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      <hr class="my-2">
      <p style="text-align: center;">ENG 419: Writing for Sciences, Social Sciences, and
Technology</p>
      <p style="text-align: center;">California State University Long Beach</p>
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          <dt style="font-size: 125%;"><a href="#Levels of Automation">Levels of Automation</a></dt>
          <dt style="font-size: 125%;"><a href="#Benefits of Self-Driving Cars">Benefits of Self-Drving Cars</a></dt>
          <dt style="font-size: 125%;"><a href="#Faulty Technology">Faulty Technology</a></dt>
          <dt style="font-size: 125%;"><a href="#Safety and Regulation Concerns">Safety and Regulation Concerns</a></dt>
          <dt style="font-size: 125%;"><a href="#Autonomous Morality">Autonomous Morality</a></dt>
          <dt style="font-size: 125%;"><a href="#Other Concerns">Other Concerns</a></dt>
          <dt style="font-size: 125%;"><a href="#Conclusion">Conclusion</a></dt>
    </ul>
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    <br>
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<h2 id="Levels of Automation">Levels of Automation</h2>
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alt="Waymo self-driving taxi created by Google"

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 <figcaption style="font-size: small;">The Waymo self-drivng taxi created by Google.

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</figure>

To explain the various narratives surrounding self-driving cars, the levels of automation should be understood first. Brian Browne's article "Self-Driving Cars: On the Road to A New Regulatory Era" provides a general overview of these cars and their different automation levels. (2017) "The term "self-driving car" is misleading because self-driving cars can have various levels of automation" (Browne 2017). All cars fall under a level of automation, with Level 0 being the least and Level 4 being fully automated. At level 0, the driver completely controls all car features. Cars with stick shifts to manually change gears in the cars would be in this level. Next, the Level 1 cars have a few automated features, such as an automatic gear shift or cruise control, but the driver still maintains control of the car.

Following level 1, the level 2 cars are considered "semi-autonomous" with even more guiding features. Tesla cars fall under this category with their autopilot feature. Meanwhile, the last two levels of automation are where self-driving becomes fully functional.Level 3 cars would have full autonomous capabilities (Browne, 2017). However, level 3 cars would still have a human operator to take control if conditions call for it. Finally, level 4 refers to fully automated cars without a human driver. According to Browne, Google seeks to create cars at the highest level of automation that do not process stirring wheels or pedals. While society may advance driverless cars, the technology is still new. Therefore, it can create problems for companies who wish to rush the creation of level 4 cars.

<h2 id="Benefits of Self-Driving Cars">Benefits of Self-Driving Cars</h2>

Even though the level of technology companies are trying to achieve is still relatively new, there are potential benefits to transitioning to self-driving cars. Self-driving cars can improve traffic safety by removing human error (Browne, 2017). The cars would have two components to help: the artificial intelligence in the system and the operation design system or ODD. "The story is that AI will be able to mimic and then surpass human capability without getting drunk, distracted, or sleepy" (Stilgoe et al., 2020). The technology in level 3 and 4 cars allows them to react to obstacles as they measure the distance between themselves and other vehicles (Browne, 2017). The reduced number of crashes will also decrease car insurance rates since the

companies would not have to pay as much in damages caused by accidents. Features such as emergency braking and adaptive cruise control lower the chances of injury from a car accident and make distance driving easier to handle (Browne 2017). As a result, it can improve the driver's overall health by reducing stress while making the trip more pleasant (Winston et al., 2020).

In addition to traffic safety and the effect that comes from it, self-driving cars can improve accessibility for those who do not have a car. Winston and Kapilow, in their book "Road to Economic Growth?" provide a positive on the application of self-driving cars regarding accessibility (2020). While ride-share such as Uber and LYFT exist, they can still be prone to incidents connected to the human factor from their drivers. Winston and Kapilow mirror Browne's belief that car insurance would be lower for self-driving cars (2020). They use that stance to argue that self-driving cars would be cheaper to own or rent due to the lower insurance cost. As a result, many have the potential to benefit from self-driving cars. For example, cars can help improve the financial situation of those who lack access to their own cars (Winston et al., 2020). In addition, the improved accessibility from self-driving cars can positively influence traffic safety as well. For example, Self-driving cars can provide another safe option for passengers who are under the influence and cannot safely drive on their own.

Incorporating self-driving cars into our society also offers an opportunity to lower greenhouse gas emissions caused by Level 1 or Level 0 cars. Greenhouse gas, or GHGs for short, is a layer of energy trapped in the earth's atmosphere that causes the planet to warm abnormally, creating adverse effects on the different climate areas on the surface (Zushi, 2017). The article "Driverless Vehicles: Opportunity for Further Greenhouse Gas Emission Reductions." by Keiichiro Zushi describes various ways driverless cars can be used to lower GHGs (2017). For example, self-driving cars used as a ride-share service could help lower greenhouse . Since self-driving cars would be more efficient at accelerating and decelerating than human drivers, it would improve overall fuel economy. Due to increased driving efficiency, it will also cut down the time the cars remain idle while running. However, with the push for fully autonomous electric cars created with zero-emission in mind, greenhouse gases and the effects they cause may cause an overall improvement in the world over time.

<h2 id="Faulty Technology">Faulty Technology</h2>

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<figcaption style="font-size: small;">The Cruise car model was involved in the crash.
</figcaption>

</figure>

Recently, a car accident involving a self-driving car reinforced my belief that fully automated technology needs to improve. In San Francisco, a woman was severely injured after an incident involving a self-driving car. (Thadani 2023). The company Cruise controlled the car. The pedestrian was jaywalking in the busy intersection, which caused the accident. The pedestrian was initially hit by a human-driven car, causing her to be thrown in front of the self-driving car. The self-driving car's brakes engaged as soon as she hit the pavement, but the speed of the accident caused the car to pin her underneath. Even though the car initially employed its brakes, it then continued driving forward at a low speed, dragging the woman 20 feet and injuring her further. Despite the car being the cause of further injury, human error caused the car accident.

The San Franciso accident also highlights the ongoing problem with regulating fully automated cars. Despite the cause of the accident being a human error, widespread criticism was directed at the company (Thadani, 2023). The company misrepresented the information surrounding it since they did not immediately share that the car kept moving. The company initially released the accident video up to where the car first deployed its brakes. Upon further investigation, the DMV discovered the existence of a longer video showing the car still moving and required the company to release it to them. It showed the sensor system is not foolproof, leaving legislators questioning the readiness of self-driving cars on the road where human factors are constantly present.

Currently, driverless car companies do not have to publicly report all incidents with driverless cars. This creates the problem of what is and is not being reported by the companies. As a result, it makes it hard to gauge the true performance of driverless cars. As a result of the incident and misinformation, the Department of Motor Vehicles suspended the companies' driverless permits until the state figured out how to regulate the growing technology properly (Thadani, 2023).

<h2 id="Safety and Regulation Concerns">Safety and Regulation Concerns</h2>

Despite the benefits of self-driving cars, those critical of self-driving cars present several safety concerns as technology grows. The transition to fully automated cars may increase overall car accident risk due to the likelihood of human-controlled cars remaining dominant in the foreseeable future. As a result, confusion between manned and unmanned cars will be expected. (Browne 2017) In addition, fully automated cars have the potential risk of cybersecurity problems (Li, 2018). The cars would be wholly reliant on a computer system network to function. Therefore, it increases the likelihood that these cars will be targets for hackers. (Browne, 2017) According to Browne, the concern about hacking is not new, as cars with lower levels of automation have been subject to hacking, causing systems to malfunction the disabled

features of the car (2017). Nonetheless, stronger security features will need to be developed in order to provide a sense of security for the drivers or passengers of self-driving cars.

When it comes to regulating cars in the United States, The Department of Transportation provides oversight. The department makes all regulations through the National Highway Traffic Safety Administration, or NHTSA, to make the vehicles safer and reduce all traffic-related deaths (Browne, 2017). The NHTSA used three tools to regulate the safety of vehicles. First is the creation of Federal Motor and Vehicle Safety Standards. These create the performance and testing standards to which the safety components in vehicles must adhere. The second tool allows the NHTSA to order vehicle recalls if the safety standards are not met. Lastly, the third tool allows the NHTSA to perform the New Car assessment program (Browne, 2017). The program allows consumers to access information about the new cars, keeping them informed while incentivizing manufacturers to continue creating safer vehicles. The primary downside of the NHTSA is they lack the power to enforce regulations of cars outside of the ability to recall vehicles. Therefore, each state enforces vehicle operation and maintenance regulations and driver license standards using their police force and motor vehicle agencies.

Despite not having the power to enforce safety regulations, the NHTSA develops standards for self-driving cars that states can refer to. "In September 2016, the NHTSA, with the Department of Transportation, released a series of guidelines for best practices in developing, deploying and testing driverless cars, as well as a model state policy and a list of current and potential regulations" (Li, 2018). The NHTSA proposed installing event data recorders, or EDRs, to solve the car regulation issue. EDRs would help keep track of the car's performance and how it is operating if it crashes (Browne, 2017). The recorders would help conclude who was responsible for any potential crashes, the car itself or the human operator if present.

If the EDR was installed in the cars, it could determine what features were activated during the crash. As a result, the companies would also get important feedback, especially if it was a feature in the self-driving car that caused it to crash or injure someone. The implementation of EDRs in self-driving cars could also encourage more transparency with manufacturers about the performance of self-driving cars. While Browne said the NHTSA is committed to developing other policies that the manufacturers can refer to, he does not explain what that could be. Therefore, it remains to be seen if manufacturers would implement EDRs into their cars if the States do not enforce them.

Since the states have more power than NHTSA when it comes to enforcing vehicle standards, they did not have a cohesive method to handle regulating the rapidly growing technology. (Browne, 2017) For example, some states, such as Washington, do not relate the cars in the testing phase. Other states put restrictions on the cars to ensure there is human driver always present to take over. (Li 2018) "California, Nevada, Florida, Michigan, and D.C. set an example that other states can follow..." (Browne, 2017) For example, Michigan, Florida, and Washington D.C require a driver to be present at all times in the event the autonomous can be overridden for manual driving when road conditions are not favorable.

Michigan was among the first laws allowing freedom to the manufacturer of how they employ self-driving vehicles- as long as it followed the NHTSA Federal vehicle policy (Li, 2018). Since NHTSA create standards for all the United States, legislators in

Michigan do not see a problem with allowing companies to maintain their freedom as long as they followed them. To handle cyberattacks, California proposed setting standards that would require car manufacturers to use the best practices in the industry. Ideally, these practices would allow the car to detect and alert the operators or the company of cyberattacks so an appropriate response could be applied (Li. 2018). Meanwhile, Nevada created a license standard for the operators of self-driving cars so they receive documents of compliance that align with the State's DMV (Brown, 2017). However, each example has gaps in regulating self-driving cars. The recent accident in San Francisco proves that steps still need to be taken to regulate the vehicles properly, especially when the technology improves.

<h2 id="Autonomous Morality">Autonomous Morality</h2>

Many people may hesitate to ride in a self-driving car simply because it is not a person. It does not think or feel the same way a human does. Therefore, its decisions are unknowable, yet consumers are expected to place their trust in driverless vehicles. Tripat Gill's article "Blame it on the Self-driving Car" focuses on how autonomous cars deal with moral decisions on the road when human control is removed (2020). Gill acknowledges the benefits of incorporating self-driving cars on the road. However, he argues that people may be hesitant to ride in a self-driving car since it is still being determined what kind of moral decisions it would need to make on the road. Gill defines the scope of morality as the ability to discern right from wrong, to make judgments on what is a permissible action, to weigh different possible choices, and to act accordingly (Gill, 2020). The ability to make moral decisions is considered one of the biggest problems surrounding self-driving cars. Self-driving cars cannot perceive morality like a human driver, who must contend with the possibility of consequences if they cause an accident or injure a pedestrian.

To explore the morality conundrum, Gill researched whether the autonomous vehicle would hit a pedestrian to prevent the passenger from being harmed or serve to avoid the pedestrian to keep the passenger safe (Gill 2020). Gill believes that people would be more willing to harm a pedestrian to protect themselves since they would not have control of the AV actions if an incident were to occur. Over the course of five studies, Gill discovered that participants in control of the car mostly chose not to harm a pedestrian at the risk of injuring themselves. On the other hand, the studies also show that many the participants choose self-preservation while riding in the AV at the risk of injuring the pedestrian. He used his findings to highlight concern for adopting fully autonomous agents such on a wide scale (Gill, 2020). However, he also acknowledges limitations to his research, especially as the technology improves.

<h2 id="Other Concerns">Other Concerns</h2>

Besides regulation, safety, and moral concerns, self-driving cars could negatively impact other aspects of daily life (Winston et al., 2020). The incorporation of fully autonomous vehicles would lower the need for parking spaces in metropolitan areas, helping to lower congestion. As a result, it would open the land not used for parking lots for other things. While

that is a potential benefit to autonomous cars, it comes with a tradeoff: commute time. An autonomous vehicle would provide a comfortable trip, but it may come at the cost of long commutes. It will allow people to move to more affordable suburban areas if they choose and use an autonomous vehicle to commute to work. However, it opens the possibility of raising congestion in these suburban areas and causes the neighborhoods to become less affordable if people pursue this route.

The incorporation of self-driving cars comes with the concern of their impact on the job market (Winston et al., 2020). While self-driving cars will provide more access to distant jobs for those who do not own a car, they could negatively impact the jobs of those in the transportation industry. Self-driving cars cause truck drivers, ride-share workers, and other transportation workers' job security would be at risk. However, cars open opportunities in other areas of work in transportation. For example, a fully automated truck would likely still need an operator to provide additional security to the cargo it is transporting or take over driving if road conditions deteriorate. Other job opportunities will arise in response to maintaining upkeep on the fully autonomous cars. "Jobs will also develop to maintain, repair, and clean autonomous vehicles that are hired and owned, to handle customer service, and to keep maps for optimal routings updated" (Winston et al., 2020). Despite the impact on job security, self-driving cars may increase employment in other areas while providing improved accessibility for all.

Another criticism regarding self-driving cars is that the technology is still underdeveloped. In Stilgoe and Cummings's article "Can driverless vehicles proves themselves safe?" they argue that the perception system in the self-driving car needs to be thoroughly observed (2020). Despite the cars' capacity to potentially improve traffic safety, it simply does not perceive the world the same humans can. The perception of the system is a set of sensors in a self-driving that guides its behaviors in a situation. The system is "brittle" since it relies on machine learning, which negatively impacts the reliability of the cars. Without a standard of vehicle safety due to a lack of cohesive relations in the industry, the problem with weak computer systems is likely to continue (Stilgoe et al., 2020). However, that does not mean that the technology will remain that way. Like other forms of technology, such as cell phones and computers, it can always be improved.

In conclusion, self-driving cars will be a good thing when it comes to traffic safety. However, the technology of Level 4 cars is still too new to be implemented on the streets with cars with lower levels of automation. Making full automation an optional feature in a car instead of rushing to remove the human factor for driving will allow a smoother transition to more advanced features later when they are ready. Working on improving cars with lower levels of automation may lessen the negative sentiment towards fully autonomous cars. Until it does, all self-driving cars should have an operator present, even if they are not driving. Taking that route will create a balance that allows people to have a choice of control and show off the more positive benefits of having self-driving cars in our society.

<h2 id="Works Cited">Works Cited</h2>

Browne, B. (2017). Self-Driving Cars: On The Road to A New Regulatory Era. Journal of Law, Technology, & the Internet, 8 (1), 1-19, https://search-ebscohost com.csulb.idm.oclc.org/login.aspx?direct=true&db=a9h&AN=129365681&site=ehost-live.

Li, Victor. (2018) The Danger of Digi-things. ABA Journal, 104(3), 38-47, https://www.jstor.org/stable/10.2307/26516273

Stilgoe, J., Cummings, M. (2020) Can Driverless Vehicles Prove Themselves Safe?. Issues in Science and Technology, 37(1), 12-14, https://www.jstor.org/stable/10.2307/26949183

Thadani, T. (2023). How a robotaxi crash got Cruise's self-driving cars pulled from Californian roads. The Washington Post, https://www.washingtonpost.com/technology/2023/10/28/robotaxi-cruise-crash-driverless-car-san-francisco/

Tripat, G. (2020) Blame It on Self-Driving Cars: How Autonomous Vehicles Can Alter Consumer Morality. Journal of Consumer Research, 47, 272-291, https://doi-org.csulb.idm.oclc.org/10.1093/jcr/ucaa018

Winston, C., Karpilow, Q. (2020). Other Important Effects of Autonomous Vehicles. In Autonomous Vehicles: The Road to Economic Growth? Brookings Institution Press, 79–94, http://www.jstor.org/stable/10.7864/j.ctvwh8fdt.10

Zushi, K. (2017) Driverless Vehicles: Opportunity for Further Greenhouse Gas Emission Reductions. Carbon & Climate Law Review, 11(2), 136-149, https://www.jstor.org/stable/26353861

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Road Safety and the Future of Self-Driving Cars

By: Kayla Humphrey

ENG 419: Writing for Sciences, Social Sciences, and Technology

California State University Long Beach

Table of Contents

In our modern age, technological advances have become common. We constantly see new things developed in various fields, such as handheld technology, medicine, and transportation. However, only some things are easily accepted. Self-driving cars are a new frontier in transportation that is often viewed with trepidation or outright disdain. It is something new that makes appealing promises by removing the human factor in driving. However, are fully automated cars the best technological step for road safety? Neither the benefits nor various concerns about self-driving cars should be ignored. While self-driving cars have potential,

manufacturers should ensure that there is always an operator present until the technology improves.

Levels of Automation

The Waymo self-drivng taxi created by Google.

To explain the various narratives surrounding self-driving cars, the levels of automation should be understood first. Brian Browne's article "Self-Driving Cars: On the Road to A New Regulatory Era" provides a general overview of these cars and their different automation levels. (2017) "The term "self-driving car" is misleading because self-driving cars can have various levels of automation" (Browne 2017). All cars fall under a level of automation, with Level 0 being the least and Level 4 being fully automated. At level 0, the driver completely controls all car features. Cars with stick shifts to manually change gears in the cars would be in this level. Next, the Level 1 cars have a few automated features, such as an automatic gear shift or cruise control, but the driver still maintains control of the car.

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Even though the level of technology companies are trying to achieve is still relatively new, there are potential benefits to transitioning to self-driving cars. Self-driving cars can improve traffic safety by removing human error (Browne, 2017). The cars would have two components to help: the artificial intelligence in the system and the operation design system or ODD. "The story is that AI will be able to mimic and then surpass human capability without getting drunk, distracted, or sleepy" (Stilgoe et al., 2020). The technology in level 3 and 4 cars allows them to react to obstacles as they measure the distance between themselves and other vehicles (Browne, 2017). The reduced number of crashes will also decrease car insurance rates since the companies would not have to pay as much in damages caused by accidents. Features such as emergency braking and adaptive cruise control lower the chances of injury from a car accident and make distance driving easier to handle (Browne 2017). As a result, it can improve the driver's overall health by reducing stress while making the trip more pleasant (Winston et al., 2020).

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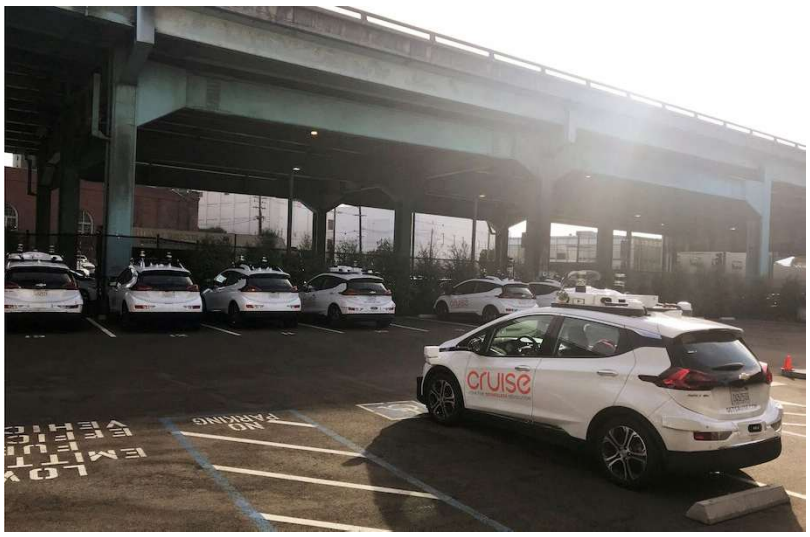
Faulty Technology



The Cruise car model was involved in the crash.

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Safety and Regulation Concerns

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If the EDR was installed in the cars, it could determine what features were activated during the crash. As a result, the companies would also get important feedback, especially if it was a feature in the self-driving car that caused it to crash or injure someone. The implementation of EDRs in self-driving cars could also encourage more transparency with manufacturers about the performance of self-driving cars.

While Browne said the NHTSA is committed to developing other policies that the manufacturers can refer to, he does not explain what that could be. Therefore, it remains to be seen if manufacturers would implement EDRs into their cars if the States do not enforce them.

Since the states have more power than NHTSA when it comes to enforcing vehicle standards, they did not have a cohesive method to handle regulating the rapidly growing technology. (Browne, 2017) For example, some states, such as Washington, do not relate the cars in the testing phase. Other states put restrictions on the cars to ensure there is human driver always present to take over. (Li 2018) "California, Nevada, Florida, Michigan, and D.C. set an example that other states can follow..." (Browne, 2017) For example, Michigan, Florida, and Washington D.C require a driver to be present at all times in the event the autonomous can be overridden for manual driving when road conditions are not favorable.

Michigan was among the first laws allowing freedom to the manufacturer of how they employ self-driving vehicles- as long as it followed the NHTSA Federal vehicle policy (Li, 2018). Since NHTSA create standards for all the United States, legislators in Michigan do not see a problem with allowing companies to maintain their freedom as long as they followed them. To handle cyberattacks, California proposed setting standards that would require car manufacturers to use the best practices in the industry. Ideally, these practices would allow the car to detect and alert the operators or the company of cyberattacks so an appropriate response could be applied (Li. 2018). Meanwhile, Nevada created a license standard for the operators of self-driving cars so they receive documents of compliance that align with the State's DMV (Brown, 2017). However, each example has gaps in regulating self-driving cars. The recent accident in San Francisco proves that steps still need to be taken to regulate the vehicles properly, especially when the technology improves.

Autonomous Morality

Many people may hesitate to ride in a self-driving car simply because it is not a person. It does not think or feel the same way a human does. Therefore, its decisions are unknowable, yet consumers are expected to place their trust in driverless vehicles. Tripat Gill's article "Blame it on the Self-driving Car" focuses on how autonomous cars deal with moral decisions on the road when human control is removed (2020). Gill acknowledges the benefits of incorporating self-driving cars on the road. However, he argues that people may be hesitant to ride in a self-driving car since it is still being determined what kind of moral decisions it would need to make on the road. Gill defines the scope of morality as the ability to discern right from wrong, to make judgments on what is a permissible action, to weigh different possible choices, and to act accordingly (Gill, 2020). The ability to make moral decisions is considered one of the biggest problems surrounding self-driving cars. Self-driving cars cannot perceive morality like a human driver, who must contend with the possibility of consequences if they cause an accident or injure a pedestrian.

To explore the morality conundrum, Gill researched whether the autonomous vehicle would hit a pedestrian to prevent the passenger from being harmed or serve to avoid the pedestrian to keep the passenger safe (Gill 2020). Gill believes that people would be more willing to harm a pedestrian to protect themselves since they would not have control of the AV actions if an incident were to occur. Over the course of five studies, Gill discovered that participants in control of the car mostly chose not to harm a pedestrian at the risk of injuring themselves. On the other hand, the studies also show that many the participants choose self-preservation while riding in the AV at the risk of injuring the pedestrian. He used his findings to highlight concern for adopting fully autonomous agents such on a wide scale (Gill, 2020). However, he also acknowledges limitations to his research, especially as the technology improves.

Other Concerns

Besides regulation, safety, and moral concerns, self-driving cars could negatively impact other aspects of daily life (Winston et al., 2020). The incorporation of fully

autonomous vehicles would lower the need for parking spaces in metropolitan areas, helping to lower congestion. As a result, it would open the land not used for parking lots for other things. While that is a potential benefit to autonomous cars, it comes with a tradeoff: commute time. An autonomous vehicle would provide a comfortable trip, but it may come at the cost of long commutes. It will allow people to move to more affordable suburban areas if they choose and use an autonomous vehicle to commute to work. However, it opens the possibility of raising congestion in these suburban areas and causes the neighborhoods to become less affordable if people pursue this route.

The incorporation of self-driving cars comes with the concern of their impact on the job market (Winston et al., 2020). While self-driving cars will provide more access to distant jobs for those who do not own a car, they could negatively impact the jobs of those in the transportation industry. Self-driving cars cause truck drivers, ride-share workers, and other transportation workers' job security would be at risk. However, cars open opportunities in other areas of work in transportation. For example, a fully automated truck would likely still need an operator to provide additional security to the cargo it is transporting or take over driving if road conditions deteriorate. Other job opportunities will arise in response to maintaining upkeep on the fully autonomous cars. "Jobs will also develop to maintain, repair, and clean autonomous vehicles that are hired and owned, to handle customer service, and to keep maps for optimal routings updated" (Winston et al., 2020). Despite the impact on job security, self-driving cars may increase employment in other areas while providing improved accessibility for all.

Another criticism regarding self-driving cars is that the technology is still underdeveloped. In Stilgoe and Cummings's article "Can driverless vehicles proves themselves safe?" they argue that the perception system in the self-driving car needs to be thoroughly observed (2020). Despite the cars' capacity to potentially improve traffic safety, it simply does not perceive the world the same humans can. The perception of the system is a set of sensors in a self-driving that guides its behaviors in a situation. The system is "brittle" since it relies on machine learning, which negatively impacts the reliability of the cars. Without a standard of vehicle

safety due to a lack of cohesive relations in the industry, the problem with weak computer systems is likely to continue (Stilgoe et al., 2020). However, that does not mean that the technology will remain that way. Like other forms of technology, such as cell phones and computers, it can always be improved.

In conclusion, self-driving cars will be a good thing when it comes to traffic safety. However, the technology of Level 4 cars is still too new to be implemented on the streets with cars with lower levels of automation. Making full automation an optional feature in a car instead of rushing to remove the human factor for driving will allow a smoother transition to more advanced features later when they are ready. Working on improving cars with lower levels of automation may lessen the negative sentiment towards fully autonomous cars. Until it does, all self-driving cars should have an operator present, even if they are not driving. Taking that route will create a balance that allows people to have a choice of control and show off the more positive benefits of having self-driving cars in our society.

Works Cited

Browne, B. (2017). Self-Driving Cars: On The Road to A New Regulatory Era. Journal of Law, Technology, & the Internet, 8 (1), 1-19, https://search-ebscohost com.csulb.idm.oclc.org/login.aspx?direct=true&db=a9h&AN=129365681&site=ehost-live.

Li, Victor. (2018) The Danger of Digi-things. ABA Journal, 104(3), 38-47, https://www.jstor.org/stable/10.2307/26516273

Stilgoe, J., Cummings, M. (2020) Can Driverless Vehicles Prove Themselves Safe?. Issues in Science and Technology, 37(1), 12-14, https://www.jstor.org/stable/10.2307/26949183

Thadani, T. (2023). How a robotaxi crash got Cruise's self-driving cars pulled from Californian roads. The Washington Post, https://www.washingtonpost.com/technology/2023/10/28/robotaxi-cruise-crash-driverless-car-san-francisco/

Tripat, G. (2020) Blame It on Self-Driving Cars: How Autonomous Vehicles Can Alter Consumer Morality. Journal of Consumer Research, 47, 272-291, https://doi-org.csulb.idm.oclc.org/10.1093/jcr/ucaa018

Winston, C., Karpilow, Q. (2020). Other Important Effects of Autonomous Vehicles. In Autonomous

Vehicles: The Road to Economic Growth? Brookings Institution Press, 79–94, http://www.jstor.org/stable/10.7864/j.ctvwh8fdt.10

Zushi, K. (2017) Driverless Vehicles: Opportunity for Further Greenhouse Gas Emission Reductions. Carbon & Climate Law Review, 11(2), 136-149, https://www.jstor.org/stable/26353861