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Autonomous Vehicles

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“In the Austin area, more than 220,000 vehicles travel on I-35 on a daily basis” [1]. This piece of data was recorded in 2015 and the number of vehicles on the road are constantly increasing each year as more and more people move to Austin Texas. Because of this increasing population, we get new drivers who have not driven much or at all on I-35. New drivers who don’t use their turn signals all the time or even know when certain lanes end. In the past couple of years police and related officials have been cracking down on drivers who text and drive as they are just as dangerous as a drunk driver. Drivers on the road also don’t obey every law on the road like speed limits and road work warning signs or even check their blind spots before merging! Buses and big 18-wheelers also share the road with these distracted and negligent drivers. These big vehicles can be carrying massive amounts of weight at a time and be traveling at 70mph or higher. They may also be traveling a great distance and may not have gotten much sleep and can end 1 or multiple lives by just falling asleep at the wheel. With all this information, what do you do? There is a simple solution that can and will fix all the dangers of driving on roads like I-35. Self-driving vehicles are the way of the future for public transportation.

In this paper, we will discuss the technological background along with a timeline of what has and will come from autonomous vehicles. We will then formulate moral rules to three ethical dilemmas with evaluation of these moral rules using our ethical theories. Then lastly we will conclude with a review over our formulations and conclusions of each moral rule.

For a vehicle to be considered autonomous it must be operated only by the vehicles programming and not by a human being. The vehicle contains a chip programmed to manipulate the gas, steering wheel and brakes. It allows the vehicle to react individual case scenarios in which it will need to either honk, turn left or right, or hit the brakes. It also keeps track of all fluids, tire pressures, and error logs. These cars can be easily updated with the latest firmware to ensure reliability and safety. Autonomous vehicles like Google’s self-driving cars use sensors to gather lots of data on their runs to better anticipate the anomalies of the road. They track the position of other cars relative to their position and provide a safe distance away from them to give them enough braking distance if needed. Their programming must allow them to follow all traffic rules including speed limits and traffic signs.

Currently Google, Uber, and Tesla are the leading makers in fully autonomous vehicles. No one has perfected the idea but they are getting closer and closer every day. In order for Google’s cars to accurately map out the world around them the use a special sensor called the LIDAR. “LIDAR fires out laser pulses to build a super accurate graphic representation of the environment” [2]. This piece of technology costs around $80,000 and is mounted on the top of the car. Tesla is trying to move away from the LIDAR to a more traditional approach using laser sensors mounted around the car detecting the distance and speed of their surroundings instead. As Tesla’s option is much cheaper, it is also much less accurate than their competition. Currently the technology is still in its early stages but newest model Tesla’s and other manufacturers are already implementing some self driving behaviors considered as safety features. Some of which will automatically apply the brakes if you are approaching an object too quickly and do not react in time and others will guide your car through your lane and prevent the car from drifting into another lane. There are also some cars that will parallel park themselves!

As we near closer and closer to the world of autonomy we also need to decide what laws should be in place for when these cars are the ones making the decisions and not a human being behind the wheel. Would it be lawful to drink and ride in an autonomous car? If the car crashes into another car, who’s at fault? Are software updates mandatory to be considered safe on the roads? Will the DMV require software version checking when you have your car inspected? These and many more questions start to come up when people think of a fully autonomous road. So, this begs the question, what will our government do? Well thankfully legislation is on the way but it is a slow process. “The Department of Transportation announced a 15-point safety standard for the design and development of autonomous vehicles; called for states to come up with uniform policies applying to driverless cars” [3]. Tesla’s Elon Musk is planning to have a fully autonomous car by the end of 2017, Ford aims for 2021, China’s Baidu 2019, GM and Google have not set a firm date but expect for something around 2021 [2]. With these dates coming up lawmakers must work quickly at adapting towards the future.

Let’s paint out a scenario where autonomous cars are in full effect and with that we have a man named John. John takes rides in his brand new google car that takes him where ever he wants to go by just inputing an address. This address is then sent to Google’s online database in which it will search inside to find the best directions it can to take John there. Every time he inputs a new address the address gets saved into an online database Google can use for data mining purposes. Now on John has a surprise for his wife and he does not want her to find out! John goes to the restaurant he wants to take her to and makes sure it is perfect. Well later that night John receives ads on his phone about the restaurant he just visited and his wife sees them. Surprise ruined all because Google wanted to direct ads to him thinking this is something he wanted. Granted this is a very light scenario but our ethical dilemma we will be discussing is: Do autonomous vehicles track too much data and is it an intrusion of privacy? To figure this out we must start out with a Moral Rule we will focus on and that is: To provide a safe and reliable vehicle they must continuously collect data. The data being collected is usually for the purposes of protecting the driver from incorrect directions and allowing the vehicle to accurately predict unforeseen situations. For instance, the vehicle may notice that there is a pothole right where most cars have their right wheels at and it will remember to avoid that spot. The vehicle could also upload this information to Google’s database and have other cars download this information and avoid said pothole. The car will also track the speed, direction, mileage, gas mileage, GPS, and distance objects are around the vehicle. All this information will be uploaded for future updates in software and or future iterations of the vehicle. As we have seen in this scenario, the information can also be used to more accurately target ads to the user. This transmission of information also increases security risks as criminals could possibly intercept the information and use it to track your daily commutes. This can result to an estimated 1GB a second of data which would then theoretically create about 2 petabytes of data per year [4].

To provide a safe and reliable vehicle they must continuously collect data. To evaluate this moral rule, we will evaluate it with a Kantian approach. Kant uses two formulations of the Categorical Imperative to evaluate morality. The first formulation indicates that “you should act only on moral rules that you can imagine everyone else following without deriving a logical contradiction [5]. To evaluate our rule, we must first universalize it. If all cars recorded all their data at the cost of privacy but at the result of safety is it ok? To that we can say yes and that is because we want to trust our autonomous vehicles in the future and for these vehicles to learn better stopping techniques or driving maneuvers they must be collecting constant data. The second formulation states to not use anyone as a means to an end. With the collection of data the manufactures are not using people to purely data mine but in actuality they are using the data to protect their customers and continue a positive customer service relationship. From a Kantian point of view, it is moral for the vehicles to continuously collect data for the safety of its users.

Another approach to this moral rule is to use the Social Contract Theory. In the Social Contract Theory (SCT), we as a society assume basic rights such as privacy when we enter a new society. With these autonomous vehicles tracking our every move we lose that basic right to privacy which can be considered a limited right. With the loss of this limited right we in turn gain a very important right which is the right to safety on the road. This right is an absolute right in which we can prevent thousands of deaths on the road. To that we can say it is moral to continuously collect data at the cost of privacy for public safety.

John has just gone through his divorce due to the ruined surprise. He decides to take his car to a nearby park to get some fresh air. John rides through a very hilly neighborhood when suddenly four kids run out in front of his car! The car tries to hit the brakes but for some reason his brakes have malfunctioned. The car is left with only two options at this point. Option one, go straight and kill the four kids who ran in front of his car but saving John. Or option two, turn the wheel to avoid the kids but crash into the side of a building killing John inside. Should the programming in the vehicle ever have the option to kill its passengers if it means saving the lives of others? To evaluate this, we will state the moral rule we will evaluate. Under any circumstance the vehicle shall value the life of its passengers over the lives of others.

To start things off let us take this moral rule through a Rule Utilitarianism evaluation. Rule Utilitarianism looks at the big picture and formulates rules that if followed by everyone will generate the greatest happiness [5]. There isn’t much happiness deriving from either option so we’ll have to go off of the least suffering in this. Yes option two will result in less deaths but from an outsiders point of view we can see that these kids were either not being supervised and should put more blame on the parents or they are just doing what kids do and that is to constantly put themselves in harms way. If self-driving cars were making decisions to kill their own passengers, then no one would buy these vehicles. We all want a utilitarianism approach to these decisions but never to ourselves or family members involved. “A study, based on surveys of U.S. residents, found that most respondents would not want to ride in these vehicles themselves, and were not in favor of regulations enforcing utilitarian algorithms on driverless cars” [6]. If no one were to buy these vehicles, deaths on the roads will increase because of it. So, the lives lost in this scenario are sad but are also preventable. Option one will have to be the default choice in order for people to trust these vehicles with their lives. Through Rule Utilitarianism we can conclude that in any circumstance the vehicle shall value the lives of its passengers over the lives of others as moral.

The categorical imperative states we must universalize our moral rule so that all cars follow this rule. If all cars valued the lives of its own passengers over the lives of others we would see safe roadways in which all cars drive defensively. If all cars drive defensively then trust in autonomous vehicles will increase. If the trust increases, then sales will increase. If sales increase, then supply will increase. With high supply and demand, comes increase in jobs. Increase in jobs increases the wealth of the middle class. Everyone benefits if autonomous vehicles value the life of its passengers than the lives of others. Because this works with Kant’s categorical imperative then we can definitively say that the rule is moral.

Our last ethical dilemma come from the job losses of our bus, taxi, truck and delivery drivers. With the introduction of autonomous vehicles companies like Uber are working on removing the human element from their services and just have automated vehicles roaming the streets picking up their customers and dropping them off at their designated locations. Truck drivers have a very difficult and tiresome job to drive 11 cumulative hours and must follow a strict rule of at least 10 hours of rest time before continuing [7]. Not every truck driver follows these rules as they may be running behind schedule and want to catch up or maybe they just want to get the job done and go home. Either way, with autonomous vehicles these jobs can be replaced with vehicles that don’t need sleep and don’t make mistakes when driving. “In 2010 Texas had more than 115,00 18-wheeler accidents. Of those accidents, 3,285 involved one or more fatalities and 44,310 resulted in injuries” [8]. With this many accidents happening every year something needs to change. For the greater public safety and for all traffic flow, autonomous vehicles shall replace all vehicles on public roads. For this rule, we will use Rule Utilitarianism and Social Contract Theory to ethically evaluate the morality of this rule.

Rule Utilitarianism states we need to use our rule and see if it generates the greatest net happiness. With that we can list out the cause and effects of this rule over a period of time. First if all of these jobs are lost we will see a large amount of job loss from everyone in these markets. These people will have to find jobs elsewhere and hopefully they can adapt to the changes and maybe work as maintenance workers for these vehicles or maybe find a new profession. They could also help in the development of these vehicles by providing these companies with useful data and advice during development and updates. Once these vehicles have taken over the roads then we will see a massive reduction in deaths on the road along with reductions in the time it takes to travel from point A to B. Traffic will be reduced substantially as each car will run uniformly and quickly. Without people behind the wheel, autonomous cars will no longer need to guess what the other car will do. It will instead know the algorithms of other cars on the road and be able to know when the car will apply brakes or accelerate which will remove the slinky effect we see when someone hits the brakes in traffic. People will be able to work or read or study or learn new skills while being a passenger on these autonomous vehicles. Stress levels will go down as people don’t have to stress over driving and become exhausted. Minus the loss of these jobs and work, the majority of the people will receive the greatest amount of happiness and pleasure just from removing the aspect of driving on the public roads thus making the rule moral.

Social Contract Theory states that in order for us to avoid the “state of nature” we must formulate rules for society to thrive. The rule will prevent humans from operating their vehicles and only allowing the computer drive the vehicles. This rule will stop people from making poor judgement calls when driving and will prevent future deaths. These cars are programmed to follow all rules of the roads and to function as a quick and safe transportation to your destination. The right to life is an absolute right in which we all must respect for each other. Because of the right to life we can consider driving your own car on the road as an infraction to this right and should not be acceptable. We can consider our moral rule as a positive right that obligates others to do their part in not driving their cars and allow autonomous cars to do their purpose. With social contract theory, we can say this is a moral rule.

Autonomous cars, or Self-Driving cars, will be the future of transportation. We will see in the coming years the development of these cars unfold and see the true beauty of a fully autonomous road. We discussed three possible ethical dilemmas including the tracking of data, if cars should take a utilitarianism approach to a crash, and if the loss of delivery jobs are more important than public safety on roads. The rules we used for each were evaluated as moral in that it is moral for our cars to collect data as we travel to ensure better safety features. It is moral for our cars to not take a utilitarianism approach but instead prioritize the lives inside the vehicle over the lives outside the vehicle. And it is moral to sacrifice the jobs of delivery people by replacing their vehicles with autonomous vehicles for the greater public good and safety. With thousands and thousands of deaths each year on public roads it is time we look to the future of autonomous vehicles.

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