Opposition to Autonomous Vehicles as Threats to Employment

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring 2022

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:

Recent advances in Artificial Intelligence and robotics are increasing automation. According to McKinsey Global Institute, automation could cause 400 to 800 million workers to lose their jobs globally by 2030; 75 to 375 million of these workers are expected to develop new skills to change their occupations (Manyika et al., 2021). Schwab (2016) contends that the job market may become divided into "low-skill/low-pay" and "high-skill/high-pay" jobs. The polarization of the job market could exacerbate existing economic and social inequalities (Schwab, 2016). Some workers are worried that they may lose their job to automation. This has been the case with the advent of autonomous vehicles (AVs). For the last century, cars have not been merely used a mode of transport, but they have also become symbols of expression, freedom, and wealth. New computing and sensing advances are now enabling the development of AVs. The threat of self-driving vehicles taking over driver jobs has generated opposition from some social groups. This paper will apply the Social Construction of Technology (SCOT) framework to analyze the opposition to AVs from social groups, consisting of transportation drivers in the truck, taxi, and transit industries. This will provide insight into the societal barriers to the adoption and widespread usage of AVs that automotive manufacturers and policymakers face.

Brief History and Present State of Vehicle Autonomy:

Over the last decade, driverless vehicles have become prominent, garnering interest from drivers, mainstream media, and policymakers. These vehicles use a sensor suite consisting of

cameras, radar, and LiDAR to scan and map the surrounding environment. The software then processes the data from sensors and makes decisions to drive the vehicle. Automation has been steadily increasing in newer vehicles with more driver assistance features like cruise control, lane change assistance, collision warning, auto park, etc.

However, the idea of driverless vehicles is not anything new. The first demonstration of a driverless vehicle was of a radio-controlled vehicle in 1925 by Francis Houdina, but the system was unreliable and rudimentary (History, 2022). Technological advances in sensing, global positioning systems (GPS), and computing have now facilitated the development of AVs. Between 2003 and 2007, the Defense Advanced Research Projects Agency (DARPA) promoted AVs by hosting a set of autonomy competitions in desert and urban environments (Anderson et al., 2014). Today, many automotive manufacturers and tech companies are competing to develop commercial AVs. One of the major milestones in this commercial development phase was Tesla's release of autopilot in 2015 through a software update, which could "control steering, speed, braking, and lane changing" (LeBeau, 2015).

Over the last few years, developers of AVs have faced technical and legal challenges as vehicles in partially autonomous mode were involved in fatal collisions. These accidents have raised serious questions about the liability and safety of AVs. Companies advise drivers to keep monitoring the vehicle in autonomous mode and take control, when necessary. However, drivers tend to become inattentive and place too much trust in the system. The National Transportation Safety Board (NTSB) determined inadequate monitoring of automated system by the driver to be the probable cause of the Uber crash in 2018, which resulted in the first fatality involving a driverless vehicle (National, 2018). Weather, infrastructure/road conditions, and regulations remain some of the biggest roadblocks to vehicle autonomy. The Society of Automotive

Engineers (SAE) describes vehicle automation on a scale ranging from level 0 (no automation) to level 5 (full automation) (NHTSA, n.d.). While companies continue making promises of full autonomy, both technical and social problems pose significant challenges to AV development and adoption.

Social Construction of Technology:

The SCOT framework explores the development and success of technology through the influence of social forces. This contrasts with Technological Determinism, which claims that technology shapes societal values and behavior. SCOT analysis is based on the consideration of relevant social groups. The stakeholders involved in the development of driverless vehicles include drivers, manufacturers of AVs, and policymakers. The SCOT framework will be applied to specifically explore how transportation drivers view AVs and the implications for developers of AVs and policymakers.

Important tenets of SCOT include interpretative flexibility, design flexibility, closure, and stabilization. Interpretative and design flexibility describe "flexibility in how people think of or interpret artifacts" and "in how artifacts are designed" (Pinch and Bijker, 1984). This can be seen with self-driving vehicles, which automotive manufacturers and tech companies promote as being safe and beneficial. According to Pettigrew et al. (2018), AVs are expected to reduce collisions and emissions, and relieve traffic congestion. These benefits make AVs a promising technology, but transport drivers view AVs with concern and pessimism. Analyzing truck drivers' perception in a Reddit truck group, Orii et al. (2021) found drivers "expressed fear of job loss due to automation"; 17 percent of the comments questioned the feasibility of autonomous

trucks in complex environments. Furthermore, a public opinion survey in Australia found that 60 percent of respondents were “moderately concerned with job losses” due to AVs (Pettigrew et al., 2018). The various levels of autonomy depict how there is flexibility in the design of AVs. For example, in the trucking industry, some of the autonomous truck developers are designing platooning systems before a fully autonomous vehicle. In a platoon, one or more automated vehicles follow a human controlled vehicle through a form of wireless communication. This shows the tradeoff between autonomy and human control that engineers developing AVs are considering in their designs.

With AV technology still in development phase, the closure and stabilization phases have not been reached. In this phase, the different social groups are satisfied with the new product after the design changes. Pinch and Bijker (1984) assert that the invention of safety bicycle was an interactive process, in which social groups competed to influence the design over a period of 19 years. Therefore, considering the view of transport drivers through SCOT is useful for lawmakers and AV developers to understand how they can achieve closure and resolve issues that may prevent the adoption of AVs in the future.

Transportation Drivers Oppose Autonomous Vehicles:

Transportation drivers have expressed their concern and opposition to AVs through unions. In a letter to Congress, the Transportation Trades Department (TTD), representing 33 unions and millions of transportation drivers, opposed what it condemned as “anti-worker, anti-safety automated vehicles proposal” (Regan, 2021). The TTD has also requested the Congress to “mitigate projected job losses and changes to jobs from automation” through legislation (Regan,

2021). Similarly, the International Brotherhood of Teamsters union has lobbied the Congress to slow down the integration of self-driving vehicles and the group wants to "ensure that automation is not used to take advantage of workers" (Denton, 2018). The TTD and Teamsters unions collaborated to define five principles that future AV related legislation must include to guarantee "safety, equity, and the integrity of jobs and wages" (Teamsters, 2021). Both unions not only describe AVs as a threat to jobs, but they also characterize AVs as dangerous and unsafe. This is referring to the recent crashes involving vehicles in autonomous mode, some of which have been deadly.

Taxi drivers have organized to oppose the advent of driverless taxis, also known as robo-taxis. Recently, the drivers have been also fighting extensively against ride sharing companies, which have been hurting their profits. Taxi companies in New York formed the Upstate Transportation Association (UTA) to fight Uber and Lyft's push for AVs (Colon, 2017). Taxi cabs have been an iconic and prominent part of New York City's landscape. Developers of AVs and taxi driver groups are competing intensely to influence the policies of AVs in New York. In a letter to Governor Cuomo, the president of UTA requested an outright ban on self-driving cars for the next 50 years to protect taxi and transport driver jobs (Colon, 2017). The Independent Drivers Guild (IDG), another group representing 35,000 Uber drivers in New York City, has also opposed Uber's self-driving cars and promised to "aggressively fight" to keep the current legislation banning self-driving cars (Huston, 2021). In response, an uber spokesperson stated that "ride sharing will be a mix-with rides provided by drivers and self-driving Ubers" (Huston, 2016). While the response from Uber attempts to assuage the fear of job loss, the unions remain determined to limit the integration of driverless vehicles.

Other unions and organizations have opposed self-driving vehicles in a more active manner through protests. The Transport Workers Union (TWU) launched a campaign called "People Before Robots" in Ohio to prevent "unchecked and dangerous automation" in transit transportation (TWU, 2018). President Samuelsen of TWU International said that the jobs of bus drivers are "important to the safety of riders and the public" and essential for "working class families" (TWU, 2018). Like other unions, TWU also mentions the unsafe nature of AVs and how having a driver present in vehicle would increase safety. In some cases, drivers may be needed to ensure the proper operation of AVs and lower the fear of passengers and other drivers on the road. Bus and taxi drivers do not just drive but also respond to passenger needs and concerns. For example, drivers of school buses monitor the well-being of children and ensure their safety. President Samuelsen has also stated that "new technology can be a win … only when workers are proactively protected" (Teamsters, 2021). This highlights how the success of a technology holds a different meaning for transport drivers than even regular drivers. Another advocacy group actively opposing the advent of AVs is America Without Drivers (AWD). Will Cook, the founder of AWD, helped organize protests called "MayDay" in Indianapolis and Washington, D.C., to express concerns to lawmakers over self-driving trucks eliminating middle class jobs (TNN, 2021). The analysis of these unions and organizations through the lens of SCOT reveals that some of the transport drivers perceive AVs as unsafe and consider it as a threat to their livelihoods.

The influence these unions and organizations exert versus the developers of AVs on lawmakers could determine the design and implementation of AVs. Unions of transportation drivers are using collective bargaining to negotiate on behalf of drivers and to also protect them from impacts of automation. For example, a spokesperson for the Teamsters union stated that

they do not want workers to become “scapegoats for any issues that might occur with the technology” (Denton, 2018). During the industrial revolution, the harsh working conditions, long hours, and low wages contributed to the rise of unions in the United States. Today, unions are not as politically and economically influential as they once were. However, Nissim and Simon (2021) contend that unions “could play a major role in designing the emerging new labor market” to protect workers, promoting workers’ “health, safety, and privacy” in workplaces with increasing automation. They also recommend that unions adapt by staying up to date with new automation and Artificial Intelligence advances (Nissim and Simon, 2021).

Impact of Autonomous Vehicles on Jobs:

The concerns of robots taking over jobs is similar to the fear of machines replacing humans during the industrial revolution. These machines increased productivity and efficiency, while workers found new job opportunities. Machines made work easier for many workers and so far, driver assistance features in vehicles have made driving safer and easier also. With AV technology, it is challenging to predict exactly when and how it will impact the jobs of transportation drivers. Widespread availability and usage of AVs could be years away with more delays and challenges than the developers of AVs initially expected. In 2015, Elon Musk promised fully autonomy for Tesla vehicles in the period of three years and continues to make the same promise despite setbacks every year (Gilbert, 2022). Detailed analysis to quantify the impact of AVs on jobs is outside the scope of this paper, but some of the major findings by researchers will be considered. Based on their simulations, Groshen et al. (2019) expect widespread adoption of AVs after 2030 and claim that 1.3 to 2.3 million workers in United States could lose their jobs between 2030 and 2050. Due to the demographics of transport drivers, the

loss of jobs will have a disproportionate impact on men who are above the age of 45, do not have a college education, and are located in the western and southern regions of United States (Groshen et al., 2019). This indicates that the elimination of transport driver jobs could further deteriorate social inequalities.

The impact of AVs on employment will vary by the industry and geographic regions. Current labor shortages, potential profits from efficiency savings, and ease of implementation make long-range trucking more prone to automation. Viscelli (2018) contends that most high- to mid-wage driving jobs are at risk, and that automation is likely to take the jobs of 294,000 long-distance truck drivers. Without policy intervention, Viscelli (2018) predicts a system in which human drivers will drive in cities to deliver and pick up trailers from autonomous truck ports (ATPs), while most of the long-range trucking on highways is completed autonomously. This could eliminate high paying trucking jobs. On the other hand, transport drivers in paramedical fleets will not be impacted as much. Their job also consists of patient care responsibilities and the driving in not as easy to automate.

Historically, technological innovations created more jobs than they have eliminated in the long-term. The advent of AVs will also create new employment opportunities. These new jobs include “remote assistance operators, vehicle safety drivers, mapping data collector, and service technicians for car fleets” (Coppola, 2021). However, many new jobs will be engineering related or require technical expertise that transport drivers won’t possess. As mentioned earlier, drivers may still be needed in vehicles to monitor the vehicle and ease the anxiety of passengers and other drivers on the road. This will result in transport driver jobs becoming similar to a pilot’s role, as a pilot directly controls the plane for only a few minutes during landing and take-off, but monitors the instruments majority of the time (Groshen et al., 2019). There is uncertainty in

predicting the exact job loss numbers due to the limitations of simulations. The nature of transport drivers' job is likely to change with increasing automation and disruptions in the job market are more likely for some transport drivers than others.

Implications for Policymakers and Autonomous Vehicle Companies:

Transportation drivers' perception of AVs highlights the broader problem of societal obstacles to the adoption of this technology. Normal drivers have also made similar remarks regarding the safety of AVs. Feelings of animosity and discomfort have even manifested into physical attacks on AVs. Over a period of two years, Waymo encountered resistance during AV testing in Phoenix, Arizona, with "at least 21 instances documented by local police involving people harassing Waymo vehicles" (Newcomb, 2018). Some of the examples of these road rage incidents against AVs include damage to vehicle, a man pointing a pistol at the AV, and the AV getting ran off the road multiple times (Newcomb, 2018). In California, a taxi driver physically attacked a General Motors' AV (Mitchell, 2018). The extensive sensor suite on the car's body makes it easy to distinguish an AV from a normal vehicle. These attacks illustrate that policymakers and AV developers need to address the societal concerns of transport and regular drivers to ensure successful adoption of AVs.

Historically, vehicles have been developed under a defined set of safety regulations and this remains to be determined for AVs. The recent crashes involving AVs are an indication that policymakers need to implement appropriate legislation to ensure AVs are developed to a high degree of safety. Without proper legislation, companies may prioritize profits and exploit drivers. The implications will vary by industry, geographic region, and the autonomous driving

technology that is being implemented. For example, Viscelli (2018) suggests that lawmakers should use legislation to promote platooning in trucking, in which one or more autonomous trucks follow a human-led truck. This keeps high paying truck driver jobs and allows automated trucks to navigate complex environments, while companies benefit from efficiency savings (Viscelli, 2018). For taxis and buses, lawmakers could encourage development and integration of semi-autonomous vehicles. These will allow for driver control in congested areas, with autonomous mode taking over in highway driving. For the short-term, this will ease public concerns with AVs, while keeping driving jobs. This will also make the driver's job easier, but the design of the system needs to ensure drivers keep paying attention when they are not in control of the vehicle.

Most importantly, collaboration and thorough communication between policymakers, AV developers, transport workers, and general public is needed to increase transparency and understanding of AV technology. For trucking industry, Viscelli (2018) suggests the creation of "Trucking Innovation and Jobs Council" to unify stakeholders. This suggestion can be taken further to have such a council for drivers in all industries. Furthermore, companies working on ride sharing fleets could create programs for transport drivers to provide them testing and mechanic jobs. Drivers who may lose jobs need to be informed early and given ample time to re-train. Policymakers can set up federal or local programs to help drivers develop new skills and facilitate changing occupations, if necessary. Some older drivers may require unemployment assistance. Therefore, early and detailed planning is needed by lawmakers at federal and local levels. Policymakers can play a pivotal role by developing a workforce plan and ensuring new technology does not worsen existing social, economic, and geographic disparities.

Conclusion:

Currently, AVs are a developing technology with many companies competing to reap their benefits. Most automotive manufacturers and tech companies are concerned with technical issues. The analysis of transport drivers' view of AVs through SCOT provides insight into societal barriers that may impede the adoption of AVs. Transport drivers are worried about losing their jobs to automation. Unions and organizations representing these drivers have protested to express their concerns and requested lawmakers to intervene to mitigate job loss. Increasing automation will change the nature of driving. Some drivers may lose their job completely, but many could experience degradation in job quality and pay. AVs promise a wide range of benefits, but policymakers need to ensure companies develop vehicles to a high degree of safety and prevent exploitation of transport drivers.

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