ETHICAL ISSUES WITH SELF-DRIVING CARS

Prepared for

Prof. Christine Choi
New York City College of Technology, CUNY

Prepared by

Ashton Anderson
Sean Kelly Datu
Islam Elborolosy

December 15, 2020

TABLE OF CONTENTS

(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

The Ethical Issue

with Self-Driving Cars

Section I

Introduction(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

Technology is changing and evolving more, and it is becoming more powerful. People find themselves absorbed in the modern technology that they have in today's generation. However, there are other perspectives in the new era in technology. There are self-driving cars and also called machine-driving cars or vehicle intelligence. The human-driver is replaced by a robot/artificial intelligence(AI), there is an autopilot mode which has to be used on Tesla model cars, which is entirely automated. The car is basically driving itself. Self-driving cars can bring people's safety to the future, making sure that self-driving cars decrease traffic casualties. The ethical problem with self-driving cars is decision making and who has the right to make that decision. The big issue is all of the outside forces, such as pedestrians, bicyclists, and other vehicles. Because self-driving cars cannot interpret human behavior behind the wheel, it is very difficult for them to be implemented right now. Right now that is one of the biggest hurdles holding them back .And the fact is in the world we're living in now, where nothing is genuinely safe, and a system like this could potentially have many vulnerabilities. Anyone with malicious intent can potentially compromise this system and do a lot of damage in a short amount of time. Technology is evolving, but so are the hackers around us. We have many pros and cons when it comes to autonomous vehicles and in the end we hope to achieve the same thing which is trusting autonomous vehicles.

(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

- **Table: Pros and Cons**

The table below shows a few pros and cons of autonomous vehicles.

PROS	CONS
Save time	Ethical decisions (Who has the right to make choices in the event of a crash)
Easy drive	Hacking
Safe Road	Potential Malfunction
Improve traffic	Expensive to implement

Autonomous vehicles save time because the way it would work is wherever it is routed to it will look for the fastest way to get there which will save time. Easy drive is because it is designed to cause no issue while driving which will let the passengers relax and do whatever they want until they get to their location. Safe road is because all autonomous vehicles will not be directed to any dangerous roads; it will take the safest road it can so nothing bad happens. Improving traffic is because all autonomous vehicles will know the best way to go so they can't get stuck in any type of situation which will never cause a road block due to too many cars or situations where a car made a wrong turn because it is designed to prevent any of those mistakes. Those are the four pros we have for autonomous vehicles.

Also, ethical decisions (Who has the right to make choices in the event of a crash) is an issue because at the moment people will just blame the vehicles and incase a crash happens or a life/death situation we need to be able to make a decision on who has the right. Hacking is an important issue we need to address because the generation we live in now even though security and technology are evolving so are the hackers around us. There are people just sitting at home wanting to hack into any type of system for fun so if our system isn't hundred percent safe then there is no telling what can happen at any given time. Potential malfunction is an issue because if the system isn't written properly and one little mistake inside the system can malfunction the car at any time and if it tends to malfunction while they are making a turn or driving then an accident

can happen. It is too expensive to implement autonomous vehicles at the moment because we need to be able to upgrade the system and add many new programs into the car to make it perfect and we are already living in a world where people are losing their jobs over silly things so money is an issue at the moment. These are the four cons we addressed on the table.

Objective (Islam Elborolosy, Sean Kelly Datu)

The objective of this research is to show the ethical issues with self-driving cars. In the current society, there have been repeated accidents, some even fatal, due to self-driving cars. Due to these incidents, a lot of people died/got killed, and got injured. Self-driving cars are dangerous, it can give anyone a short life. There are many dilemmas that occur when driving, how can a system of if statements know which action to take? Some programs base it on which outcome reduces the number of people hurt or worse killed but that begs the question of whether the severity of the injuries should also play a part in the decision making. For example, if a car is driving in the dark has two passengers in the backseat speeding due to an emergency. All of a sudden, there are two kids who are crossing the street. Due to the speed of the car, it can not stop in time without hurting the passengers in the car and without damaging the car. However, if the car does not brake, the kids could potentially be severely injured or even killed. Due to the algorithms currently in place, self-driving cars base it on the number of people who could be injured and not the severity. Therefore, human compassion is needed in these types of situations and cannot be easily replicated by an Artificial Intelligence (AI)/robot.

This research paper will delve deeper into these scenarios and the ethical decisions that are made by drivers on an almost daily basis. In situations like this both AI and humans can be right but, in the end, humans can overpower the robot decisions because they are the creators, and they will know what they want at that moment. Self -driving vehicles are having a problem on decision making when it comes to pedestrians, bicyclists, and vehicle to vehicle. Throughout this report, there will be problems, solutions, and examples. The solutions to every problem that autonomous

vehicles have, is to fix the algorithm, which is reprogram it and also test the autonomous vehicles before it is released.

Methodology(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

We seek to understand and to discuss the ethical issues of self-driving cars, which is the focus of the report. We went through a lot of sources to find the specific ethics and other topics that are related to self-driving cars. We found the ethical issues of self-driving cars, which is the risk, and the safety. The problem is the behavior of the artificial intelligence (AI) / robot is not the same as human behavior. The system of autonomous cars is not perfectly programmed, there are still accidents. Another problem is that the system that is programmed into the car is not hundred percent safe. We can still have people hacking into it and changing the directions/route on where you are going. It is not safe at all and it's one of the reasons why people don't trust autonomous vehicles. The traffic rules are important to be followed by the drivers, especially pedestrians and the trust of the people are important to achieve without that there is no one going to want self-driving cars. We chose the sources that provide the information about the ethics of autonomous cars, the problems and the solutions. We searched the term self-driving and autonomous cars with ethics. We collected the information from the City Tech library's articles, journals, and books.

Results (Islam Elborolosy, Sean Kelly Datu, Ashton Anderson)

We found that machine-driving is dangerous for the passengers. In the article The Future of Transportation: Ethical, Legal, Social and Economic Impacts of Self-driving Vehicles in the Year 2025 it was stated that "*Cyber-security* People have been fearful that SDVs will be easily hacked because of the abundance of digital infrastructure required for them to work. Criminals have been making explicit use of the data that they retrieve, hacking the vehicle and getting it to perform actions the user is unaware of, unable to undo, and maliciously causing harm to the individual(s) in the car (Bowles 2018). " In the generation we live now everything is getting hacked easily and until they are confident and hundred percent sure that the cars can't get hacked

it is too risky to do anything like this. Also, we found that human-driving and machine-driving are equal for the passengers. In NewsRx Health (2019, July 28) said that, "The overall result was that there was only a marginal difference in trust between the two driving methods" (page 1). The volunteers tested the autonomous car and some passengers saying that the two driving methods have similarities but it is more confidence in human-driving. Most passengers would like to do nothing or chill while traveling.

(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

- ❖ The figures below is showing passengers opinions or actions in autonomous vehicles:

- ❑ **Figure: Cognitive Distribution of Travelers**

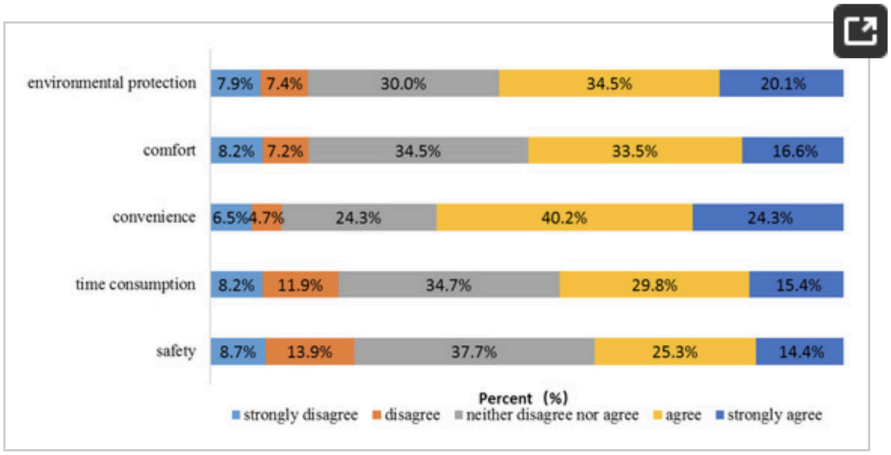

Figure 2. Travelers' cognitive distribution of autonomous vehicles (AVs).

Tan, L., Ma, C., Xu, X., & Xu, J. (2019). Choice Behavior of Autonomous Vehicles Based on Logistic Models. *Sustainability*, *12*(1), 54. **https://doi.org/10.3390/su12010054**

- ➢ Based on the figure above, the travelers are mostly "neither disagree nor agree" and "agree", which is most travelers saying that autonomous vehicles are convenient, and it can give the traveler a autopilot, free hand, and others are saying that autonomous vehicles are safe.

(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

❑ **Figure: Time Utilization Travelers' Distributions**

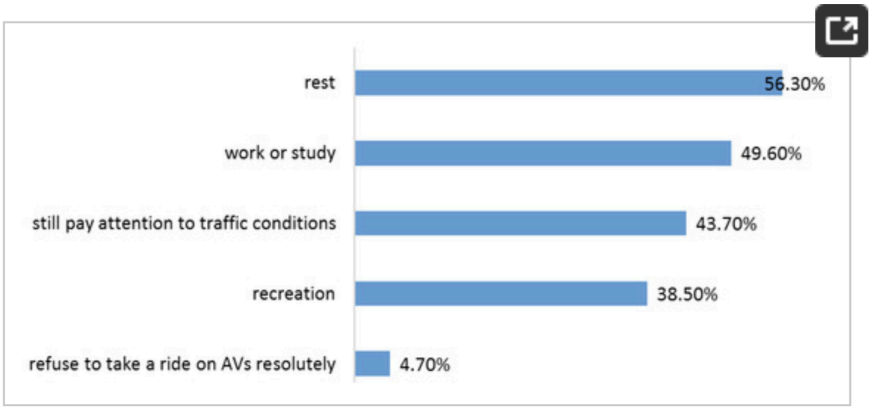

Figure 3. Distribution of travelers' time utilization in AVs.

Tan, L., Ma, C., Xu, X., & Xu, J. (2019). Choice Behavior of Autonomous Vehicles Based on Logistic Models. *Sustainability*, *12*(1), 54. **https://doi.org/10.3390/su12010054**

➢ Based on the figure above, the travelers are mostly resting, but still paying attention to traffic conditions, which travelers still do not trust autonomous vehicles 100% even though it is convenient. There are travelers who at least refuse to take a ride on autonomous vehicles, they do not have confidence to be a passenger on a machine-driver.

(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

❏ **Table: General Problems**

General Problems			
	Problem	**Reason**	**Definition**
1.	Accidents	Decision Making	It is a system/computer malfunction, the algorithm is not that good. The decision making in pedestrians, bicyclists, and vehicle-to-vehicle.
2.	Losing jobs	Machine-driving	Drivers who are working Uber, Grab, etc., are losing jobs because of autonomous cars, it is a robot car, it can drive by itself.

➢ The table above is the top problem of autonomous vehicles, it is because of machine-driving. Algorithms are just autonomous vehicle have, and it is hard to trust robot cars.

Solution:

The solution for the travelers who do not trust and who do not have confidence to ride autonomous vehicles, there is a book that has a solution for every programmer and for the manufacturer companies. According to the authors of the book "Autonomous Cars", Sakthivel R., Narayan, F. O., Narayan, S., Abubakar, S., Kaisan, M. U., & Alammari, Y. (2019). Mentioned the solution to the problems of autonomous vehicles is to create a hierarchy of

barriers that cannot be violated compared to other barriers. The approach that the authors mentioned is to follow laws proposed by Issac Asimov (p. 164). The table below is showing the solution for autonomous vehicles to follow.

(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

Isaac Asimov stated:

- **Table: Three Basic Laws of Robotics**

Three Basic Laws of Robotics:	
1.	Robot should not injure anyone
2.	A robot must obey commands
3.	A robot must protect itself

Sakthivel R., Narayan, F. O., Narayan, S., Abubakar, S., Kaisan, M. U., & Alammari, Y. (2019). Autonomous Cars. In Introduction to Automotive Engineering (pp. 161–170). John Wiley & Sons, Incorporated. https://doi-org.citytech.ezproxy.cuny.edu/10.1002/9781119480099.ch8

(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

- In general, the solutions are:
- **Table: General Solutions**

General Solutions		
	Solution	**Definition**
1.	Leave the ethical decision up to the customer	When purchasing a vehicle let the customer decide when they buy it
2.	Fix algorithm	Reprogram the system
3.	Test Drive	Test the autonomous vehicle before it being release

- The table above is showing the solution for the ethical issues of autonomous vehicles to gain the trust of the people. Leaving the ethical decision up to the customer is the best solution for the customers to think about it. Fixing algorithms is the best solution to improve the system of autonomous vehicles. Also, Test Driving is the important solution to be more safe to everyone.

Discussion (Islam Elborolosy, Sean Kelly Datu, Ashton Anderson)

In our research, we found that our results are similar and that self-driving cars are dangerous. There were many accidents resolving self-driving cars. Nowadays, people do not trust autonomous vehicles nor should they due to all the chaos going around in our generations. It is too dangerous, the system can get hacked, and is too expensive. Also, We looked for humans' actions, and their opinions on autonomous vehicles. The results showed how dangerous / not safe autonomous vehicles are. We found a result about the two driving methods, which is the human-driving method and machine-driving method in "Do passengers prefer autonomous

vehicles driven like machines or like humans?" (2019, July 28). We found that these two methods are equally not safe, but machine-driving has more percentage for not being safe. The programmers' goal for autonomous cars are not being fulfilled right now as there is a long way to go to perfecting the technology. We have a long way to go as development continues however being realistic we are about 30 years away from self-driving cars being fully implemented well after the time lines companies like Tesla and Waymo initially set. However there are many players in this game such as taxi giants Uber and Lyft, also automobile manufacturers such as Audi, GM , TATA, Hyundai, and even tech giants like Apple taking stakes in companies who are developing them. Even with all these players involved there are still other problems that need to be sorted out such as government regulations, Customer satisfaction , market saturation, cost, reliability, and safety.

Let's look further:

In our research, there are many incidents going on around the world which proves to be why we can't trust or use self-driving cars yet. In some cases it can be small and some cases it can be big but there are few cases which tend to be complicated and it's just a hard decision to make. One incident that occurred was a self-driving car got stuck at a stop sign for hours because it was waiting for the cars around it to come to a complete stop. The problem with this situation was that the computer driving the car was not very good with reading human behavior. In this case the computer couldn't figure out that most people when coming to a stop sign rarely ever come to a complete stop. Imagine two cars driving full speed or one car with two passengers vs two kids crossing the street in the dark, the car has a malfunction and does not stop. In these situations where do we draw the line between the decisions that humans make and what a computer can make or who would take the responsibility. Yes, we can leave it all up to the human or whoever buys the cars but as a third party in the world or judges would they take their side. As in if it was the person who bought the car fault will anyone around the world blame him only or will they blame the vehicles and not trust them? In these types of situations it's hard to trust self-driving cars in the end even if we pin the responsibility to someone or let the humans make decisions on what should happen in those situations. It is one step closer to making it right by deciding who

takes the responsibility is good but there's still another picture behind this and that's how people will look at autonomous vehicles after that incident. In our opinion, they don't just blame the person, they will be too scared and blame it on the vehicles regardless so we need to figure out a way to not cross that line when it or if it happens. After we figure out how to not cross that line then it would be safe and trust self-driving cars.

Goals:

What we hope to achieve!

In the end we do have a few goals as a group we talked about and we think if we achieved these goals then the day would come when autonomous vehicles would be a thing. Goal number one is a safe self-driving vehicle. Goal number two is a way for vehicles to communicate with one another. Goal number three is no potential job loss. Goal number four is to gain the trust of the people for autonomous vehicles. Automation is here and its here to stay, as much as people don't like the idea society will need to adopt the idea and figure out how to change the world and allow everyone to adapt to this upland coming reality .We do think it would take a while for these goals to be accomplished but one step at a time and soon each goal will be achieved and when that happens it will change the world for the better.

Section II

Conclusions (Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

In conclusion, self driving cars have more negatives than positives (for now) and should be avoided until all of these issues have been addressed. Having self-driving cars leaves a very important ethical issue that needs to be answered. After looking at the results, we have seen countless examples of accidents that have taken people's lives or have seriously harmed them. We have people who could potentially lose their jobs in the near future to self-driving cars and trucks. It is estimated that over 10 million jobs could be lost in the next 20 years due to automation in the transportation sector alone. This change is reaching into other industries such as construction and customer service industries.The transportation sector employs a large number of people and lots of questions are being raised such as where will these people go when their job is eliminated in the future. For now we have come to the conclusion that autonomous cars are not completely safe and it will take a while for people to get used to them being the norm. The significance of what we discovered is right now that people do not trust autonomous cars due to all the accidents that have happened even though car designers are trying to make it better. Self-driving cars just have an algorithm and they are not totally 100% safe. There are a lot of accidents involving autonomous vehicles. Some people do not trust autonomous vehicles because of the idea of a robot driving them around. They are more confident in riding ordinary vehicles with a human driver. They have more confidence in human-driving than machine-driving despite humans not being perfect and often making mistakes. There are travelers that did not try to take a ride on autonomous vehicles even though autonomous vehicles can be viewed as convenient. One problem that they can potentially eliminate is people driving while impared this includes being intoxicated and being sleepy behind the wheel. Because humans are far from perfect accidents still do happen and because autonomous vehicles are not perfectly programmed, they may not recognize potential dangers up ahead. The programmers' did not reach their end goal which is to make autonomous vehicles safe however it still can be done; they just need more time to sort all of the problems out.

Recommendations(Sean Kelly Datu, Islam Elborolosy, Ashton Anderson)

In our opinion, we think it is better to test autonomous vehicles rigorously first before allowing them to be released to the general public. Testing the autonomous vehicles before being released and proving that it is safe is the best way to gain the trust of people. Improve the algorithm and how machines are taught to interpret human behavior. According to the authors of the "Autonomous Cars", Sakthivel R., Narayan, F. O., Narayan, S., Abubakar, S., Kaisan, M. U., & Alammari, Y. (2019), the rules must be followed (pp. 163- 164). Familiarize in roads and the laws/rules should be programmed and especially the decision making to make it more safe. Autonomous vehicles can work if we solved all the major problems first like how expensive it is, the potential job loss, and to upgrade the system to make sure it doesn't get hacked. It is dangerous and there have to be a standard amount of rules to keep it safe. At the moment trust for self-driving vehicles is low because of how dangerous it seems. The idea of a computer controlling a vehicle is still kind of new to people but that idea has already been introduced to us already. Various driver aids such as lane keep, park assist, object detection systems are some of the building blocks for self-driving cars. All of these systems are operated by the car's computer and can react to certain hazards even if the driver fails to act. One example would be backing your car up and something either a person or another car comes in your path the car can react and stop itself before you even see the hazzard. Technology like this is a great way to see that complete automation of a car is possible but it just needs more time to be developed . In the long run the technology will improve and more people would be open to the idea.

References

Debord, M. (2018, December 2). Drive My Car. *The New York Times Book Review*, 33(L). https://link.gale.com/apps/doc/A564005980/LitRC?u=cuny_nytc&sid=LitRC&xid=9344a1b2

Do passengers prefer autonomous vehicles driven like machines or like humans? (2019, July 28). *NewsRx Health*, 56. Retrieved November 15, 2020, from https://link.gale.com/apps/doc/A594032206/AONE?u=cuny_nytc&sid=AONE&xid=37a48309

Hussain, Rasheed, and Sherali Zeadally. "Autonomous Cars: Research Results, Issues, and Future Challenges." *IEEE Communications Surveys and Tutorials*, vol. 21, no. 2, 2019, pp. 1275–1313. https://doi.org/10.1109/comst.2018.2869360

Hevelke, A., Nida-Rümelin, J. 2015. Responsibility for Crashes of Autonomous Vehicles: An Ethical Analysis. https://doi-org.citytech.ezproxy.cuny.edu/10.1007/s11948-014-9565-5

New Autonomous Systems Study Findings Have Been Reported by Researchers at University of Bergen (Formal verification of ethical choices in autonomous systems). (2016, March 14). *Journal of Engineering*, 908. https://link.gale.com/apps/doc/A446097082/AONE?u=cuny_nytc&sid=AONE&xid=389e36c4

Ryan, M. (2019, September 3). *The Future of Transportation: Ethical, Legal, Social and Economic Impacts of Self-driving Vehicles in the Year 2025*. Retrieved November 8, 2020, from

https://link-springer-com.citytech.ezproxy.cuny.edu/article/10.1007/s11948-019-00130-2.

https://doi-org.citytech.ezproxy.cuny.edu/10.1007/s11948-019-00130-2

Sakthivel R., Narayan, F. O., Narayan, S., Abubakar, S., Kaisan, M. U., & Alammari, Y. (2019). Autonomous Cars. In Introduction to Automotive Engineering (pp. 161–170). John Wiley & Sons, Incorporated. https://doi-org.citytech.ezproxy.cuny.edu/10.1002/9781119480099.ch8

Tan, L., Ma, C., Xu, X., & Xu, J. (2019). Choice Behavior of Autonomous Vehicles Based on Logistic Models. *Sustainability*, *12*(1), 54. **https://doi.org/10.3390/su12010054**