Fully Autonomous Vehicles

Issues Faced by The Self-Driving Car Revolution

Americans spend an average of 17,600 minutes driving each year. Instead of spending so much time at the wheel, what if we had the technology to transport us from one place to another safer and faster than we currently can? Not too long ago, self-driving cars seemed like a distant concept only viable in science fiction movies. However, in the last decade or so, professionals in the field of computer science and artificial intelligence have been working tirelessly to develop fully autonomous driving technology. For example, since 2009, Google has been developing its self-driving technology. This technology has driven over four million miles on its own and is now undergoing a public trial phase in Phoenix, Arizona. Additionally, at this year's Consumer Electronics Show, Toyota and Audi unveiled prototypes for self-driving cars to ordinary car buyers (Cohen, 2013). Although you probably haven't seen someone taking a nap at the wheel yet, it inevitable that autonomous vehicles will be a part of our reality in the very near future. Self-driving cars are no longer a fantasy, and now that we are on the brink of such a technological shift, an important question has come into the spotlight: Should we even allow them on public roads? If they are, how will all of our rules about driving have to adapt? Who will be held accountable in the case of an accident? The installation of autonomous vehicles is a multifaceted issue both practically and theoretically that requires professionals to discuss both sides of the debate before it can become a more widespread technology.

The computerization of driving can be traced as far back as the 1970s with the introduction of electronic antilock brakes. In recent years, high-tech features such as automated steering, lane keeping, acceleration, and emergency braking have become a norm in the car industry. As momentum for the autonomous vehicle revolution continues to build, there are several pros and cons to consider before any major decision can be made to allow these vehicles on public roads. There are many convincing reasons why self-driving cars would be beneficial for society, one of which is safety. According to a recent National Highway Traffic Safety Administration study, a full ninety-four percent of traffic accidents are caused by human

error (Singh, 2015). Simple mistakes made by drivers lead directly to accidents. Self-driving technology could eliminate distracted behavior such as texting or drinking while driving. By removing human error from the equation, more lives could be saved. In addition to reducing the rate of traffic accidents, self-driving cars would also be efficient. They could travel at much higher speeds and closer to other cars without having to worry about hitting each other (Keating, 2015). This would reduce the rate of traffic congestion on roads as well as decrease the amount of time people spend traveling – a major win for productivity. On the other hand, despite the many benefits that this new technology could provide us, there are many people still opposed to the idea of letting fully autonomous vehicles onto public roads. A major obstacle in the way of integrating driverless cars into society is the traffic laws we currently have in place. These complex laws are enforced under the assumption that there will always be a human at the wheel (Cohen, 2013). Obviously, with self-driving cars, this would not be the case. The way we hold each other accountable for our actions will have to undergo major alterations legally and practically. There are many ethical issues regarding the way autonomous vehicles operate in situations in which getting into an accident is inevitable. This eventually leads back to the engineers who code the software that tells the car how to react. Cars operated by computers are simply not as adept as human drivers – if the software malfunctions, it may cause more problems than there currently are. Regardless of the technology powering self-driving cars, ordinary people can contribute and understand this debate. Our society is heavily structured around using vehicles to transport people and things from one place to another, and cars are integral and familiar parts of our lives. You don't have to be a computer scientist to recognize that the big problem with self-driving cars is people, not the technology.

Despite the fact that it is possible for everyone to be sympathetic to the debate of allowing autonomous vehicles on public roads, these issues are especially pertinent to those in the field of engineering and technology – particularly software engineering. The software that tells these cars how to operate is comparable to the brain of a human driver, and there is no doubt that the software engineers who built these programs are required to take every single

possibility into account. Building smart, autonomous, and most importantly safe vehicles requires an incredible amount of research, engineering, and testing. From conceptualizing how the vehicle will operate to actually implementing the hardware, software, and everything in between, it takes years for these technologies to be built. This relates to why autonomous vehicles have not yet been available to the public, and why there is still an ongoing debate on whether or not to actually allow them on public roads. When it comes down to the lives of passengers, self-driving car companies are definitely not going to gamble with technology that's "good enough". People's lives are at stake, and manufacturers need to be as close to one-hundred percent sure that their autonomous cars are safe. If a self-driving car gets into an accident, who is liable? There is no human driver to take the blame, so who do we hold accountable? The software engineers who programmed the car? Or maybe the person who owns the vehicle? Moreover, if we have both regular vehicles and autonomous vehicles on the road, how do we navigate the complex dynamics of error prone humans in conjunction with artificial intelligence? These are just a few of the many questions we will need to answer before the expansion of self-driving cars to the public.

No one ever questions the actions of a driver right before a crash. It's natural for most drivers to panic and have knee-jerk reactions in the critical moments before an accident. However, when a computer is the one making the decisions in the case of an accident, it is now valid ask *why* the software responded this way. We can trace this back to the code and the developers who coded it. It is safe to say that most people will do the right thing in the time of an emergency, but this is definitely not something we can assume with artificial intelligence. Good judgment is something we will need to "teach" artificial intelligence; in other words, code into the software. The multifaceted issue of programming ethics into autonomous vehicles is effectively explained in "Can You Program Ethics Into A Self Driving Car?" by Noah J. Goodall. This article was published in *IEEE Spectrum*, the flagship magazine and website of the Institute of Electrical and Electronics Engineers (IEEE), the world's largest professional organization devoted to engineering and the applied sciences. According to their website, the goal of *IEEE Spectrum* is to "keep over 400,000 members informed about major trends and developments in

technology, engineering, and science" (Brooks, 2017). Their blogs, podcasts, news and features stories, videos and interactive infographics engage their visitors with clear explanations about emerging concepts and developments. It's clear that the intended audience of this article is people who are interested in STEM (Science, Technology, Engineering, and Mathematics). More specifically, electrical engineering, computer science, and electronics. However, the discourse community of this document would be the people who are in the business of building self-driving cars, particularly those who program the software that are responsible for the actions of these vehicles. The general audience of this article is knowledgeable about technology to some degree and can relate to several of the issues brought up within the article. And since they are members of the IEEE, they are also probably biased towards cutting edge technology – in this case, self-driving cars. Software engineers, will find that the issues brought up within the article are at least somewhat relevant to the work they do on a daily basis.

Goodall's intention for "Can You Program Ethics Into A Self Driving Car?" is to generate discussion and deliberation around the subject of programming ethics into artificially intelligent technologies for engineers and ordinary people alike. Throughout the article he provides the audience with several hypothetical situations to ponder and asks rhetorical questions throughout the article to get his point across. For instance, one hypothetical situation he sets up gives the reader a good perspective on what kind of nuanced ethical issues autonomous vehicles would have to face:

> …an automated vehicle that treated every human life alike would have to give more room on the road to a motorcyclist riding without a helmet than to another one wearing full protective gear because the unprotected one would be less likely to survive a crash. This seems unfair—why should the safety-conscious rider be punished for his virtues? (Brooks, 2017)

This simple situation allows the audience to ponder the complexities of self-driving cars they may not have thought about before. Goodall employs this effective method several times

throughout the article. In conjunction with this technique, he also provides the reader many facts and figures about how autonomous vehicles work, the laws that are currently in place, and the ethical questions that need answers. By presenting the facts, discussing the dilemmas, and then presenting potential solutions, Goodall presents solid evidence works towards getting the reader to ponder the issues related to programming ethics into self-driving cars. His writing is a prime example of logos, using a logical appeal to compel the audience to ask themselves whether or not they think self-driving cars are a good idea. He doesn't try to appeal to the audience with sympathy, but instead with professional, all-knowing language.

Due to the logical appeal of this article, the tone of Goodall's writing comes across as objective. He never sounds biased when presenting the different sides of a debate, but rather has a matter-of-fact tone. He presents us with the facts and speculates on the potential solutions to the problem at hand, never expressing whether or not he believes one solution to be better than another. The hypothetical situations paired with the rhetorical questions he uses give the article a friendly, conversational tone – one that is open to suggestion, but still leaves the audience little to no room for questioning his credibility. Furthermore, the diction used in this article is easy to understand by everyone, tech-savvy or not. There is hardly any jargon used in his writing, allowing the general audience to be just as engaged with his writing as the discourse community. The pacing of the article is also very easy to follow, since it is an article in a magazine. The paragraphs are short and digestible, and read similar to how an informational podcast would sound. Overall, "Can You Program Ethics Into A Self-Driving Car?" was an interesting and eye-opening read. Goodall's writing was effective at making the article informational yet conversational, and helped his audience generate discussion around the debate of allowing autonomous vehicles onto our streets and everyday lives. As you have read, there are practical, theoretical, and ethical dilemmas that will need to be addressed by professionals with the inevitable emergence of autonomous driving technology in the car industry.

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