Jesus Take The Wheel: Exploring Public Perceptions and Attitudes Towards Autonomous Vehicles

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

The history of autonomous vehicles (AVs) ties back to almost a century ago. Beginning in 1925, it was an electrical engineer, Francis Houdina, who presented a demonstration of the world's first unmanned vehicle via radio control. As the public awed at the vehicle navigating its way down Broadway in New York City, the ideas of a future with driverless cars never seemed more exciting. Ironically, as the vehicle navigated through corners, shifting in acceleration, the demonstration ended with the vehicle crashing into another (Engelking, 2019). However, this did not spark any outcry or disinterest in autonomous vehicle technology. In fact, this marked an era for automation in vehicles which grew with time. Most prominently, AVs became truly autonomous for the first time in the 1980s with the integration of computer technology which has begun to change the way many processes are done today (Gil, 2021).

With that, the past two decades have seen large transformations in the AV industry garnering potential to transform society itself. Companies like Tesla, Waymo, and General Motors have been on the forefront of this quickly transforming technology throughout the past decade making larger and larger strides towards safer, more affordable, and more accessible autonomous vehicles to the general public. Regardless, AVs continue to bring major concerns regarding safety, job security, and its overall integration into society (Thomas et al., 2020). As a result, significant challenges remain involving policymakers and public perceptions among the many ethical considerations to be made. While the past of AVs has been filled with optimism and the present has fulfilled its duty in modernizing this technology, the future holds many questions as to how the public will perceive and accept this technology.

In this era marked by the rapid advancement of autonomous driving, it becomes crucial to understand the complex dynamics of skepticism, acceptance, and trust surrounding emerging AI

technology and automation (Ajenaghughrure, 2020). This includes the explicit and implicit factors that exist to influence one's perceptions whether or not apparent to the individual. Therefore, at the core of this socio-technical research is a combination of fundamental research questions: How can individuals be made more accustomed to, or accepting of, AV technology? What are the determinant factors that influence a person's perception of AVs? These questions aim to uncover the hindering factors in promoting a future of AVs while understanding what could be done to facilitate its integration. By bridging the gap between societal perceptions and technological advancement, this research aims to pave the way for a future where autonomous technologies are not only trusted but embraced, enabling safer, more efficient, and more accessible transportation solutions for the greater good.

Background and Significance

Today, autonomous vehicles are classified into six levels, established by the Society of Automotive Engineers (SAE). At SAE Levels 3 and above, vehicles are capable of autonomous driving without manual input. At SAE Levels 2 and below, vehicles are engaged with driver support features such as automatic emergency braking and adaptive cruise control (*SAE Levels of Driving Automation*, 2021). Notably, this classification exists within a dynamic regulatory environment for AVs full of legislative disparities throughout the United States (*Autonomous Vehicles: Self-Driving*, 2020).

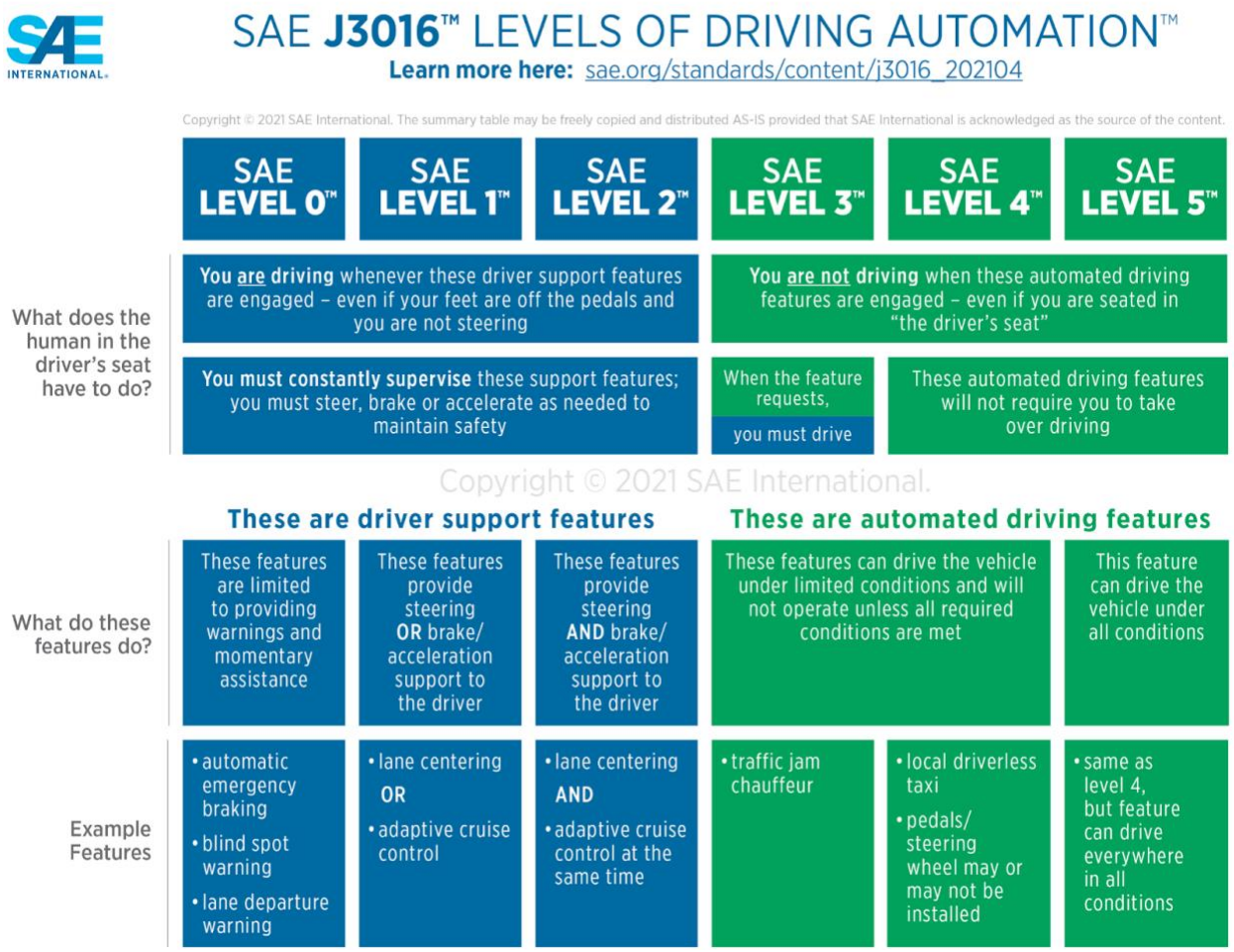

Figure 1. SAE Level descriptions and classifications for driving automation.

While modern understanding of autonomous driving is shaped around fully autonomous driving, the existence of automated driving has long been integrated within society notably in the realms of SAE Levels 0 to 2. Thus, with the success of these integrated "driver support features" it can only be inferred that autonomous driving will become a part of one's daily life in the future. However, this research goes beyond understanding the sociotechnical dimensions of autonomous vehicles and the public's perceptions. It provides insight into how other future

autonomous technologies may be perceived at different stages in development and in its integration into society.

Although the general public is one of the most notable actors in play, the realm of regulation is one that must also be explored. Currently, differences exist and will continue to emerge between state and federal government regulations concerning autonomous vehicles. While some states are open to the gradual integration of SAE Level 3 and above vehicles into society, other states refrain from any kind of integration with varying levels between them (*Autonomous Vehicles: Self-Driving*, 2020). This provides an additional area of exploration for not only how the public perceives autonomous vehicles, but also how the federal government and state governments perceive and decide to regulate autonomous vehicles over time.

Ultimately, the research questions to be explored hold profound significance due to their far-reaching implications, encompassing both the technical and sociotechnical aspects of AVs. The acceptance of AVs is not a matter of personal preference; it is a critical factor that influences the successful integration of this technology into our society. It touches on much more than just how individuals perceive AVs and delves into the influences and determinant factors that shape these perceptions. These influences can be social, cultural, psychological, and technological (Thomas, 2020). Therefore, understanding their dynamics is essential for addressing the broader question of how we can foster greater trust and acceptance of autonomous technology (Raats, 2020).

In addition to recognizing the factors that can hinder progress for AV technology, it is important to also recognize the factors that can positively contribute to its progress. Although skepticism can be a hindrance, it is vital to the technology to reach a state in which more people are accepting of or willing to integrate AV technology in their lives. With skepticism, time plays

a critical role acting as a catalyst for change which brings more familiarity and experience with these systems as they become more integrated. The gradual acclimatization to AV technology can be seen as a natural progression similar to other previous technological advancements, where initial skepticism occured but gave way due to widespread acceptance after its benefits came to fruition.

Furthermore, striking a balance between skepticism and optimism is crucial towards AV technology adoption. As skepticism remains, AV technology continues to make progress towards a future with safer, more efficient, and more accessible alternatives to transportation. Lastly, awareness of biases and influences can help play a role in fostering an open-minded approach to the evaluation of AV technology. By acknowledging the biases, such as over reliance on anecdotal evidence and fear of the black box, individuals and policymakers can make more informed decisions in regards to AVs. This approach to address bias enhances public discourse which can also promote trust in AV technology at both social and regulatory levels.

In summary, the concepts of skepticism, optimism, time, and bias awareness are integral to understanding the paradigms of AV technology which supports its acceptance and integration into society. Through incorporation of these concepts in the research framework, insights can be discovered to shape public discourse and facilitate the responsible integration of AV technology into our society. Thus, as AVs begin to become more integrated, skepticism will begin to fade and AVs will be given the opportunity to showcase its benefits influencing social acceptance. In doing so, AVs would create a future with revolutionized transportation, benefiting individuals from diverse communities and enhancing accessibility and mobility for all.

Methodology

To navigate the complexities of this socio technical issue, a comprehensive methodology is adopted. This methodology integrates multiple approaches to provide a holistic understanding of the dynamics around AVs and its integration into society. This includes the utilization of case studies, a thorough analysis of existing regulations and policy measures, and the administration of surveys (Raats, 2020).

Firstly, case studies serve as invaluable tools for delving into the real-world implications of AV technology, offering a window into how various groups interact with and perceive this transformative technology. The case study to be explored include in this research is that of Joshua Brown who was an avid user of Tesla's beta Full Self-Driving (FSD) feature which led to his death. By examining this specific instance of AV implementation and the interactions between professionals, policymakers, and users, insights can be gathered into the challenges, benefits, and impacts of AVs. Case studies alike will show how perceptions and attitudes are influenced towards AVs.

Secondly, analyzing regulation and policy disparities throughout the nation provide insights into the legal framework surrounding AVs, shedding light on the governance and and their impact on societal perceptions. Given that disparities exist between the federal and state level, insights can help improve the governance of AV technology in general providing unison. Otherwise, a differing legal framework will lead to further complexity hindering AV regulation in the future.

Thirdly, surveys will be reviewed to gather data on how individuals are perceiving and trusting current AV technology. This includes the investigation of previous surveys relating to perceptions on AV technology showing how they have changed over time and among different

groups. Moreover, this research benefits from the integration of personal anecdotes, drawing on the experiences and feedback of those engaged with autonomous technology including personal experiences in its developmental process. These first-hand accounts offer an enriched perspective on the practical implications and challenges associated with AVs.

It is important to acknowledge the contextual and cultural factors that may influence trust in autonomous technology (Thomas, 2020). The evidence will be thoroughly analyzed to identify patterns, correlations, and trends, offering deeper insights into the key factors of trust and acceptance in AV technology. Through this sociotechnical analysis, this research aspires to make meaningful contributions to the ongoing discourse surrounding AVs.

In addition to the three methodologies discussed, anecdotal evidence as an engineer working in the development and integration of AV technology will be used to support this analytical framework. This will provide an engineer's perspective into how the technology is being developed and in consideration of social needs and perceptions. Ultimately, with the combination of valuable firsthand experience, past and modern surveys, analysis of regulations, and analysis of case studies, a cohesive understanding will support meaningful findings to the research questions explored in this paper.

Literature Review

The literature surrounding autonomous vehicles (AVs) spans various disciplines, including engineering, psychology, sociology, economics, and law. Understanding this technology from all viewpoints are critical for advancements in this field. Hence, this literature review aims to synthesize key findings from case studies, pre-existing surveys, and additional anecdotal experiences.

One of the most notable AV case studies of the past decade is that of Tesla and Joshua Brown. Joshua Brown was an avid user of Tesla's new autopilot feature since its release in October 2015. However, in May 2016, Brown was involved in a fatal crash, while using autopilot, becoming the world's first person to die in an autonomous vehicle (*The driver who died in a Tesla crash, 2017)*. This marked a pivotal moment in the perception of autonomous vehicle technology. As a result, an extensive investigation into the safety and ethical implications of autonomous vehicle technology was prompted.

From the investigation it was found that Brown had ignored several safety warnings with six audible warnings to keep his hands on the steering wheel and seven visual warnings on his Tesla's dashboard (*The driver who died in a Tesla crash, 2017)*. Additional vehicle data reviewed by the National Transportation Safety Board (NTSB) confirmed that Brown had his hands off the wheel for 90% of his final drive. Although Elon Musk, the CEO of Tesla, expressed his condolences regarding the tragic loss, his company deflected blame citing that this was the first known death from roughly 130 million miles driven by his customers compared to the national average of 94 million miles across all vehicles (*The driver who died in a Tesla crash, 2017)*.

In the end of the investigation, the National Highway Traffic Safety Administration concluded that because Brown was supposed to be monitoring the vehicle's driving, it was human error that caused the crash (Marshall, 2017). Although it has always been recommended to keep your hands on the wheel and monitor the vehicle on autopilot, several changes have been made since this incident involving a measure to slow the vehicle to a stop if no action is taken after three warnings. While no malfunction was determined on Tesla's end, the NHTSA recommended that Tesla and other AV companies program their vehicles for use in appropriate

areas (Marshall, 2017). Despite several warnings and guidelines for the usage of autonomous vehicles, several cases of autopilot misuses continued, sparking more controversy against autonomous vehicles.

In addition to case studies regarding AV technology, numerous surveys have been conducted to gauge public opinion on AVs in all aspects including safety, ethics, acceptance, and regulatory concerns. For example, a survey conducted by Pew Research Center explored the perceptions of Americans on the widespread deployment of AVs. The surveys found that a significant portion of respondents expressed caution and skepticism about the societal implications of autonomous vehicles. Concerns ranged from safety risks to job displacement and environmental impact (Rainie et al., 2022).

Demographic differences were evident, with age, gender, and education level influencing attitudes towards AVs. Younger adults, men, and those with higher education levels were generally more open to the idea of autonomous transportation (Rainie et al., 2022). Nonetheless, it was found that 83% of U.S. adults believe AVs would displace jobs and 76% believe vehicles could be easily hacked putting individuals' safety at risk. Only 72% of adults found AVs as a benefit for the elderly and people with disabilities with 56% believing that AVs would reduce stress (Rainie et al., 2022). While these statistics show that a majority support the possible benefits of AVs, it also shows current AV technology has a lot to address in the realm of job displacement and safety.

Lastly, anecdotal experiences from the disabled community provide unique perspectives into the benefits of AV technology. Myrna Peterson, who has quadriplegia, is one of many unable to drive themselves due to injury or disability. Despite this, she has made an effort to

attract government funding for five autonomous vans to her small city of Grand Rapids in Minnesota. For people like her outside big cities, Peterson predicts that autonomous vehicles will be a way out of isolation and loneliness (Leys, 2024).

Although Grand Rapids has access to public buses and taxi services available unlike other small cities, Peterson claims those options don't work well, especially for people with disabilities (Leys, 2024). Hence, Peterson finds autonomous vehicles as a great alternative to this issue given that she used to rely on her power wheelchair to travel around the town already. With access to AVs, the National Disability Institute predicts that people with disabilities would have more opportunities to get out of their homes and obtain jobs (*Economic Impacts of Removing Transportation Barriers*, n.d.). Ultimately, autonomous vehicles can positively impact the quality of life for those with disabilities or old age who do not have any other practical alternatives (Leys, 2024).

Discussion/Results

With all that has been presented, the following research questions must be addressed: How can individuals be made more accustomed to, or accepting of, AV technology? What are the determinant factors that influence a person's perception of AVs? While it is clear that the autonomous vehicle industry is still in development of SAE Level 4 and 5 vehicles, the progress made in the past few years alone tells that AVs are going to be increasingly integrated into society. Hence, in order to make individuals more accustomed to, or accepting of, AV technology, it is crucial to educate society about the benefits and of course implement AV technology at small steady increments.

Seeing is believing which is a testament to the success of current automated driving features such as cruise control, automatic emergency braking, and lane centering in vehicles today. Thus, with the success of implemented AV systems, it is expected that a similar trend to automated driving features will follow in the acceptance of AV technology. Nonetheless, skepticism will continue to persist across all groups who could also be influenced by determinant factors. The determinant factors in question may either be known or unknown to an individual but prove to fall under safety, reliability, level of education, and personal impact.

The case study about Joshua Brown and Tesla is a critical example of how perceptions on AV technology shifted and impacted the industry. Although Joshua Brown was one who had embraced AVs at the time, uploading several videos on Youtube and being featured by Elon Musk himself in a tweet, his passing gives society reason to be skeptical. Although his death was attributed to "over-reliance" on the AV technology, the industry aims to reach a point to which individuals have no other option. Hence, Brown's case should be viewed as an example to approach autonomous vehicles in smaller steady increments of reliance.

By becoming more educated about the proper usages of AV technology and the current capabilities and limitations, individuals are increasing their own safety and lowering the risks for any true malfunction. Nonetheless, AVs will not be perfect any time soon which makes testing vital for its development. This can only be done through gradual implementation which can influence people's perceptions as they become more familiarized with the technology.

When it comes to social impact, however, there are two sides to the story of autonomous vehicle technology. On one side, there are the truck workers who see AVs as a threat to their financial security and understandably believe AVs will negatively impact their life. On the other side, there are the elder and disabled communities who see AVs as a ticket out of loneliness and

into opportunity for transportation and better financial security. While it may be easier for those of certain groups to align heavily against or for AV technology, understanding both perspectives and the bigger picture will lead to a greater integration of AV technology in society.

For the truck workers, they may find an opportunity in the emergence of AV technology to transition into new roles within the industry which could utilize their experiences. This could include AV maintenance for trucks, monitoring, or overseeing. For those in the elder or disabled community, AV research shows promise for increased mobility and accessibility. Altogether, finding light in the potential impact of AV technology can help guide it in the right direction that suits society best.

From a regulatory perspective, AVs have differing legislation from state to state which is due to the recency of this technology. This shows that even the government is still trying to figure out how to perceive AV technology. Thus, it can be expected that areas with restrictive regulations on AVs may see less progress than other areas with more liberal regulations. The environment this creates can be attributed to the determinant factors that influence public perception on AVs such as personal impact and level of education.

Lastly, personal experience from working with AVs have supported the findings relating peoples' perceptions on AVs. While many people were delighted by the work being shown off at the UVA Engineering Open House, much concern was expressed regarding the functionality and implementation of AV systems throughout UVA. Regardless, the SAE Level 2 system was well received with pushback at higher SAE Level systems. Although acceptance of AV technology can be dependent on the determinant factors stated throughout this research, awareness is key to understanding that these factors may introduce unjustified bias which can ultimately hinder success for AVs. Hence, it is crucial to integrate AV technology at steady increments.

Conclusion

Whether the industry of autonomous vehicles continues to face challenges in its societal implementation, time will continue to progress AVs in the right direction. While some may embrace these revolutionary changes, concerns and skepticism are expected to persist. However, it must be recognized that these concerns, rather than hindering progress, can be catalysts for fostering a more informed and responsible integration of autonomous vehicles into our daily lives.

The societal perceptions surrounding autonomous vehicles are as diverse as the factors that influence them. By being more aware of these influences, we reduce bias and are able to approach any concerns with clarity. How we navigate this transition, embracing innovation while addressing concerns, will ultimately shape the future landscape of transportation. Through careful consideration, we can work towards a future where autonomous vehicles serve as safe, efficient, and accessible means of transportation.

Furthermore, the acceptance of AVs is not one to isolate from the acceptance of other autonomous technologies. With the emergence of artificial intelligence, similar concerns and skepticisms will emerge with varying perceptions. However, by looking beyond the determinant factors, progression can be made for more beneficial integration of technology in society. Only then may technology advance in ways acceptable to the public while improving the quality of life for all.

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