Liability Of Autonomous Vehicles

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Abstract

As autonomous vehicles (AVs) become increasingly common, determining liability in the event of an accident presents a major legal and ethical challenge. With 91% of Americans holding a driver's license and over 60% of cars on the road featuring some level of autonomy, understanding who bears responsibility—drivers, manufacturers, or software developers—is crucial. This paper explores the evolving debate over AV liability, highlighting the complexity of assigning blame as technology progresses toward full automation.

Some argue that manufacturers should hold primary liability due to their role in designing and programming AV systems, especially as traditional product liability laws apply to technological defects. Others emphasize the continued need for driver oversight, particularly for Level 1–3 AVs, which still require human intervention. Assigning responsibility to drivers can prevent complacency and overreliance on automation. Software developers are also considered for liability, given their role in decision-making algorithms; however, legal and moral complications arise when coding ethical choices into AV behavior.

This paper ultimately argues for a shared liability model, where both manufacturers and drivers hold responsibility based on the vehicle's level of autonomy and situational context. This approach balances safety, accountability, and ethical concerns, reflecting the transitional nature of AV technology. By distributing responsibility, it discourages driver negligence and promotes higher safety standards in vehicle development, guiding the safe integration of AVs into society.

Introduction

Driving is a necessity. In fact, according to the FHWA Office of Highway Policy, 91% of all Americans hold a driver's license (2021). For the past decade, creation, testing, and overall usage of autonomous vehicles (AVs) has been an area of immense growth. Within the last 10 years alone the percentage of newly registered vehicles that did not have any sort of autonomy in its operation dropped from 51.4% to a mere 14.4% (Statista Mobility Market Insights, 2023). As AV usage continues to rise in recent years, the public's eye has turned to two of the largest producers, Tesla and Waymo. With artificial intelligence decision making ability advancing at an unprecedented rate combined with its expanding integration into day to day driving, decisions made by such AI must be considered from a legal standpoint in order to maintain clarity in liability and ensure safety for all parties involved. However, to what extent and in what path would autonomous vehicles take liability? What parties should be involved when considering the liability for potential mistakes made by AVs? Could the AI that holds the decision making power over the vehicle be considered an entity in which it takes blame, or should there be a novel approach created to address such a situation?

These issues and their solutions would hold immeasurable significance to our current and potential advancement for society as whole. Currently, usage of autonomous vehicles is provided at different levels: zero to five. Level 0 has no automation, while Level 1 includes basic

driver assistance such as cruise control of lane assist. Level 2 offers partial automation, combining steering and acceleration, but the driver must remain attentive. Level 3 allows conditional automation, where the car handles driving in certain situations, but the driver must take over when required. Level 4 offers high automation, managing most driving tasks, but still with some restrictions. Level 5 is full autonomy, where the vehicle handles all driving without any human intervention. With there being over 60% of all vehicles on the road that have at least a level one autonomy, allowing the drivers of the vehicles to take a step back from total authority over the operation of the car starts to blur the lines of liability. However, increased autonomy of these vehicles reduces the control that drivers hold over the vehicles, raising the question of who should be held responsible in the event of an accident. In addition, when considering the fact that there are five levels of vehicle autonomy, it is difficult to define a clear line from where the decisions made by the vehicle become the responsibility of the driver themselves. In exploring these issues, this paper will examine one main overarching question: Who should be liable for decisions made by autonomous vehicles and to what degree?

Manufacturer Liability

Many argue that manufacturers should be held liable for AV accidents, as they design, produce, and program the technology. When a self-driving car misjudges an object, fails to analyze road conditions, or experiences a system malfunction, the fault lies within the manufacturing of the vehicle, rather than any other source of failure. An emphasis for manufacturer liability is that traditional product liability laws hold manufacturers accountable for defects in their products that cause harm. Some may argue, however, that though manufacturers are responsible for the design, testing, and programming of AV technology, it is not the actions of the manufacturer that may have put the vehicle in that situation in the first place. Decisions from the driver may have been the real cause for the AV being forced to make a decision in the first place. Even in this scenario, human error must be expected and the complex systems of sensors, cameras, and algorithms that the autonomous vehicle relies on to make real-time decisions must account for the error of humans, so any failure or miscalculation of these algorithms are still a result of the vehicle's manufacturing (Brookings, 2014). Though some opponents claim that placing full liability on manufacturers could slow invention and raise costs due to increased testing, this is exactly what would promote safety over rushed innovation. Applying this framework to AVs ensures consistency in legal standards and reinforces manufacturers' responsibility for their products' safety. John Villasenor's research on autonomous vehicle's accident liability under Brookings Institution emphasizes that vehicle manufacturers should be held responsible for defects in their automation systems, aligning with standard product liability. As a result of this liability shifting to the manufacturer of the vehicle, companies are then obligated to increase spending on additional safety features for the vehicles, prioritizing protection of passengers over efficiency of production. In an interview with Waymo founder, Tekedra Mawakana, Mawakana advocates for increased government regulation over the production of AV's because "making the road safer is an important mission,

and it's too big for one company" (2025). By supporting the fact that government regulation would increase safety within autonomous vehicles, Mawakans holds clear support for the standpoint that companies that create the AVs should be held responsible for the safety and liability of its actions. Tesla founder, Elon Musk, also agrees with this point and has attempted to get the federal government to speed up its approval of self-driving cars and increase its regulation over safety requirements (2024). Though this attempt may be attributed to his own personal desire to expand and advertise Tesla, Elon's advocacy for getting autonomous vehicles onto the roads sooner is evidence for his support that manufacturers should express greater emphasis on their car's protection of the drivers due to consequences of the AVs actions being traced to the manufacturer.

Gordon Anderson and Austin Brown from UC Davis Institute of Transportation Studies also agree on this point. In a standard condition, approximately 94 percent of car crashes are caused by human driver error: the human driver can be held liable. However in a self-driving car, the vehicle's true "driver", the party actually controlling the vehicle, is not the passenger in the vehicle but the vehicle itself (2019). In fact, many recent AV models do not even have a steering wheel or pedals that allow the occupant to control the vehicle. In this case, the passenger is completely unable to exert any form of control over the vehicle and thus cannot make a driver error (2019). Due to the lack of possibility of human error in this type of self-driving car, the only source of blame can only be traced back to the manufacturer of the vehicle itself.

Driver Liability

Though the progression of AV's reliability has a level of public trust, even with automation, human oversight is often still a necessity. Especially since 45% of all cars on the road have between a level of autonomy between 1 and 3, levels that still require driver intervention and attention to the operations of the car, it would be inaccurate to state that driver's have no hand in the car's actions. One of the main counter arguments towards a driver liability approach is that: as we approach a future where autonomous vehicles are a norm for all automobiles on the road, shouldn't the control system within the vehicle be the only factor that is able to be held liable for the vehicle's actions? Though this argument holds some validity, current projections of AV manufacturing only foresees that 17% of all cars being produced by the year 2035 to have at maximum an autonomous rating of level 3 (Mckinsey and Company). In addition, because this counter-argument is held under the assumption that a statistically significant percentage of vehicles on the road would be solely under the judgement of the automobile rather than a human, it does not hold for the current extended period of time before the percent of level 4 and level 5 vehicles on the road can be considered as non-negligible. In fact, according to a projection by Goldman Sachs, the percentage of autonomous vehicles with such levels of autonomy estimated to be in production and in use globally is less than 3% by the year 2030 and less than 8% by the year 2035. As a result, until the number of vehicles on the road that holds the driver responsible for the operation of the vehicle is statistically significant when

compared to all vehicles on the road, the current counterargument to driver liability can not be proven valid.

In the current state and projected next 10 years of AVs, fully autonomous vehicles (Level 5) are not yet deployed commercially, and current control systems still heavily depend on human intervention and awareness. In fact, the Insurance Institute for Highway Safety (IIHS) warns that AV systems that promise too much autonomy and hold too much power in the operation of the vehicles can cause users to become complacent and overtrust the technology, leading to more errors (IIHS). Because of this, one of the strongest arguments for the view of driver liability is that placing responsibility onto the driver encourages attentiveness and discourages overreliance on the technology. If individuals are not held accountable for the action of the vehicle why would they pay attention at all? Currently, the National Highway Traffic Safety Administration (NHTSA) emphasizes that even with advanced control systems, such as artificial intelligence decision making algorithms, drivers are still always responsible for the vehicle's operation. According to NHTSA, "as the driver, [you] are responsible for driving the vehicle. All vehicle features are assistive and do not operate the vehicle. You must steer, brake, and accelerate." The particular stress that the NHTSA places onto the driver underscores that current automation levels (Levels 1–3) are designed to assist rather than replace human drivers, necessitating continuous driver awareness and intention to overtake control of the vehicle. Assigning liability to drivers in such scenarios reinforces the importance of their constant engagement when driving. The dangers of this overreliance can be demonstrated by real-world incidents involving Tesla's Autopilot system. The National Highway Traffic Safety Administration has investigated multiple fatal crashes where Tesla’s autopilot was engaged, revealing that in several cases, the driver disengaged the automated control system less than a second before impact, leaving insufficient time for drivers to navigate the car to safety. This pattern indicates that drivers may become complacent, mistakenly believing the vehicle can operate autonomously without their input. Because these incidents were preventable given it was a result of the driver’s lack of awareness, it can be concluded that the driver should be held partially, at the minimum, accountable for the following consequences. While the vision of fully autonomous vehicles, such as those including level 4 and level 5, dominating our roads is compelling, current projections indicate that such widespread usage of fully autonomous vehicles such as these remains decades away. S&P Global Mobility forecasts that Level 5 autonomy—vehicles capable of performing all tasks equivalent to a human driver—will not be publicly available before 2035, and likely not for some time after that. On the other hand, this tempered outlook reflects the significant technological regulation that continues to impede the potential for society's realization of full autonomy.

Software Liability

The last of the largest arguments for vehicle liability in the event of an incident is that the software development team should take sole responsibility for the faulty decision making within the programming. Because the software development team has complete control over the

decisions of the vehicles in potentially fatal scenarios, the consequences of these actions are borne by the programmers. Just as car manufacturers are held responsible for defects in physical components, developers should be liable for digital defects that endanger users. According to a paper published by the USC Gould School of Law, software, as an integral product component, should not be exempt from liability simply because it is intangible (USC Gould). This approach ensures that all parts of a vehicle, whether physical or digital, are held to the same standard of safety and accountability. In addition, just like the manufacturer liability perspective, placing responsibility on developers incentivizes extensive testing and quality assurance to prevent potential malfunction. Knowing they may be held liable, developers are more likely to implement stronger debugging processes, engage in more comprehensive safety testing, and push for software design standards that would allow easier collaboration and be more effective. Increased diligence within software designers would lead to safer, more reliable AV systems and ultimately enhance public trust in the technology.

The most significant philosophical and legal challenge to assigning liability to software developers in autonomous vehicles, however, lies in the fact that the decisions embedded within AV software often reflect the moral judgments of the programmers yet moral choices are inherently subjective. For instance, in unavoidable crash scenarios, an AV may have to decide whether to protect its passengers or pedestrians. Programming such outcomes requires ethical assumptions, such as prioritizing one life over another or choosing the lesser harm, choices that are controversial even for humans. This dilemma was highlighted by the MIT Media Lab's "Moral Machine" experiment, which gathered 40 million responses worldwide about how AVs should behave in various ethical scenarios. The study found significant differences in moral preferences across countries, cultures, and age groups (MIT Moral Machine). If human society can't reach a consensus on what the "right" decision is, it becomes problematic to hold software engineers legally accountable for, intentionally or not, integrating a moral bias within the program code. Furthermore, law and morality do not always align. What may be considered morally right is not necessarily legally enforceable. Because legal systems aim for clarity and consistency, whereas moral systems are often fluid, holding developers responsible for the outcomes of moral dilemmas assumes that a definitive morally correct decision could be made for all scenarios, an assumption that is innately flawed. For this reason, many argue that legal responsibility for these ethical decisions should lie with legislators and regulatory bodies, not programmers, who lack the mandate to define or enforce societal values that are not even unanimous.

My statement

I believe that in the current state of autonomous vehicles, liability should not be placed exclusively on one party, but rather split between the driver and the manufacturer. Using this shared liability model, where both parties bear responsibility depending on the situation, offers the most balanced and realistic approach. Incorporating a hybrid framework helps mitigate two major risks: driver complacency and manufacturer negligence. Not only does it align with both technological reality and ethical reasoning by recognizing that AVs are not yet fully autonomous

and still require human oversight, but this approach also holds companies accountable for the systems they develop and deploy.

First, maintaining driver liability is crucial to prevent the growing issue of overreliance on automation. Many AV systems currently in use, such as Tesla's Autopilot or GM's Super Cruise, are considered Level 2 or 3 autonomy. Despite these levels still requiring driver attention and intervention, several high-profile accidents have shown that drivers often become disengaged, mistakenly believing the car can drive itself. Assigning some degree of legal responsibility to the driver encourages them to remain attentive and reinforces the understanding that current AVs are not fully self-operating and, just as the NHTSA stated, the driver is still responsible for the operation of the vehicle. The driver holding some liability also helps bridge the gap between human behavior and technological limitations, acknowledging that machines still cannot handle every road situation, especially unexpected ones.

At the same time, manufacturer liability must be enforced to ensure companies are held accountable for the reliability, accuracy, and safety of the systems they produce. As technology advances, I believe that companies have an increasing moral and legal duty to ensure that the AI systems driving vehicles make safe and predictable decisions. By assigning legal responsibility to manufacturers for failures in their systems, such as faulty sensors or design flaws, a split liability system creates a powerful incentive for thorough testing, greater transparency, and slower, more deliberate innovation that promotes reliability of vehicles over the speed of production. This is critical in preventing rushed releases that prioritize market competition over public safety. According to a 2022 Brookings Institution report, enforcing regulatory oversight on AV development ensures that companies comply with safety standards that might otherwise be ignored in a self-regulated environment. A shared model of liability also promotes better system design. If manufacturers know they share liability, they may implement more rigorous driver-monitoring systems to ensure users are actively engaged when required. Similarly, drivers will be less likely to misuse the technology if they understand that they remain legally accountable while behind the wheel.

Ultimately, combining driver and manufacturer liability reflects the current state of AV technology as vehicles approach greater autonomy. While full autonomy may be the future, we, as a society, are not there yet. Until we reach a point where AVs can truly operate independently, both drivers and manufacturers have crucial roles to play in ensuring safety. By holding both sides accountable, drivers for their actions and manufacturers for their systems, we can create a legal and ethical framework that protects the public, promotes safe and reliable innovation, and builds a sense of responsibility around one of the most transformative technologies of our time, autonomous vehicles.

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