The Promotion of Autonomous Vehicle Safety in the United States

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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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In the United States in 2019, motor vehicle crashes caused 2,740,000 injuries and 36,096 fatalities, making them a leading cause of death in the U.S. (NCSA, 2021; Heron, 2021). Automakers and tech companies claim that so-called autonomous vehicles (AVs) can "significantly mitigate the safety risks ... on U.S. roads" (AVIA, 2022a). Since 2014, automakers [worldwide? U.S.?] have invested $200 billion in AVs (Holland-Letz et al., 2022). Though AV developers claim their systems can improve road safety, some experts disagree (Reed et al. 2021; Clifford Law, 2021; Sotudeh, 2020). Only 39 percent of U.S. adults agree that widespread use of AVs would decrease "the number of people killed or injured in traffic accidents" (Rainie et al., 2022). To characterize AVs as the best means by which to improve traffic safety, companies make unsubstantiated promises, disparage conventional automobiles, and seek to influence news coverage.

Review of Research

Jabbari, Auld, and MacKenzie (2022) evaluated the importance of AVs' perceived safety to their adoption. The researchers posit that "when safety perception improves, more people switch to AVs from their regular cars." Less than 40 percent of subjects surveyed were either "extremely confident" or "confident" that AVs "can drive as well as human drivers in general." Consumers may be willing to pay more for AV technology if they perceive it as safer.

Shariff, Bonnefon, and Rahwan (2017) examined the main obstacles for convincing the public AVs are safe. The researchers posit that "the absolute reduction in risk to passengers due to overall accident reduction" from AV use must be conveyed to improve their perceived safety. AVs must be safe and provide a positive "self-image and reputation" for their owners. Marketing

of ideas is paramount for changing the perception of AVs, but can backfire for certain demographics.

Xing et al. (2022) evaluated what influenced the perceptions of AV safety for pedestrians and bicyclists. The researchers posit that primarily physical interactions with AVs increased this demographic's perceived safety of them from 2017 to. Xing et al. suggested "vulnerable road users have an optimistic outlook of AV safety." News consumption of a fatal AV accident lowered respondents' perceived safety of AVs. Xing et al. concluded that policymakers should focus on communicating safety benefits of AVs and "combat generalized confusion."

The Utopian Promise

Overstating Capabilities

AV proponents paint a picture of a utopian world where AVs minimize accidents, decrease reliance on personal vehicles, improve workforce efficiency, eliminate traffic, and enable a higher quality of life (Joshi, 2022). This future is always right around the corner (Alang, 2013; Molina et al., 2017; Sundin, 2022), but corners have rounded and the promised future has yet to materialize. This cycle is partially the result of AV manufacturers and proponents overselling their products. To claim that AVs will be safer than conventional automobiles, companies must assume that AVs will be equal to or better than humans at driving. So far, this has not been achieved.

Tesla, an American company accounting for approximately two-thirds of new electric vehicle sales in 2022 as of August, 2022, has been bullish on AVs in recent years, making many optimistic claims (Barry, 2021). Tesla is far from the only company highly invested in AVs, but Teslas account for the largest share of electric vehicles on U.S. roads. Its commitment to so-

called “Full Self-Driving software (FSD)” capability and its history of extravagant promises make it a prime proponent of AV hype.

Elon Musk, CEO of Tesla, stated in October, 2016 that by the end of 2017 one of the company’s vehicles would be able to drive “all the way from LA to New York” with “full autonomy” (Thompson, 2016). Tesla failed to deliver on this promise (Palli, 2022). Only in 2020 did Tesla finally release a beta version of FSD that users could test (Barry, 2021). Software being in beta versions cannot be considered a released product. Tesla FSD is still in beta as of early 2023, over five years after Musk told the world “full autonomy” would be available (Autopilot Review, 2023). Numerous Tesla customers are angry. One customer called Tesla’s FSD Beta “unnerving and scary” primarily referencing the software’s tendency to brake for no apparent reason, an issue prevalent enough to have been dubbed “phantom braking” by the community (leothelocust, 2021). The Department of Justice is conducting a criminal investigation of Tesla for unfounded self-driving claims (Etherington, 2022; Gitlin, 2023). In 2018, Musk tweeted that Tesla superchargers would have coverage for “100% of Europe next year” (Musk, 2018). Five years later wide supercharger deserts persisted, especially in eastern Europe (Supercharge.info, 2023). In 2019, Musk tweeted that it would be “possible for Tesla to have a million robotaxis by [the] end of 2020 if [Tesla] upgrade[s] existing HW2 fleet of ~500k & make at least ~500k FSD cars” (Musk, 2019). Tesla’s robotaxis never hit public roads and the promise has since been altered to having “1 million people in FSD Beta” (Lambert, 2022). These three failed promises by Tesla are typical of innumerable others like them.

Kia, whose market share in the U.S. by car sales is an impressive 5 percent, posits that not only can AVs understand their immediate surroundings, but they can “anticipate what’s coming up ahead, which humans are not capable of” (GoodCarBadCar, 2023; Kia, 2023). For

AVs the claim is a vast overstatement at best; for humans it's false. While the company refers to this as current AV technology, it does not currently produce a self-driving car. Its vaguely optimistic timeline is to be ready "over the next few years" (Boyko & Barrett, 2022).

The Autonomous Vehicle Industry Association (AVIA) is a major trade association for the AV industry backed by the likes of Ford, Lyft, Uber, Volkswagen, Volvo, and Waymo. It is a voice for much of the AV industry as a whole (AVIA, 2023a). Like Tesla and Kia, AVIA fixates on unrealized future potential benefits of AVs such as the "logistical efficiencies and safety improvements that cutting-edge AV technologies can bring to the supply chain" (AVIA, 2023b). But AVIA's promise making is more cautious, presumably in an effort to sustain credibility.

Accessibility

Many proponents of AV technology talk about the future as if it is already widespread in the present. Everything Supply Chain (2023) posits that by "eliminating the need for a human driver, autonomous vehicles can reduce the risk of accidents and injuries." As he was driven around Phoenix, Arizona, in a Waymo with no driver, Michael Wayland of CNBC described his brief journey as "liberating" (Wayland, 2022). While it may appear Wayland's experience being driven in an AV supports Everything Supply Chain's vision of a driverless future, the issue is that experiences such as these are few and far between. Waymo One, the service Wayland used, is only available in Phoenix, four other cities in Arizona, and small parts of San Francisco (Waymo, 2023a). Waymo surpassed 1 million "rider-only miles" in January 2023 (Waymo, 2023b). Two years of Waymo's rider-only service in Phoenix (KTAR, 2021) and other trips in San Francisco have only amounted to the mileage of approximately 14 taxi drivers in New York City doing their jobs as normal for one year (NYC TLC, 2014).

For every AV enthusiast, there is a concerned skeptic who may believe there are "dangers inherent with driverless cars" (Clifford Law, 2021). AV testing on public roads is therefore not legal in most states, and the services Waymo One offers are limited (Banner, 2023). Some passengers have enjoyed pleasant rides in driverless vehicles, but this does not demonstrate that such vehicles can be the safe, practical, or affordable transport modes that companies promise. The promises that AV companies make are wistful boasts that misrepresent what the technology can do. Depending upon the promise, either the technology to fulfill it does not exist, is not safe enough, or is not affordable or accessible to the public.

Safest Vehicles in the World

In one of the boldest claims made by an established company that seeks to develop AVs, Tesla stated its vehicles "are engineered to be the safest cars in the world" (Tesla, 2023). To back this claim, Tesla averred that the National Highway Traffic Safety Administration (NHTSA) assigned its cars high safety ratings. The Model 3, for example, had "the lowest probability of injury of any vehicle ever tested by NHTSA" (Tesla, 2018). Tesla also claimed that "NHTSA's tests also show that it has the lowest probability of injury of all cars the safety agency has ever tested," but NHTSA objected, telling Tesla that this claim is false (Evarts, 2019). A report containing 79 pages of communications between NHTSA and Tesla was obtained via a Freedom of Information Act Request (PlainSite, 2018). Emails from NHTSA directly warned Tesla against their assertions of safety based on NHTSA tests because "such statements mislead consumers about the relative safety of different vehicle models." It is likely more people saw and were influenced by Tesla's range of claims in 2018 misrepresenting safety test data than saw the rebuttal by NHTSA discrediting those same claims.

AV companies are determined to present their technologies as infallible, but there are numerous accidents involving their self-driving software. From 2016 to mid-2022, the NHTSA "opened 30 investigations into crashes involving Tesla vehicles where Autopilot was understood to be in use, which included 19 fatalities" (Mulach, 2022). One technology contends that Tesla is often singled out in news articles about AV safety investigations because the company accounts for the vast majority of vehicles on U.S. roads equipped with AV technology (Everett, 2022). This could partially explain the persistence of Tesla AV controversies in the news cycle, but the prevalence of accidents in Tesla vehicles opposes the company's contention that their vehicles are the safest in the world. Outside governmental investigations, Tesla customers have continually pointed out dangerous flaws with FSD Beta such as phantom breaking, ignoring speed limits, and flashing oncoming traffic with high beams (leothelocust, 2021).

Growing Pains

Hundreds of accidents have occurred in recent years under the supervision self-driving technology (The Associated Press, 2022). Some advocates of AV safety dismiss the data showing self-driving accidents to be more common than human-driving accidents as outdated or downplay the sustained injuries (Ramos, 2022; 1-800 Injured, 2021). Jonathan Lopez takes the alternative stance that while "unfortunate" and "tragic," accidents are "not unexpected" and are part of the growing pains we society must endure to allow self-driving technology time to improve (2016). In response to three high-profile accidents involving Tesla's autopilot, Lopez posits that people should worry less about the regulation and safety of AVs since the "hard truth" is that "incidents are the unavoidable result of humanity's perpetual experiment for a better tomorrow." Lopez contends incidents are "bound to happen, [will] happen again, and there's nothing you can do about it."

Other AV advocates contend we must endure the growing pains until more driving data is accumulated (2016; Pladson, 2021), GPS inaccuracies are fixed, or infrastructure is updated

(Hannah, 2023); all of which are scapegoated for holding up progress. Lopez purposefully ignores those issues and looks ahead believing "humanity will push past the roadblocks and strive for something better." It is not possible to guarantee when or if the "roadblocks" will be pushed past and AVs will be perfectly safe. The question now is: Should society be forced to live with these growing pains where individuals may be harmed by technology they haven't consented to live with? Regardless of personal beliefs, Lopez may be right that if the government is permissive, society may be forced to live with the growing pains and "there's nothing you can do about it."

Disparaging Conventional Automobiles

A fundamental argument of proponents of AV safety is that humans, driving conventional automobiles, make mistakes leading to accidents when AV software would not, decreasing the frequency of accidents (Consumer Reports, 2014). When Lopez discusses a series of accidents involving Tesla Autopilot, he makes a concerted effort to clarify that "in each scenario, it was the brain behind the wheel calling the shots, not the Autopilot" (2016). Waymo promoted their robotaxis in early 2023 by publicizing that they would shuttle football fans in order to "keep drunk drivers off the road on Super Bowl Sunday" (Muller, 2023). AVIA pressured Mississippi to pass AV-friendly legislation by underscoring Mississippi has "the highest rates of motor vehicle fatalities in the nation" (AVIA, 2023c). It is a common belief that AVs are inherently safer than human drivers because "An automated driver will never text and drive, drive drunk, or get distracted or drowsy" (Venture Beat, 2022).

Proponents of AV safety often cite the NHTSA as saying 94 percent of car accidents are caused by human error (Chain Law, 2020). Derek Muller, a science influencer boasting 13.5 million subscribers on YouTube (Veritasium, 2023), rode in a Waymo AV as part of a sponsored video (Veritasium, 2021). Muller stated "The National Transportation and Safety Board has identified human error as the cause of 94 percent of accidents. Most of these errors are impossible for a machine to make." Muller contends that a hypothetical AV with "LiDAR and radar and 29 cameras" would not make the same mistake as a human driver. "We don't have eyes in the back of our head" or "long range vision" enabling AV a car to "detect a stop sign or a

pedestrian 500 meters away." Muller states with the amount of sensors and technology that can be squeezed into AVs, it should be relatively simple for them to make fewer mistakes than humans and account for less than 94 percent of accidents.

The 2015 NHTSA memo that inspired the notorious 94 percent statistic offers more insight into its actual meaning (NHTSA, 2015). The memo examined car crash reports from 2005 to 2007. Each report was assigned a "critical reason" or "the immediate reason for the critical pre-crash event and is often the last failure in the causal chain of events leading up to the crash." The following sentence is "[the critical reason] is not intended to be interpreted as the cause of the crash." The critical reason is the last action that took place before a crash, but not the crash's cause. In approximately 94 percent of the crash reports examined, the critical reason was assigned to the driver. In many cases where this figure is cited, it is interpreted incorrectly. For some groups the misinterpretation is likely unintentionally. For industry giants like Waymo who touts the figure as showing "an opportunity to improve road safety by replacing the human driver with the Waymo Driver" (Waymo, 2021), the failure to properly interpret the data appears willful (Gordon, 2022). The companies have more than enough backing to warrant thoroughly reading the three sentences above the table they repeatedly reference.

Controlling the Narrative of News

Trade Association Membership

Many companies sponsor their membership in a trade association that represents their industry (AED, 2020). AVIA is one major trade association in the AV industry (AVIA, 2023d). A group of AV companies formed AVIA to "advance AVs' tremendous safety, mobility and economic benefits to consumers in the safest and swiftest manner possible." Companies join AVIA to take on industry issues as a coalition rather than alone. Issues include improving the reputation of the industry, facing legal hurdles, and having a centralized voice for the industry. New members expect to benefit substantially from AVIA. Cavnue, the most recent inductee, says it is "excited to partner with AVIA in this mission and usher in a new transportation future"

(AVIA, 2023b). The centralized platform afforded by AVIA is regularly used for the dissemination of information (AVIA, 2023e). In over 500 news posts from AVIA since 2016, zero have included "Tesla" in their titles (AVIA, 2023f). Tesla is notably not one of the many AVIA members (AVIA, 2023a). AVIA members likely see Tesla as a threat due to its size and aggressiveness (Lopez, 2016) or its recklessness which could harm the reputation of the industry as a whole (Hawkins, 2022). In an effort to push back against Tesla's market control, AVIA rebranded from the Self-Driving Coalition for Safer (SDCS) and removed Tesla's "Self-Driving" term.

Industry Investments

AVIA promotes articles detailing investment into the AV industry and leverages the investors' reputations to lend credibility to the industry (AVIA, 2023f). Each article is used as evidence of the validity of the AV future AVIA members hope will come to fruition. One article promotes the safety of AVs by framing Volvo's backing of AV technology for trucks as: "Volvo has long been recognized as arguably the world's leading company in terms of automotive safety, and its belief that this can be advanced by self-driving tech has been reflected in the creation of its Volvo Autonomous Solutions (VAS) division" (Hope, 2023). A second article uses US military funding of a company to support the company founder's vision that "autonomous technology can save lives" (Hawkins, 2022b). A third article notes IKEA's partnership with an AV startup quoting the startup's CEO as saying "together [with IKEA] we can enhance safety, improve working conditions for drivers, and create a more sustainable freight transportation system" (Rosevear, 2022). Every posted article – many involving a

reputable company or organization as the centerpiece – is specifically chosen to show success in the AV industry and project the reputation AVIA wants the AV industry to have.

Accidents

AVIA does not comment on crashes involving autonomous technology, but goes out of their way to discuss the dangers of conventional automobiles (AVIA, 2023g). Discussing NHTSA's report on fatal motor vehicle crashes in 2016, AVIA, general counsel David Strickland stated "with more than 37,000 lives lost on U.S. roads and highways last year, it is critical that policymakers support the safety benefits of fully self-driving technology" (AVIA, 2017). Strickland also directly misattributed the cause of crashes to human error by saying "Human error causes 94% of all motor vehicle crashes, due to mistakes like speeding, fatigue and drunk and distracted driving." Responding to NHTSA's report for 2017, Strickland exaggerated the figure slightly more while giving almost exactly the same statement as the previous year: "Human error causes more than 94% of all motor vehicle crashes due to mistakes like speeding, reckless driving, fatigue, and drunk and distracted driving" (AVIA, 2018). Responding to NHTSA's subsequent reports for 2020 and 2021, AVIA quoted their general counsel Ariel Wolf twice as saying "AVs … do not speed, become impaired or get distracted" (AVIA, 2021a; AVIA 2022b). Tesla FSD Beta customers have noted their frustration with their vehicles ignoring speed limits (leothelocust, 2021).

Legislation

AVIA promotes legislation favorable to the AV industry. AVIA has thanked involved parties for legislation that passed in Washington, DC (AVIA, 2020), Arizona (AVIA, 2021b),

Pennsylvania (AVIA, 2022c; AVIA 2022d), Oklahoma (AVIA, 2022e), and Mississippi (AVIA, 2023h). In these statements, AVIA states AVs will "increase safety," "boost economic development," and "expand mobility opportunities for disability and elderly communities." Each piece of favorable legislation passed is hailed as a win while roadblock legislation is ignored.

Conclusion

The safety of AVs has been relentless promoted in recent years as the industry has grown. Tesla in particular has frequently made unrealistic promises in order to attract customers (Etherington, 2022; Gitlin, 2023). Some individuals have tried to make AV technology appear ubiquitous and accessible to everyday people (Wayland, 2022; Banner, 2023). Promoters have attacked conventional automobiles in order to make current AV products appear more favorable (Venture Beat, 2022) and excused any shortcomings of the technology as "growing pains" (Lopez, 2016). AV companies have banded together to create a voice for the industry and applaud favorable legislation relating to the industry (AVIA, 2023a; AVIA, 2023g). Despite the difficulty of assessing how safe current AV technology is, there are many participants within the industry that want society to believe it is safer than conventional automobiles and the only logical step forward for transportation in the future.

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