishbein & Ajzen, 1977), (5) Combined TAM-PBT (Taylor & Todd, 1995), (6) Theory of Planned Behavior (Ajzen, 1991) (7) Social Cognitive Theory (Bandura,1989) and (8) Motivational Model (Davis, Bagozzi, & Warshaw, 1992).

After their review, Veskenash et al. (2003) is UTAUT consists of four factors: (1) performance expectancy, (2) social influence, (3) effort expectancy and (4) facilitating conditions. In addition, Venkatesh et al. (2003) included four intermediate individual variation variables to predict the relationship between the primary factors and the behavioural intent and use of technology. Since the study by Venkatesh et al. (2003) got published, the UTAUT has been one of the most used theories to explain technology compatibility. As expected, the UTUAT is also a popular model in the field of autonomous vehicle acceptance. Researchers like Kaur & Rampersad (2018) and Nordhoff et al. (2019) have used UTAUT to create an explicit model for the intent to use and adoption of autonomous vehicles. Even so, Shabanpour et al. (2018) mention that, when it comes to autonomous vehicles, the potential in investigating the use of acceptance models has not yet been exploited to its fullest. But lately, Nordhoff et al. (2016) have made strides in creating conceptual models for autonomous vehicle adoption.

Multi-level model on automated vehicle acceptance

In 2016 Nordhoff et al. started developing the autonomous vehicle acceptance model (AVA). A model based on two dominant theories in technology acceptance: the UTAUT from Venkatesh et al. (2003) and the Pleasure-Arousal-Dominance-Framework (PAD) from Mehrabian and Russel (1974). During re-evaluation in 2018, the AVA model got expanded by adding a multi-level factor using UTAUT3 (Venkatesh, Thong, & Xu, 2016) and the Car Technology Acceptance Model (CTAM) of Osswald, Wurhofer, Trösterer, Beck and Tscheligi (2012). Nordhoff et al. (2018) later mention: "Current studies on Autonomous Vehicle Acceptance do not capture a multi-determination. Instead, they mainly investigate the influence of factors in isolation, and through the lenses of technology acceptance."Acknowledging the following leads to the creation of the multi-level model on automated vehicle acceptance; the MAVA model, as seen in figure 1, was developed in 2019.

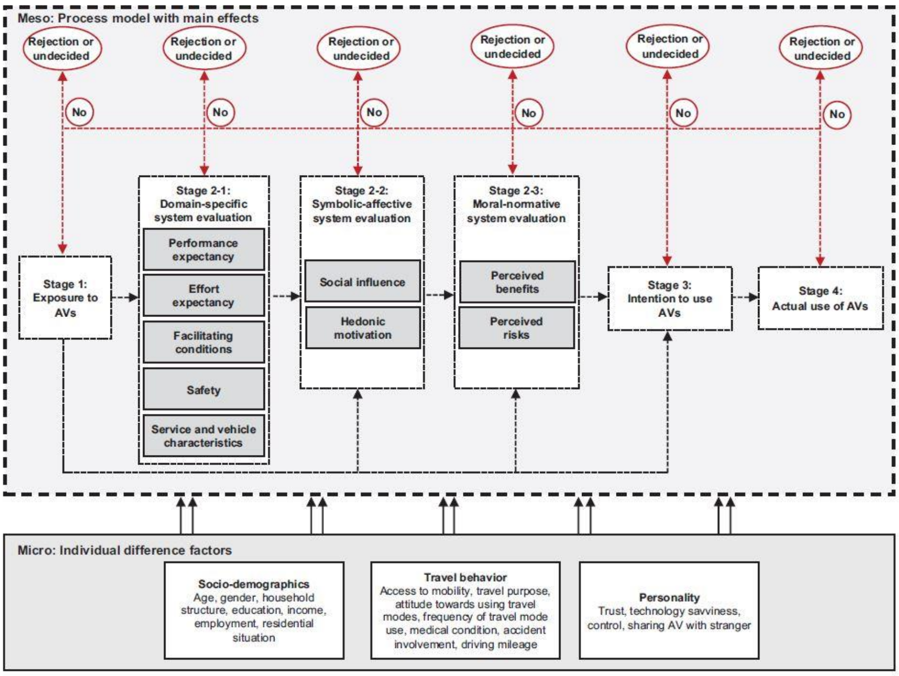

figure 1: MAVA as proposed by Nordhoff et al. (2019)

Even though the MAVA model is still theoretical, it is, at its core, the most comprehensive model for testing the willingness to use and adopt autonomous vehicles to date. Combining a process-oriented view based on Maslow's (1954) hierarchy of human needs and modern models like UTUAT and CTAM resulted in the best fit to predict and compare how different demographic groups will adopt autonomous vehicles.

Using the four stages (1) exposure to autonomous vehicles, (2) formation of favourable or unfavourable attitudes towards autonomous vehicles, (3) decision to adopt or reject autonomous vehicles and (4) implementation of autonomous vehicles into practice, Nordhoff et al. (2019) outline that the steps towards adaption are more of a process rather than being predicted by one or more factors. Underlying these steps is a multi-level adoption model based on the Domain-Specific-, Symbolic-Affective- & Moral-Normative system evaluation factors that we see in UTAUT. Additional theoretical foundation is found within the Car Technology Acceptance Model (CTAM) introduced by Osswald et al. in 2012. CTAM posits that in-car technology acceptance is associated with the UTAUT constructs performance and effort expectancy, social influence and facilitating conditions adding the factor of perceived safety to get a complete overview of how the adoption of car technology takes place.

Using this theoretical foundation, Nordhoff et al. (2019) created the MAVA model that incorporates Micro and Meso acceptance factors representing nine main acceptance classes: (1) performance expectancy, (2) effort expectancy, (3) facilitating conditions, (4) safety (3) service and vehicle characteristics, (6) social influence, (7) hedonic motivation, (8) perceived benefits and (9) perceived risks. New within the model are hedonic motivation and social influence. Incorporating these two factors is seen as essential by Nordhoff (2018) as they have been found to have a significant impact on consumer adoption behaviour and intentions for privately owned vehicles. Nordhoff bases this assumption on previous research by Panagiotopoulos & Dimitrakopoulos (2018), Rezvani et al. (2015) and Steg et al. (2001).

With the MAVA model being the newest and most complete model, using both UTUAT and Micro factors, it seems like the best model to use for this study to compare the intent to use autonomous vehicles between rural and urban demographic groups.

Micro: individual difference factors

Within the MAVA model, micro factors are influential in all four steps of the model. Besides the more common social demographics like age, gender, education and living situation, Nordhoff (2019) also incorporates travel behaviour (e.g. Mobility) and personality, which reflect items like exposure to technology and trust in technology.

Initial exposure to autonomous vehicles

Considering to use it is impossible without people being cognitively aware of a specific technology. That is why initial exposure and introduction to new technology like autonomous vehicles is an important factor before people consider potentially adopting. Using this philosophy, Nordhoff et al. (2019) state that the first step in adopting autonomous vehicles is exposure to autonomous vehicles. This is in line with how consumers acquire, represent and encode advertising information before purchasing (Bargh, 1984).

Even more so, research was done by Sommer (2013) for continental AG that suggested that the concept of automated driving is not as well known in all countries. The study found that whilst more than two third of the respondents in Germany and China were aware of autonomous vehicles, only one-third of respondents in Japan were.

Even though this hypothesis seems logical, it has not been tested concerning autonomous vehicles. Therefore it is the hypothesis that:

H2 *Initial exposure to autonomous vehicles is equally significant to the intention to use autonomous vehicles in rural and urban areas.*

Tech attitude

Attitude is anchored within the social research domain. It stems back to the tri-component attitude model (Rosenberg, Hovland, McGuire, Abelson & Brehm 1960), which stipulates that attitude is formed on an affective, behavioural, and cognitive component. Since 1960 many theories like Fishbein and Ajzen's (1967) Theory of Reasoned Action have used the component attitude or equivalents like subjective norm to predict behaviour. These beliefs also hold regarding models predicting intent to use and adoption of autonomous vehicle technology. Nordhoff et al. (2019) incorporate attitude toward technology as a personality-related factor, saying that it plays a vital role in how the technology of autonomous vehicles will be perceived. This is based on the findings by Bansal et al. (2016) and Lavieri, Garikapati, Bhat, Pendyala, Astroza and Dias (2017). They found that tech-savvy individuals, e.g. individuals with a positive attitude towards technology, are likely to be early adopters of autonomous vehicles. Haboucha, Ishaq, and Shiftan (2017) solidify this theory by discovering that individuals with a higher interest in technology were more likely to choose autonomous vehicles as their mode of transport. Whilst, Wien (2019) found a positive relationship between interest in technology and the perceived utility and the use of an automated bus.

Tech-savvy individuals are often portrayed as young males between 18 and 35 living in an urban environment with a keen interest in trying out new technology. Laggards or late adopters of technology are often elderly living in rural areas. Research in acceptance of autonomous vehicles shows the same beliefs, with Lee et al. (2017) finding a significant relationship between age and the interest in autonomous vehicles, with older generations less favouring the technology than younger generations. Therefore it is stated that:

H3 Tech attitude will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas.

Domain-specific system evaluation

Domain-specific system evaluation is dedicated to the factors like Effort Expectancy, Performance Expectancy, Facilitating Conditions, Vehicle characteristics and Trust in safety that influence and determine how technology will function. According to Nordhoff et al. (2019), it plays a fundamental role in the intent to use and adopt autonomous vehicles. This is a statement based on research by Nieuwenhuijsen, de Almeida Correia, Milakis, van Arem and van Daalen (2018). They state that safety and comfort determine the attractiveness of the intention to use autonomous vehicles.

Performance expectancy

Performance expectancy or its equivalent perceived usefulness is significantly associated with the intent to use autonomous vehicles (Kaur & Rampersad, 2018; Nordhoff et al., 2019). In 2018 Nordhoff et al. measured performance expectancy and effort expectancy using the component' shuttle effectiveness' and found a positive correlation. Since fully autonomous vehicles have not been developed, their performance is difficult to predict. However, experts expect that autonomous vehicles will outperform traditional vehicles (Paden, Čáp, Yong, Yershov & Frazzoli, 2016). Comprehensive testing by driving thousands of miles with various AV prototypes confirms this prediction. However, some feel more testing is needed. (Raj et al., 2020).

Kyriakidis et al. (2015) mention that autonomous vehicles will not only outperform regular cars on a technical level and safety but can increase passenger performance too. But when it comes to rural areas, critics of the technology raise some concerns related to the performance of autonomous vehicles. A concern is the idea that the technology is not mature and has primarily been tested in closed environments or urban areas. These environments generally have good connectivity that can optimally support autonomous vehicle technology, which is not always the case in rural areas. With rural areas being prone to lesser mobile connectivity, non-paved roads and other technical challenges (Chmielewski, 2018; Eurofound, 2019), it will be more likely that concerns around the performance of the technology can occur amongst the population. That is why we stipulate that,

H4 Performance expectancy will have a more significant impact on the intention to use autonomous vehicles in rural compared to urban areas.

Effort expectancy

Venkatesh et al. (2003) refer to effort expectancy as the level of ease an individual will achieve while using technology, e.g. the effort needed to use the system. According to the UTAUT, developed by Venkatesh et al. 2003, effort expectancy influence the behavioural intention of an individual to use technology.

Kaur & Rampersad (2018) hypothesize that performance expectancy positively influences intent to adopt autonomous vehicles, but they do not find significant evidence for this during their research. Their stipulation is based on predictions that autonomous vehicles will outperform traditional driving and can even enhance the performance of passengers (Kyriakadis et al., 2015). Nordhoff et al. (2018) measured an equivalent of effort expectancy called ‘shuttle effectiveness’ (e.g. how easy it is to use the autonomous shuttle) in their research with autonomous shuttles. They found that this factor significantly correlated with the intention to use the shuttle.

Dino & de Guzman (2015) discovered that effort expectancy negatively influenced the intent to use Tele-Healthcare for the elderly. This is similar in research about autonomous vehicles; older respondents do not show much interest or motivation in using self-driving cars (Bansal et al., 2016; König & Neumayr, 2017; Kyriakidis et al., 2015). Nordhoff et al. (2019) also suggest that the demographic factor of age strongly influences performance expectancy and behavioural intention. A confirmation was made by research by Adler and Rottunda (2016) and Chen and Chan (2011), who both show that older adults expressed less confidence in their ability to use new technology successfully. Concluding on the fact that rural areas, on average, have a more ageing population compared to urban areas, it is hypothesised that:

H5 *Effort expectancy will have less impact on the intention to use autonomous vehicles in rural compared to urban areas.*

Trust in Safety

Generally, people do not trust something unsafe, making safety an essential factor for adopting technology. This is not different for autonomous vehicles, with safety being one of the key drivers influencing the intent to use the technology. (Bansal & Kockelman, 2018; Brell et al., 2019; Cho, Park, Park & Jung, 2017; Gkartzonikas & Gkritza, 2019; Nordhoff et al., 2019 Rovira, McLaughlin, Pak, High, 2019). Topics included when evaluating safety are equipment and system failure, cybersecurity and system performance in unexpected conditions like bad terrain or weather (Nordhoff et al., 2019).

Bansal en Kockelmann (2018) conducted expert interviews, and more than one-quarter of experts agreed that autonomous vehicles must be at least twice as safe as conventional vehicles. During the same research, they also found that people who have been in accidents with regular cars are more likely to use autonomous vehicles. Kyriakidis et al. (2015) did a large-scale study in Europe that revealed that respondents were most concerned about information security issues and legal liability associated with autonomous vehicles.

Related to safety is the individual factor of trust. Trust is seen as a good foundation for interaction between humans and machines (Hengstler, Enkel & Duelli., 2016), determining humans' willingness to depend on automated systems like autonomous vehicles (Hoff & Bashir 2015; Zhang, Tao, Qu, Zhang, Lin, & Zhang, 2018). Zmud and Sener (2017) revealed that lack of trust in the technology is a reason for not using autonomous vehicles for everyday use. The annual automated vehicle (AAA) survey in the USA found that this was still the case in 2019. During the survey, 63% of Americans indicated they lack trust in autonomous vehicles. Abraham, Reimer, Seppelt, Fitzgerald, Mehler and Coughlin (2016) contradict this finding by showing that more comfort using higher levels of automation can improve trust and is associated with the willingness to pay more for autonomous vehicles.

H6 *Trust in safety will have a more significant impact on the intention to use autonomous vehicles in rural compared to urban areas.*

Facilitating conditions

Facilitating conditions are knowns under many equivalents like perceived behavioural control, helpfulness, convenience, technical support, (technical) self-efficacy, conceptual compatibility, lifestyle fit and technology confidence. But it can be explained as an individual's belief in the availability of the needed organizational and technical tools for users to use a system.

Veskenash et al. (2003) incorporates facilitating conditions in UTAUT based on three definitions taken from other research. This first is the reflection of internal and external perception on constraints of behaviour that encompasses self-efficacy, resource facilitation and technology facilitation, which is based on Arzjen's Perceived Behavioural Control (1991). The second is objective factors that make an act easy to perform based on research by Thompson et al. (1991). The third is based on compatibility research from More and Benbasat (1991), measuring the degree to which an innovation is perceived as being consistent with existing values, needs and experiences of potential users.

The definition set by Veskenash et al. (2003) seems to have an equally important role in the intent to use autonomous vehicles. Howard and Dai (2014) used a questionnaire with video to explore opinions on autonomous vehicles, and they found that 61% of respondents said that convenience is one of the most attractive conditions of automated driving. In the same line, Madigan, Louw, Wilbrink, Schieben and Merat (2017) found that facilitating conditions positively impacted respondents' intent to use technology. In other words, autonomous vehicles need to be accessible and convenient for users, highlighting the need for designers and developers to provide a good infrastructure (e.g. facilitating conditions) for potential users. This is supported by Buckley, Kaye and Pradhan (2018), Brell, Philipsen and Ziefle (2019), Hewitt, Politis, Amanatidis and Sarkar (2019) and Jing, Huang, Ran, Zhan and Shi (2019), whom all found similar effects. Even more so, Osswald (2012) stipulates that facilitating conditions not only influence the intent to use but also directly influence the use of autonomous vehicles.

Taking into account that rural areas have mobility inequality (e.g. a lesser infrastructure & lower accessibility for mobility) compared to urban areas, it is therefore likely that it is more important for people living in a rural areas that a good infrastructure for autonomous vehicles is established before one can consider to use them. Therefore it is hypothesised:

H7 Facilitating conditions will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.

Vehicle characteristics

A core aspect of the intention to use new technology is the question: what can it do for me? Service and vehicle characteristics addressed this by attributing factors like comfort, availability and convenience for the user of the vehicles. Site, Filippi & Giustiniani (2011) revealed that comfort impacts how individuals rate autonomous vehicles. Krueger, Rashidi, and Rose (2016) added to this finding that travel time, waiting time and travel costs (e.g. convenience) are significant determinants of the intent to use autonomous vehicles. Nordhoff et al. (2019) had similar findings during their interview survey. A majority of respondents said that service aspects are important determinants for using autonomous vehicles.

An interesting study done by Bhat, Sen & Eluru (2019) compared vehicle characteristics based on location attribution. They found that rural households often have older trucks made for rugged terrain, compared to the urban and suburban households who own newer cars more geared towards driving pleasure. Interpreting the results of Bhat et al. (2019) shows us that vehicle characteristics can be seen differently by any social or demographic group but are important to fit the needs of the individual. Therefore we state that:

H8 Vehicle characteristics are equally significant for the intention to use autonomous vehicles in rural and urban areas

Symbolic-affective evaluation

Hedonic motivation and social influence are constructs within the Symbolic-affective domain of the MAVA model created by Nordhoff et al. (2019). It focuses mostly on instinctive intentions that affect decision-making and behaviour. Both factors play a significant role in the intention to use technology. This has been proven in research concerning private motorised cars and electric (semi)automated vehicles. (Panagiotopoulos & Dimitrakopoulos, 2018; Rezvani, Jansson & Bodin, 2015; Steg et al., 2001).

Hedonic Motivation

Hedonic motivation is an intrinsic motivation to initiate behaviours that create a positive experience whilst avoiding those that negatively affect it (Kaczmarek, 2017). Intrinsic motivation has had a role in technology acceptance ever since Carroll and Thomas (1988) discovered that fun/enjoyment is a key underlying factor of user acceptance. Davis, Bagozzi,& Warshaw (1992) confirms this theory by finding a positive interaction effect between enjoyment and usefulness. Or, as Davis et al. (1992) explain, “the effect of enjoyment on user acceptance of technology is high when the technology has a high-perceived usefulness and vice-versa.”

Hedonic motivation is seen as a strong predictor for Technology Adoption and is used by a majority (58%) of researchers operationalising the UTUAT model (Tamilmani, Rana, Prakasam & Dwivedi, 2019). Even more so, Tamilmani et al. (2019) found that hedonic motivation is an umbrella construct with a high correlation to Effort Expectancy, a dominant predictor of individual technology acceptance. This is in line with Hartwich, Beggiato, and Krems (2018), who state that affective variables are increasingly important for drivers' vehicle choices. They found a significant difference between enjoyment and intent to ride autonomous vehicles, validating Van der Heijden's (2004) theory that enjoyable technology is perceived as more useful and easier to use and will be adopted faster.

In contrast, there are concerns that autonomous vehicles may take pleasure out of driving because driving is regarded as an adventurous experience (Eyerman & Löfgren, 1995; Steg, 2005). Rödel, Stadler, Meschtscherjakov & Tscheligi (2014) have confirmed this and found that fun declines with a higher level of vehicle automation, whilst Kyriakidis et al. (2015), revealed that respondents rate manual driving as more enjoyable compared to fully automated.

H9 Hedonic motivation will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.

Social influence

The effect of social influence impacts the willingness to adopt technology has been controversial. Some have argued for including them in adoption models (Taylor & Todd, 1995; Thompson et al., 1991), while Davis et al. (1989) has not included them in their Technology Acceptance Model. It has also been found that the construct does work in a mandatory setting (Venkatesh & Davis, 2000), or it is more significant for older people or women in the early stages of experiencing the technology (Venkatesh & Morris, 2000). Even with all this controversy, Venkatesh et al. (2003) decided to include it in the UTUAT stating that the construct social influence does matter when it comes to intent to use technology.

The different views on the effect of social influence also persist in the acceptance of autonomous vehicles; Bansal and Kockelman (2018) show us that social pressure has a mixed opinion regarding the use of autonomous vehicles. Many respondents mentioned they do not care what their friend thinks about autonomous vehicles before using them, while others rely heavily on their friend's opinion. For example, older people living farther from bus stops but in an urban area seem more dependent on their friends' adoption rate. The opposite is stated by Acheampong and Cugurullo (2019), who only found a positive relationship between subjective norms, an equivalent of social influence, and perceived benefits

Assuming that rural areas often have a strong sense of social coherence (e.g. it matters what my neighbours think) and the demographical characteristics of rural areas tend to lean towards older people, we, therefore, state that:

H10 Social influence will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.

Moral-normative evaluation

Many researchers argue that perceived risks and benefits are critical factors in predicting the intention to use autonomous vehicles (Nordhoff et al., 2019; Kohl, Knigge, Baader, Böhm, & Krcmar, 2018; Raue, D'Ambrosio, Ward, Lee, Jacquillat, & Coughlin, 2019). Fraedrich and Lenz (2016) even state: "Automated vehicles will arguably only gain acceptance within society when the perceived benefit outweighs the expected risks." Several researchers like Ward, Raue, Lee, D'Ambrosio and Coughlin (2017), Piao, McDonald, Hounsell, Graindorge, Graindorge, and Malhene (2016) and Wu, Liao, Wang and Chen (2019) have found strong indications that benefits positively correlate and risks negatively correlate with the intent to use or buy an autonomous vehicle. With the risk-benefit evaluation taking place in the cognitive decision-making process of the intention to use, it is therefore vital to include these factors in future research that revolves around adopting autonomous vehicles.

Perceived risks

The impact of risk perception in autonomous driving has not fully been explored (Brell et al., 2019). Nonetheless, researchers often implicate topics like energy consumption, economic damage, public health and social risks when discussing perceived risks (Gkartzonikas & Gkritza, 2019; Nordhoff et al., 2019). Risks that the public tends to associate with autonomous vehicles typically include legal liability, data privacy, loss of driving skills or how the technology will interact with other cars, pedestrians or cyclists (Bansal & Kockelman, 2018; Bloom, Ramjohn, & Bauer, 2017; Fortunati et al., 2019; Gkartzonikas & Gkritza, 2019). These findings indicate that it is essential for the general public to know and assess the risks of how autonomous vehicles would interact with others on the road. But the perception of risks that come with autonomous vehicles is covered by negative press, resulting in uncertainty about the technology amongst potential adopters (Brell et al., 2019; Deloitte, 2022; Levin, Carrie, Wong & Woolf, 2016).

Brell et al. (2019) state that risk perceptions represent adaptive cognitions and emotions to cope with uncertainty and novel driving technology. This is in line with Renn (1998), who found that risk perceptions are a mechanism for people to be able to asses if it is justified to neglect concerns and risks in favour of taking a certain action like using new technology. By understanding perceived risks and the impact on the intent to use autonomous vehicles, society can get close to the global adoption of the technology.

To add to this, most people are acquainted with current traffic situations. Based on their own experiences and locus of control, they can imagine difficulties when navigating traffic daily. Comparing rural and urban traffic situations shows that daily traffic in urban areas is more complex and poses more risks to safety than on rural roads. This is something that most people living there would also be aware of, and with this research focussing the narrative from populations, it is therefore stated that:

H11 *Perceived risks will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.*

Perceived benefits

Perceived benefits of autonomous vehicles are often seen as factors like increased productivity, increased mobility, fewer accidents leading to lower insurance rates and lower repair costs, and quicker, less expensive parking (Fraedrich & Lenz, 2016; Nordhoff et al., 2019).

In 2013 Jardim, Quartulli and Casley had mixed results regarding the expected increased productivity. Whilst most of their respondents (40%) rated the items about productivity positive, one-third (32%) were neutral, and 28% did not have faith in autonomous vehicles increasing productivity during travel. Menon (2015) had similar results, showing us that highly educated respondents that drive alone feel they could increase their productivity using autonomous vehicles. The opposite can be said for older generations. Both studies report that older respondents are less likely to perceive travelling in an autonomous vehicle as a more productive way to spend time. Bansal and Kockelman (2018) confirm this finding, showing that younger respondents are willing to pay more for autonomous vehicles because of the promise of increasing connectivity and productivity.

Ease of driving, e.g. increased mobility due to not needing to drive yourself is often mentioned as a benefit of autonomous vehicles. In particular, people that are physically impaired are among those that will gain the most from the use of autonomous vehicles (Buckley et al., 2019). Brinkley, Posadas, Woodward and Gilbert (2017) explored the potential for autonomous vehicles in a focus group with the visually impaired. They found that their respondents were overwhelmingly optimistic about the potential of autonomous vehicles for individual mobility. Especially the freedom to move around without having friends or family needing to help was appealing to the respondents.

Menon (2015) found some scepticism related to the benefit of having fewer accidents and lower car insurance due to autonomous vehicles. In their research, older respondents (aged 50+) and females were less likely to see this as a benefit, but higher educated respondents and those with a higher income did.

Concerning what is generally known, on an average older demographic build-up of rural areas, it is expected that the benefits of autonomous vehicles will be less accepted compared to those in urban areas with a younger population.

H12 *Perceived benefits will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas*

A research model, as seen in Figures 2.1 and 2.2, has been developed to answer the hypothesis and research questions.

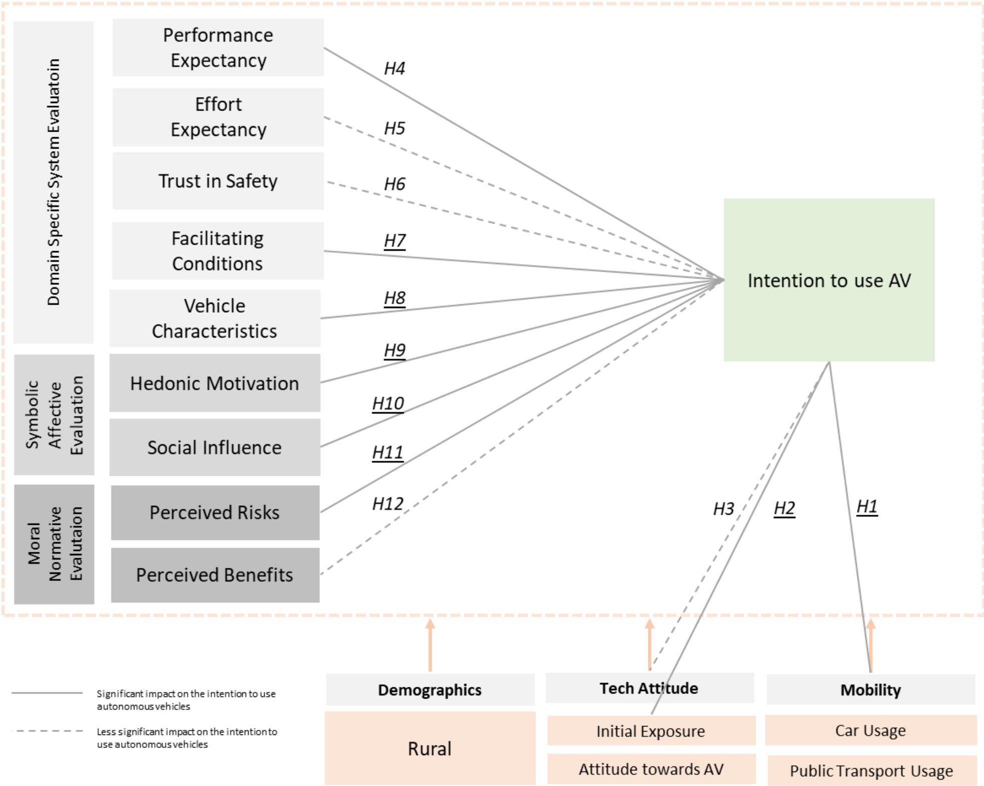

figure 2.1: Research model, significant predictors for rural areas

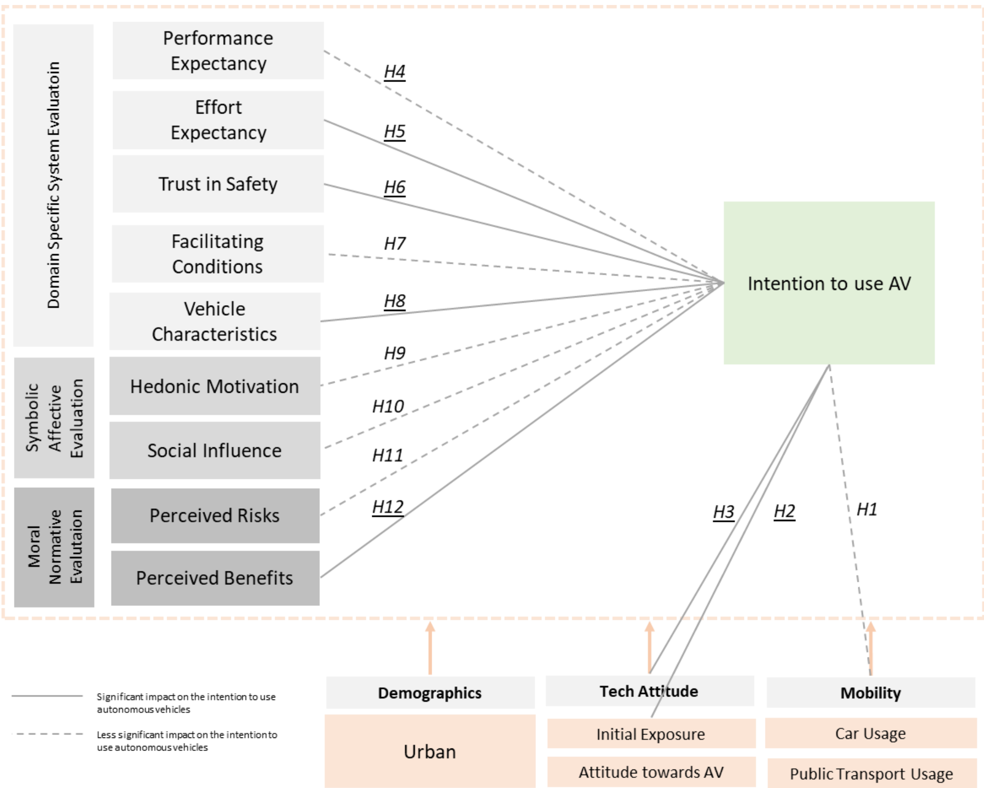

figure 3.2: Research model, significant predictors for urban areas

Table 1: Overview of Research Question and Hypothesis

Nr.	Hypothesis
RQ	In what way does the intent to use Autonomous vehicles as a mode of transport, and the factors that are crucial to do so, differ between rural and urban areas?
H1	Mobility will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas
H2	Initial exposure to autonomous vehicles is equally significant to the intention to use autonomous vehicles in rural and urban areas
H3	Tech attitude will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas
H4	Performance expectancy will have a more significant impact on the intent to use autonomous vehicles in rural compared to urban areas
H5	Effort expectancy will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas
H6	Trust in safety will have a more significant impact on the intention to use autonomous vehicles in rural compared to urban areas
H7	Facilitating conditions will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas
H8	Vehicle characteristics are equally significant for the intention to use autonomous vehicles in rural and urban areas
H9	Hedonic motivation will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas
H10	Social influence will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas
H11	Perceived risks will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas
H12	Perceived benefits will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas

METHODS

A confirmatory study operationalizing the MAVA model from Nordhoff et al. (2019) was conducted to understand and compare the intention to use autonomous vehicles in rural and urban areas. By examining the intent to use autonomous vehicles and then splitting the group into two populations, (1) rural and (2) urban, it was possible to compare the specific factors for each population.

An online survey was used to collect ordinal data that included the nine main and micro factors from the MAVA model from Nordhoff et al. (2019); see page 16 for the MAVA model. Online surveys are often used in social science and research about autonomous vehicles (Raj et al., 2020; Gkartzonikas & Gkritza, 2018). They are a modern method that can be quickly distributed and completed by various participants simultaneously (Downs & Adrian, 2004), thus reducing time effects. Another reason to choose an online questionnaire is that confidentiality is high compared to other methods (Downs & Adrian, 2004).

The survey was created in Qualtrics and distributed online using a voluntary sampling method. Distribution was done using social media networks and the website Surveyswap.io, a website dedicated to research for academics worldwide; respondents were gathered for two months. Respondents did not get screened to ensure a random sample was taken, but screening during the research was done to ensure that both groups (rural and urban) would be represented in the final data set. Since the distribution between rural and urban respondents was in line with normal demographic distribution, no adjustments or interventions to the sampling needed to be taken. Afterwards, the results got analysed using SPSS.

Before conducting the main online survey, a pre-test was necessary. The pre-test included a small sample of users filling out the survey to confirm its clarity, find any errors and time the survey to be 15 minutes as a benchmark for the study. Participants of this pre-test have been excluded from the sampling during the final data review.

MEASURES

Next to the nine independent factors that are discussed below, this included demographical factors and the two influential factors, tech attitude and mobility. All questions have been rated on a 5-points Likert scale ranging from strongly disagree to strongly agree unless otherwise stated below.

Performance expectancy (PE) was measured using nine items from Nordhoff et al. (2008) that have been reformulated to fit the current research. The nine questions were split into two sections, one asking respondents If they would like certain performance factors like: "I would like to have a panic button or control button". The second section questioned how they think that autonomous vehicles would perform using items like, "They are ready for off-road situations". For both sections, a 5-point-Likert-scale was used, ranging from definitely not to definitely yes.

Five items adapted from Nordhoff et al. (2018) and Chu (2019) were used to measure effort expectancy (EE), asking participants to what extent they agree with statements like "I think it will be easy for me to use one".

Facilitating conditions (FC) were measured using five items adapted from former research done by Acheampong and Cugurullo, F. (2019), Nordhoff et al. (2008), Venkatesh et al. (2003), Sripalawat, Thongmak & Ngarmyarn (2011). Exampled of the statements are "I will use one because it fits to my personal needs and living conditions".

Service & vehicle characteristics (VC) were measured using five statements adapted from Nordoff et al. (2018). Examples of the questions are: "I expect autonomous vehicles will be convenient and easy to use" or "Autonomous vehicles will give me flexible travelling options".

Trust in safety (TS) was measured using six items taken and adapted from previous research done by Nordhoff et al. (2018) and Acheampong and Cugurullo (2019). Participants were asked, "How likely do you think the following safety issues will occur using autonomous vehicle**s**?" having to rate items on a 5-point-Likert scale from Definitely not to Definitely yes. Examples of items used are "technical failure" and "terrorists taking over control."

Six statements were used to measure the hedonic motivation (HM) construct. All items have been adapted from former research by Hartwich, Beggiato and Krems (2018) and Nordhoff et al. (2018). Participants rated Items like "Using one will be exciting" and “Using an autonomous vehicle will be fun.”

Measurements for the independent variable social influence (SI) were split into two sections. The first section measured how opinion is formed and the second how participants perceive social status when using autonomous vehicles. All items were adapted from Nordhoff et al. (2018) and Acheampong and Cugurullo (2019). Section one contained four items with statements like, "My opinion about autonomous vehicles is based on news and media reports, " measured on a 5-point Likert scale rating from definitely not to definitely yes. Section two contained four items with questions like "I will travel in one if my friends and family do the same" and "I would gain respect and recognition in my community if I use one".

Perceived benefits (BF) were measured using eight items with questions like: "I think they will reduce travelling cost" and "parking in the city won't be an issue anymore". All items have been adapted from Nordhoff et al. (2018) and Acheampong and Cugurullo (2019).

The six items used to measure Perceived risks have been adapted from the research done by Nordhoff et al. in 2018. Participants had to rate questions like "It will be difficult to decide who has the legal liability in case of an accident."

Intention to use (IU) was measured using five items using a 5-point Likert scale rating from strongly disagree to strongly agree with questions like: " The idea of using an autonomous vehicle for transport is appealing to me”, "I intend to use an autonomous vehicle" and “I would encourage others to use autonomous vehicles”. All items have been adapted from Nordhoff et al. (2018).

VALIDITY & RELIABILITY ANALYSIS

Because the model researched is comprised of knowledge attained from prior studies and models, a Confirmatory Factor Analysis (CFA), as opposed to an Exploratory Factor Analysis (EFA), was best suited, according to Suhr (2006) and Dooley (2009). Before the factor analysis, all items were examined to see if the questioning was consistent and if items needed to be recoded.

During the confirmatory factor analysis, 14 constructs emerged from the research model. This was surprising as 10 constructs were expected based on the model. Performance Expectancy, Social Influence and Perceived Benefits all revealed underlying factors resulting in a new model as seen in figure 3: Revised Research Model on page 21. All reliability and factor analysis statistics are presented below in table 2 on pages 19 and 20.

Table 2: Reliability & factor analysis statistics

Factor	*Cronbach Alpha*	*% of Variance*	*Eigenvalue*	*Factor Loading*
1. Intention to Use	0.920	29.36%	10.86	
IU1: The idea of using an autonomous vehicle for transport is appealing to me				0.604
IU2: I intend to try out autonomous vehicle				0.698
IU3: I intend to use an autonomous vehicle				0.819
IU4: I would buy an autonomous vehicle				0.823
IU5: I would encourage others to use autonomous vehicles				0.732
2. Effort Expectancy	0.884	9.49%	3.51	
EE1: Autonomous vehicles will be intuitive and straightforward in use				0.800
EE2: Autonomous vehicles will be easy for me to use				0.802
EE3: I think it will be easy for me to become skilful in using autonomous vehicles				0.717
EE4: It will not take much effort to use autonomous vehicles				0.828
3. Trust in safety	0.812	7.53%	2.78	
TS1: How likely do you think that system failure will occur when using an autonomous vehicle?				0.777
TS2: How likely do you think that hacking of the computer system will occur when using autonomous vehicles?				0.826
TS3: How likely do you think that terrorists taking over control of autonomous vehicles will occur?				0.752
TS4: How likely do you think that technical failure will occur when using autonomous vehicles?				0.770
4. Practical Benefits	0.862	5.29%	1.96	
PB6: Traveling in autonomous vehicles would enable me to look out of the window and enjoy the scenery				0.766
PB7: Traveling in autonomous vehicles would enable me to relax (e.g. read a book or play a game)				0.852
PB8: Traveling in autonomous vehicles would enable me to do some work				0.842
5. Perceived Risks	0.884	4.65%	1.72	
PR1: Autonomous vehicles can safely interact with: human-driven vehicles				0.745
PR2: Autonomous vehicles can safely interact with: cyclists				0.847
PR3: Autonomous vehicles can safely interact with: pedestrians				0.796
6. Social Recognition	0.905	3.96%	1.46	
SI7: I would gain respect and recognition from my friends and family if I used autonomous vehicles				0.856
SI8: I would gain respect and recognition in my community if I used autonomous vehicles				0.871
7. Facilitating Conditions	0.829	3,505	1.33	
FC4: Autonomous vehicles will decrease travelling time in general				0.860
FC5: Autonomous vehicles will be accessible for everyone				0.827
8. Performance Control	0.814	3.26%	1.20	
PE2: I would like to be able to take over manual control if needed				0.849
PE3: I would like to have a panic or control button				0.843
9. Social Opinion	0.756	3.25%	1.20	
SI2: My opinion about autonomous vehicles is based on the opinions of friends and family				0.885
SI3: My opinion about autonomous vehicles is based on the opinions of colleagues				0.826
10. Social Pressure	0.837	2.64%	0.97	
SI5: I will travel in one if my friends and family do the same				0.789
SI6: I will travel in one if my colleagues do the same				0.781
11. Hedonic Motivation	0.867	2.47%	0.91	
HM5: Using an autonomous vehicle will be fun				0.684
HM6: Using an autonomous vehicle will be exciting				0.698

Table 2: (continued)

12. Vehicle Characteristics	0.631	2.27%	0.84	
VC3: Autonomous vehicles will give me flexible travelling options				0.758
VC4: Autonomous vehicles will decrease travelling time in general				0.727
13. Vehicle Performance	0.741	1.99%	0.74	
PE5: Autonomous vehicles are suitable for real road environments				0.706
PE8: Autonomous vehicles will work well in urban areas				0.755
14. User Benefits	0.573	1.78%	0.66	
PB3: I think autonomous vehicles will reduce travelling cost				0.629
PB4: Parking in the city won't be an issue anymore				0.843

EMERGED NEW SUB-CONSTRUCTS

From Performance Expectancy (PE), two factors emerged. The first is Performance Control (PC), which relates to the control users can have over the performance of autonomous vehicles using the items PE2 and PE3. The second is Vehicle Performance (VP), using the items PE5 and PE8 to measure how respondents rate their expectations of autonomous vehicle performance in certain situations.

Social Influence (SI) has been split into three underlying factors: (1) Social Opinion (SO) using items SI2 and SI3, telling us more about how an opinion is formed based on respondents' social environment. (2) Social Pressure (SP), relating to considering using an autonomous vehicle if people in the social surrounding do so, measured by the items SI5 and SI6. The third factor of Social Influence is Social Recognition (SR). Using items SI7 and SI8 to measure how respondents think they will be perceived socially using an autonomous vehicle.

The final variable with underlaying factors is Perceived Benefits (PB), which has been split into two different factors: (1) Practical Benefits (PB) and (2) User Benefits (UB). Practical benefits uses the items PB6, PB7 and PB8 to measure benefits that result indirectly from using autonomous vehicles, like a cost reduction or not needing to look for a parking spot. In contrast, User Benefits relate to direct benefits for the user, like being able to work, play games or enjoy the view during travel. The items PB3 and PB4 are used to measure this.

Furthermore, items of low factor loadings have been excluded from the research to keep validity and reliability at an acceptable level. This was especially the case with the variable Vehicle Characteristics, Facilitating Conditions and Hedonic Motivation. All three variables have had one or more items deleted to get a reliable and valid model fit. None of the items used in the final analysis needed to be recoded.

Using all factors within the analysis, the cumulative variance explains 81.5% of the model for the intent to use autonomous vehicles. Factor one (Intention to Use) and two (Effort Expectancy) hold the most value, explaining 38.8%. By adding the factors of Safety, User Benefits, Perceived Risks, Social Recognition, Facilitating Conditions, Performance Control and Social Opinion, which all have an eigenvalue of 1.2 or higher, over 70% of the model is explained.

The remaining factors, Social Pressure, Hedonic Motivation, Vehicle Characteristics, Vehicle Performance and User Benefits, have an eigenvalue lower than 1. In research, these values and factors are often discarded because they are seen as to low. Some researchers contradict this, saying that the eigenvalue 1 rule should be dropped in favour of other interpretations (Patel et al. 2008). Especially when deploying CFA, lower values must also be retained to test the model as intended. Based on this contradicting view from research, the approach of not excluding the factors was chosen. This was done because they are underlying factors of crucial variables for the entirety of the model. Thus, they hold importance within the overall model to explain the intent to use autonomous vehicles.

After looking for underlying constructs within the items of measurement, a reliability analysis was considered useful to establish the consistency across items that were labelled to measure the same construct (Dooley, 2009). For that purpose, Cronbach's coefficient alpha was used to determine how consistent the questionnaire was on an inter-item basis. According to Dooley (2009), this is one of the most common methods to establish internal reliability.

All factors have a reliability criterion within or higher than the range of 0.6-0.7 recommended by Cline (2015), with the exception of Practical Benefits (α = .573). However, since this factor is only measured using two items and is a subfactor of the variable Perceived Benefits, the factors' reliability score is seen as acceptable and has not been discarded.

Based on the CFA, the original model was revised (see Figures 3.1 and 3.2, page 22) by adding the new underlaying factors.

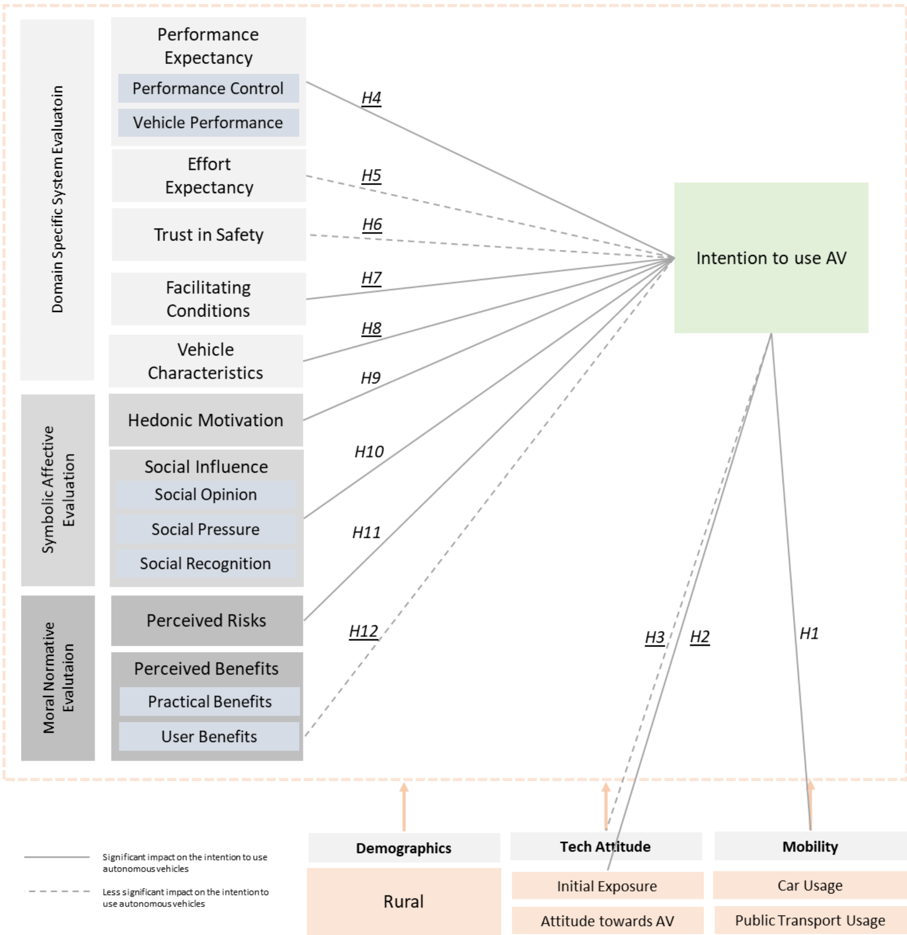

figure 3.1: Revised research model, significant predictors for rural areas

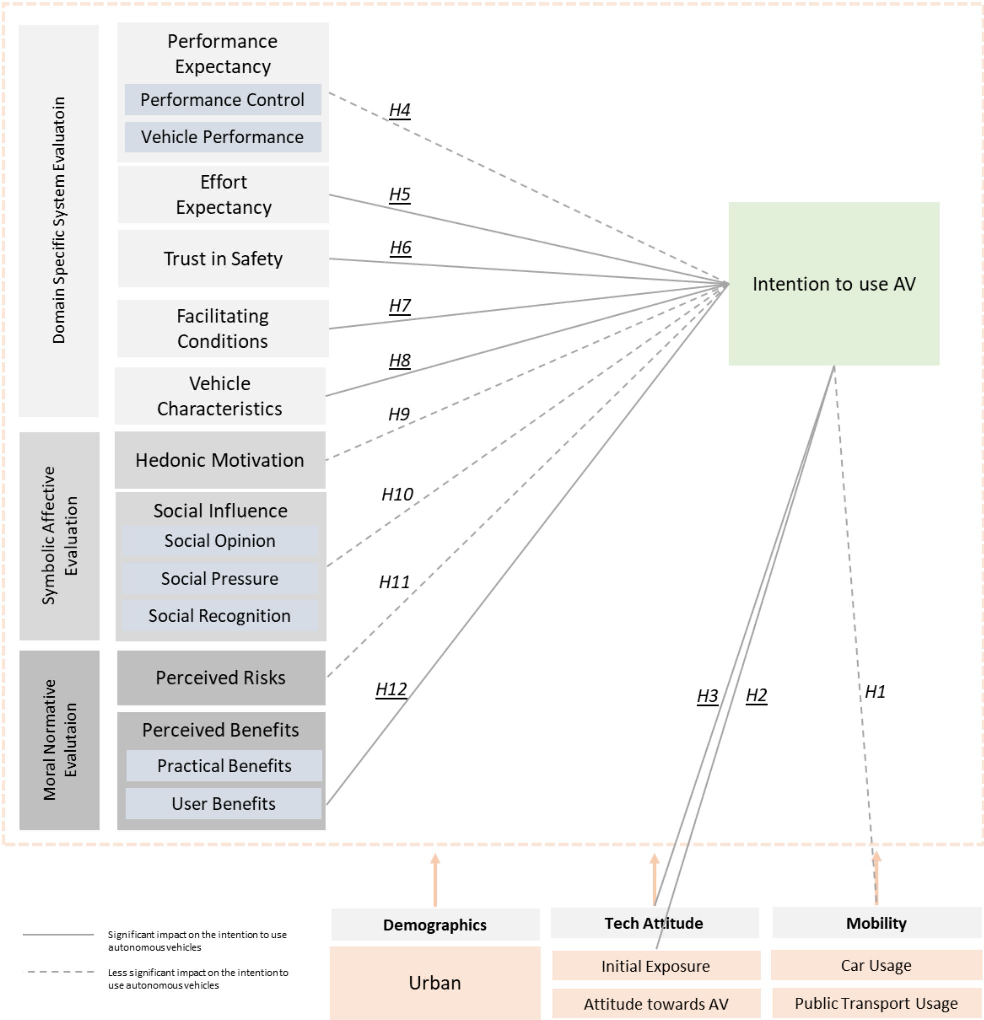

figure 3.2: Revised research model, significant predictors for urban areas

PROCEDURE

The methods used in this research have been reviewed and approved by the BMS Ethics committee of the University of Twente. They have found no critical ethical considerations to take into account for the research.

Using a random sampling method, participants got asked to fill out a survey about future mobility rather than autonomous vehicles. This was done to minimize the risk of only getting biased participants toward autonomous vehicles. After welcoming participants with a general explanation and disclaimer, they were asked to fill in some basic demographic information, such as the country they lived in and their postcode. After that, they got two self-evaluative questions where they had to consider if they saw themselves as living in a rural or urban area. It was essential to divide the participants into two groups to make a comparison between rural and urban. The combined scores of the two evaluative questions are used to determine whether participants consider themselves living in a rural or urban environment.

After that, the survey consisted of questions concerning the micro factor mobility and the intent to use technology, which included questions about initial exposure and the attitude towards autonomous vehicles. The general section of the survey was concluded by showing the participants a video about automated driving produced by the Federation Internationale de l'Automobile (FIA). The short video of two minutes starts by explaining what an autonomous vehicle is and the levels of car automation there are. It then continues with the benefits of autonomous vehicles like shorter travelling times, less pollution, not having to park and safety. The video continues with the stipulation: are autonomous vehicles safer? Explaining that it has to share the road with other users like pedestrians, cyclists and other vehicles. To conclude the video, the risks of autonomous vehicles are discussed, like who is to blame in case of an accident, security and the fact that you might like driving as an activity. The video then concludes with reference to find out more about autonomous driving at www.fia.com. This step was taken to avoid subjective norm bias and help prime the participants for the upcoming survey.

After watching the video, the main section of the research started, which entailed all nine factors under the Domain Specific Evaluation, Symbolic Affective and Moral Normative evaluation within our model. Each of the factors consisted of at least four items to keep internal consistency. The survey then concluded with the collection of respondent socio-demographics before finishing up with a final disclaimer about privacy and opt-out rules, including a thank you for your participation.

Population & sampling

A voluntary-convenience sampling method using a snowball method and the website Surveyswap.io, a website dedicated to research used for academics worldwide, were used to gather respondents over a period of three months. The web platform allows implementing the online survey using the Qualtrics Survey Program. Qualtrics then exports the data, ready for import to SPSS for processing and statistical testing.

The target group of this research are young adults aged 16 and up that are active within the mobility domain. E.g. respondents must be familiar with the concept of transportation, either by car or by public transport, and use these modes of transport. The survey did not contain an age limitation for respondents or any limitations regarding respondent demographics. However, using a random sampling method, two participants younger than 16 filled in the survey. Both are 15 years of age and from the USA. With it being possible to drive a car on a learner's permit from the age of 14 in the USA, both respondents are considered valid entries and were included in the research.

During the research, respondents were asked to rate themselves being rural or urban to be able to organise them in their correct sampling group afterwards. During the data collection process, the gathered responses were monitored to ensure that the general population ratio between rural and urban areas respondents was evenly distributed. This was done to ensure that the data would not be skewed in either one or the other direction.

RESPONDENT SOCIO-DEMOGRAPHICS

The questionnaire was distributed for a period of three months. The total number of participants amounted to 239, of which 202 fully filed in the questionnaire. The dropout rate, defined as the number of participants who started but did not complete the survey divided by the total number of participants who started it, was 15.5%. One response was excluded from the dataset because the answering pattern indicated that the respondent did not faithfully fill in the questionnaire, therefor the total number of respondents in the dataset for analysis is 201. Due to contemporary social networks and web-based communication channels, it was impossible to obtain a tangible number for the survey's reach. Table 3 shows 62 participants from rural areas (30.8%) and 139 from urban areas (69.2%) included in the research. A Chi-square test was performed to compare all demographical traits; no significant differences were found between the rural and urban groups.

The Chi-square test results recorded for age were $X^2(3, N = 201) = 1.522$, $p = .677$, indicating that there is no significant difference between the two groups regarding age. Usually, an older population is expected in rural areas compared to urban areas (Eurostats, 2021; U.S. Census Bureau, 2021). Looking at age, the distribution favours the younger generation, with most participants aged below 35 (88.1%). When looking at generations, Gen Z (59.7%) and Millennials (31.8%) make up most of the respondents, with older generations Gen X and Boomers only taking up 8.5% of total respondents

With a Chi-square of $X^2(5, N = 201) = 7.869$, $p = .164$, there is no indication of statistical difference between the demographics. The participants' education primarily reflects that of the author, with 68.2% having completed higher education, e.g. a Bachelor's Degree (35.8%), Master's Degree (28.4%) or Doctorate (4.0%).

As with the other demographic variables, the Chi-square test (X2(2, N = 201) = 1.816, p = .403) indicated no significant difference between rural and urban groups regarding living status. However, when examining the exact values, there are minor differences. More rural respondents are married versus the number of singles in an urban environment. This was expected as it corresponds with the general concept that people in rural areas marry younger than people in urban environments.

Table 3: Demographics Overview

			Rural			*Urban*			*Total*
		N	*Rur%*	*Total%*	*N*	*Urb%*	*Total%*	*N*	*Total%*
Characteristic	Total	62		30.8%	139		69.2%	201	100%
Age									
	Gen Z	34	54.8%	16.9%	86	61.9%	42.8%	120	59.7%
	Millennials	23	37.1%	11.4%	41	29.5%	20.4%	64	31.8%
	Gen X	3	4.8%	1.5%	9	6.5%	4.5%	12	6.0%
	Boomers	2	3.2%	1.0%	3	2.2%	1.5%	5	2.5%
Gender									
	Male	20	32.3%	16.7%	43	30.9%	21.4%	63	31.3%
	Female	41	66.1%	20.4%	90	64.7%	44.8%	131	65.2%
	Non-Binary/Third Gender	0	0.0%	0.0%	5	3.6%	2.5%	5	2.5%
	Prefer not to say	1	1.6%	0.5%	1	0.7%	0.5%	2	1.0%
Education									
	Less than high school	1	1.6%	0.5%	4	2.9%	2.0%	5	2.5%
	High School	6	9.7%	3.0%	28	20.1%	13.9%	34	16.9%
	College Degree	7	11.9%	3.5%	18	12.9%	9.0%	25	12.4%
	Bachelor Degree	26	41.9%	12.9%	46	33.1%	22.9%	72	35.8%
	Master Degree	17	27.4%	8.5%	40	28.8%	19.9%	57	28.4%
	Doctorate	5	8.1%	2.5%	3	2.2%	1.5%	8	4.0%
Living Status									
	Single	36	58.1%	17.9%	94	67.6%	46.8%	130	64.7%
	Married	9	14.5%	4.5%	14	10.1%	7.0%	23	11.4%
	Living Together	17	27.4%	8.5%	31	22.3%	15.4%	48	23.9%
Total		62		30.85%	139		69.2%	201	100%

MICRO INDIVIDUAL DIFFERENCE FACTORS OF THE TARGET SAMPLE

Mobility characteristics of the target sample

A series of car and public transport usage questions were formulated to measure mobility. Respondents were asked if they used either and to what extent by rating how often they used specific modes of transport for work, travelling to family, and going shopping for fun on a scale of 1 to 7 from never to daily. Respondents that did not use a mode of transport were not asked to answer a set of questions relating to its usage leading to missing values. The missing values have been recoded to the corresponding scale (1, Never) to be able to calculate the correct means for the value's Car Usage (CU) and Public Transport Usage (PT).

Table 4: Mobility Availability

			Rural			*Urban*			*Total*
		N	*Rur%*	*Total%*	*N*	*Urb%*	*Total%*	*N*	*Total%*
Characteristic	Total	62	100%	30.8%	139	100%	69.2%	201	100%
Car Available									
	Yes	46	74.2%	22.9%	88	63.3%	43.8%	134	66.7%
	No	16	25.8%	8.0%	51	36.7%	25.4%	67	33.3%
Public Transport Usage									
	Yes	36	58.1%	17.9%	105	75.5%	52.2%	141	70.1%
	No	26	41.9%	12.9%	34	24.5%	16.9%	60	29.9%
Total		62	100%	30.85%	139	100%	69.2%	201	100%

Table 5: Variable Scores for Car Usage and Public Transport Usage per target group

	Rural		*Urban*		*All*	
Variable	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*
Car Usage	3.45	1.73	2.89	1.82	3.06	1.81
Public Transport Usage	2.36	1.42	2.81	1.53	2.67	1.51

All items have been measured using a 7-point Bivariate Scale from Never to Daily

Most participants have a car available to them (66.7%), although the amount of people relying on a car for transport is higher among the rural respondents, with 74,2% having a car available to them compared to 63,3% in the urban population. When it comes to public transport, the opposite is seen. Of rural participants, 58% use public transport versus more than 75% for urban participants. This can be confirmed by looking at the differences between car usage and public transport usage. For car usage there was a significant difference ($t(199) = -2.024$, $p = 0.044$) with rural population using cars more than urban population. The opposite can be seen for public transport usage, with urban respondents having a higher score than rural respondents. Additionally, the significance level for public transport usage is slight less significant with a t-test value of $t(199) = 1.955$, $p = 0.052$. This founding corresponds to what is known about mobility and transport usage relating to the difference between connectivity of transport networks when comparing urban and rural areas.

Attitude toward technology & Autonomous Vehicles

Attitude toward technology (TA) and autonomous vehicles (AS) are seen as important micro-demographics influencers that help form a first cognitive view and a general understanding of how participants will rate the other nine factors towards overall factors of intent to use autonomous vehicles.

Attitude toward technology (TA) was measured using six statements taken from previous research done by Acheampong, R. A., & Cugurullo, F. (2019), like "I am excited about the possibilities offered by new technologies". To validate the internal validity of the measured construct, Cronbach's alpha was calculated, resulting in the removal of the items TA5 and TA6 to achieve an alpha of .841.

Table 6: Variable Scores for Attitude towards Technology & Autonomous Vehicles and Initial Exposure per target group

	Rural		*Urban*		*All*	
Variable	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*
Attitude Towards Technology	3.97	0.77	4.07	0.73	4.04	0.74
Attitude Towards Autonomous Vehicles	3.76	0.64	3.79	0.69	3.79	0.67
Initial Exposure	3.25	0.90	3.05	0.88	3.11	0.89

Attitude towards technology and Initial Exposure were measured using a 5-point Likert scale rating from Definitely yes to Definitely not
Attitude towards autonomous vehicles was measured using a 5-point Differential Semantic scale; for example, useless - useful

The urban and rural participants in the research target group are favourable towards technology, with M=3.79 and M=3.76, respectively. This result can be explained by the age distribution and the fact that the data was gathered using an online survey. Online surveys often attract young, tech-savvy respondents (Pettigrew, Worrall, Talati, Fritschi & Norman, 2019).

The same result is reflected in Attitude towards Autonomous Vehicles, albite with a little more caution and a slightly lesser heavy trend towards the positive score. Attitude toward autonomous vehicles (AS) was measured using a semantic scale where respondents had to agree or disagree with opposite statements related to autonomous vehicles. Examples of those statements are useless-useful, unsafe-safe and uninteresting-interesting. Cronbach's alpha was calculated at .821 after removing item AS4, expensive-inexpensive, to validate the instruments.

Initial exposure to Autonomous Vehicles

Both groups have a decent amount of knowledge about autonomous vehicles, with the means of the combined score being M= 3.05 and M= 3.25 for urban and rural respondents, respectively. They indicate that respondents in rural areas know slightly more about the topic. This becomes more apparent when analysing the different items that were used to measure Initial Exposure to Autonomous vehicles. On all statements, rural respondents score higher compared to their urban counterparts. This is most clear with item IE5: I think Autonomous Vehicles will become mainstream very soon.

Table 7: Variable Scores on items measuring Initial Exposure to Autonomous Vehicles

	Rural		***Urban***		***All***	
Item	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*
IE1: I have heard about Autonomous Vehicles	3.65	1.73	3.45	1.13	4.04	1.81
IE2: I am excited about the prospect of Autonomous Vehicles	3.50	1.42	3.18	1.19	3.79	0.67
IE3: Autonomous Vehicles are a good idea	3.40	1.42	3.22	1.17	3.11	0.89
IE4: I know a lot about Autonomous Vehicles	2.63	1.42	2.56	1.05	3.11	0.89
IE5: I think Autonomous Vehicles will become mainstream very soon	3.10	1.42	2.88	1.08	3.11	0.89

All items were measured using a 5-point Likert scale rating from A great deal to None at all

RESULTS

Having confirmed, tested and constructed the validity and reliability of the model for intent to use autonomous vehicles as adopted from the MAVA model, a correlation and regression analysis can be conducted to test our hypothesis. The factors found during the confirmatory factor analysis were used for this analysis. For detailed information, refer to table 8 and figure 3 in the previous section of this paper.

DESCRIPTIVE STATISTICS

The descriptive statistics were analysed by calculating the mean scores and standard deviations for the target groups to examine the data and possible irregularities in the research. A complete overview of descriptive statistics for the scores in the model's variables can be found in table 8: Variable Scores per Independent factor.

All scores seem comparable with no big difference in the mean for the total, rural or urban populations. Remarkably, the mean score for all items is rather high, indicating that respondents largely agreed with the statements presented during the survey. Agreement is especially high when it comes to Performance Control, scoring four or higher out of a 5-point-Likert scale. Amongst the lower scores are Social Opinion (Rural M = 2.96 / SD = 1.10, Urban M = 2.95 / SD = 1.02) and Social Recognition (Rural M = 2.74 / SD = 1.09, Urban M = 2.80 / SD = 1.04), which still have scores that are fairly in agreement with the made statements when taking the 5-point-Likert scale into consideration.

Overall a relatively high standard deviation is reported too. This could indicate many outliers within our data, which shows that respondents have very different options for the various topics. This is especially the case for the factors of Social Opinion, Social Pressure, Social Recognition and User Benefits, where the standard deviations account for one-third of the mean measured for this factor. These extremes could mean that standard distribution is not the case for our data, meaning that further normal distribution analysis must be done before regression analysis.

Table 8: Variable Scores per Independent Factor

	Rural		Urban		All	
Variable	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*	*Mean*	*Std. Deviation*
Vehicle Characteristics	3.60	0.88	3.53	0.83	3.55	0.85
Trust in safety	3.29	0.70	3.43	0.82	3.39	0.79
Performance Control	4.31	0.65	4.28	0.86	4.29	0.80
Vehicle Performance	3.49	0.64	3.67	0.89	3.62	0.83
Effort Expectancy	3.70	0.72	3.77	0.86	3.67	0.82
Facilitating Conditions	4.06	0.87	3.97	0.84	4.00	0.85
Hedonic Motivation	3.58	0.77	3.69	0.96	3.66	0.91
Social Opinion	2.96	1.10	2.95	1.02	2.96	1.05
Social Pressure	3.08	1.02	3.17	0.99	3.14	1.00
Social Recognition	2.74	1.09	2.80	1.04	2.78	1.06
Practical Benefits	3.00	0.89	3.05	0.94	3.04	0.93
User Benefits	3.35	1.03	3.43	1.00	3.41	1.01
Perceived Risks	3.25	0.91	3.18	0.95	3.20	0.94
Intent to Use	3.29	0.94	3.27	0.96	3.28	0.96

All items have been measured using a 5-point Likert Scale

MODEL TESTING

All factors resulting from the Confirmatory Factor Analysis have been included for the final model testing. This means that minor changes have been adopted in our initial model as a result of certain variables having subfactors. Our new model, as seen in figure 3, will be used for further analysis and testing.

Assumptions for Model testing

To confirm the linearity of the tested model in this research, the normal distribution was examined by looking at the unstandardised residuals (Dobson & Barnett, 2018). Figure 4: Normal P-P Plot of Regression Standardized Residual illustrates the values gathering curve on and off the regression line but does stay fairly close to them, thus indicating the normality of the distribution. To verify this, the Durbin-Watson statistic was calculated at 2.037 for the Urban population and 2.039 for the rural population. This is seen as adequately indicating the independent measurements according to Fombey and Guilkey (1978), who suggest a rating of 1.5 to 2.5.

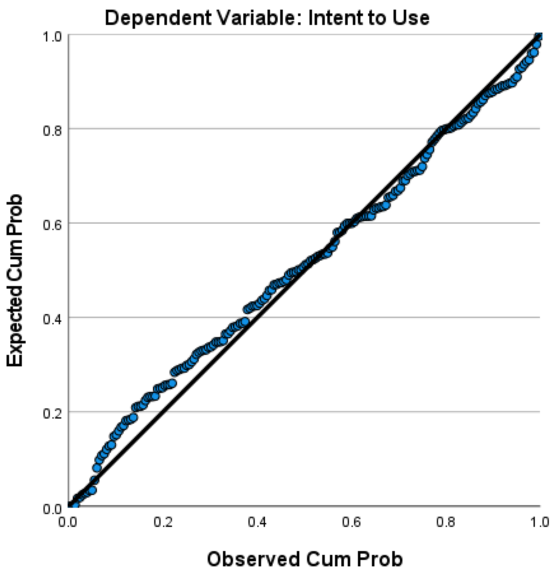

figure 4: Normal P-P Plot of Regression Standardized Residual

Additionally, multicollinearity has been tested by calculating to see if there is any correlation between the predictors in the model. The calculated variance inflation factors for all items in the model are between 1.1 and 3.6, indicating low to moderate correlation. This is far enough below the threshold of 5 that researchers usually use to determine if multicollinearity is an issue (Dodge, 2008).

Correlations

Table 9: Correlation in relation to Intent to Use

Area	Rural	Urban
Attitude towards Technology	**.389****	**.235****
Initial Exposure	**.493****	**.509****
Attitude towards autonomous vehicles	**.463****	**.596****
Car Usage	0.069	0.074
Public Transport Usage	0.031	-0.095
Vehicle Characteristics	**.415****	**.509****
Trust in safety	**-.330****	**-.302****
Performance Control	-0.041	0.024
Vehicle Performance	**.499****	**.495****
Effort Expectancy	**.406****	**.554****
Facilitating Conditions	**.442****	**.366****
Hedonic Motivation	**.626****	**.678****
Social Opinion	**.341****	0.085
Social Pressure	**.426****	**.280****
Social Recognition	**.540****	**.245****
Practical Benefits	**.372****	**.460****
User Benefits	**.588****	**.503****
Perceived Risks	**.463****	**.606****

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Examining the correlation between Intent to Use (IU) and the independent variables shows us that the populations differ from each other on most factors. The exemption on the rule is Vehicle Performance, which shows a similar correlation for both populations.

Remarkable higher correlation with IU was observed in the rural population in comparison to the urban population for Social Pressure ($r = .426$, $p < \alpha = .05$ and $r = .280$, $p < \alpha = .05$ respectively) and Social Recognition ($r = .540$, $p < \alpha = .05$ and $r = .245$, $p < \alpha = .05$ respectively). When it comes to Social Opinion there is no significantly correlation for urban respondents ($r = .085$), whereas there is for the rural population ($r = .341$, $p < \alpha = .01$).

All other factors show correlation with slight differences between both populations. The factors Vehicle Characteristics, Vehicle Performance, Hedonic Motivation, Perceive Benefits and Perceived Risks show a slightly higher correlation for the urban population compared to the rural population. The opposite is the case for Trust in safety, Facilitating Conditions and User Benefits, which shows a slightly stronger correlation within the rural population. Finally, Car Usage, Public Transport Usage and Performance Control do not significantly correlate with IU for either population. Interestingly, Performance Control does show a significant correlation with Vehicle Performance, Effort Expectancy and Facilitating Conditions.

Table 10: Model Summary

Model		Rural	Urban
Model 1: Demographics			
	Adjusted R Square	0.051	-0.023
	Delta R Square	0.000	0.000
	Std. Error of the Estimate	0.927	0.957
Model 2: Model 1 + Tech Attitude			
	Adjusted R Square	0.322	0.352
	Delta R Square	0.271	0.375
	Std. Error of the Estimate	0.783	0.762
Model 3: Model 2 + Mobility			
	Adjusted R Square	0.335	0.358
	Delta R Square	0.013	0.006
	Std. Error of the Estimate	0.775	0.758
Model 4: Model 3 + Domain Specific Evaluation			
	Adjusted R Square	0.593	0.484
	Delta R Square	0.258	0.126
	Std. Error of the Estimate	0.607	0.680
Model 5: Model 4 + Symbolic Affactive Evaluation			
	Adjusted R Square	0.658	0.571
	Delta R Square	0.065	0.571
	Std. Error of the Estimate	0.556	0.620
Model 6: Model 5 + Moral Normative Evaluation			
	Adjusted R Square	0.701	0.590
	Delta R Square	0.043	0.019
	Std. Error of the Estimate	0.520	0.600

Dependent variable: Intention to Use

First, the model was tested on the demographics of rural or urban. This revealed a low significant role within the model with an R square of .000 and an adjusted R square of -.005, confirming that the intent to use autonomous vehicles does not heavily rely on the region respondents come from. However, this research compares and finds the differences in the intention to use autonomous vehicles between rural and urban.

Analysis shows that our final model strongly predicts the intent to use autonomous vehicles (IU). Regression model 6 shows that the model is a stronger predictor for the intention to use autonomous vehicles for rural than urban respondents, with 59% of the variance in the dependent variable (IU) being explained for the urban population and 70% for the rural population.

Looking at the model breakdown, apparent differences can be seen. Model 1, which is based on the demographic values of age, gender, education and living status, already shows a significant difference between the two populations. Whilst for urban respondents, it negatively explains a small margin of the model. For the rural population, it holds value with 5% of the variance explained.

Tech attitude (Model 2) adds a lot to the intention of using an autonomous vehicle, whilst adding mobility in Model 3 does not add much variance explained for either population. Another big shift is seen when adding the Domain Specific factors (Model 4) that include the factors Performance Control, Vehicle Performance, Effort Expectancy, Facilitating Conditions, Vehicle Characteristics and Trust in Safety. Using these factors, over 50% of the model is explained for both target groups. After this, the models stabilise with similar increments for both rural and urban.

Table 11: Model 6 Regression Coefficients

Area	*Factor*	Rural *B*	Rural *t*	Rural *Sig.*	Urban *B*	Urban *t*	Urban *Sig.*
Demographics	(Constant)	-0.683	-0.740	0.464	-0.291	-0.442	0.659
	Age	-0.004	-0.388	0.700	-0.009	-1.121	0.265
	Gender	0.007	0.034	0.973	-0.009	-0.066	0.947
	Education	-0.012	-0.150	0.881	0.026	0.464	0.644
	Living Status	0.089	0.442	0.661	0.023	0.178	0.859
Tech Attitude	Attitude Towards Technology	**0.252**	**2.452**	**0.019****	0.045	0.517	0.606
	Attitude Towards Autonomous Vehicles	0.127	0.721	0.475	0.025	0.187	0.852
	Initial Exposure	0.082	0.562	0.578	**0.192**	**2.225**	**0.028****
Mobility	Car Usage	0.010	0.233	0.817	0.033	0.900	0.370
	Public Transport Usage	0.003	0.045	0.965	0.014	0.335	0.738
Domain-specific Evaluation	Vehicle Characteristics	0.081	0.641	0.525	**0.140**	**1.729**	**0.087***
	Trust in Safety	-0.179	-1.501	0.142	**-0.128**	**-1.732**	**0.086***
	Performance Control	**-0.344**	**-2.400**	**0.021****	-0.071	-0.880	0.381
	Vehicle Performance	**0.244**	**1.696**	**0.098***	-0.086	-0.947	0.346
	Effort Expectancy	-0.047	-0.319	0.751	**0.206**	**2.108**	**0.037****
	Facilitating Conditions	**0.230**	**2.205**	**0.034****	0.033	0.406	0.685
Symbolic Affective Evaluation	Hedonic Motivation	**0.228**	**1.793**	**0.081***	**0.316**	**3.783**	**0.000****
	Social Opinion	0.114	1.521	0.137	0.003	0.054	0.957
	Social Pressure	0.054	0.570	0.572	0.000	0.005	0.996
	Social Recognition	0.100	0.860	0.395	0.022	0.299	0.765
Moral Normative Evaluation	Practical Benefits	0.039	0.331	0.743	0.043	0.631	0.529
	User Benefits	**0.256**	**2.792**	**0.008****	**0.144**	**2.223**	**0.028****
	Perceived Risks	-0.066	-0.561	0.578	-0.291	-0.442	0.659

Dependent variable: Intention to Use
** Significance at level P < 0.05
* Significance at level P < 0.10

Looking closer at table 11, it is clear that the region plays a significant role in how the decision to use autonomous vehicles is formed. It shows us that rural and urban respondents both see different factors as significantly important predictors but have some overlap.

The only significant predictors for both populations are Hedonic Motivation and User Benefits. For the latter it is a stronger predictor for rural (B = .259, Sig. = .008) than the urban population (B = .144, Sig. = .028). The opposite can be said for Hedonic Motivation with urban population (B = .316, Sig. = .000) putting more weight on the factor compared to rural population (B = .228, Sig. = .081) in relation to the intent to use autonomous vehicles.

Beyond this point, there are some significantly different predictors for the intent to use autonomous vehicles for rural and urban respondents. The significant predictors for rural areas are Attitude Towards Technology, Performance Control and Facilitating Conditions. This is Initial Exposure, Effort Expectancy and Perceived Risks for urban areas. Another interesting result is that none of the Symbolic Affective Evaluative factors seems to be significant predictors for the intent to use autonomous vehicles for rural and urban populations.

RESULTS OF RESEARCH HYPOTHESIS

Out of the twelve hypotheses, see table 12 below, three are supported, and nine are not supported. Further elaboration on this will be given in the discussion.

Table 12: Results of Research Hypothesis

Nr.	Hypothesis	Status
H1	Mobility will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.	Not Supported
H2	Initial exposure to autonomous vehicles is equally significant to the intention to use autonomous vehicles in rural and urban areas	Not Supported
H3	Tech attitude will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas	Not Supported
H4	Performance expectancy will have a more significant impact on the intent to use autonomous vehicles in rural compared to urban areas	Supported
H5	Effort expectancy will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas	Supported
H6	Trust in safety will have a more significant impact on the intention to use autonomous vehicles in rural compared to urban areas	Not Supported
H7	Facilitating conditions will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.	Supported
H8	Vehicle characteristics are equally significant for the intention to use autonomous vehicles in rural and urban areas	Not Supported
H9	Hedonic motivation will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.	Not Supported
H10	Social influence will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.	Not Supported
H11	Perceived risks will have a more significant impact on the intention to use autonomous vehicles in rural areas compared to urban areas.	Not Supported
H12	Perceived benefits will have a less significant impact on the intention to use autonomous vehicles in rural compared to urban areas	Not Supported

DISCUSSION

Examining how and why different groups intent to use autonomous vehicles will contribute to understanding the adoption of autonomous vehicles for the broader public. That is why research aims to clarify and compare the intent to use autonomous vehicles between rural and urban populations. Especially rural population is under-researched when it comes to technological advancements.

By comparing rural and urban populations on the intention to use autonomous vehicles, this research found prevalent evidence that the rural population does, in fact, see autonomous vehicles as an interesting mode of transport. Even more so, differences between the populations have been found that could be of interest for further research in the field of acceptance and the intention to use autonomous vehicles. These differences become even more apparent when testing our hypothesis, of which three have been confirmed, and nine could not be confirmed during this research. This shows that more research needs to be done into the field and different target groups to further understand how, why and if various groups would use autonomous vehicles as an alternative mode of transport.

MAIN FINDINGS

Before discussing the factors influencing the intent to use autonomous vehicles, it is worth addressing the intent to use autonomous vehicles for rural and urban respondents. Referring to the descriptive statistics (table 8, p. 26), it can be said that both populations do intend to use autonomous vehicles. Both rural and urban responders are in high agreement with the items measuring intent to use. Even more so, on statement IU2: "I intend to try out autonomous vehicle", 64,6% of rural and 64,0% of urban respondents indicated that they probably would or definitely would.

On a more micro basis, the implication that demographics significantly impact (Nordhoff et al., 2019) the intent to use technology was not supported during this research. It is in line with Menon (2015), who found that once familiarity with autonomous vehicles is introduced, intended adoption rates between demographic differences are insignificant. The same can be said for the relation between mobility and the intent to use autonomous vehicles. For both populations, there is no significant relationship in the current data of the results of the items' car usage and public Transport that could suggest otherwise. This means that statements regarding mobility made by Meyer (2017) and Shabanpour et al. (2018) could not be tested or supported and that further research within the domain of mobility and intent to use autonomous vehicles is needed.

Looking at factors related to technical attitude, the factor of initial exposure is only significant to the urban population in the model for intent to use. This partly contradicts a well-established theory of Bargh (1989) about how consumers acquire, represent and encode advertising information before purchasing an item. Additionally, it breaks with Nordhoff et al. (2019) line of thought that initial exposure to autonomous vehicles is a factor that influences decision-making in all four steps of the MAVA model. It is in line with the gratification theory by Lasswell (1948) and findings by Shabanpour et al. (2018). Both indicate that people act for different reasons when it comes to the intent of having a new experience, e.g. using new technologies like autonomous vehicles. It could imply that respondents in urban areas are more likely to use autonomous vehicles if they get to know them. Manufacturers can use this to their advantage to improve the intention to use rate by using the well-known test-drive method when introducing autonomous vehicles.

The opposite is seen for attitude toward technology in general. A positive correlation for rural respondents is found where a negative one would have been expected, and a non-significant relation in urban respondents towards intent to use autonomous vehicles. This might be because the rural respondents lack the usually elderly-focused demographic build-up. Combining it with de finding by Lee et al. (2017), who found that age positively influences attitude toward technology, the positive correlation for the rural respondents can be explained. It, however, does not explain why the urban respondents show a non-significant relation.

Interestingly attitude towards autonomous vehicles as a separate factor does not add anything to the model as a single factor. But there is a moderate correlation between the intent to use and the factors within the domain of Moral Normative Evaluation, showing us that attitude towards autonomous vehicles is factored in when rating the statements within the factors Practical Benefits, User Benefits and Perceived Risks.

Related to the main constructs in the meso-domain, there are clear indicators that different groups intend to use autonomous vehicles for different reasons, as Shabanpour et al. (2018) suggest. Rural respondents seem to base their choice on intent to use more on practical factors like how 'will autonomous vehicles perform' (vehicle performance) or 'are they available to me' (facilitating conditions), whilst urban respondents base their choice based on factors like 'will it decrease my travelling time' (vehicle characteristics), how hard is it to use one (effort expectancy) and is it safe to use an autonomous vehicle (safety), that have a more direct gratification and self-gain aspect to it. These differences can be utilised by researchers, policymakers and manufacturers to also include rural areas when implementing, testing or developing new ideas related to autonomous vehicles.

PREDICTORS FOR RURAL AREAS

H4 is statistically supported by the data, with one of the two subfactors within Performance Expectancy, Performance Control, showing a significantly negative impact on the intent to use autonomous vehicles for the rural population. This is not surprising. These findings also align with Chmielewski (2018) and Eurofound (2019), who suggest that performance expectancy for autonomous vehicles would be negative in rural areas due to technical difficulties that implementation could face. Additionally, the second subfactor, Vehicle Performance, falls outside the 95% significance level threshold, but it could be considered a semi-significant factor when applying a significance level of 90%. The difference in this significance level does indicate that rural respondents have more concern over how they can influence control of the vehicle than the actual performance of the vehicle itself. A surprising finding in this comparison is that Performance Expectancy does not seem to be a significant factor for urban respondents. Especially since respondents from Nordhoff et al. (2018) experiment with self-driving shuttles in an urban environment indicated that having some control over the vehicle was important.

Facilitating conditions are seen as a significant factor for intent to use by rural respondents but holds no significant value for urban respondents. This is in line with the stated hypothesis (H7) and confirms the stipulation based on the findings by Howard and Dai (2014) and Madigan et al. (2017). The fact that it seems non-significant for the tested urban population does contradict the consensus that facilitating conditions are essential to intent to use autonomous vehicles. An explanation for the result could be that the nature of the selected questions (FC4: Autonomous vehicles will decrease travelling time in general; FC5: Autonomous vehicles will be accessible for everyone) seems more favourable for rural respondents.

PREDICTORS FOR URBAN AREAS

Interestingly, trust in safety does not seem to affect the respondents in this study as much as in previous studies (Bansal & Kockelman, 2018; Brell et al., 2019; Cho et al., 2017; Gkartzonikas & Gkritza, 2019; Nordhoff et al., 2019 Rovira et al., 2019). Both groups show a moderate negative correlation with the intent to use, indicating that trust decreases the intent to use an autonomous vehicle. But the final regression model it is showing that rural respondents do not really care about the trust in safety, whilst urban respondents are worried about this. It could be because of their generally positive attitude towards technology or that they might feel that the technology has matured enough. with

For urban respondents, the factor of vehicle characteristics is a significant factor (B = .140, sig. = 0.087), whereas, for rural respondents (B = .081, sig. = 0.525), it is not that significant when it comes to the intent of using an autonomous vehicle. The result does not support the hypothesis (H8) that both populations have an equal interest in vehicle characteristics concerning the intent to use autonomous vehicles. Even more so, this is not in line with Site et al. (2011) and Nordhoff et al. (2019), who found that service and quality aspects like availability, flexibility and convenience are important determinants within vehicle characteristics when considering to use of autonomous vehicles.

Similar to findings from Bansal, Kockelman, & Singh (2016), König & Neumayr (2017), and Kyriakidis et al. (2015), effort expectancy has a positive influence on the tested urban population. This can very well be explained by the fact that residents living in an urban environment often see themselves as digital and technically capable, resulting in being confident that they can perform the task at hand, in this case, being able to use an autonomous vehicle. The opposite counts for our rural respondents, with the data showing a slightly negative impact on the intent to use autonomous vehicles, but this cannot be statistically proven.

PREDICTORS FOR RURAL & URBAN AREAS

The factor of perceived benefits provides some interesting findings that is partly in line with Jardin (2013) and Menon (2015), who had mixed results. First, the factor is split into two underlying factors, Practical Benefits and User benefits, related to the intent to use autonomous vehicles. Secondly, only User Benefits can be proven to be statistically significant for both of the populations in the research. This shows us that respondents seem to only positively award direct benefits in line with findings by Shabanpour et al. (2017). Practical benefits, like being able to do more work or play a game, do not play a significant role in the intent to use autonomous vehicles. This is surprising since most respondents in the research are young, tech-savvy individuals, and all previous research (Jardim et al., 2013; Menon, 2015; Bansal and Kockelman, 2018) points out that this group is more willing to adopt autonomous vehicles based on the promise of higher productivity.

With respect to the factor of hedonic motivation, the research yielded some interesting findings. Tamilmani (2019) found related to hedonic motivation is an umbrella factor for effort expectancy and performance expectancy. Considering that these factors are both more significant for the rural respondents, the same result would be expected for hedonic motivation. Instead, urban areas show a higher correlation with hedonic motivation compared to the respondents that live in rural areas. With rural respondents being more frequent car users compared to urban respondents, this result could be explained by the findings of Rodel et al. (2014) and Kyriakadis et al. (2015) that people who enjoy the activity of driving experience a lower hedonic motivation to use autonomous vehicles.

SOCIAL INFLUENCE AS A NON-PREDICTOR

The controversy about social influence being a predictor for intent to use autonomous vehicles, or technology for that matter, is made evident once more with the finding of this paper. All social predictors are insignificant for either population in the research, rejecting the hypothesis that a rural population would be more impacted by social influence than their urban counterparts. This supports the statement of Davis et al. (1989), who excluded social influence from the Technology Acceptance Model, and the findings of Bansal and Kockelman (2018), who found that some respondents do not care about social influential predictors either.

LIMITATIONS

An issue that did arise was how the research sample reflects a young, tech-savvy population for both rural and urban populations. This means that bias towards technology can be an issue. Additionally, the sample for rural areas does not fully reflect a normal demographic build-up. Another concern is related to the age distribution of the respondents. Normally distribution would mean that roughly 15% of our population should be aged 65+ (Parket et al., 2018); within this research, this group is underrepresented, with only 2.5% being aged 65 or older. To get a better overview of the intention to use autonomous vehicles, further research on the elderly population should be done, especially in rural areas that are known to have a higher percentage of elderly in their population.

Even though this research includes the factors from the MAVA model set by Nordhoff et al. (2019), it did not test the four-phase approach for adopting autonomous vehicles. According to the MAVA model, there is. The method used in this research does not take this into account. It only measures a general attitude towards autonomous vehicles before considering all factors, and afterwards, the intent to use autonomous vehicles is measured. To thoroughly test the MAVA model, as Nordhoff et al. (2019) suggested, a check of acceptance or rejection needs to occur after each phase.

Additionally, the research design method was a confirmatory approach to test the MAVA model as designed by Nordhoff et al. (2019). A model fit was hard to make during factor analysis, resulting in a new model. As this is not a true limitation in nature, it does show that untested models are not always a good fit for confirmatory research and can end up being more exploratory during the analysis phase of research.

ACADEMIC IMPLICATIONS

Like many studies, the lack of field testing of autonomous driving within the current research is a major limitation. Since autonomous vehicles will not be available for the foreseeable time, evaluating real-life determinants is difficult (Kaur & Rampsteder, 2018). Due to this, respondents had to base their opinion on little knowledge or information they already had. This is a limitation that Pettigrew et al. (2019), Nordhoff et al. (2016), and Furtunati et al. (2019) also acknowledge. An introductory video was included in the survey as a countermeasure, but this cannot match real-life experience. Further research has to be done where respondents can test the real-life product because trying and having a good experience with a product can positively affect the attitude towards that product.

Secondly, the many factors that play a role in the intent to use or adopt autonomous vehicles have not yet been tested and confirmed. This research is proof of that, finding several new underlying factors within the model proposed by Nordhoff et al. (2019). The relation between intent to use autonomous vehicles and the factors Effort Expectancy, Social Influence, Trust in safety, Perceived Risks and Perceived Benefits. Especially the Risk-Benefit relation is a critical factor to understand to be able to create a model for the widespread adoption of autonomous vehicles (Fraedrich & Lenz, 2016; et al., 2017; Pioa et al.; 2016).

Increased mobility and being able to work while travelling (e.g. increased productivity) are seen as one of the most attractive attributes of autonomous vehicles (Bansal & Kockelman, 2018; Jardin et al., 2019; Menon, 2015). In this research, this does not seem to resonate. Additionally, the findings on this topic vary a lot, meaning that further specific research or education is needed to clarify this.

As mentioned in the limitation section of this paper, more between age groups research within the domain of autonomous vehicles is needed. More research needs to be done to acquire knowledge about how different age groups in different areas intend to use or adopt autonomous vehicles. Only Lee (2017) and

Rovina et al. (2019) have done studies related to the topic; they, however, only touch on the general public and do not differentiate between rural, suburban and rural.

PRACTICAL IMPLICATIONS

Apart from the academic implications, this research can provide insights to policymakers in the field of mobility and developers of autonomous vehicles. By showing which factors are important to which community, efforts could be made to invest or educate people to be more receptive to the idea of using autonomous vehicles. For example, since we know that individual user benefits positively affect the adoption of autonomous vehicles, governments could investigate the possibility of free parking or toll-free roads as an incentive to use autonomous vehicles. Likewise, manufacturers can focus on the issues related to performance control and vehicle performance to make sure potential users feel comfortable using autonomous vehicles.

CONCLUSION

This research set out to compare the intent to use autonomous vehicles between rural and urban populations to identify if the rural population is ready for the concept of autonomous vehicles. The MAVA model explains the intention to use autonomous vehicles to a high degree, and this is specifically the case for rural respondents. It has been a good tool for examining the difference between both populations and identifying the significant factors for the intent to use autonomous. The presented results also break with the known consensus that rural areas are less interested in new technology than urban respondents. This insight opens up possibilities for policymakers and technology companies to explore future testing of autonomous vehicles in rural areas. As for academics, there are still many aspects of the intent to use autonomous vehicles to be researched, with only three out of twelve hypotheses confirmed in the current study.

Both populations show different approaches when looking at the significant factors to intent to use autonomous vehicles. Rural respondents seem to base their choice on intent to use more on practical factors like how ‘will autonomous vehicles perform’ (vehicle performance) or ‘are they available to me’ (facilitating conditions), whilst urban respondents base their choice based on factors like ‘will it decrease my travelling time’ (vehicle characteristics), how hard is it to use one (effort expectancy) and is it safe to use an autonomous vehicle (safety), that have a more direct gratification and self-gain aspect to it.

On a more detailed level, user benefits and hedonic motivation seem to be the strongest predictors for the intention to use autonomous vehicles. This shows us that users' risk-benefit equation related to autonomous vehicles is not solely based on practical factors but that factors related to feelings like joy and pleasure also play a significant role. User benefits seem to address the more direct benefits of the spectrum, like finding a parking spot or cost reductions, reflecting our instant gratification-orientated society. Knowing this could be used as an advantage in designing autonomous vehicles to fit user needs or in promotional activity to increase the likeliness of potential users for autonomous vehicles. An example of this could be a campaign to avoid more traffic in the city by leveraging free parking when using autonomous vehicles (e.g. take an AV and park for free).

Another benefit that needs to be leveraged is increased mobility. Researchers like Meyer (2017), Chmielewski (2018) and Vitale et al. (2020) think they can improve life for many demographic groups, especially those living in rural areas. Nevertheless, this research shows that respondents do not seem aware of this. Promotional groups for economic growth in less connected areas need to become aware of these benefits and communicate this to inhabitants and policymakers.

Finally, developers of autonomous vehicles also have to look at how performance control affects their potential users since this is an essential factor for rural respondents that negatively influences the intent to use the technology. Communicating how autonomous vehicles work and how easy they are to use could play a pivotal role in the public's acceptance and initial use.

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APPENDIX

SURVEY

Future mobility adoption Rural vs Urban

Start of Block: Welcome

W1 Dear participant,

You are invited to participate in a study about **the adoption of future mobility for people that live in different geographical areas.** During this online survey, you will be asked about your opinion, meaning no skills or knowledge will be tested.

Participation takes **approximate 10-15 minutes** of your time. It is entirely voluntary; you can withdraw at any time and are free to omit any question.

We believe there are no known risks associated with this research study; however, as with any online-related activity, the risk of a breach is always possible. To the best of our ability, your answers in this study will remain **confidential and anonymous.** All data related to this study is stored on EU servers and will be deleted 12 months after completion of the study. *This study is being executed by Michael Gale from the Faculty of Behavioural, Management and Social Sciences at the **University of Twente**. For further information related to the survey and study, please contact: m.n.gale@student.utwente.nl*
Thank you for taking the time to participate!
By continuing, you give your consent to take part in this survey.

End of Block: Welcome

Start of Block: Geographical

G1 In which country do you currently reside?

▼ Afghanistan (1) ... Zimbabwe (1357)

G2 Please enter your postcode:

____

G4
For the following question, move the sliders to answer the question. Please move the slider on the scale from not at all (1) to very much (7)

	Not at all					Very much	
	1	2	3	4	5	6	7
I consider the area I live in as Rural (e.g. country side, village) ()							
I consider the area I live in as Urban (e.g. metro pole or city) ()							

End of Block: Geographical

Start of Block: Car ownership & usage

C1 Do you have a car available to you?

- Yes (1)
- No (2)

Skip To: End of Block If Do you have a car available to you? = No

C2

	Yes (1)	No (2)
Owned by me (1)		
Privately leased or Rented (2)		
Leased by the company I work for (3)		
Borrowed from friends or family (4)		

Skip To: C4 If Please fill in yes or no for the following statements: The car I use is... = Owned by me [No]

*

C3 How many cars do you own?

____

C4 How do you primarily use your car? Please move the slider on the scale from never (1) to daily (7)

Never						Daily
1	2	3	4	5	6	7

Going to work ()	
Driving for joy & fun ()	
Doing shopping & groceries ()	
Visiting friends & family ()	

End of Block: Car ownership & usage

Start of Block: Public Transport

PT1 Do you use public transport?

- Yes (1)
- No (2)

Skip To: End of Block If Do you use public transport? = No

PT2 For what purpose do you use public transport? Please move the slider on the scale from never (1) to daily (7)

	Never				Daily		
	1	2	3	4	5	6	7
Going to work ()							
Bus rides for joy & fun ()							
Doing shopping & groceries ()							
Visiting friends & family ()							

End of Block: Public Transport

Start of Block: Tech-Attitude

TA1 In the box below, you will find a number of statements about using **new technology** like computers, mobile phones, drones and cars. Please specify to what extent you agree with the statement.

	Definitely yes (1)	Probably yes (2)	Might or might not (3)	Probably not (4)	Definitely not (5)
I am excited about the possibilities offered by new technologies (1)	○	○	○	○	○
I consider myself comfortable using (new) technology (2)	○	○	○	○	○
I always try out new technology (3)	○	○	○	○	○
I think advancement in technology is generally a positive thing (4)	○	○	○	○	○
I am sceptical about technology and its promises for a better future (5)	○	○	○	○	○
I fear technology will completely replace humans and take over our jobs (6)	○	○	○	○	○

End of Block: Tech-Attitude

Start of Block: Introduction

Q22
You will now be shown a video. Please watch carefully.

Q23 Timing

First Click (1)
Last Click (2)
Page Submit (3)
Click Count (4)

End of Block: Introduction

Start of Block: Initial Exposure

IE1 In the box below, you will find a number of statements about **autonomous vehicles (**self-driving cars). Please specify to what extent you agree with the statement.

	A great deal (1)	A lot (2)	A moderate amount (3)	A little (4)	None at all (5)
I have heard about Autonomous Vehicles (1)	○	○	○	○	○
I am excited about the prospect of Autonomous Vehicles (2)	○	○	○	○	○
I think Autonomous Vehicles are a good idea (3)	○	○	○	○	○
I know a lot about Autonomous Vehicles (4)	○	○	○	○	○
I think Autonomous Vehicles will become mainstream very soon (5)	○	○	○	○	○

End of Block: Initial Exposure

Start of Block: Attitude / Semantic

AS1 Taking into consideration the video you have just seen. How would you rate the following characteristics in relation to autonomous vehicles? Please rate them on a scale of 1 to 5, with 3 being neutral

	1	2	3	4	5	
	1 (1)	2 (2)	3 (3)	4 (4)	(5)	
Useless	○	○	○	○	○	Useful
Uninteresting	○	○	○	○	○	Interesting
Unsafe	○	○	○	○	○	Safe
Expensive	○	○	○	○	○	In-expensive
Bad Performance	○	○	○	○	○	Good Performance
Time-consuming	○	○	○	○	○	Time-saving
Difficult to use	○	○	○	○	○	Easy to use

End of Block: Attitude / Semantic

Start of Block: Vehicle Characteristics

VC1 Taking into consideration the video you have just seen, please specify to what extent you agree with the statements below.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I think autonomous vehicles will be high-quality cars (1)	o	o	o	o	o
I expect autonomous vehicles will be convenient & easy to use (2)	o	o	o	o	o
Autonomous vehicles will give me flexible travelling options (3)	o	o	o	o	o
Autonomous vehicles will decrease travelling time in general (4)	o	o	o	o	o
Autonomous vehicles will be accessible for every one (5)	o	o	o	o	o

End of Block: Vehicle Characteristics

Start of Block: Personal Safety

S3 How likely do you think the following **safety issues** will occur **using autonomous vehicles**?

	Definitely not (1)	Probably not (2)	Might or might not (3)	Probably yes (4)	Definitely yes (5)
System failure (1)	o	o	o	o	o
Hacking of the computer system (2)	o	o	o	o	o
Terrorists taking over control (3)	o	o	o	o	o
Technical failure (4)	o	o	o	o	o
Systems not being able to recognize complex conditions on the road (5)	o	o	o	o	o
The ability to drive in bad weather conditions (e.g. Heavy rain or snow) (6)	o	o	o	o	o

End of Block: Personal Safety

Start of Block: Performance Expectancy

PE1 Please answer the following statements related to the **performance of autonomous vehicles**.

	Definitely not (1)	Probably not (2)	Might or might not (3)	Probably yes (4)	Definitely yes (5)
I would feel comfortable using one without any direct controls like a steering wheel (1)	○	○	○	○	○
I would like to be able to take over manual control if needed (2)	○	○	○	○	○
I would like to have a panic or control buttons (3)	○	○	○	○	○
I would expect the technology to fail a lot (4)	○	○	○	○	○

PE2 How do you think that **autonomous vehicles** will be **performing in the following situations**?

	Definitely not (1)	Probably not (2)	Might or might not (3)	Probably yes (4)	Definitely yes (5)
They are suitable for real road environments (1)	○	○	○	○	○
They are ready for off-road situations (2)	○	○	○	○	○
They will work well in remote and rural areas (3)	○	○	○	○	○
They will work well in urban areas (4)	○	○	○	○	○
They will only work well in controlled environments like motorways or university campuses. (5)	○	○	○	○	○

End of Block: Performance Expectancy

Start of Block: Effort Expectancy

EE1 Below, you will find a number of statements about the **use of autonomous vehicles**. To what extent do you agree with the statements?

	Strongly agree (21)	Somewhat agree (22)	Neither agree nor disagree (23)	Somewhat disagree (24)	Strongly disagree (25)
They will be intuitive and straightforward in use (1)	○	○	○	○	○
I think it will be easy for me to use one (2)	○	○	○	○	○
I think it will be easy for me to become skilful in (3)	○	○	○	○	○
It will not take much effort to use one (4)	○	○	○	○	○
Using one will be easy for every one (5)	○	○	○	○	○

End of Block: Effort Expectancy

Start of Block: Facilitating Conditions

FC1 In the box below, you will find a number of statements about the **use of autonomous vehicles**. To what extent do you agree with the statements?

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
It would be up to me whether I would travel in one (1)	○	○	○	○	○
I would use one for daily travel because it will be more convenient (2)	○	○	○	○	○
I will use one because it fits to my personal needs and living conditions (3)	○	○	○	○	○
Showing me how to use one would make me more confident about using them (4)	○	○	○	○	○
Knowing help is available when using one would make me more confident about using them (5)	○	○	○	○	○

End of Block: Facilitating Conditions

Start of Block: Hedonic Motivation

HM1 Please answer the following statements about **how it would be to use an autonomous vehicle**.

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
Travelling in one will be comfortable (1)	o	o	o	o	o
I would enjoy being driven by one (2)	o	o	o	o	o
I would miss the joy of driving myself (7)	o	o	o	o	o
They must be pleasing aesthetic in form of styling and design. (4)	o	o	o	o	o
Using one will be fun (5)	o	o	o	o	o
Using one will be exciting (6)	o	o	o	o	o

End of Block: Hedonic Motivation

Start of Block: Social Influence

SI1 My **opinion about autonomous vehicles** is based on:

	Definitely not (6)	Probably not (7)	Might or might not (8)	Probably yes (9)	Definitely yes (10)
News and media reports (1)	o	o	o	o	o
Opinions of friends and family (2)	o	o	o	o	o
Opinions of colleagues (3)	o	o	o	o	o
Opinions of celebrities and people I look up to (4)	o	o	o	o	o

SI2 To what extent do you agree with the following statements related to the **social status of using an autonomous vehicle**?

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
I will travel in one if my friends and family do the same (1)	○	○	○	○	○
I will travel in one if my colleagues do the same (2)	○	○	○	○	○
I would gain respect and recognition from my friends and family if I use one (3)	○	○	○	○	○
I would gain respect and recognition in my community if I use one (4)	○	○	○	○	○

End of Block: Social Influence

Start of Block: Perceived Benefits

PB1 To what extent do you agree with the following statements about the **benefits that autonomous vehicles could bring?**

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
They would reduce the stress of driving (1)	○	○	○	○	○
They would make it possible to travel to places I otherwise could not travel to (2)	○	○	○	○	○
I think they will reduce traveling cost (3)	○	○	○	○	○
Parking in the city won't be an issue anymore (4)	○	○	○	○	○

PB2 Continued

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
To drive in an autonomous vehicle you do not need a drivers license (5)	○	○	○	○	○
Traveling in it would enable me to look out of the window and enjoy the scenery (6)	○	○	○	○	○
Traveling in it would enable me to relax (e.g. read a book or play a game) (7)	○	○	○	○	○
Traveling in it would enable me to do some work (8)	○	○	○	○	○

End of Block: Perceived Benefits

Start of Block: Perceived Risks

PR1 To what extent do you agree with the following statements regarding the **risks of using autonomous vehicles**?

	Strongly disagree (6)	Somewhat disagree (7)	Neither agree nor disagree (8)	Somewhat agree (9)	Strongly agree (10)
They can safely interact with: human driven vehicles (1)	○	○	○	○	○
They can safely interact with: cyclists (2)	○	○	○	○	○
They can safely interact with: pedestrians (3)	○	○	○	○	○
Sensitive data like usage, travel history or personal information will be safely stored when using one (4)	○	○	○	○	○
It will be difficult to decide who has the legal liability in case of an accident (5)	○	○	○	○	○
Eventually no one will know how to drive manually anymore (6)	○	○	○	○	○

End of Block: Perceived Risks

Start of Block: Intention to Use

IU1 **Imagine that Autonomous Vehicles would become available to you in the near future.** Please specify to what extent you would be freely willing to use an autonomous vehicle.

	Definitely not (1)	Probably not (2)	Might or might not (3)	Probably yes (4)	Definitely yes (5)
The idea of using autonomous vehicle for transport is appealing to me (1)	o	o	o	o	o
I intend to try out autonomous vehicle (2)	o	o	o	o	o
I intend to use autonomous vehicle (3)	o	o	o	o	o
I would buy an autonomous vehicle (4)	o	o	o	o	o
I would encourage others to use autonomous vehicles (5)	o	o	o	o	o

End of Block: Intention to Use

Start of Block: Demographics

D1 How do you identify yourself?

- Male (1)
- Female (2)
- Non-binary / third gender (3)
- Prefer not to say (4)

*

D2 What is your age? (Please enter in digits)

____

D3 What is the highest level of education you have completed?

- Less than high school (1)
- High school graduate (2)
- College Degree (3)
- Bachelor Degree (4)
- Master Degree (5)
- Doctorate (6)

D4 What is your current living status?

- Single (1)
- Married (2)
- Living together (3)

Skip To: End of Block If What is your current living status? = Single

---

*

D5 Of how many people does your household consist?

____

End of Block: Demographics

TABLE X: ROTATED COMPONENT MATRIX

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IU1	.604													
IU2	.698													
IU3	.819													
IU4	.823													
IU5	.732													
EE1		.800												
EE2		.802												
EE3		.717												
EE4		.828												
TS1			.777											
TS2			.826											
TS3			.752											
TS4			.770											
PB6				.766										
PB7				.852										
PB8				.842										
PR1					.745									
PR2					.847									
PR3					.796									
SR7 (SI7)						.856								
SR8 (SI8)						.871								
FC4							.860							
FC5							.827							
PC2 (PE2)								.849						
PC3(PE3)								.843						
SO2 (SI2)									.885					
SO3 (SI3)									.826					
SP5 (SI5)										.789				
SP6 (SI6)										.781				
HM5											.684			
HM6											.698			
VC3												.758		
VC4												.727		
VP5 (PE5)													.706	
VP8 (PE8)													.755	
UB3 (PB3)														.629
UB3 (PB4)														.843
Cronbach Alpha	***.920***	***.884***	***.812***	***.862***	***.884***	***.905***	***.829***	***.814***	***.756***	***.837***	***.867***	***.631***	***.741***	***.573***
% of Variance	***29.36%***	***9.49%***	***7.53%***	***5.29%***	***4.65%***	***3.96%***	***3.60%***	***3.26%***	***3.25%***	***2.64%***	***2.47%***	***2.27%***	***1.99%***	***1.78%***
Eigenvalue	***10.86***	***3.51***	***2.78***	***1.96***	***1.72***	***1.46***	***1.33***	***1.20***	***1.20***	***0.97***	***0.91***	***0.84***	***0.74***	***0.66***

Factors: Intention to Use (IU), Effort Expectancy (EE), Trust in Safety (TS), Practical Benefits (PB), Perceived Risks (PR), Social Recognition (SR), Facilitating Conditions (FC), Performance Control (PC), Social Opinion (SO), Social Pressure (SP), Hedonic Motivation (HM), Vehicle Characteristics (VC), Vehicle Performance (VP), User Benefits (UB)

TABLE X: CORRELATION TABLE URBAN & RURAL

Correlations: Urban & Rural

	Area	TA	IE	AS	CU	PT	VC	ST	PC	VP	EE	FC	HM	SO	SP	SR	PB	UB	PR	IU
TA	Urban	1																		
	Rural	1																		
IE	Urban	.448**	1																	
	Rural	.399**	1																	
AS	Urban	.180*	.532**	1																
	Rural	.352**	.515**	1																
CU	Urban	.154	.120	-.038	1															
	Rural	.004	.094	-.037	1															
PT	Urban	.040	.038	-.031	-.359**	1														
	Rural	-.079	-.247	-163	-.296*	1														
VC	Urban	.054	.281**	.523**	.039	-.105	1													
	Rural	.329**	.357**	.562**	.059	-.109	1													
TS	Urban	-.120	-.106	-.156	-.030	.206*	-.122	1												
	Rural	.019	-.049	-.103	.078	-.080	.061	1												
PC	Urban	.159	.083	.161	-.112	.111	.033	.276**	1											
	Rural	.161	.004	.319*	-.073	-.242	.267*	.076	1											
VP	Urban	.163	.477**	.634**	-.017	-.098	.415**	-.157	.256**	1										
	Rural	.138	.291*	.433**	-.059	-.012	.250*	-.281*	.247	1										
EE	Urban	.136	.416**	.651**	-.114	-.076	.393**	-.095	.309**	.624**	1									
	Rural	.198	.332**	.543**	.104	-.177	.369**	-.103	.308*	.366**	1									
FC	Urban	.173*	.139	.321**	-.045	-.055	.318**	-.105	.362**	.365**	.356**	1								
	Rural	.042	.216	.327**	.128	-.129	.166	.012	.273*	.407**	.353**	1								
HM	Urban	.171*	.303**	.493	.039	-.149	.426**	-.197*	.121	.448**	.479**	.496**	1							
	Rural	.229	.278*	.405**	.084	-.034	.266*	-.262*	.065	.359**	.482**	.422**	1							
SO	Urban	.136	.068	.044	-.108	.057	.041	-.011	.035	.149	-.017	.138	.119	1						
	Rural	.009	.209	.047	.076	.049	.158	-.106	-.042	.160	.011	.151	.061	1						
SP	Urban	-.029	.014	.218**	.080	-.055	.210*	-.077	.118	.279**	.139	.228**	.353**	.273**	1					
	Rural	.047	.192	.148	.178	-.030	.352**	-.079	.023	.217	.144	.275*	.213	.380**	1					
SR	Urban	-.036	.117	.125	.099	-.041	.209*	-.089	.037	.169*	.082	.227**	.209*	.272**	.618**	1				
	Rural	.111	.383**	.180	.040	.222	.193	-.261*	-.183	.187	.177	.138	.245	.451**	.529**	1				
PB	Urban	.049	.257**	.366**	.102	-.150	.382**	-.250**	-.113	.342**	.339**	.155	.407**	-.003	.193*	.204*	1			
	Rural	.285*	.316*	.272*	.223	-.050	.479**	-.075	-.046	.092	.242	-.016	.353**	.295*	.260*	.212	1			
UB	Urban	.095	.320**	.452**	-.016	-.121	.313**	-.130	.116	.379**	.354**	.244**	.443**	.038	.213*	.180*	.350**	1		
	Rural	.258*	.300*	.250	-.005	.058	.299*	-.150	.221	.278*	.460**	.281*	.431**	.056	.240	.264*	.190	1		
PR	Urban	.107	.371**	.563**	-.006	.019	.429**	-.249**	.055	.489**	.460**	.274**	.503**	.147	.400**	.329**	.398**	.322**	1	
	Rural	.144	.331**	.395**	.070	.114	.131	-.421**	.036	.514	.318	.267	.468	.268	.261	.358	.375	.176	1	
IU	Urban	.235**	.509**	.596**	.074	-.095	.509**	-.302**	.024	.495**	.554**	.366**	.678**	.085	.280**	.245**	.460**	.503**	.606**	1
	Rural	.389**	.493**	.463**	.069	.031	.415**	-.330**	-.041	.499**	.406**	.442**	.626**	.341**	.426**	.540**	.372**	.588**	.463**	1

** correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

TABLE X: REGRESSION MODEL URBAN & RURAL

Regression Coefficients

Region	Model	Factor	B	Std. Error	Beta	t	Sig.
Urban	1	(constant)	-0.190	0.472		-0.404	0.687
		TA	0.055	0.097	0.042	0.561	0.576
		AS	**0.636**	**0.109**	**0.456**	**5.815**	**0.000**
		IE	**0.270**	**0.094**	**0.248**	**2.869**	**0.005**
	2	(constant)	-0.072	0.504		-0.143	0.886
		TA	0.053	0.098	0.041	0.544	0.587
		AS	**0.633**	**0.111**	**0.454**	**5.714**	**0.000**
		IE	**0.272**	**0.095**	**0.250**	**2.859**	**0.005**
		CU	0.014	0.039	0.026	0.351	0.726
		PT	-0.052	0.045	-0.082	-1.145	0.254
	3	(constant)	0.092	0.573		0.161	0.872
		TA	0.034	0.091	0.026	0.373	0.710
		AS	0.209	0.131	0.150	1.596	0.113
		IE	**0.237**	**0.089**	**0.218**	**2.675**	**0.008**
		CU	0.036	0.035	0.068	1.014	0.313
		PT	0.012	0.042	0.020	0.295	0.768
		VC	**0.233**	**0.083**	**0.202**	**2.795**	**0.006**
		ST	**-0.184**	**0.077**	**-0.158**	**-2.382**	**0.019**
		PC	-0.130	0.080	-0.116	-1.609	0.110
		VP	-0.003	0.093	-0.003	-0.037	0.971
		EE	0.289	0.097	0.259	2.967	0.004
		FC	0.178	0.080	0.157	2.236	0.027
	4	(constant)	-0.172	0.529		-0.325	0.745
		TA	0.028	0.083	0.021	0.331	0.741
		AS	0.122	0.119	0.088	1.026	0.307
		IE	**0.230**	**0.082**	**0.211**	**2.794**	**0.006**
		CU	0.023	0.032	0.043	0.699	0.486
		PT	0.025	0.038	0.040	0.672	0.503
		VC	**0.165**	**0.076**	**0.143**	**2.175**	**0.032**
		TS	**-0.153**	**0.069**	**-0.131**	**-2.197**	**0.030**
		PC	-0.098	0.073	-0.088	-1.348	0.180
		VP	-0.041	0.086	-0.038	-0.479	0.633
		EE	**0.219**	**0.090**	**0.197**	**2.439**	**0.016**
		FC	0.014	0.078	0.012	0.181	0.857
		HM	**0.389**	**0.073**	**0.388**	**5.317**	**0.000**
		SO	-0.001	0.055	-0.002	-0.026	0.979
		SP	0.039	0.072	0.040	0.539	0.591
		SR	0.047	0.066	0.051	0.718	0.474
	5	(constant)	-0.355	0.525		-0.675	0.501
		TA	0.042	0.081	0.032	0.522	0.603

		AS	0.025	0.119	0.018	0.207	0.836
		IE	**0.195**	**0.080**	**0.179**	**2.431**	**0.017**
		CU	0.026	0.031	0.050	0.830	0.408
		PT	0.021	0.037	0.034	0.572	0.569
		VC	0.136	0.075	0.118	1.829	0.070
		TS	-0.119	0.069	-0.102	-1.734	0.086
		PC	-0.093	0.072	-0.084	-1.306	0.194
		VP	-0.067	0.084	-0.062	-0.796	0.428
		EE	**0.199**	**0.088**	**0.179**	**2.269**	**0.025**
		FC	0.030	0.075	0.027	0.404	0.687
		HM	**0.313**	**0.075**	**0.312**	**4.200**	**0.000**
		SO	0.002	0.053	0.002	0.030	0.976
		SP	0.009	0.071	0.009	0.128	0.898
		SR	0.018	0.064	0.019	0.274	0.784
		PB	0.033	0.064	0.032	0.508	0.612
		UB	**0.137**	**0.059**	**0.143**	**2.313**	**0.022**
		PR	**0.171**	**0.074**	**0.169**	**2.326**	**0.022**
Rural	1	(constant)	0.029	0.689		0.042	0.966
		TA	0.227	0.146	0.185	1.554	0.126
		AS	0.360	0.186	0.247	1.933	0.058
		IE	**0.307**	**0.137**	**0.292**	**2.244**	**0.029**
	2	(constant)	-0.692	0.799		-0.865	0.391
		TA	0.222	0.145	0.181	1.533	0.131
		AS	**0.394**	**0.186**	**0.270**	**2.120**	**0.038**
		IE	**0.338**	**0.138**	**0.322**	**2.440**	**0.018**
		CU	0.058	0.061	0.107	0.951	0.346
		PT	0.133	0.076	0.200	1.743	0.087
	3	(constant)	0.340	0.933		0.364	0.717
		TA	**0.298**	**0.117**	**0.243**	**2.553**	**0.014**
		AS	-0.024	0.186	-0.016	-0.127	0.900
		IE	0.179	0.115	0.170	1.555	0.126
		CU	0.014	0.050	0.025	0.272	0.787
		PT	0.068	0.063	0.103	1.084	0.284
		VC	**0.255**	**0.112**	**0.238**	**2.267**	**0.028**
		TS	**-0.346**	**0.121**	**-0.257**	**-2.859**	**0.006**
		PC	**-0.380**	**0.145**	**-0.262**	**-2.627**	**0.011**
		VP	0.268	0.152	0.184	1.758	0.085
		EE	0.141	0.138	0.107	1.019	0.313
		FC	**0.362**	**0.107**	**0.332**	**3.384**	**0.001**
	4	(constant)	-0.727	0.871		-0.834	0.408
		TA	**0.272**	**0.105**	**0.222**	**2.581**	**0.013**
		AS	0.011	0.168	0.008	0.066	0.948
		IE	0.079	0.111	0.076	0.715	0.478

	CU	-0.006	0.045	-0.011	-0.135	0.893
	PT	0.016	0.060	0.024	0.265	0.792
	VC	0.157	0.108	0.147	1.459	0.151
	TS	-0.194	0.115	-0.144	-1.691	0.098
	PC	**-0.274**	**0.132**	**-0.189**	**-2.075**	**0.044**
	VP	0.235	0.137	0.161	1.719	0.092
	EE	0.033	0.130	0.025	0.257	0.798
	FC	**0.219**	**0.103**	**0.202**	**2.131**	**0.038**
	HM	**0.332**	**0.119**	**0.272**	**2.797**	**0.007**
	SO	0.087	0.074	0.102	1.174	0.246
	SP	0.058	0.093	0.062	0.621	0.538
	SR	0.149	0.097	0.172	1.542	0.130
5	(constant)	-0.484	0.797		-0.607	0.547
	TA	**0.232**	**0.097**	**0.189**	**2.391**	**0.021**
	AS	0.163	0.160	0.112	1.016	0.315
	IE	0.012	0.104	0.012	0.116	0.908
	CU	0.002	0.042	0.004	0.046	0.964
	PT	-0.015	0.057	-0.022	-0.258	0.797
	VC	0.096	0.109	0.089	0.873	0.388
	TS	-0.174	0.109	-0.130	-1.598	0.117
	PC	**-0.352**	**0.123**	**-0.243**	**-2.853**	**0.007**
	VP	0.259	0.132	0.177	1.960	0.057
	EE	-0.091	0.124	-0.069	-0.731	0.469
	FC	**0.201**	**0.097**	**0.185**	**2.079**	**0.044**
	HM	**0.258**	**0.117**	**0.212**	**2.209**	**0.033**
	SO	0.110	0.071	0.128	1.547	0.129
	SP	0.033	0.085	0.036	0.391	0.698
	SR	0.140	0.089	0.161	1.576	0.122
	PB	0.029	0.102	0.028	0.289	0.774
	UB	**0.277**	**0.081**	**0.301**	**3.404**	**0.001**
	PR	-0.051	0.108	-0.050	-0.474	0.638

a. Dependent Variable: IU