A Virtue Ethics Analysis of the Business Practices of Tesla

STS Research Paper
Presented to the Faculty of the
School of Engineering and Applied Science
University of Virginia

By

Bryant Chow

March 28, 2024

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.

ADVISOR

Benjamin J. Laugelli, Assistant Professor, Department of Engineering and Society

Introduction

In January 2024, the dashboard of a Tesla Model X belonging to a man named Ali Amjad unexpectedly caught fire. Despite being idle and unconnected to power, Amjad still found his car up in flames in his driveway and a cause has still not been identified. Amjad was quick to point out that it was fortunate that nobody was in the car and that his car was not inside of the driveway, else more damage to a person or his home could have occurred. Furthermore, Amjad explained that Tesla's customer service was also unhelpful and they pushed him to have his insurance perform an investigation rather than immediately upholding his valid warranty. It was not until Amjad reached out to CBS did Tesla give him an offer to purchase a new car (Terry, 2024).

This situation is one of several documented examples of Tesla electric vehicles unexplainably catching fire. As Tesla makes up 50 percent of electric vehicle sales in the US, the safety and quality of their vehicles have been called into question (Wilowski, 2023). Consumers have become concerned about the value of a Tesla car versus a typical gas powered car and whether or not to believe in the fast growing electric vehicle market. There exists a great deal of works which evaluate Tesla vehicles as a technology by investigating the environmental and financial benefits of their electric vehicles over gas powered ones and the safety of their batteries compared to a typical gas engine. However, these works fail to assess the ethics and behavior of Tesla as a company. By failing to take Tesla's practices into account, consumers lose the ability to understand whether or not Tesla has their interests in mind and if they can be trusted to create worthy products. Putting Tesla's morality into the spotlight could shed light on whether their conduct has played a role in sudden emergencies such as in the case of Amjad's car.

I believe that evaluating Tesla using virtue ethics will provide an organized framework to gain the insights needed to judge the morality of their business practices. I will present how Tesla possesses or lacks the virtues of being creative, commitment to quality, professionalism, and the ability to communicate. By doing so, I will demonstrate how they fall short of being moral engineers.

Literature Review

With improvements in electric vehicle technology and the availability of charging stations, electric vehicles have emerged as a fast growing market with total sales surpassing 1 million for the first time in 2023 (Wilowski, 2023). Since Tesla holds the largest share of the market, there are numerous works evaluating their electric vehicles. This research typically aims to gauge the success or failure of Tesla vehicles by examining their environmental benefits over gas vehicles, efficiency of travel and fuel cost, and overall safety.

In *Total CO2-equivalent life-cycle emissions from commercially available passenger cars*, Johannes Buberger et al. compared the total CO_2 equivalent emissions of the life cycles of different types of passenger cars. The types of cars explored include battery electric vehicles, compressed biogas vehicles, compressed natural gas vehicles, fuel cell electric vehicles, internal combustion vehicles, and plug-in hybrid electric vehicles. When modeling the total CO_2 emissions, they took into account three main stages of a car's life cycle: production, utilization, and recycling. In this study, a Tesla Model 3 was selected as the representative battery electric vehicle. It was found that Tesla vehicles did have higher total CO_2 emissions during production compared to other vehicles; however, CO_2 emissions during utilization far outweigh any other life cycle phases. A Tesla Model 3 fueled using renewable energy had a lifetime CO_2 equivalent

emissions of 5,492 kg (Buberger et al., 2022). In comparison, the Volkswagen Passat 2.0 TSI, which is powered by gasoline, had a lifetime emission of 49,559 kg of CO_2. Therefore, Teslas and other vehicles powered by electricity produce much less emissions than vehicles powered purely by gasoline or diesel. Vehicles powered by compressed biogas do have lower or similar emissions to battery electric vehicles; however, Buberger et al. discuss how the sources of biogas are not sustainable for the wide adoption of these types of vehicles. Furthermore, their modeled lifetime emissions for the Audi A4 40 g-tron are lower than reality as they did not include emissions produced by cattle.

In *Determination of Fire Protection Distances During a Tesla Model S Fire In a Closed Parking Lot*, Gavryliuk et al. created a simulation to model a Tesla Model S catching fire within a parking lot surrounded by other parked vehicles. Electric vehicles suffer from the fact that battery fires are much more problematic to deal with than a typical gas powered engine. Not only do battery fires release toxic chemicals and gas, but they also pose a unique challenge called thermal runaway; this is when the fire will uncontrollably keep heating itself until the battery is out or responders are able to contain the heat. Furthermore, the power of heat release of an electric vehicle fire can be up to two times greater than that of a car with an internal combustion engine (Gavryliuk et al., 2023). After evaluating their tests, Gavryliuk et al. suggest that a minimal fire-fighting distance of 10m should be adopted to ensure fire protection if a fire was allowed to develop freely for 610s. This research could be beneficial when designing parking lots, arranging vehicles, and during preparation for fire responses.

Understanding the specifications and logistics of Tesla vehicles is imperative in determining their value and quality. Evaluating the technical aspects is often the immediate response people have when creating a judgment of quality or an investigation of an accident of a

Tesla vehicle. Also often, research typically ends here; however, there exists many benefits to also considering the virtues and purity of Tesla's behavior as a company. Understanding if Tesla acts ethically can help consumers picture their company mission, their commitment to creating a safe and high quality product, and their ability to satisfy customers over time. This paper will use the virtue ethics framework as a structure to create a judgment of the morality of Tesla business practices based on their work and actions.

Conceptual Framework

My analysis of Tesla draws on virtue ethics and the virtues outlined by Michael Pritchard which gives me a structured framework to evaluate whether or not Tesla has shown the characteristics of moral engineering. First defined as a field of inquiry by Aristotle and popular with other Greek philosophers such as Plato and Socrates, virtue ethics is a guideline with the goal of striving for eudaimonia. Eudaimonia, or "the good life," describes the state of living as a good person and utilizing one's human potential (van de Poel & Royakkers, 2011). So how does one reach a virtuous state? First, a moral virtue is a characteristic that is a mean between two vices. The vices either exceed or fall short of the right amount of a certain trait, and the mean can be determined by the rationale of a man of practical wisdom. van de Poel & Royakkers give the example of courage being a moral virtue; it is the mean between the vices of cowardice and recklessness. Aristotle states that virtues are not inherently given to someone at birth; although, they can be developed and practiced through one's actions. In essence, virtue ethics is concerned with choice and how to find the optimal mean for each choice; whether or not to be more courageous or less reckless. Therefore, what is "good" is ambiguous and dependent on context. The virtues of a moral actor will be different depending on the situation.

So, if the required virtues for a moral agent are situational, what virtues must Tesla exhibit in their work? In *Responsible Engineering: The Importance of Character and Imagination*, Michael Pritchard lays out virtues that are required for any moral engineer. Pritchard states that these virtues are not necessarily the only virtues needed to be a moral engineer; however, the absence of any of these virtues is enough to make it so one is a non-virtuous engineer. Pritchard's virtues for moral engineers are having expertise/professionalism, the skill of clear and informative communication, cooperation skills, the ability to compromise, objectivity, being open to criticism, stamina, being creative, dedication to quality, having attention to detail, and having a good practice of reporting work (Pritchard, 2001). Using Pritchard's virtues, the following analysis section will draw on virtue ethics by first analyzing the conduct of Tesla. Then, I will discuss how these works, research, or actions exemplify the presence or absence of certain virtues of moral engineers.

Analysis

The electric vehicle industry is fast growing and relatively new. In 2020 three million electric vehicles were sold worldwide, and since then, the market has more than tripled with 10 million sales worldwide in 2023 (Zhang, 2023). Tesla is the global leader of this market, hence, they have inherited the challenges and responsibilities of a producer of electric vehicles. Tesla bears the responsibility of ensuring their vehicles meet safety standards, and they take on the challenge of innovating the designs of electric vehicles, ethically producing them, and faithfully advertising them. Tesla has also taken the pursuit of innovation further by delving into the research and development of autonomous vehicles. Tesla is constantly tested to balance their strive for cutting-edge technology with the need for patience to ensure an excellent product.

Based on their work, Tesla has shown strengths as a company that exemplify creativity, a commitment to quality, and professionalism. Nevertheless, other aspects of Tesla's conduct demonstrates a poor ability to communicate clearly and informatively; thus, Tesla falls short of being virtuous engineers.

Creativity and Commitment to Quality

In order to assess Tesla's creativity and commitment to quality, one must evaluate aspects of the company's products and operations. To start, the reliability and performance of Tesla vehicles can be rated. Additionally, examining Tesla's approach to innovation and design can provide insights into its dedication to creativity. Tesla advertises its vehicles as a green alternative to petrol powered vehicles, so it is important to verify this claim. Another core aspect of the company is their investment into research in order to push the boundaries of autonomous vehicle solutions. Lastly, Tesla's business decision to create their own recycling factory should be taken into consideration.

The most obvious place to start, would be to rate their vehicles and to check for any shortcomings. In terms of safety, Tesla has set a high standard for electric vehicles. In 2014, the Model S received a 5-Star Euro NCAP Safety Rating which it would again achieve in 2022 (The Tesla Team, 2022). Tesla also rolls out safety improvements immediately to ensure it reaches its customers. To do so, they make changes to manufacturing as improvements are made and send out software updates to vehicles already in use.

Tesla also advertises the green aspect of these vehicles and how their environmental footprint is much less than that of a typical car. Nearly all gasoline vehicles have lifetime emissions of greater than 350 $gCO_2eq/mile$, while Tesla vehicles all have below 300

gCO_2eq/mile (Miotti, M., & Trancik, J. E., 2023). Having such relatively low lifetime carbon emissions for their vehicles puts Tesla below the 2030 carbon emissions target. The Tesla Model 3 goes even a step further and lays below the 2040 carbon emissions target of approximately 175 gCO_2eq/mile. Critics will point out that the electricity used to power Tesla vehicles can use non-renewable energy. Although non-renewable energy is used to produce much of the country's electricity, using the national averages of energy sources, it is seen that electric vehicles still produce less carbon emissions than that of other vehicle types (US Department of Energy, n.d.). Tesla also shows further innovation and devotion to their mission as they have laid out a 5 stage plan for their company to reach sustainability. This plan does not only include the production of electric vehicles but also includes external projects such as the conversion of the energy grid to renewable energy through the use of solar panels ("Environmental Impact," 2022).

Tesla has also started to broaden its reach into different technologies other than cars and renewable energy. One such operation is the dedicated recycling plants that they are constructing. These plants will be used to properly dispose of electric vehicle batteries in an environmentally safe way with a high yield of material recovery (Lambert, 2021). Another investment area of Tesla is into the research and development of autonomous vehicles. Currently their vehicles have their Autopilot software loaded which assists with acceleration and braking; however, Tesla has conducted work into creating a fully autonomous vehicle.

Here, Tesla's commitment to quality and creativity is evident through their deeds and company culture. Their commitment to quality is seen by their dedication to ensuring passenger safety through immediate updates and their vehicle performance. Their creativity shows through their mission to endeavor towards environmental sustainability by looking to improve their vehicles, create solar panel grids, and enact a long term plan to reduce climate change. Their

unique operations of creating their own recycling plant and spearheading research into autonomous vehicles also demonstrates their creativity.

Professionalism

In order to determine if Tesla incorporates professionalism in their business practices, I will investigate how they have acted responsible and upheld ethical integrity and accountability. To do so, I will discuss how Tesla has organized their operations in order to minimize any humanitarian and environmental issues that may occur during any phase of the lifecycle of a Tesla vehicle. One way this is done is by Tesla's forward-thinking design choices of their battery. Another aspect is how Tesla has developed a direct hands-on business model when it comes to resource procurement and battery recycling.

First, to understand the importance of Tesla's decisions, it is necessary to understand the context of why there exists humanitarian and environmental issues with electric vehicles. The issue primarily has to do with the materials that the batteries of these vehicles are made of: cobalt and lithium. Most electric vehicles have some type of nickel manganese cobalt (NMC) lithium-battery powering the car. The mining of cobalt, the more abundant resource of the two, has been associated with an increase in violence, substance abuse, environmental and community damage, and health challenges towards the miners (Morris, 2021). The working conditions are poor with miners working stressful and intense work hours where they have unsafe conditions as they are susceptible to injury and are exposed to toxic chemicals and gasses without protection. The work culture of these mines is just as bad, as violence, racism, and abuse have been documented. Furthermore, mining cobalt has released toxic chemicals into the environment, potentially contaminating the water sources of communities. In some situations such as the Democratic Republic of Congo, there are traces of Uranium in the Cobalt mines which also

cause some radiation leaks to the surrounding area. Nearby communities also suffer from breathability issues due to airborne dust from the mines (Zheng, 2023). Unorganized mining practices have also led to mining occurring on peoples' private property and farmland, damaging the food accessibility of the communities too (Morris, 2021). The mining of lithium also shares the same humanitarian crisis aspects. In some cases, lithium is extracted from underground saltwater reserves. The toxic runoff in this water can contaminate water supplies that affect both humans and the animals inhabiting the area (Zheng, 2023). Also, during recycling, many electric vehicle batteries are improperly left in landfills which can lead to contamination from toxic leaks that often cause underground fires or pollution to the atmosphere (Zheng, 2023).

One way Tesla has taken this humanitarian dilemma into account is the switch to lithium iron phosphate (LFP) batteries for much of their fleet (Wayland, 2021). These batteries do not retain as much of a charge as NMC batteries; however, as a tradeoff they are cheaper to produce and cut out cobalt as a necessary material; therefore, Tesla is able to bypass cobalt mining and is able to use more available and ethically sourced metals.

Tesla has also started to directly source its own materials. Tesla was able to procure >95% of the lithium, >50% of the cobalt, and >30% of the nickels used in their batteries (Agaite, 2022). In doing so, they are able to oversee the conditions of mining and allow them to have access to more transparent and traceable supply chains. Tesla is well aware of the humanitarian issues of mining elsewhere, as stated in their Conflict Minerals Report, and have committed to ensuring that the suppliers that they purchase from are ethical and accountable for reporting the source of their metals. Tesla's recycling operations at their super facilities also claim to be able to recover 92% of battery cell material in their process (Lambert, 2021).

Overall, Tesla's acknowledgement of issues surrounding material procurement and their willingness to directly oversee steps of the lifecycle of their product demonstrate the presence of professionalism in their practice. They were able to uphold ethical practices by changing design aspects of their product and were able to take direct responsibility of eliminating any humanitarian and environmental issues by handling mining and recycling services themselves.

Ability to Communicate

Although Tesla has shown many strengths as a company and as innovators, they fall short when it comes to their ability to communicate effectively. In order to illustrate how they are unable to communicate clearly and informatively, I will assess repeated examples of Tesla failing to be transparent or being misleading.

The most major example of Tesla's misleading promises and failure of transparency has to do with their autopilot feature and full self driving (FSD) technology. In 2016, Elon Musk made claims that Tesla's would be shipped with full self-driving capabilities that would allow it to travel driverless. Since then, Tesla has failed to ever deliver a driverless car despite competitors doing so, and their Autopilot feature and FSD beta have been shipped with flaws. There are many documented accidents of Tesla vehicles due to Autopilot and even several documented deaths. The flaws of their systems even prompted a major recall (Hawkins, 2023). The National Highway Traffic and Safety Administration has pressured Tesla to release more safety information about the Autopilot feature (Kolodny, 2023). This is even after previous investigations had been conducted and has happened in light of further accidents occurring. The NHTSA has also stated concerns of Tesla being unclear and reckless with FSD beta users. This beta allows users to voluntarily opt in to use Tesla's FSD capabilities; however, this work has not been debugged and is essentially being tested by those in the beta program (Kolodny, 2023).

Tesla has also been given several lawsuits. One such lawsuit is the class action lawsuit for false advertisement of the autonomous features of Tesla vehicles being taken up in California (Tobacco, 2022).

Furthermore, Tesla is not transparent on even their most prominent flagship products. Arabesque is a company that uses environmental, social, and governance criteria to rate automobile companies based on environmental impact. They have ranked Tesla poorly due to their lack of exact figures released. Not only does Tesla not release exact emission data, they also do not release the details or context of the data they do release and they release said data in inconsistent time intervals (Bansal, 2021). Tesla also has a history of blaming customers for issues due to defective parts that they had internally identified beforehand (Fitzgerald, 2023).

Due to Tesla's repeated misleading advertising, failure to report information to credible organizations, lack of accountability for faults, and overall failure to be transparent, I argue that Tesla lacks the virtue of being able to communicate clearly and informatively. Some may argue that it is the customer's job to shop with diligence and perform research into products. They may argue that strong promises, even if they are unrealistic or end up in failure, is an acceptable tactic used by companies to promote their technology. Although these arguments may hold strongly for other industries, they fail to consider the novelty of Tesla vehicles and the EV industry as a whole. Unlike other products, there are a very limited number of options of comparable electric vehicles to be used in comparison to Tesla vehicles; this makes it difficult to gauge a standard to hold Tesla to. When the autonomous factor of some Tesla vehicles is taken into account, there are even less commercially available comparisons. This means, as consumers, we currently rely on data released directly from Tesla or the results of investigations of third parties; therefore,

Tesla holds a unique role of power and greater responsibility due to the lack of alternate sources of information and owes it to the public to release reliable data.

Conclusion

By assessing the behaviors and moral practices of Tesla, greater informed judgements of their products and services can be made. Understanding their ethical conduct can help one picture their company mission and the steps the company takes towards responsibility and quality. In the context of Amjad's car fire, assessing the morality of Tesla has led to insights on how Tesla's execution may have led to the fault in his vehicle. Under the virtue ethics framework and using Pritchard's virtues of a moral engineer, Tesla is found to be an immoral engineering company. Although aspects of Tesla's products, inventive mindset in creating cutting-edge technology, broad business reach, hands-on development, and goals of minimizing humanitarian and environmental issues demonstrate virtuous characteristics, their lack of the virtue of being able to communicate clearly and informatively make them fall short of being a moral engineer. Their failure to report data transparently and their misleading advertising and information to consumers make it so all the other works of the company are scrutinized. Their sketchy way of interacting with the public brings into question their honesty. It becomes a valid question for one to wonder if Tesla's goals or commitments are being met. Based on their history, it is not impossible that Tesla has failed to meet its goals on safety and commitments behind closed doors which have led to the many documented accidents to date.

References

Agatie, C. (2022, May 12). *Tesla sources the bulk of its raw materials directly from the mines*. Autoevolution. https://www.autoevolution.com/news/tesla-sources-the-bulk-of-its-raw-materials-directly-from-the-mines-188620.html

Bansal, T. (2021, May 13). *How green is Tesla, really?* Forbes. https://www.forbes.com/sites/timabansal/2021/05/13/how-green-is-tesla-really/?sh=46768afe1576

Buberger, J., Kersten, A., Kuder, M., Eckerle, R., Weyh, T., & Thiringer, T. (2022). Total CO2-equivalent life-cycle emissions from commercially available passenger cars. *Renewable and Sustainable Energy Reviews, 159*, 1-12. https://doi.org/10.1016/j.rser.2022.112158

Environmental Impact. (2022). Tesla. https://www.tesla.com/impact/environment#:~:text=The%20Path%20to%20a%20Sustainable%20Future&text=We%20believe%20these%20growth%20rates%20are%20achievable.,-Displacing%20Fossil%20Fuel&text=Every%20product%20we%20sell%20helps,sell%20helps%20owners%20lower%20emissions.

Fitzgerald, J. (2023, December 20). *Report: Tesla accused drivers for failures of parts it knew were defective*. Car and Driver. https://www.caranddriver.com/news/a46189608/report-tesla-blamed-drivers-for-part-failures/

Gavryliuk, A., Yakovchuk, R., Chalyy, D., Lemishko, M., & Tur, N. (2023, April 29). Determination of fire protection distances during a Tesla model S fire in a closed parking lot. *Eastern-European Journal of Enterprise Technologies, 2*(10), 39–46. https://doi.org/10.15587/1729-4061.2023.277999

Hawkins, A. J. (2023, August 23). *The false promises of Tesla's full self-driving.* The Verge. https://www.theverge.com/2023/8/23/23837598/tesla-elon-musk-self-driving-false-promises-land-of-the-giants

Kolodny, L. (2023, July 6). *NHTSA presses Tesla for more records in autopilot safety probe.* CNBC. https://www.cnbc.com/2023/07/06/nhtsa-presses-tesla-for-more-records-in-autopilot-safety-probe.html

Lambert, F. (2021, August 9). *Tesla claims 92% battery cell material recovery in new recycling process.* Electrek. https://electrek.co/2021/08/09/tesla-battery-cell-material-recovery-new-recycling-process

Miotti, M., & Trancik, J. E. (2023). *Cars evaluated against climate targets*. Carboncounter.com. https://www.carboncounter.com/#!/details?cars=36840;36668

Morris, A. (2021, December 17). *Understanding cobalt's human cost*. Northwestern Now. https://news.northwestern.edu/stories/2021/12/understanding-cobalts-human-cost/

Pritchard, M. (2001). Responsible engineering: The importance of character and imagination. *Science and Engineering Ethics, 7*(3), 391–402.

Tabacco, C. (2022, September 19). *Tesla hit with false advertising class action over cars' self-driving features.* Law Street Media. https://lawstreetmedia.com/news/tech/tesla-hit-with-false-advertising-class-action-over-cars-self-driving-features/

Terry, J. (2024, January 30). *Suburban Chicago man says dashboard of his Tesla caught fire out of the blue.* CBS News. https://www.cbsnews.com/chicago/news/suburban-chicago-man-dashboard-tesla-fire/

The Tesla Team. (2022, November 16). *Model S receives 5-star Euro NCAP safety rating*. Tesla. https://www.tesla.com/blog/model-s-receives-5-star-euro-ncap-safety-rating#:~:text=Following%20this%20test%2C%20Model%20S,91%25%20in%20Child%20Occupant%20Protection.

U.S. Department of Energy. (n.d.). *Emissions from electric vehicles*. Alternative Fuels Data Center. https://afdc.energy.gov/vehicles/electric_emissions.html

Van de Poel, I., & Royakkers, L. (2011). *Ethics, technology, and engineering: An introduction*. Hoboken, NJ: Blackwell Publishing Ltd.

Wayland, M. (2021, October 20). *Tesla will change the type of battery cells it uses in all its standard-range cars.* CNBC. https://www.cnbc.com/2021/10/20/tesla-switching-to-lfp-batteries-in-all-standard-range-cars.html

Wilowski, M. (2023, October 13). T*esla's share of US electric vehicle market slipped to a new low in Q3.* Investopedia. https://www.investopedia.com/teslas-share-of-us-electric-vehicle-market-slipped-to-a-new-low-in-q3-8356288#:~:text=Key%20Takeaways,market%20share%20as%20competition%20grew.

Zhang, A., Haddad, M., & Chughtai, A. (2023, June 5). *Visualising the growth of the electric car industry.* Al Jazeera. https://www.aljazeera.com/news/2023/6/5/visualising-the-growth-of-the-electric-car-industry

Zheng, M. (2023, March 31). *The environmental impacts of lithium and cobalt mining.* Earth.Org. https://earth.org/lithium-and-cobalt-mining/