THE OMNIPOTENT PROGRAMMER: AN ETHICAL AND LEGAL ANALYSIS OF AUTONOMOUS CARS

William J. Tronsor*

* J.D., May 2018, Notre Dame Law School. I would like to thank Professor Jay Tidmarsh for his guidance and assistance with the article. I would also like to thank my family and friends for their support.

I. AUTONOMOUS CARS

When people think of self-driving cars, they most likely conjure up images of themselves relaxing in their car, possibly watching Netflix, while their car takes them to their destination. While that may not be far from a reality, with the Center for Automotive Research predicting that the first fully autonomous vehicles will be available in 2019,[1] it is not the type of self-driving cars you would see on the market today. Currently, the National Highway Traffic Safety Administration (NHTSA) has defined vehicle automation as having five different levels.[2] The first level is level zero, meaning that the vehicle has no automation and the driver is in complete and sole control of the primary vehicle controls such as, brakes, steering, and the throttle at all times.[3] This ranges all the way to level four automation, where the vehicle is fully automated.[4] A vehicle

---

[1] Josh Sanburn, *Self-Driving Cars Available by 2019, Reports Says*, TIME (Aug. 16, 2012), http://business.time.com/2012/08/16/self-driving-cars-available-by2019-reports-says.

[2] *U.S. Department of Transportation Releases Policy on Automated Vehicle Development*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN. (May 30, 2013), http://www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Vehicle+Development.

[3] *Id.*

[4] *Id.*

classified as having level four automation is designed to perform all safety-critical driving functions and monitor roadway conditions for the entire trip.[5] All the driver would need to do is set the destination and they would not be expected to be available for control at any time during the trip.[6]

For this paper, we are only going to focus on vehicles that would be classified as having limited self-driving automation (level three) and level four automation.[7] The differences between levels three and four automation is that a level three vehicle allows the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions.[8] However, if those conditions change, the car alerts the driver that they need to take back control. The driver can then choose to take back control and are expected to be available for occasional control when the conditions on the road call for it.[9] Whenever self-driving or autonomous cars are mentioned in this

---

[5] *Id.*

[6] *Id.*

[7] *Id.* (Function –Specific Automation (level 1) is automation that involves one or more specific control functions, such as pre-charged brakes, where the vehicle automatically assists with breaking. Combined Function Automation (level 2) involves automation of at least two control functions designed to work together. An example of this is adaptive cruise control in combination with lane centering.)

[8] *Id.*

[9] *Id.*

paper, it refers to vehicles that fall under either level three or four automation.

The technology for how self-driving cars work is essentially the same, whether a vehicle is classified as a level three or four. Self-driving cars are usually outfitted with a GPS unit, an internal navigation system, and a range of sensors including laser rangefinders, radar, and video.[10] These tools allow self-driving cars to localize themselves and build a three-dimensional image of its environment. The way vehicles use this data to make decisions about how to operate the vehicle and these decisions are determined by its control system. Most self-driving vehicles control systems implement a deliberate architecture. This means that the vehicle makes intelligent decisions by maintaining an internal map of the world that they have created. They use the map to find the optimal path to avoid obstacles, such as pedestrians and other vehicles and to develop several different possible paths to get where they are going as safely and effectively as possible.[11] Once the best path to take is determined the decision is dissected into commands, which the vehicle's actuator uses to control the vehicles steering, braking, and throttle. This process is repeated multiple times each second until the vehicle reaches its destination. The process takes, on average, fifty milliseconds but it could take longer or shorter depending on the amount of data collected and the complexity of the path-planning algorithm.[12]

---

[10] Shima Rayej, *How Do Self-Driving Cars Work?*, ROBOHUB (June 3, 2014), http://robohub.org/how-do-selfself-driving-cars-work/.

[11] *Id.*

[12] *Id.*

The way the vehicles are able to build a map of their environment is through the use of laser rangefinders and cameras.[13] The laser rangefinder shoots bands of beams and calculates how long it takes for each laser beam to travel back to the vehicle.[14] This helps the vehicle to create a three-dimensional map. The vehicle then uses its video cameras to extract and add color to the map it creates.[15] This is all very important because it allows the vehicle to know the current and predicted locations of objects based on whether they are moving or not, as well as their shape.[16] This information allows the vehicles to categorize objects and make predictions on what it will do based off how they match up with the library of predetermined shapes and motion descriptions that are pre-programmed into their system.[17] All of this information allows self-driving cars to continually make decisions and get you to your destination safely.

Even with all of this technology, some people believe that self-driving cars are not as safe as having a human behind the wheel.[18] This belief is not completely unfounded with two of Tesla's self-driving cars resulting in the death of two separate

---

[13] *Id.*

[14] *Id.*

[15] *Id.*

[16] Rayej, *supra* note 10.

[17] *Id.*

[18] Steve Lohr, *A Lesson of Tesla Crashes? Computer Visions Can't Do It All Yet*, N.Y. TIMES (Sept. 19, 2016), hhtp://nyti.ms/2d1ztxY.

people in 2016.[19] Unfortunately on May 7, 2016, in Williston Florida the first known fatal accident involving a self-driving car occurred when a tractor-trailer made a left turn in front of the Tesla, and the car failed to apply the brakes.[20] Tesla's cars are equipped with an autopilot driver-assistance system,[21] which means each vehicle would be classified as having level three automation. Tesla has stated that the autopilot is not meant to take over completely for a human driver and in its news release about the accident; the company stated that, "Neither autopilot nor the driver noticed the white side of the tractor-trailer against a brightly lit sky, so the brakes were not applied."[22] Tesla later announced that it was modifying its system so that it will issue more frequent warnings to put the driver's hands on the steering wheel.[23]

More recently, dashcam footage of another crash involving a Tesla car driving with its autopilot feature further

---

[19] *Id.*; *see also*, Bill Vlasic & Neal E. Boudette, *Self- Driving Tesla was In Fatal Crash, U.S. Says*, N.Y. TIMES (June 30, 2016), https://www.nytimes.com/2016/07/01/business/self-driving-tesla-fatal-crash-investigation.html.

[20] Vlasic & Boudette, *supra* note 19, at 1.

[21] Lohr, *supra* note 18, at 1.

[22] Vlasic & Boudette, *supra* note 19, at 1.

[23] Lohr, *supra* note 18, at 2.

demonstrated the shortfalls of autonomous vehicles.[24] In the video, the Tesla Model S is cruising down the highway near Dallas when it slams into a barrier.[25] The accident brought the vehicle to a smoky halt and luckily no one was hurt.[26] The vehicle crashed into a construction barrier that had no cones or other warnings ahead of the barrier.[27] Watching the video, one can see that the barrier seems to come out of nowhere[28], but it is likely that a human driver would not have made the same mistake. Despite this incident, the evidence demonstrates that Tesla's autopilot has had a positive effect on their vehicles' crash rates, with the NHTSA[29] stating that the autopilot feature dropped Tesla vehicles crash rate by forty percent.[30]

---

[24] James Grebey, *Dashcam Footage of Tesla Crash Shows Why Autopilot Needs a Driver*, INVERSE (Mar. 3, 2017), https://www.inverse.com/article/28630-tesla-autopilot-crash-dashcam-footage-human-driver.

[25] *Id.*

[26] *Id.*

[27] *Id.*

[28] *Id.*

[29] U.S. DEP'T OF TRANSP., NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., ODI RESUME INVESTIGATION PE 16-007, (Jan 19, 2017), available at https://static.nhtsa.gov/odi/inv/2016/INCLA-PE16007-7876.PDF.

[30] *Id.*

These accidents demonstrate that there are still some shortcomings to self-driving cars. Another issue that is still problematic for self-driving cars is predictive ability, which may have played a role in the Tesla barrier accident.[31] Understanding and predicting what is going to happen based on the physics of everyday life are inherent to humans, but currently beyond the reach of self-driving cars.[32] Self-driving cars are able to categorize things based off the information presented.[33] Therefore, if there were a two-wheeled object traveling at 40 mph it would categorize the object as a motorcycle and not as a bike due to the speed it is traveling.[34] It would then make predictions on what the future path of that object is most likely going to be based on how it categorized the object.[35] Self-driving cars are currently able perform and rely on image recognition, but they are unable to understand the actions and behaviors of the objects they recognized.[36] Currently many different computer scientists are working on creating a better form of visual intelligence to combat this issue.[37] A computer vision scientist named Gary Bradski seemed to think the solution to this issue is not too far in the future, when he said, "We're not there yet, but the pace of improvements is getting us there . . . We don't have to wait years and years until some semblance of intelligence arrives, before we have self-driving

---

[31] Greby, *supra* note 24, at 1.

[32] Lohr, *supra* note 18, at 2.

[33] Rayej, *supra* note 10, at 4

[34] *Id.*

[35] *Id.*

[36] Lohr, *supra* note 18, at 2-5.

[37] *Id.*

cars that are safer than human drivers and save thousands of lives."[38]

Even with the current issues facing self-driving cars, they appear to be safer than human-driven cars. The NHTSA Administrator Dr. Mark Rosekind stated, "Ninety-four percent of crashes on U.S. roadways are caused by human choice or error."[39] Self-driving cars could eliminate the main risks we face on the road every day, which is other drivers. Bob Lutz, who is the former General Motors Vice Chairman, told CNBC, "The autonomous car doesn't drink, doesn't do drugs, doesn't text while driving, doesn't get road rage . . . Young, autonomous cars don't want to race other autonomous cars, and they don't go to sleep."[40] Lutz illustrates the benefits of self-driving cars and that is that they can save lives. Today 1.3 million people a year

---

[38] *Id.* at 6.

[39] *DOT Issues Federal Policy for Safe Testing and Development of Automated Vehicles*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN. U.S., (Sept. 20, 2016), https://www.nhtsa.gov/press-releases/us-dot-issues-federal-policy-safe-testing-and-deployment-automated-vehicles.

[40] Michelle Fox, *Self-Driving Cars Safer Than Those Driven By Humans: Bob Lutz*, CNBC (Sept. 8, 2014), https://www.cnbc.com/2014/09/08/self-driving-cars-safer-than-those-driven-by-humans-bob-lutz.html.

are killed by traffic accidents.[41] Self-driving cars have the potential to reduce that number drastically because they are not prone to human error, which is the cause of a majority of the accidents in America. The former U.S. Transportation Secretary Anthony Foxx said, "Automated vehicles have the potential to save thousands of lives, driving the single biggest leap in road safety that our country has ever taken."[42]

Self-driving cars have arrived and they are becoming more accessible to the public every year. For example, Nissan announced that it will have a self-driving car available by 2020,[43] Ford announced its plans to produce a driverless car by 2021, and BMW announced its plan to have a driverless car by 2021.[44] Some self-driving cars are already on the road. On September 14, 2016, Uber announced that Self-Driving Ubers are on the road in Pittsburgh.[45] The Self-Driving Uber does come with a safety driver, but if the car works as advertised, one

---

[41] Anthony Levandowski, *Pittsburgh, Your Self Driving Uber Is Arriving Now*, UBER BLOG (Sept. 14, 2016), https://newsroom.uber.com/pittsburgh-self-driving-uber/.

[42] *DOT Issues Federal Policy for Safe Testing and Development of Automated Vehicles*, *supra* note 39, at 1.

[43] Rayej, *supra* note 10, at 1.

[44] Lohr, *supra* note 18, at 1, 5.

[45] Levandowski, *supra* note 41, at 1.

day it will not need a driver at all.[46] Self-driving cars have become so prevalent that several states including Nevada and Florida have passed legislation expressly permitting self-driving cars on the road.[47]

This does not mean legislation has not hindered self-driving vehicles implementation in certain areas. For example, when Uber attempted to rollout several self-driving cars in San Francisco like they had in Pittsburg, they ran into issues with lawmakers.[48] Within hours of their launch in San Francisco, Uber was told by California's Department of Motor vehicles that the company was breaking the law and needed to halt the program until they got the proper permit for their vehicles.[49] San Francisco County Supervisor and Transportation Authority Chair, Aaron Peskin, stated that, "San Franciscans are not guinea pigs and our public streets aren't experimental test labs." Uber chose not to get the permit and decided to move its self-driving car pilot program to Arizona.[50] Uber still has not gotten the permit for its self-driving vehicles in San Francisco, but their

---

[46] Mike Isaac, *What It Feels Like to Ride in A Self-Driving-Uber*, N.Y. TIMES (Sept. 14, 2016), http://nyti.ms/2cMHYgq.

[47] *DOT Issues Federal Policy for Safe Testing and Development of Automated Vehicles*, *supra* note 39, at 1.

[48] Dara Kerr, *Uber's Self- Driving Cars Back in SF, But Now They're Legal*, CNET (Jan. 25, 2017), https://www.cnet.com/news/ubers-self-driving-cars-back-on-sf-streets-but-now-theyre-legal/.

[49] *Id.*

[50] *Id.*

self-driving vehicles are back on the road there with divers at the wheel, mapping San Francisco's streets.[51] It is unclear if they will go back to San Francisco other than with actual drivers for mapping purposes, but what is clear is that if they do, they will need a permit.

Different companies' growing use of autonomous vehicles, along with consumer's growing access to purchase their own autonomous vehicles, will lead to rapid growth of autonomous vehicles on the road in the near future. Oliver Garret who researches macroeconomic trends that affect investors stated, "Given the advanced state of driverless technologies and the amount of money being poured into the sector, there is question- make that, no question at all- that within ten years, driverless cars will be the norm."[52] He went on to say that based on his research, his conservative prediction is that there will be ten million self-driving cars on the road in 2020, with one in four cars being self-driving cars by 2030.[53] Whether Garret's predictions are correct or not is unclear. What is clear is that the number of autonomous vehicles on the road is going to grow at a fast rate in the near future.

---

[51] *Id.*

[52] Olivier Garret, *10 Million Self-Driving Cars Will Hit The Road By 2020—Here's How To Profit*, FORBES (Mar. 3, 2017), https://www.forbes.com/sites/oliviergarret /2017 /03/03/10-million-self-driving-cars-will-hit-the-road-by-2020-heres-how-to-profit/#aa3f5d57e508.

[53] *Id.*

Due to the fact that self-driving cars are gaining traction every year and the amount of self-driving vehicles is likely to grow, federal regulators have even stepped in and announced the first ever safety checklist for semiautonomous and driverless cars.[54] Former U.S. Transportation Secretary Anthony Foxx stated, "This is an unprecedented step by the federal government to harness the benefits of transformative technology by providing a framework for how to do it safely."[55] The Guidelines created by the U.S. Department of Transportation in association with the NHTSA urges automakers and tech companies to make sure their self-driving vehicles comply with their fifteen-point safety expectations before their vehicles hit the road. [56]

The checklist that was created touches on many different issues facing self- driving cars,[57] but for the purposes of this

---

[54] Cecilia Kang, *The 15-Point Federal Checklist For Self-Driving Cars*, N.Y. TIMES (Sept, 20, 2016), https://www.nytimes.com/2016/09/21/technology/the-15-point-federal-checklist-for-self-driving-cars.html.

[55] *U.S. Department of Transportation Releases Policy on Automated Vehicle Development*, *supra* note 2, at 1.

[56] Kang, *supra* note 54, at 1.

[57] *Id.* (15 point Federal checklist: 1- Data Sharing; 2- Privacy; 3-System Safety; 4- Digital Security; 5- Human-Machine Interface; 6-Crashworthiness; 7- Consumer Education; 8- Certification; 9- Post-

article, we are only going to focus on number eleven in their checklist, which are ethical considerations.[58] One big issue facing self-driving cars is what should they do in a no-win scenario; when either the safety of the driver needs to be protected or the safety of another party or parties needs to be protected. In the Federal Automated Vehicles policy checklist it states that, "a conflict within the safety objective can be created when addressing the safety of one car's occupants versus the safety of another car's occupants. In such situations, it may be that the safety of one person may be protected only at the cost of the safety of another person. In such a dilemma, the programing of the HAV[59] will have a significant influence over the outcome for each individual."[60] The guideline does not give an answer to how self-driving cars should be programed when there is a no-win scenario; it only states that this is an issue that manufactures need to keep in mind when programing their self-driving vehicles.

Crash Behavior; 10- Law And Practices; 11- Ethical Considerations; 12- Operational Design; 13-Detection And Response; 14- Fallback; 15-Validation).

[58] U.S. DEP'T OF TRANSP., NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., FEDERAL AUTOMATED VEHICLES POLICY (Sept. 2016), available at https://www.transportation.gov/AV/federal-automated-vehicles-policy-september-2016.

[59] *Id.* ("Highly automated vehicles.")

[60] *Id.* at 26.

The purpose of this article is to answer that question. Part II describes the philosophical thought experiment known as the trolley problem. It will explain how even though the problem currently faced by programmers of autonomous vehicles is new, the debate about what to do in a situation like this has been going on for decades. Part III will expand on part II by introducing different philosophical theories and how they would decide the problem faced by the programmers of autonomous vehicles based on what they believe to be the proper ethical considerations. Part IV will explain what the current state of products liability and agency is. It will also apply the law to answer the question of who should be liable for damage caused by autonomous vehicles? Part V briefly reiterates the main points made through the entire paper. The main thread that ties all the parts of this paper together is question of how should autonomous vehicles be programed to act when placed in no-win scenarios based on the ethical and legal considerations surrounding this issue?

II. THE OMNIPOTENT PROGRAMMER

The ethical issues faced by manufactures of autonomous cars in how they should program their vehicles to act in situations where they can either protect the occupants in the vehicle or third parties is a new issue, but the ethical considerations that should be taken into account when making those decisions are far from new. Philosophical thought experiments such as the trolley problem have had students, academic ethicists, philosophers, and many other brilliant minds grappling with issues similar to this one for years. [61] Thought experiments have been used to help answer profound ethical questions since the ancient Greek and Romans. The first

[61] Judith Jarvis Thomson, *The Trolley Problem*, 94 YALE L.J. 1395 (1985).

thinkers to popularize the trolley problem were philosophers after the 1960s.[62] In 1967 at Oxford University, Philippa Foot devised an example of a runaway tram, in which the driver could either continue on the track killing five workmen or the driver could steer the tram from the track they were on to the only other track, killing a single workmen that was on that track.[63] A few years later, Judith Thomson, expanded on Foot's example and created what we call the trolley problem today.[64]

Thomson came up with a few different variants of Foot's original example, but her most famous example was the "Bystander at the Switch."[65] The bystander at the switch alters Foot's example slightly. Instead of you being the driver of the trolley you are a bystander strolling past the trolley path. The driver of the trolley sees five workmen on the track ahead of him and attempts to apply the breaks, but they fail. You see this unfolding and happen to be standing next to a switch. You can pull the switch to divert the trolley onto another track, but there is a single workman on the other track. If you pull the switch to save the five workmen the lone workman will certainly die, but if

---

[62] Lauren Davis, Would *You Pull the Trolley Switch? Does it Matter?*, THE ATLANTIC, (Oct. 9, 2015), http://www.theatlantic.com/technology/archive/2015/10/trolley-problem-history-psychology-morality-driverless-cars/409732/.

[63] Philippa Foot, *The Problem of Abortion and the Doctrine of the Double Effect*, OXFORD REV., no. 5 (1967).

[64] Thomson, *supra* note 61, at 1395.

[65] *Id.* at 1397.

you do not pull the switch the five workmen will certainly die.[66] Is it morally permissible to pull the switch to save the five workmen at the expense of the other workmen, or do you have a moral obligation to pull or not pull the switch? While this philosophical thought experiment sparked massive debate during the 70s and the 80s about what was ethically the best decision to make based on the situation, it was just a thought experiment. By the late 90s discussions about the trolley problem began to die down because many philosophers questioned the value of the conclusions reached by analyzing such a bizarre and specific scenario.[67]

Unfortunately for manufacturers of self-driving cars, this is no longer just a thought experiment. It is inevitable that autonomous cars will be placed in situations in which the vehicles will either need to sacrifice the occupants in their vehicle or third parties; and it is the programmers of these cars who will have their hands on the lever. The situation here is different though, because the bystander by the lever in the trolley problem did not create or in any way control the operation of the trolley. Here, the programmers are essentially the drivers of the autonomous cars, vicariously through their programing, as opposed to someone is just present and able to switch the track of a speeding trolley. This difference is important because if the bystander in the trolley problem does nothing (by not throwing the switch), then he drives no trolley into anybody, and he does not kill anyone.[68] As the quasi-drivers of their autonomous vehicles, the programmers are the ones driving the vehicle into third parties to protect the people in the car, or in a way that sacrifices the people in the car for the

---

[66] *Id.* at 1397.

[67] Davis, *supra* note 62, at 2, 3.

[68] Thomson, *supra* note 61, at 1397.

safety of third parties. They do not have the option of doing nothing, like the bystander in the trolley problem, because whatever choice the programmers make, they are taking an affirmative action. This makes the situation faced by the programmers more similar to the driver in Foot's example. Even if the driver of the tram chooses not to steer the tram to the other track with a single person on it, the driver would still be driving the tram into five people.[69]

Since the trolley problem does not fit perfectly with the situation affecting self- driving car manufacturers, the best way to analyze the ethical considerations programmers and manufactures of self-driving cars should take into account is with a new thought experiment. I will call this new thought experiment "The Omnipotent Programmer" and it will be the example used throughout the rest of this paper to analyze what autonomous cars should do in no-win scenarios. In this situation, the programmer predicts a possible situation that his self-driving car could be placed in order to try and decide what the car should do in such a scenario. The autonomous car is driving up the side of a narrow mountain pass. As the car comes around a bend it quickly processes and determines that there are five teenage skateboarders coming right towards the car. Based on all the information it has, it quickly calculates that there is no time to break and the only possible way to save the skateboarders would be to veer off the road into a giant crevasse, which would certainly kill the individual in the car. The programmer has all the power to predetermine what the outcome of this scenario and any similar ones should be. For the purpose of this paper, we are going to put ourselves in the programmer's shoes and come up with how autonomous cars should be programed to perform in situation like this one.

---

[69] *Id.* at 1397.

III. PHILOSOPHICAL RESOULUTIONS

There are many different moral theories for how individuals or institutional agents ought to act when placed in different situations. These theories generally have two different components.[70] The first component puts forward a view about what is good or what we should value, such as the divine law, human freedom, or happiness. The second component describes how individuals and institutional agents should act based on the properties they chose to value.[71] Based on the things these moral theorists chose to value they generally fall into two different moral groups, consequentialist and deontological theorist.[72] In an attempt to come up with the best possible solution to The Omnipotent Programmer thought experiment, we are going to look in depth at how different moral theories in both groups would solve this problem.

A. Consequentialism

One way to look at how autonomous cars should be programed to act in these situations is by looking solely at the relevant consequences of a particular action. Individuals who think this way are called consequentialists. Consequentialism is a theory that is only concerned with the consequences of an action.[73] The two most well know consequentialist theories are ethical egoism and utilitarianism. An ethical egoist believes that humans ought to act in a way that will bring out the best consequences for themselves, whereas utilitarian's believe that

---

[70] Philip Pettit, *Consequentialism* (1991), *in* CONSEQUENTIALISM 95 (Stephen Darwall ed., 2003).

[71] *Id.* at 96.

[72] *Id.* at 96.

[73] JACQUES THIROUX, ETHICS THEORY AND PRACTICE 35 (6th ed. 1977).

human being ought to act in a way that brings about the best consequences for all involved or for society as a whole.[74] Due to the serious ethical issue of ethical egoism, which states that people should only act for their own self-interest[75], we are going to focus on the different forms of utilitarianism in an attempt to find a solution to the ethical issues facing the autonomous car programmer.

Utilitarianism is a philosophical theory that was created around the nineteenth century in Europe by Jeremy Bentham and John Stuart Mill.[76] A simple explanation of utilitarianism is that people or institutions must make choices based on what will bring the highest overall happiness, and the least amount of suffering.[77] Activities or rules that stimulate overall happiness and reduce suffering are said to have "utility."[78] The main objective to a utilitarian is to act or create rules that maximize utility. For a utilitarian, the ends justify the means for what will

---

[74] *Id.* at 21.

[75] Alexander Moseley, *Egoism*, INTERNET ENCYCLOPEDIA OF PHILOSOPHY (Jan. 10, 2018, 4:22 PM), http://www.iep.utm.edu/egoism/.

[76] JAMES RACHELS & STUART RACHELS, THE ELEMENTS OF MORAL PHILOSOPHY 99, 100 (8th ed. 2014).

[77] *Id.* at 111.

[78] Jeremy Bentham, *An Introduction to the Principles of Morals and Legislation* (1996), *in* CONSEQUENTIALISM 11-15 (Stephen Darwall ed., 2003).

cause the outcome with the best utility. A utilitarian would say that an act or rule is moral if it brings about the best utility.[79] The consequences of the chosen action only matter insofar as they will affect the utility for the individuals involved and each individual's happiness gets equal consideration. Utilitarianism itself breaks down into two different forms; act utilitarianism and rule utilitarianism.[80]

Act utilitarians state that everyone should perform that act which will bring about the greatest utility for each situation that they are put in.[81] Advocates of act utilitarianism do not believe in setting up particular rules for acts because they feel that every situation is different. They believe that the person taking a particular action should assess the particular situation, like a math equation, and chose to perform the action that will bring about the greatest amount of good over bad for everyone involved.[82] Here as applied to our thought experiment "The Omnipotent Programmer," an act utilitarian would state that the vehicle should veer off the road, killing the driver to save the five skateboarders. This is because sacrificing the driver to save the lives of the five skateboarders would bring about the greatest utility for the most people in that situation. An act utilitarian would state that autonomous vehicles should be programed to asses each particular situation they are put in and make a decision based on which action will have the best outcome for all involved in that particular situation. This means that if the situation were slightly different, such as their being five people in the car and one skateboarder; an act utilitarian would state

---

[79] THIROUX, *supra* note 73, at 28.

[80] *Id.* at 28.

[81] *Id.* at 28-29.

[82] *Id.*

the autonomous vehicle should protect the occupants in the vehicle at the expense of the skateboarder.

The belief that autonomous vehicles should be programed to sacrifice their own passengers when this sacrifice would save a greater number of lives is a popular one. In a study in *Science*, "The Social Dilemma of Autonomous Vehicles," researchers attempted to discover how people felt autonomous cars should be programed when faced with moral decisions that could result in death.[83] The results indicated that seventy-six percent of participants thought that it would be more ethical for autonomous vehicles to sacrifice their own passengers when this sacrifice would save a greater number of overall lives.[84] While this data shows that a majority of people would approve of autonomous vehicles that might sacrifice passengers to save others, it does not give us the solution to our problem. This is because even though people in the study approved of act utilitarianism in principle, it would not work in practice. It could increase the number of casualties on the road by delaying the adoption of self-driving cars by the public. This is because when participants were asked in the study how likely they were to buy an autonomous vehicle that was programed to minimize casualties, which could cause their death, or that of a close family member; they overwhelmingly said they would not.[85] While act utilitarianism seemed to be the right answer for how autonomous vehicles should be programed in principle, in

---

[83] Jean-Francois Bonnefon et al., *The Social Dilemma of Autonomous Vehicles*, 352 SCIENCE MAG 6293 (2016).

[84] *Id.* at 1574.

[85] *Id.* at 1574-75.

practice it will cause a delay in the adoption of self-driving automobiles, which would result in more automobile fatalities.

Rule utilitarianism could be the solution that resolves the issues faced by the act utilitarian version of self-driving cars. Rule utilitarians believe that everyone should always establish and follow rules that will bring about the greatest good for all of those concerned.[86] They believe that individuals should, by careful reasoning, set up a series of rules that, when followed, will yield the greatest good for all of humanity.[87] For example, a rule utilitarian would state that we should have rules against breaking promises, such as in contract law, because following through on promises on a regular basis will promote the general happiness. Rule utilitarians do not judge acts by the amount of utility caused by the individual act, but by the way the actions conform with the rules.[88] They shift the emphasis from justifications for an act to what the justifications are for a particular rule.[89]

A rule utilitarian might argue that we should have a law that all self-driving cars should be programed to minimize casualties in each situation they are in. This theory is unlikely to be accepted because it would delay the adoption of automated vehicles for the same reasons stated in the previous theories, and most people disproved of regulations that would enforce such a rule.[90] In the study in *Science*, the researchers asked 393 participants on a scale from 0-100 whether they would agree to

---

[86] THIROUX, *supra* note 73, at 31.

[87] *Id.* at 31.

[88] RACHELS & RACHELS, *supra* note 76, at 121.

[89] *Id.*

[90] Bonnefon et al, *supra* note 83, at 1575-76.

purchase automated vehicles whose algorithms had been regulated by the government to minimize casualties. The median for individuals who were asked if they would buy an automated vehicle with unregulated automation was 59; compared with a median of 21 when asked if they would purchases an automated vehicle who's automation was regulated.[91] Therefore, a law that all self-driving cars should be programed to minimize casualties would add to their delay on the market because people are less likely to buy an autonomous vehicle that has been regulated by the government.

Based on all the information, a rule utilitarian would most likely state that programmers should make their own rule, and that the rule should be to protect the occupants of self-driving cars when put in no-win scenarios. This is because, as already stated earlier, self-driving cars will lead to less casualties on the road. Former President Barack Obama stated, "Right now, too many people die on our roads – 35,200 last year alone – with ninety-four percent of those the result of human error or choice. Automated vehicles have the potential to save tens of thousands of lives each year."[92] A rule utilitarian would state that a rule protecting the occupants of self-driving cars in no-win scenarios would not deter people from purchasing these vehicles. This would promote the general happiness of everyone by cutting down on the number of automobile deaths each year

---

[91] *Id.* at 11, 12.

[92] Barack Obama, President of U.S., *Self-driving, yes, but also safe new technologies and regulations will be explored at a White House conference in Pittsburg*, PITTSBURG POST-GAZETTE, (Sept. 19, 2016), http://www.post-gazette.com/opinion/Op-Ed/2016/09/19/Barack-Obama-Self-driving-yes-but-also-safe/stories/201609200027.

because people would be more likely to purchase autonomous vehicles.

If adopted by the programmer, this rule is clearly not without its own flaws. This can best be illustrated by the results of what would transpire if an autonomous vehicle were programed with this rule. If this rule were applied to our example The Omnipotent Programmer, the autonomous vehicle would apply its brakes, but it would continue down the road killing the five skateboarders, to save its passenger. This rule could lead to even more shocking outcomes. For example, if it were twenty skateboarders instead of five the car would still plow through them, as opposed to veering off the road due to its programming. To someone who is a rule utilitarian, this unfortunate outcome might be upsetting, but they would state that the rule is still justified and moral because it would lead to more purchases of autonomous vehicles. Which would lead to more autonomous vehicles on the road faster, thus cutting down on the number of automobile deaths, yielding the greatest utility for all of humanity.

For some programmers faced with this problem they may accept the rule utilitarian's moral reasoning and program their autonomous vehicles in accordance with that rule, but other programmers may find the rule utilitarian's moral reasoning appalling. This is because they may see the critical flaws with utilitarianism. The main issues with utilitarianism in general is that it is impossible to assess all the consequences of a rule or action because we cannot see the future, and it is impossible to truly measure happiness.[93] Along with these flaws the programmer who disagrees with this rule might believe that there are just some absolute moral rules, and that sacrificing some people to achieve an end violates those rules. This method of thinking would place this programmer in the group of

[93] THIROUX, *supra* note 73, at 36.

deontological theorists, who would have their own answer to what the best ethical answer is to the programmers issue.

B. Deontology

Deontological theories base their views of morality on something other than the consequences of a person's action.[94] Deontology stresses the role of basic moral rules and principles, as constraints on what individuals should do in different situations. For them, actions should be judged solely on whether they are good, based on some higher standard or standards of morality.[95] This means that acts are judged as being moral or immoral based on their conformity to the higher standard rather than on the action's consequences.[96] Just as utilitarianism can be broken down into act and rule utilitarianism, deontological theories can be broken down into act and rule deontological theories.[97]

Act deontologists believe that each time an individual needs to decide to take an action, a unique ethical problem is presented. They believe that individuals must decide what is right or wrong in every situation by consulting their own

---

[94] *Id.* at 40.

[95] PETER BYRNE, THE PHILOSOPHICAL AND THEOLOGICAL FOUNDATIONS OF ETHICS AN INTRODUCTION TO MORAL THEORY AND ITS RELATION TO RELIGIOUS BELIEF 86 (1992).

[96] THIROUX, *supra* note 73, at 40.

[97] LOUIS P. POJMAN, ETHICS DISCOVERING RIGHT AND WRONG 92, 93 (1990).

conscience or intuitions.[98] They believe that there are no general moral rules or theories. For each situation, individuals must approach each situation as one-of-a-kind and somehow come up with what the right action is to take in that situation.[99] Individuals who think this way are known as intuitionists, and the ethics of this theory were first devised by the Bishop of Durham, Joseph Butler, during the 1700s.[100] Butler believed that we each have a conscience that is able to discover what the right and wrong answer is in every situation. Butler belived that individuals do not need general rules to learn what is right and wrong, because our intuition will inform us of the right or wrong thing to do in every situation.[101]

While this theory may be acceptable to some people it is littered with flaws and it is an unusable theory for our problem. The first issue is that there is no evidence that people have or are born with innate moral rules, which we can compare to come up with the right action to take in each situation.[102] The biggest issue this theory faces is that intuition is immune to objective criticism because it applies only to the possessor. For example, if I believe that a specific act such as gay marriage is morally permissible, and you believe that it is morally wrong, we could ask each other to look deeper into our consciences, but we cannot argue about the subject itself.[103]

---

[98] *Id.* at 92.

[99] THIROUX, *supra* note 73, at 41.

[100] POJMAN, *supra* note 97, at 92.

[101] *Id.*

[102] THIROUX, *supra* note 73, at 41.

[103] *Id.*; *see also* POJMAN, *supra* note 97, at 93.

This theory is useless to the programmers in our scenario because they are forced to make a rule that will be applied to every situation, which is the opposite of what an intuitionist is supposed to do. As previously stated, one of the shortcomings of autonomous vehicles is that all they are currently able to do is image recognition.[104] They cannot be programed with some form of intelligence, which would have its own intuitions. The programmer can program the autonomous vehicle to protect the driver or preserve the most life when faced with no-win scenarios, but technology has not advanced far enough for an autonomous vehicle to be programed with its own intuitions. The programmer could state that they programed the vehicle to preserve the most life or to protect the occupants in the car in no-win scenarios, based upon their own intuitions, but they would be unable to objectively argue that their decision was a morally correct one. They would end up finding themselves attempting to justify decisions based on theories discussed earlier or by one of the rule deontological theories. This is the reason this theory does not help us. All it does is give the programmer an extra justification for their decision in that it just felt right, but it does not actually help us determine the morally correct answer.

Rule deontological theories base their views on the morality of an action on the action's adherence to a rule or rules.[105] Such rules include always obeying the commands of God, do not lie, and always keep your promises. Some rule deontological theorists focus on absolute moral rules and use empirical facts or supernatural beings in determining the validity of an action such as found in Divine Command

---

[104] Lohr, *supra* note 18, at 2-5.

[105] POJMAN, *supra* note 97, at 93-4.

theory.[106] Others used reason alone to make out basic absolute moral rules, which everyone should follow.[107] The most well-known deontological theorists and one of the most well-known philosophers of all time, Immanuel Kant, held this belief.[108]

Kant devised the idea of "Duty Ethics" in his book "Groundwork of the Metaphysic of Morals," which was published in 1785.[109] Kant believed that the most important human characteristic was a good will.[110] Kant wrote, "a good will is not good because of what it effects or accomplishes - because of its fitness for attaining some proposed end: it is good through its willing alone - that is, good in itself."[111] He believed that morality had value in itself, and that its value was not based on the fact that it could accomplish things such as human happiness. For Kant, it is a human's ability to reason, which gives us the ability to create universal moral laws; laws that if followed absolutely will lead to you having a good will.[112] Kant also stated that it was reason that gave us the ability to act in accordance with these rules, laws, or principles regardless of our

---

[106] BYRNE, *supra* note 95, at 87.

[107] *Id.* at 88.

[108] POJMAN, *supra* note 97, at 95.

[109] IMMANUEL KANT, GROUNDWORK OF THE METAPHYSIC OF MORALS 10 (Lawrence Pasternack, ed. 2002) (1785).

[110] *Id.* at 25.

[111] *Id.* at 25, 26.

[112] *Id.* at 27, 28.

individual interest or consequences.[113] Once we create these moral rules, Kant stated that we have a duty to act in accordance with those moral rules or laws. For Kant, an action done from duty, which sets aside any other reason for taking an action except for pure reverence to this practical law, is what gives the action moral worth and the individual a good will.[114] Morality for Kant is an individual's ability to act based on their duty to follow properly reasoned universal laws.[115]

Kant believed the way individuals should come up with universal laws is through reason by using the categorical imperative.[116] Kant offered two main formulations of the categorical imperative. The first formulation is, "Act only on that maxim through which you can at the same time will that it should become a universal law."[117] By 'maxim,' Kant means a general rule in accordance with which the agent intends to act; such as if you need money, you can lie to get it.[118] By 'law,' he means an objective principle, such as its morally permissible for everyone to lie if they need money.[119] For Kant, your action is immoral if it would lead to a self-defeating law.[120]

---

[113] THIROUX, *supra* note 73, at 43.

[114] KANT, *supra* note 109, at 30-32.

[115] *Id.*

[116] *Id.*

[117] *Id.* at 50.

[118] *Id.*

[119] POJMAN, *supra* note 97, at 96.

[120] *Id. see also* KANT, *supra* note 109, at 50-51.

The best way to see how the first formulation of categorical imperative works is through Kant's most famous "lying" example. Imagine I needed some money and I was considering whether it would be morally permissible to borrow the money from you without ever intending to pay you back.[121] The maxim of my act would be, whenever I need money, I should ask to borrow money from someone and lie about the fact that I am going to pay him or her back. Then I would ask could my maxim be adopted universally as a principle. The principle or law would be, whenever anyone needs money they should lie to get it. This principle fails because it is self-defeating. It is self-defeating because if everyone could lie to get what they wanted, people would stop believing one another, making it impossible to lie.[122]

The maxim of a lying promise fails as being self-defeating when applied as a universal law, making the action immoral. Now imagine the opposite maxim; whenever I need money I should only make truthful promises that I will pay you back. The principle or law would be, whenever anyone needs money they should only make truthful promises that they will pay people back. There is nothing self-defeating about this rule and it is self-consistent, so it can be universalized.[123] Therefore, making a truthful promise is moral, and we all have a duty to only make truthful promises.

The second formulation of the categorical imperative is often referred to as the principle of ends.[124] Kant wrote, "Act in

---

[121] *Id.* at 97; *see also* RACHELS & RACHELS, *supra* note 76, at 131.

[122] KANT, *supra* note 109, at 51.

[123] *Id.* at 51; *see also* POJMAN, *supra* note 97, at 97.

[124] POJMAN, *supra* note 97, at 103.

such a way that you always treat humanity, whether in your own person or in the person of any other, never simply as a means, but always at the same time as an end."[125] Kant believed that human beings held a special place in the world and had their own intrinsic value because humans are rational agents.[126] This means that they are free agents capable of making their own decisions, setting their own goals, and taking action strictly by duty.[127] This means that humans are the only rational creatures that can act from a good will, so they have their own innate moral value because for Kant morality has value in itself.[128] That is why Kant believed that morality required us to treat other humans who have their own intrinsic value, "never simply as a means, but always at the same time as an end."[129]

What Kant meant by this is that because people are so valuable; we have a duty to always treat others justly. Since each person has their own self-worth, we must never exploit, manipulate or use others merely as an end for achieving what we believe is best for the general good or for our own personal ends.[130] It is important that we promote their welfare, avoid harming them, and respect their rights as another rational creature. Take, for example, the lying example from earlier. Kant would state that it is immoral to lie to get the money

---

[125] KANT, *supra* note 109, at 57.

[126] *Id.*

[127] *Id.*

[128] *Id.* at 56-57; *see also* RACHELS & RACHELS, *supra* note 76, at 138.

[129] KANT, *supra* note 109, at 57.

[130] POJMAN, *supra* note 97, at 103-04; *see also* RACHELS & RACHELS, *supra* note 76, at 139.

because you are simply using that person only as a means to your end, which is to get the money you need.[131] Kant is not objecting to using someone as a means, he is objecting to using someone only as a means.

For example, if I had asked you for the money, told you I could not pay you back, and you decide to give me the money anyway, I would have taken a morally permissible action. Even though I would be using you to get money, I am not only treating you as a means. You are freely choosing to give me the money. This means that you as a rational free agent are choosing to make as your own end the action of giving me money. Thus, I would be treating you as a means, but I am also treating you with dignity as an "end-in-himself."[132]

Kant believed that both of his formulations of the categorical imperative were substantively identical, but most scholars disagree with him. Most scholars argue that it is better to just add the principle of ends as an additional step when creating universal moral laws.[133] The process for deciding whether an action is moral under the categorical imperative is as follows: First you formulate your maxim, such as, "if I need money it is okay to lie to get it." Then you ask, "Does this maxim mean I am using another rational being only as a means to an end." If it passes that step, which it would not using the lying maxim, then you ask, "could this maxim be adopted universally or is it self-defeating." If your action survives both steps of the test, then you have a duty to act according to this rule. If you then act based strictly based off your duty to follow this well-

---

[131] RACHELS & RACHELS, *supra* note 76, at 139-40.

[132] *Id.*

[133] POJMAN, *supra* note 97, at 104.

reasoned universal moral law and not for any other reason; then the action you took would have been moral.

Now that we understand how Kant's formula for creating moral rules works, his solution to The Omnipotent Programmer would most likely be a rule that protects the occupant in the autonomous vehicle. This is because a rule that would sacrifices the driver for the five skateboarders, or a rule that would just protect the most lives in a no-win scenario, would not survive the categorical imperative. Imagine the programmer programed the car to save the most lives when faced with a no-win scenario. The maxim of the programmer's act would be, whenever my autonomous vehicle is faced with a no-win scenario, I will program it in a way that it will sacrifices the lowest number of people to save the most lives. This fails the first part of the test because it would mean that in programing the cars this way, the programmer would be intentionally sacrificing the occupants in the vehicle or third parties. This means he would be using them only as a means to an end to save the most lives. Kant wrote that you should never use other rational beings "merely as a means for arbitrary use by this or that will."[134] It does not matter that the programmer may believe that he is taking an action that he believes will result in the greatest good. This is because all that matters to Kant are actions taken based on duty from properly reasoned universal laws that pass the categorical imperative. By intentionally sacrificing someone to save the most amount of people, the programmer would not be treating the people he sacrificed with dignity, as rational agents, or as ends in themselves. Since this rule does not pass the principle of ends section of the test, it is an immoral rule, meaning there is no need to continue to the second part of the test.

Kant would most likely accept a rule that protects the occupants in the car as a properly reasoned ethical rule because

---

[134] KANT, *supra* note 109, at 56.

it would survive both parts of the categorical imperative. The maxim of the programmers' act would be, whenever my autonomous vehicle is faced with a no-win scenario, I will program it in a way that it will protect the occupants in the car. This rule would result in the deaths of the five skateboarders in that scenario, but the result does not mean the rule is asserting that others can be used as a means to an end.

The maxim is not affirmatively stating that others should be sacrificed to protect the driver. Kant stated, "the moral worth of an action does not depend on the result expected from it"[135] It is expected that this maxim would result in the deaths of others, but consequences are not what is considered when formulating an ethical rule. On its face, all the maxim is affirmatively stating is that autonomous cars should be programed to avoid harming its own occupants. The maxim means that in these unfortunate situations the autonomous vehicles are going to attempt to protect their occupants, but they are not intentionally sacrificing third parties to save their occupants. Third parties may be lost because of the autonomous vehicles' attempt to protect their occupants, but that is different than an autonomous vehicle intentionally sacrificing one group of people so that another group can live.

The loss of a third party may be an unfortunate consequence of this maxim, but that does not mean third parties are being used as a means to an end. For example, imagine you were the driver of a non- autonomous vehicle and you are faced with the scenario stated in The Omnipotent Programmer. You chose to protect the occupants in the vehicle by slamming on the breaks. That saved you and anyone else in the vehicle, but the five skateboarders lost their lives as a consequence of your choice. You are not choosing to sacrifice the skateboarders as the means in the scenario to achieve your end of protecting the

[135] *Id.* at 32.

occupants in the vehicle. The means used to protect the occupants in the vehicle is applying the breaks and the loss of the skateboarders is not intentional, but just an unfortunate result. Therefore, neither you nor the autonomous vehicle programed to protect the occupants in the vehicle is using third parties as a means to achieve that end. Due to the fact that third parties are not being used as a means to the end of protecting occupants in the vehicle the rule passes the first part of the test.

Since this maxim passes the first part of the test, the next question is whether this maxim can be adopted universally or if it is self-defeating. The principle or law would be, whenever any autonomous vehicle is faced with a no-win scenario all programmers should have programed their vehicles in such a way that it will always protect the occupants in the car. This rule has no logical contradiction, so it is not self-defeating. Therefore, we can make the maxim of programmers programing their autonomous vehicles to protecting the occupants in the car a universal law. This means that programmers have to program their cars in this way based on a duty to follow this properly reasoned universal law.

For some programmers faced with this problem, they may accept Kant's categorical imperative and believe that they have a duty to act on this new rule. Other programmers may reject this view because they believe that morality does not come from human reason, but from God. This type of thinking is associated with Divine Command Theory (DCT) and individuals who think this way believe that moral obligations consist in obedience to God or God's commands.[136] Simply put they

---

[136] Michael W. Austin, *Divine Command Theory*, INTERNET ENCYCLOPEDIA OF PHILOSOPHY (Nov. 1, 2016), http://www.iep.utm.edu/divine-c/.

believe that all actions that God commands us to do are morally required and actions that God forbids us to do are immoral.[137] Now the specific content of these commands differs according to the divine command theorist particular religion, but all of the theories believe that morality and moral obligations are dependent on God.[138]

DCT has many advantages. To begin with, this theory provides an objective metaphysical foundation for morality. This means that morality is not based on someone's particular beliefs, but that there are objective moral truths that apply to everyone based on Gods commands.[139] DCT also gives an answer to why we should even be moral in the first place. For a DCT, God holds us accountable for our actions. Those who do not follow his commands will be punished and those who live morally upstanding lives will be rewarded.[140] Generally, a divine command theorist believes good will triumph over evil. Even though DCT has advantages, it also has some serious flaws.

The biggest flaw faced by DCT is the Euthyphro Dilemma.[141] In 380 B.C.E., Plato wrote a dialogue in which Socrates, who is being charged with corrupting the youth of Athens, has a conversation with Euthyphro, an individual who is

---

[137] RACHELS & RACHELS, *supra* note 76, at 51.

[138] Austin, *supra* note 136.

[139] *Id.*

[140] *Id.*; *see also* RACHELS & RACHELS, *supra* note 76 at 51.

[141] Plato, *Euthyphro*, The Internet Classics Archive (Nov. 1, 2016, 2:45 PM), available at http://classics.mit.edu/Plato/euthyfro.html.

prosecuting his own father for the murder of a servant.[142] This dialogue was about holiness, and during the dialogue Socrates asked Euthyphro what makes an action moral. Simply put, Socrates asked if an action is moral because the Gods command it, or is it just morally right, so the Gods command it?[143] No matter how a divine command theorist attempts to answer this question they are faced with a problem. If a defender of DCT responds that an action is morally right because God commands it, then if God commanded that we must torcher others for fun, doing so would be morally right.[144] If a defender of DCT responds that God commands an action because it is morally right, then God's ethics are no longer depends on him or her in the way divine command theorist claim. This would also mean God is no longer omnipotent and is subject to moral law external to himself.[145] Even with its flaws, many people still believe morality is dependent on God.[146] So what is the ethically correct decision for a programmer who thinks this way and is faced with our example?

Almost all religions have a rule or command by God against killing other people. This makes it extremely difficult for a programmer who is a divine command theorist to decide how their autonomous vehicle should act in a no-win scenario, because someone is almost certainly going to be killed as a result of their action. One individual who may have come up with an answer for the programmer in this situation is St. Thomas

---

[142] *Id.*

[143] *Id.*; *see also* POJMAN, *supra* note 97 at 181.

[144] Austin, *supra* note 136.

[145] *Id.*

[146] *Id.*

Aquinas. In a work entitled *Summa Theologica*, Aquinas introduced the doctrine of the double effect when discussing the permissibility of killing in-self defense.[147] Aquinas wrote "Nothing hinders one act from having two effects, only one of which is intended, while the other is beside the intention. Now moral acts take their species according to what is intended, and not according to what is beside the intention…"[148] Aquinas is stating that it is sometimes permissible to cause harm as a side effect of a morally permissible intended act to bring about a good result; even though it would not be permissible to intentionally cause the other effect to bring about the same end.[149]

The doctrine of the double effect is invoked to explain the permissibility of an action that has the effect of causing serious harm or even death.[150] For example, Aquinas argued that the act of self-defense may have two effects, one is saving your own life and the other is killing the aggressors.[151] Killing ones assailant is justified, so long as your intention is to save your

---

[147] St. Thomas Aquinas, *Summa Theologica*, New Advent (Nov. 1, 2016, 2:45 PM), available at http://www.newadvent.org/summa/3064.htm.

[148] *Id.*

[149] *Id.*

[150] Alison McIntyre, *Doctrine of Double Effect*, The Stanford Encyclopedia of Philosophy (Nov. 2, 2016, 12:00 PM), available at http://plato.stanford.edu/entries/double-effect/.

[151] *Id. see also* Aquinas, *supra* note 147.

own life and not to kill the assailant.[152] The action is morally permissible because the death of your assailant is a side effect of your morally permissible action, and not the intention of your action.[153] For Aquinas, if an individual uses more than necessary violence in self-defense their action would be immoral, the right to self-defense is not absolute.[154]

A programmer who believes in DCT would most likely find him or herself using the doctrine of the double effect so that they can program their autonomous vehicles in accordance with God's commands. Their solution to The Omnipotent Programmer would most likely be a rule that protects the occupant in the autonomous vehicle. To choose a rule that would intentionally sacrifice the driver or the skateboarders is morally impermissible for a divine command theorist. This is because their death would not be the side effect of a morally permissible action, but it would be the direct effect of a morally impermissible action. An autonomous vehicle programed with a rule such as, protect the occupants in the vehicle, is a morally permissible action. The fact that we foresee the deaths of the skateboarders or other third parties is different then intending their death. Their deaths occur as a side effect of the autonomous vehicle attempting to protect the driver, as opposed to them being the means of protecting the occupants in the car, meaning that programing autonomous cars with a rule such as protect the occupants in the vehicle is not adverse to the

[152] Aquinas, *supra* note 147.

[153] McIntyre, *supra* note 150.

[154] Aquinas, *supra* note 147.

commands of God. [155] Therefore, it is a morally permissible action for a divine command theorist.

Almost all of the moral theories discussed, whether it was a consequentialist theory or deontological theory, ended up reaching the same decision. Their decisions are that the programmer in The Omnipotent Programmer should program their autonomous vehicle to protect the occupants in the vehicle. They come to this decision for vastly different ethical reasons, but their answer to the question of how autonomous vehicles should be programed to act when placed in no-win scenarios leads them to the same rule. Therefore, programmers faced with this issue should program their vehicles to protect the occupants in the car when faced with no-win scenarios.

The ethical considerations of this decision would not be the only thing vehicle manufacturers or the programmers would take into account when deciding if this is the best way to program their autonomous vehicles. They would also ask themselves what are the legal consequences of such a decision? How will the law parse out liability for autonomous vehicles programed with this rule? Will the manufactures be liable for the damage caused by their autonomous vehicles, or will the owners of the vehicles be liable for any damage caused by their autonomous vehicle? While the law has not specifically dealt with this issue, there is precedent, which can give us some guidance for how the law will most likely handle this issue.

IV. LIABILITY

When it comes to technological innovation, the legal system faces the challenge of attempting to reduce the number of personal injuries caused by innovation and allocating the costs of victims injured by new technology while also attempting

[155] McIntyre, *supra* note 150.

to incentivize innovation.[156] The United States of America has many different theories of liability that could possibly be applied to autonomous vehicles, to address the issues faced by this particular technological innovation. There are two areas of the law that can best tackle the issue of liability for accidents involving autonomous vehicles and they are product liability, and the common law of agency. Products liability is used to hold manufacturers accountable when a product contains a manufacturing defect, a defect in design, or a defect due to inadequate instruction or warnings.[157] The common law of agency is generally used to hold principals liable for the acts of their agent.[158] Both these areas of the law have highly developed sets of principles that can be applied to accidents involving autonomous vehicles, but applying the common law of agency to autonomous vehicles will lead to the best outcomes for society overall.

A. Products Liability

Products liability is the main way consumers in America can hold manufacturers liable for issues with their product.[159]

---

[156] F. Patrick Hubbard, *"Sophisticated Robots": Balancing Liability, Regulation, and Innovation*, 66 FLA. L. REV. 1803, 1811 (2015).

[157] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 (AM. LAW INST. 1998).

[158] RESTATEMENT (THIRD) OF AGENCY § 1.01 (AM. LAW INST. 2006).

[159] Jeffrey Gurney, *Sue My Car Not Me: Prods. Liab. & Accidents Involving Autonomous Vehicles*, 13 U. ILL. J.L. TECH. & POL'Y 247, 257 (2013).

Plaintiffs can sue manufacturers for a manufacturing defect, design defect, or for inadequate instruction or warnings about the product.[160] A manufacturing defect occurs when the product departs from its intended design and causes harm.[161] Design defects are alleged when a product meets the manufacturer's design specifications, but the product's design itself creates an unreasonable risk.[162] Inadequate instruction or warnings are alleged when the manufacturer fails to provide instruction on how the product should be properly used or when the manufacturer fails to provide a warning about risks of injury posed by their product.[163] The first step for a consumer faced with an injury because of a product is to decide which of these three categories their case falls under. Then they must figure out what they need to prove to make out their case for that category.

If a product hurt an individual because it did not meet the manufacturer's specification, then that individual would bring a suit against the manufacturers, commercial seller, or distributor for a manufacturing defect.[164] Generally someone would bring a claim of a manufacturing defect when a product causes harm because it is physically flawed, damaged, or incorrectly

---

[160] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB § 2 (AM. LAW INST. 1998).

[161] *Id.* §2(a); *see also id.* § 2 cmt. a.

[162] *Id.* § 2(b); *see also id.* cmt. d..

[163] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. §2(c); *see also id.* cmt. i.

[164] *Id.* §2(a); *see also id.* §2 cmt c.

assembled.[165] In order to make out their case, a plaintiff must prove that the product does not conform to the proper specifications and that the defect existed in the product when it left the manufacturer or commercial seller.[166] If the plaintiff is able to make out their case, the manufacturer is strictly liable for the damage caused. It does not matter whether the manufacturer's quality control efforts satisfy standards of reasonableness.[167]

In the context of autonomous vehicles, a manufacturer would be found liable if a plaintiff could prove that one of the pieces of equipment in their autonomous vehicle was defective when it was installed. For example, if an accident occurred because one of the lasers in the plaintiff's autonomous car was defective, they would be able to recover under a manufacturing defect claim. A manufacturing defect claim could not be brought against a manufacturer for how the programmer choses to program their autonomous car when faced with a no-win scenario. This is because courts have not applied the manufacturing defect doctrine to software because nothing tangible is being manufactured.[168] A plaintiff will not be able to allege that there was a software error under a manufacturing defect theory.[169] Consumers will have the ability to allege a claim under a manufacturing defect theory, just like they would for

---

[165] *Id.* §2 cmt c.

[166] *Id.* §2(a); *see also* Gurney, *supra* note 159, at 258.

[167] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(a) (AM. LAW INST. 1998).

[168] Gurney, *supra* note 159, at 259.

[169] *Id.*

any other product, if a part of their autonomous vehicle did not meet manufacturing specifications.

If someone wanted to bring a lawsuit against a manufacturer for how an autonomous vehicle was programed, they would likely assert a design defect. A design defect occurs when the "…foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design…"[170] Simply put, when someone asserts a design defect, they claim that the product meets the manufacturer's design specifications, but they raise the question of whether the design itself creates an unreasonable risk of harm.[171] The test for judging whether a design is defective is the risk-utility balancing test. The test is "…whether a reasonable alternative design would, at reasonable cost, have reduced the foreseeable risk of harm posed by the product and, if so, whether the omission of the alternative design…rendered the product not reasonably safe."[172] To prevail on their claim a plaintiff must prove that a reasonable alternative was, or reasonably could have been available at the time of sale of the product.[173] Courts use a reasonable person standard when comparing the product's design and the alternative design.[174]

There are many different issues a plaintiff would face if they decided to bring a lawsuit for a design defect based on how

---

[170] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(b) (AM. LAW INST. 1998).

[171] *Id.* at §2 cmt. d.

[172] *Id.*

[173] *Id.*

[174] *Id.*

an autonomous car was programed in a no-win scenario. First off, plaintiffs would need a highly specialized expert to come up with a safer algorithm that the vehicle could have been programed with, and then they would need to testify as to how this algorithm would have prevented an accident in a no-win scenario.[175] Currently if a plaintiff brings a claim that a cruise control system was defectively designed, they need to prove that a reasonable alternative designee existed, and had their design been in use, the accident would not have occurred.[176] The structure of what a plaintiff needs to prove to make out a case for a design defect based on an algorithm would likely be similar to the one used by plaintiffs attempting to claim that their cruise control was defectively designed.[177] This means that a plaintiff attempting to bring a claim here would be faced with an insurmountable task. This is a no-win scenario, so there is no way any expert could come up with an algorithm to prevent the accident from occurring.

Another issue a plaintiff would face is that when courts evaluate the reasonableness of a design alternative, they look at the overall safety of both designs in general.[178] It is not enough to just prove that the alternative design would have reduced or prevented harm to the plaintiff if the alternative would have produced dangers of equal or greater magnitude.[179] There is going to be damage to someone in a no-win scenario. It would

---

[175] Gurney, *supra* note 159, at 263.

[176] Hubbard, *supra* note 156, at 1851.

[177] *Id.*

[178] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 CMT. F (AM. LAW INST. 1998).

[179] *Id.*

be practically impossible for a third-party plaintiff to successfully prove that an autonomous vehicle programmed to sacrifice its own occupants is more reasonable than one that is programed to protect its occupants. An additional issue plaintiffs would face is that the state-of-the-art defense would be a powerful block to design defect claims.[180] Autonomous car manufacturers would state that the programing of their vehicles reflects technology at the cutting edge of scientific knowledge, and based on current technological limits, the risk is unavoidable.[181] Most courts would likely be extremely receptive to this defense, making it a tough obstacle to overcome assuming a plaintiff was even able to prove that there was a reasonable alternative design that would have reduced or prevented harm.

The final type of products liability claim that can be brought is one of inadequate warnings or instructions. Manufacturers and commercial product sellers have a duty to provide reasonable instructions and warnings about the risk of injury posed by their product.[182] A product is defective under this theory if, "…the foreseeable risk of harm posed by the product could have been reduced or avoided by the provision of reasonable instructions or warnings…and the omission of the instruction or warning renders the product not reasonably safe."[183] Generally a warning or instructions concerning a serious risk need to be given if there is a foreseeable risk, and a

---

[180] Gurney, *supra* note 159, at 269.

[181] *Id.*

[182] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 CMT. I (AM. LAW INST. 1998).

[183] *Id.* at § 2(c).

significant number of people who buy your product would not be aware of the risk.[184] The standard under which the court evaluates this is reasonableness based on the circumstances.[185]

Autonomous vehicle manufacturers could find themselves liable for inadequate warnings or instructions for many reasons. For example, an autonomous vehicle manufacturer would have a duty to warn consumers of any known dangers they may encounter due to the current shortcomings of autonomous vehicles.[186] They would probably need to warn consumers that after an accident their autonomous vehicle may be unable to operate properly, so they would need to take the wheel until the damaged parts are replaced. They may also need to warn consumers that the computer vision systems can be compromised in various weather conditions, so they would need to take the wheel then too.[187]

This type of liability would be applicable to the issue of how an autonomous vehicle is programed to act in a no-win scenario no matter the rule manufactures decide to take. If the vehicle might sacrifice you or the other occupants in the car, the manufacturer would have a duty to warn you of that, and that would certainly deter people from buying an autonomous vehicle.[188] If the vehicle was programed to protect you in a no-win scenario they would need to warn you of the risk of injury

---

[184] Hubbard, *supra* note 156, at 1822.

[185] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 CMT. I (AM. LAW INST. 1998).

[186] Gurney, *supra* note 159, at 264.

[187] Rayej, *supra* note 10, at 4.

[188] Bonnefon, *supra* note 83, at 9.

posed by your autonomous cars to third parties. If autonomous car manufacturers instruct consumers on how to safely use their cars and warn them of possible dangers, they will have met the duty they owe to consumers.

If an autonomous vehicle suffers from a manufacturing defect, or if it was sold without proper warnings or instructions, consumers injured will be able to bring lawsuits against the manufacturer, like they would for any other product. The biggest issue will be injuries caused by autonomous vehicle accidents, in which the plaintiff cannot bring a claim under either of those theories of liability. The clear majority of plaintiffs will find themselves forced to attempt to fit their claim into some type of a design defect. Most likely they will fail at this and lose their case for the reasons stated earlier. This deficiency of products liability applicability to autonomous vehicles does not currently have a simple answer unless courts began to state that software is a product, which is extremely unlikely to happen. Most likely courts would not impose liability to a manufacturer for an accident involving an autonomous vehicle because courts do not generally apply liability to certain categories of products if they are just inherently risky and in wide use.[189] Courts generally have concluded that it is legislatures' and administrative agencies' job to come up with how certain categories of widely used and consumed, but nevertheless dangerous products, should be treated.[190] Automobiles in general are inherently risky and the way things are going, fully autonomous vehicles are likely to be in wide use in the near future.

---

[189] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 CMT. D (AM. LAW INST. 1998).

[190] *Id.*

One individual who believes car manufacturers should be held liable, under a theory of products liability for most accidents caused when a vehicle is in autonomous mode, is Jeffrey K. Gurney. In his article, "Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles," Gurney makes a few different arguments as to why manufacturers should be held liable when an accident occurs with an autonomous car.[191] His argument stems from his belief that if an autonomous vehicle gets into an accident, it is probably the manufacturer's fault because the technology itself was operating the vehicle.[192] He is not alone in this belief. In a poll conducted by the insurance information institute in May of 2016, 50 percent of the people they polled said that driverless car manufacturers should bear the responsibility in the case of an accident.[193]

Gurney argues that the primary purpose of products liability is to ensure that manufacturers put reasonably safe products on the market.[194] For him, holding autonomous vehicle manufacturers liable under a theory of products liability for accidents involving their vehicles would mean manufacturers would constantly be trying to make their vehicles safer.[195] Additionally, he argued this would not deter innovation. He

---

[191] Gurney, *supra* note 159, at 271.

[192] *Id.*

[193] *Self-Driving Cars & Insurance*, INS. INFO. INST. (July 1, 2016), https://www.iii.org/article/background-on-self-driving-cars-and-insurance.

[194] Gurney, *supra* note 159, at 271.

[195] *Id.* at 272.

claims manufacturers would just spread the extra cost to consumers of autonomous vehicles, who would not mind paying the extra cost for their vehicle because they would be generally shielded from liability.[196]

While Gurney's argument seems strong, it overlooks a few things. To start, even if all of what he stated was true, products liability is not the answer to holding manufacturers liable for the reasons stated earlier. The government would need to step in and create legislation that would hold manufacturers liable for accidents involving their autonomous vehicles. Another issue is that it would most likely deter innovation. Gurney's argument that liability cost could be passed onto the consumer without an effect on their willingness to buy the cars is incorrect. A poll by the insurance information institute in May of 2016 found that only 25 percent of people said they would be willing to pay more for driverless cars to cover the cost of manufacturers liability.[197] Faced with this statistic, an autonomous vehicles manufacturers may chose not to make fully autonomous vehicles if they know they are going to need to take on all the liability or struggle to sell their vehicles if they pass on that cost to consumers.

It is important to remember that the legal system is attempting to reduce the number of personal injuries caused by innovation; allocating the costs of victims injured by new technology while also attempting to incentivize innovation.[198] While Gurney is correct in that we want autonomous vehicle manufacturers to produce the safest car, holding manufacturers liable for all accidents is not the best way to do that. You do not

---

[196] *Id.*

[197] Self-Driving Cars & Insurance, *supra* note 193, at 2.

[198] Hubbard, *supra* note 156, at 1811.

need to hold manufacturers strictly liable for damage caused by their autonomous vehicles for them to continually attempt to make the safest autonomous vehicle they can. People are still wary of autonomous vehicles and any accident currently that has involved a vehicle in autonomous mode has made front-page news.[199] This makes people less likely to buy autonomous vehicles.

The market itself will likely ensure that manufacturers are constantly increasing the safety of their autonomous vehicles because people are not going to warm up to, and purchase autonomous vehicles if they are constantly causing accidents. People are not going to put their lives or their family's lives in the hands of an autonomous vehicle they do not trust. The market itself can ensure that manufacturers are constantly attempting to improve vehicle safety without the crippling effect that holding manufacturers liable could have on innovation. Also, a rule holding manufacturers liable for all accidents caused by their vehicles in autonomous mode might incentivize manufacturers to produce cars programed with act utilitarian ethics to minimize their exposure to liability. Most of the ethical theories we looked at would disapprove of this type of rule as unethical for the reasons stated earlier. Also, rules like this one would further dissuade people from purchasing autonomous vehicles and could increase the number of fatalities on the road by delaying the adoption of self-driving cars by the public.[200]

Gurney's argument at its core takes a corrective justice approach to liability. What he is claiming is that if there is an accident with an autonomous vehicle, it is probably the manufactures fault, therefore they should be held liable so that the problem is corrected. The best way to see why Gurney's view

---

[199] Lohr, *supra* note 18.

[200] Bonnefon, *supra* note 83, at 9.

is somewhat flawed is by looking at an influential corrective justice theorist named Ernest Weinrib. In Weinrib's law review article, *Corrective Justice*, he claimed that a violation of corrective justice involves an unjust act in which one party gains at the others expense.[201] Corrective justice requires the injurer to restore to the victim the amount representing the actor's self-enrichment at the victim's expense.[202] Weinrib stated, " From the standpoint of right, the essential question is whether the action of one of the two parties is consistent with the freedom of the other."[203] Simply put, justice requires the victim to be compensated by the injurer if they are the cause of the harm and that harm was caused by a negligent action taken by the injurer. For Weinrib and corrective justice theorist in general, being the cause of the harm is not enough. The injurer must also have done something wrong to be held liable.

The problem of attempting to claim that the manufactures should be held liable under a corrective justice theory like Gurney is arguing for is that there is nothing to correct. Just because an autonomous vehicle gets into an accident, like the situation present in The Omnipotent Programmer, does not mean the manufacturer has done something wrong. If the vehicles are programed in a way that they will protect the occupants in the vehicle, it is foreseeable that this rule will result in the deaths of others. This does not mean the manufacturers, or the owners of the car have committed a wrong under a corrective justice theory. Unfortunately, third parties may be lost because of the

---

[201] Ernest J. Weinrib, *Corrective Justice*, 77 IOWA L. REV. 403, 409-10 (1992).

[202] *Id.*

[203] *Id.* at 423.

autonomous vehicles attempt to protect their occupants, but they are lost as the result of a just action, not a negligent one. The reason why Gurney's theory is flawed to a certain extent is that when it comes to a corrective justice theory in general, causing harm is not enough; you also need to have done something wrong. More importantly, it fails because the law of products liability itself does not give victims an avenue for holding manufactures liable just because there was harm. There needs to be something more for the reasons stated earlier.

The reason a blanket rule holding manufacturers of autonomous vehicles liable under a theory of products liability fails, based on what the current laws are, can best be explained by looking at the reasoning behind products liability, which tends to be more about efficiencies and reducing waste. The general idea of the theories behind products liability can best be seen in the work of Richard Posner in his law review article, *A Theory of Negligence*.[204] Posner's theory was that tort law is about creating the right incentives by not wasting resources.[205] He claimed a good way to do this was by using Judge Learned Hand's famous formulation of the negligence standard. The way the formula works is if the probability of harm resulting from the party's act or omission multiplied by the gravity of the harm(loss) that may result is greater than the burden of taking the precaution to prevent the loss, then not taking the precaution is negligent.[206] The formula is just attempting to

---

[204] Richard A. Posner, *A Theory of Negligence*, 1 J. LEGAL STUD. 29, 32 (1972).

[205] *Id.*

[206] *Id.* at 32.

answer the question of whether taking the precaution is economically worth it to avoid economic waste.

Posner's main argument stems from the Hand formula and Posner believes that the main purpose of tort law is to obtain the most efficient cost justified level of accidents and safety.[207] This theory is like utilitarianism, but instead of maximizing happiness, he aims to maximize cost efficiency by minimizing the sum of accident cost and the cost of accident avoidance. The question for him is just whether taking the precaution is economically worth it to avoid economic waste. The question for Posner or anyone else who holds a similar theory is what action taken by the party's will result in the least amount of economic waste? For the reasons stated earlier, an autonomous vehicle programed to always protect the occupants in the vehicle may lead to worse outcomes in a situation, but overall it will lead to more autonomous vehicles on the road and less economic waste due to less accidents. This means that the rule is in line with the general theory of efficiency behind products liability, which is why it would be difficult to hold a manufacturer liable for an accident involving an autonomous car using products liability.

Manufacturers generally should not be held liable for accidents caused by their autonomous vehicle under a theory of products liability because at its core products liability is not about holding people liable just because there was harm. Also, based on the current state of the law of products liability itself, someone attempting to hold a manufacturer liable for how an autonomous vehicle was programed would be faced with an insurmountable task for the reasons stated earlier. Now manufacturers of autonomous vehicles could be held liable under a manufacturing defect theory or for an inadequate warning, just like they would for any other product.

---

[207] *Id.* at 33.

Unfortunately, for victims of autonomous vehicles, most of the time they are not going to be able to argue their claim under either of those theories and arguing for a design defect would be improbable. This means victims generally are not going to be able to hold manufacturers liable for accidents involving autonomous vehicles, so they will be forced to attempt to use another legal theory in an attempt to be made whole. If holding manufacturers liable is not a realistic possibility who should bear the costs of victims injured by autonomous vehicles? The owners of autonomous vehicles should be held strictly liable under the common law of agency for a number of different reasons.

B. Agency Liability

The law of agency comes from the Latin maxim *Qui facit per alium, facit per se*, which states that he who acts through another is deemed in the law to have done it himself.[208] Autonomous vehicles can sense what is happening around them, plan what they should do, and act based on the environment around them. Therefore, a theory of agency just may be the answer to the problem of who should be held liable for accidents involving autonomous vehicles.[209] Since autonomous vehicles are sophisticated the law could treat them similar to how the law treats employees under the doctrine of respondent superior,[210]

---

[208] SAMIR CHOPRA & LAURENCE F. WHITE, A LEGAL THEORY FOR AUTONOMOUS ARTIFICIAL AGENTS 18 (2011).

[209] Joel Espelien, *The Brave New World of Robot Law*, LAW PRACTICE TODAY (Jan. 14, 2016), http://www.lawpracticetoday.org/article/the-brave-new-world-of-robot-law/.

[210] *Id.*

animals, or agents under a form of computer systems law.[211] The legal responsibility for the actions of the autonomous vehicle would then fall on the individual who is granting it the permission to work on their behalf; the owners.[212] Holding owners of autonomous vehicles strictly liable for their vehicles would help to accomplish the task of reducing the number of automobile deaths on the road, while fairly allocating the cost to victims injured by autonomous vehicles without deterring innovation.

Since autonomous vehicles rely largely on computer technology, rules governing computers could hold the answer as to how owners of autonomous vehicles could be held strictly liable for damage caused by their vehicles. The law does not recognize computers as legal entities, but instead it views them as instrumentalities of the person using them.[213] Therefore, the user is liable for any damage caused by their instrumentality even if the damage they cause was unintended or unanticipated.[214] For example, courts have used trespass to

---

[211] Sophia H. Duffy & Jamie Patrick Hopkins, *Sit, Stay, Drive: The Future of Autonomous Car Liability*, 16 SMU SCI. & TECH. L. REV. 453, 462, 467 (2013).

[212] Peter M. Asaro, *Robots & Responsibility from a Legal Perspective*, ASARO (Jan. 20, 2007), available at http://www.peterasaro.org/writing/ASARO%20Legal%20Perspective.pdf.

[213] DUFFY & HOPKINS, *supra* note 211, at 462.

[214] *Id.*

chattel as a theory in which Internet service providers (ISP) can prevent unsolicited emails from spammers due to the fact that it can overburden the ISPs' computers and make the system harder to use for their customers.[215] If an operator uses an artificial agent to spam third parties computers, thereby consuming significant amounts of the third parties computer system without their consent, they may be found liable for the damage caused whether they intended to do that or not.[216]

Liability for autonomous computer systems has recently been addressed in the Uniform Electronic Transaction Act (UETS).[217] The UETS was created to make a unified body of law to govern the use of autonomous computer systems in business and government transactions. It defines systems that operate without humans as electronic agents and it views these agents as a tool of their user.[218] Under the UETA, users can be legally bound by the acts of their electronic agents, even if they were not involved in or had no knowledge of the transaction. Unfortunately, the UETA application is extremely narrow, in that it only applies to commercial transactions conducted using electronic system or documents.[219]

This means the UETA could not be applied to autonomous vehicles and this signifies an even greater issue of attempting to apply computer systems law to autonomous vehicles in general. Autonomous vehicles are much more than just a computer system; therefore they will require a different

---

[215] CHOPRA & WHITE, *supra* note 208, at 130.

[216] *Id.*

[217] DUFFY & HOPKINS, *supra* note 211, at 464.

[218] *Id.* at 465.

[219] *Id.*

assessment when it comes to liability. Certain computer laws could be used against someone if they implanted a virus into your autonomous car's computer system, but it would not be able to generally address who should be liable if your autonomous car gets into an accident.[220] Computer law could be used as an example to demonstrate that autonomous cars should also be treated as instrumentalities of their owners. Meaning that owners should be strictly liable for any injuries or property damage caused by acts of their autonomous vehicle because it is their instrumentality.

Another type of strict liability that could provide a model for how autonomous vehicles should be treated under the law is how the law governs animals. Animals are like autonomous vehicles in a few different ways. Neither can be held personally liable for their action, but they both act independently of their owners and they both can inflict personal injury or cause property damage.[221] Historically, the law provided a number of ways in which keepers of animals could be held liable for damage caused by their animals regardless of fault.[222] The common law stated that the keepers of animals likely to roam and do damage to other people's property would be strictly liable for the animals trespassing on others property.[223] Also, the owner of an animal that the owner knew or had reason to know was dangerous was strictly liable for any personal injury or physical harm caused by their animal.[224] Autonomous

---

[220] *Id.* at 466.

[221] *Id.* at 467-68.

[222] CHOPRA & WHITE, *supra* note 208, at 130.

[223] *Id.*

[224] *Id.*

vehicles are similar to certain animals that are inherently dangerous due to the fact that driving is an inherently dangerous activity. Like how the owner of a dangerous animal is held strictly liable for the damage their animal causes, so should autonomous vehicle owners.

Holding the owners of dangerous animals liable for the animal's actions fits in with tort theorists who believe that injurers should be liable to victims when they subjected their victims to a nonreciprocal risk. One tort law theorist who thought this way was George Fletcher, and in his law review article, *Fairness and Utility in Tort Theory,*[225] Fletcher argued that tort law calls upon judges to shift the burden of losses in accordance with what he called the principle of reciprocity.[226] His view of tort theory is like that of an Act utilitarian mentioned earlier, but it is not exactly the same. Fletcher stated that, "…the two central issues of tort law—whether the victim is entitled to recover and whether the defendant ought to pay—are distinct issues each resolvable without looking beyond the case at hand. Whether the victim is so entitled depends exclusively on the nature of the victim's activity when he was injured, and on the risk created by the defendant."[227] For Fletcher, the overall social costs are irrelevant, and the victim is entitled to recover based on the risk they are exposed to.[228]

Fletcher's paradigm of reciprocity determines who is entitled to compensation and who ought to pay by looking at the

---

[225] George P. Fletcher, *Fairness & Utility In Tort Theory*, 85 HARV. L. REV. 537 (1972)

[226] *Id.* at 540-42.

[227] *Id.* at 540

[228] *Id.*

activity of each of the parties involved and asking who was injured by a nonreciprocal risk.[229] A nonreciprocal risk is a risk that is created by a party that is greater in degree than the risk that is imposed upon him by other parties.[230] If it is determined that a party was injured by a nonreciprocal risk imposed on them by another party, then Fletcher would state that the party that was injured by the nonreciprocal risk is entitled to recover from the party that imposed upon them the nonreciprocal risk. Simply put, Fletcher is stating that it is fair to hold a defendant liable where they create a risk that exceeds those to which they are reciprocally subject to.[231] His main goal was to defend certain types of strict liability in tort law.

For Fletcher, the reason that the owner of an animal that the owner knew or had reason to know was dangerous should be strictly liable for any personal injury or physical harm caused by their animal is because they are subjecting others to a nonreciprocal risk.[232] When it comes to autonomous vehicles, if the manufacturer makes an autonomous vehicle with a manufacturing defect that causes the injury to a third party, then it is likely Fletcher would state the manufacturer should be liable.[233] The more difficult question is if there is no defect, then is an autonomous vehicle a nonreciprocal risk, and if it is, who is creating the risk? If there is no defect with the vehicle and an individual is dictating to their autonomous vehicle where to take them, it seems more reasonable to state that the owner of the

---

[229] *Id.* at 542

[230] *Id.*

[231] *Id.* at 548

[232] *Id.*

[233] *Id.*

vehicle and not the manufacturer is creating the risk their vehicle imposes on others. They are creating the risk by using their vehicle on the road just like anyone else with a vehicle on the road. Which is a simple way to say it seems more likely that they are the risk creators and the proximate cause of damage caused by their own autonomous vehicle.

Now the question is whether operating an autonomous vehicle is a nonreciprocal risk. Under Fletcher's view and for similar reasons owners of dangerous animals are held strictly liable, an autonomous vehicle is probably a nonreciprocal risk.[234] This is because the owners of autonomous vehicles know their vehicles are dangerous and they also know that in a no-win scenario their vehicle is always going to protect them. This means they know their vehicle is inherently dangerous and all the risks relating to their vehicle on the road are going to be bore by third parties. What makes the risk here nonreciprocal to third parties is that in every dangerous situation, the owner knows going in that they are not taking a risk, but that third parties are bearing all the risk of the vehicle on the road. They are the ones receiving all the benefits of this vehicle knowing that they are passing all the risks of this vehicle off to third parties.

For example, in our scenario under Fletcher's theory, the skateboarders could hold the owners of the autonomous vehicle liable. Their argument would be that choosing to operate a vehicle, which you know is going to always protect the occupants in the vehicle, is a nonreciprocal risk imposed upon them. This is because a person who is operating a non-autonomous vehicle could choose to protect the skateboarders over protecting themselves. This means the owners of the autonomous vehicle should be held strictly liable for their autonomous vehicle similarly to how the law treats dangerous animals because the

[234] *Id.* at 540-42.

tort theory that justifies holding the owners of those animals liable fits as well with justifying holding the owners of autonomous vehicles liable.

If autonomous vehicle owners were to be held strictly liable for the damage their autonomous vehicles cause, they would still probably be able to defend themselves from liability in certain instances. For example, the majority of states have a rule that canine owners are strictly liable for their dog's actions.[235] In most states, if your dog bites someone, you are liable for their injuries regardless of your own negligence or lack thereof.[236] Canine owners can absolve themselves of liability if they can prove that the victim provoked the dog to attack in some way.[237] If the victim trespassed on the canine owner's land, or if they taunted or hit the dog causing the dog to the attack, then the owner may be absolved of liability.[238] Autonomous vehicles cannot be provoked like a dog, but another driver or third party's actions could affect an autonomous vehicle causing the crash. Therefore, if another driver or third party's actions helped to cause the accident, the owner of the autonomous vehicle may have a defense to alleviate or negate the burden of strict liability.[239]

Looking towards the future the theory of holding parties liable for nonreciprocal risk could have far reaching ramifications for drivers of non-autonomous vehicles. This is because if autonomous vehicles are much safer than vehicles

---

[235] DUFFY & HOPKINS, *supra* note 211, at 468.

[236] *Id.*

[237] *Id.* at 470.

[238] *Id.*

[239] *Id.* at 471.

with human drivers; which seems to be the case, with ninety-four percent of crashes on U.S. roadways caused by human choice or error.[240] Then in the future, people who drive their own non-autonomous vehicles could find themselves liable for just driving their own car if they get into an accident. Since driving their own car would be considered a nonreciprocal risk as compared to the safer autonomous vehicles on the road. This is not currently the case because there are not enough autonomous vehicles on the road, but in time it may very well be the case that personally driving a vehicle is considered a nonreciprocal risk as compared to a person in an autonomous car. Whether that is how the law is going to evolve in the future in relation to non-autonomous cars is unclear. What is clear is that since strict liability has been successfully used to hold owners of dangerous animals liable for the acts of their autonomous creatures, it could be effectively applied to autonomous vehicles for the same reasons.

Autonomous vehicles could also be viewed as agents of their owners and held strictly liable for their actions under the doctrine of respondeat superior. The Latin phrase *respondeat superior* translated means "let the superior make answer."[241] This doctrine first appeared in the 17th century under the English common law system to deal with the legal consequences

---

[240] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN. U.S. DOT ISSUES FEDERAL POLICY FOR SAFE TESTING & DEVELOPMENT OF AUTOMATED VEHICLES, (Sept. 20, 2016), https://www.nhtsa.gov/press-releases/us-dot-issues-federal-policy-safe-testing-and-deployment-automated-vehicles.

[241] Hubbard, *supra* note 156, at 1863.

and liability as applied to masters working through their servants.[242] During the 19th century the doctrine was then applied to employees. Due to this, employers became vicariously liable for the actions of their employees if they committed an act that was within the scope of their employment.[243] It is important to understand that under the doctrine of *respondeat superior*, employers are responsible for their employee's autonomous acts even if they did not immediately influence or participate in the wrongful act that caused a loss.[244] The general idea behind the doctrine is that fairness requires an employer who is controlling and reaping the benefits of an employee for their own business to be held liable for the torts committed by that employee.[245] This is because they are reaping the benefit from their employees' work, so they should not get the extra benefit of being absolved of liability if their agent does something wrong while acting within the scope of their employment.

Autonomous vehicle owners will be the ones reaping the benefits of their autonomous cars, so it is only fair that they do not receive the added benefit of being absolved of liability if their vehicle gets in an accident. Holding owners of autonomous vehicles liable for their vehicles under the doctrine of respondeat superior is not without its issues. This is because the employee is an agent of the employer; the employee consents to act on behalf of their employer. Under the common law definition of agency, a consensual relationship is

---

[242] Espelien, *supra* note 209, at 2.

[243] *Id.*

[244] CHOPRA & WHITE, *supra* note 208, at 128.

[245] Hubbard, *supra* note 156, at 1863.

required.[246] Both parties need to consent to their association for the agency relationship to be formed.[247] While it is true that autonomous vehicles currently cannot give real consent as required under an agency principle, they will act on their owner's behalf and are subject to their owner's control. This type of performance is consistent with the rationale behind the consent requirement.[248]

Agency can be created in many ways. Two ways that a court could possibly conclude that an agency relationship has been formed with an autonomous car is by estoppel or necessity.[249] An agency by estoppel is formed when a person allows another to act for them to such an extent that a third party would reasonably believe that an agency relationship exists.[250] For example, imagine that the owner of an autonomous vehicle sent the vehicle to pick up their kids from school and bring them home. Now on the way to the school the unmanned vehicle is forced to swerve off the road and it collides with a parked car. The owner of the parked car would likely believe that the owner of the autonomous vehicle is liable for the damage to their car. This is because the owner of the parked car would likely see the autonomous vehicle as its owner's agent since it was acting as the principal's representative to pick up their kids.[251]

---

[246] RESTATEMENT (THIRD) OF AGENCY § 1.01(D) (AM. LAW INST. 2006).

[247] *Id.*

[248] CHOPRA & WHITE, *supra* note 208, at 18.

[249] *Id.* at 19.

[250] *Id.*

[251] *Id.*

An agency by necessity is formed when the person acts for another in an emergency without expressed authority to do so.[252] To best explain how agency by necessity could be formed with an autonomous vehicle, we should use the example of The Omnipotent Programmer. Once your autonomous vehicle comes around the corner on the narrow mountain path and immediately realizes there are five skateboarders coming right at it; it must make a split-second decision on what to do. You may be in the vehicle, but you would not have enough time to possibly switch out of autonomous mode and make the choice yourself. Therefore, the vehicle is going to be making the decision of what to do on your behalf out of necessity.

The example of The Omnipotent Programmer also brings up another issue of attempting to apply the law of agency to autonomous vehicles. If the programmer chooses to program the vehicle to save the most lives in no-win scenarios, it is extremely unlikely that the law of agency could be applied to hold the owners of autonomous vehicles liable for their cars. This is because under the common law of agency, agents owe a fiduciary obligation to their principal.[253] The term "fiduciary" means that an agent must act loyally in their principal's interest as well as on their principal's behalf.[254] Essentially, this means that an agent has the duty, to the best of their ability, to act in their principles best interest.[255] If your autonomous vehicle was programed in a way that it could sacrifice you or close family members in no-win scenarios, it would not be acting in your best interest. It would be unlikely that anyone could make a

---

[252] *Id.*

[253] RESTATEMENT (THIRD) OF AGENCY § 1.01(e) (AM. LAW INST. 2006).

[254] *Id.*

[255] *Id.*

reasonable argument that your autonomous vehicle is your agent if it does not act in your best interest in a no-win scenario.

From an ethical standpoint and for the reasons stated earlier, programmers should program their autonomous cars with a rule such as, always protect the occupants in the vehicle. Surprisingly, from a legal standpoint, manufacturers should pressure their programmers to program their autonomous vehicles with the same rule if they want to possibly shield themselves from liability. This is because how the vehicles are programed could impact whether the owners could be held strictly liable under a theory of agency for damage caused by their autonomous vehicles. It also just seems right for the owners of autonomous vehicles to compensate third parties when they receive the benefit of their vehicles protecting them at the expense of third parties. While it is clear that the owners of autonomous vehicles have not done anything morally wrong, from the perspective of the victim they were wronged.

One tort theory which explains well why victims, like the victims here, should be compensated for the harm they suffered was given by John Goldberg and Benjamin Zipursky in their law review article, *Torts as Wrongs*. The name of their article states what they believe traditional tort law is about, and that is wrongs.[256] What is central to Goldberg and Zipursky's theory of torts is not how the injurer conducted himself, but instead what happened to the victim.[257] For them, "[t]ort law provides victims with an avenue of civil recourse against those who have

---

[256] John C.P. Goldberg & Benjamin C. Zipursky, *Torts as Wrongs*, 88 TEX. L. REV. 917, 918 (2010).

[257] *Id.* at 941.

committed relational and injurious wrongs against them."[258] It is important to understand that when Goldberg and Zipursky use the word wrong, they are not just writing about moral wrongs.

They argue that moral wrongs are just one type of wrong and that there are also legal wrongs.[259] For example, if someone accidently walks on someone else's land, they are subject to tort of trespass even though they have not acted immorally and may have even acted reasonably.[260] They claim that torts are about legal wrongs, not just moral wrongs.[261] Some legal wrongs are also moral wrongs, but for them, torts are based off of legal wrongs. This means that their view of who should be liable in tort cases include situations in which the party that wronged the other may not have done anything morally blameworthy. Another thing that is central to their theory of tort law is deciding what duties of non-injury owed to other individuals are counted as legal duties and what remedies the injurer owes for failing to act in accordance with their duty.[262]

Based on their theory of tort law, Goldberg and Zipursky would likely state that the owners of autonomous vehicles did not do anything wrong, but the victims of their autonomous vehicles suffered a wrong. In our scenario, the skateboarders were injured because the autonomous vehicle was programed with a rule to always protect the occupants in the car. What happened to them is not morally wrong, but they would likely

[258] *Id.* at 946.

[259] *Id.* at 931.

[260] *Id.* at 932.

[261] *Id.* at 986.

[262] *Id.* at 919.

classify what happened to the skateboarders as a legal wrong. They would most likely claim it should be considered a legal wrong because it is foreseeable that this rule will result in injured victims, meaning the victims have suffered a wrong. While it is not morally wrong it does seem wrong for the owners of autonomous vehicles to receive the benefit of their vehicles being programed to protect them and to not have to have to compensate victims when that benefit materializes. Having an autonomous vehicle that gives the benefit of protection, at the foreseeable expense of others should be a recognizable legal wrong when third parties are injured as a result of that benefit materializing. The best way to compensate those victims for the legal wrong they suffered is by holding the owners of autonomous vehicles liable for the actions of their autonomous vehicles under some form of agency.

Holding the owners of autonomous vehicles strictly liable for damage caused by their autonomous vehicles would also be beneficial to society. This is because holding the owners of autonomous vehicles strictly liable would not deter innovation because manufacturers would no longer fear being crippled by liability for their autonomous vehicles. This would also help to decrease the time it takes for autonomous vehicles to become widely available, which would put more of them on the road causing less loss of life on roadways. Someone could argue that if consumers knew they would be strictly liable for any damage caused by their autonomous vehicle, they would be less likely to buy them because their insurance costs would go up.

Currently in the United States, almost every state requires vehicle owners to have liability insurance for their vehicle.[263] Insurance providers in the United States are already offering discounts to consumers who have vehicles that have "automated safety features, such as anti-theft devices, anti-

[263] DUFFY & HOPKINS, *supra* note 211, at 477.

collision systems, anti-lock braking, and airbags."[264] Autonomous vehicles are going to decreases the likelihood of collisions, which will result in lower cost for insurance providers and lower premiums for the autonomous car owner.[265] This means that despite being held strictly liable for accidents, the cost of their insurance would actually go down. Thus, insuring an autonomous vehicle is probably going to be cheaper than insuring the car you own today, which would further incentivize people to purchase them. Since insurance providers would be on the hook for an accident involving an autonomous vehicle, an injured victim would be able to recover financial damages caused by the vehicle, regardless of the owners' financial position. This means that holding owners of autonomous vehicles strictly liable under some form of agency would accomplish the challenge the legal system faces when it comes to technological innovation. It would reduce the number of personal injuries caused on the road; allocating the costs of victims injured by autonomous vehicles and continue to incentivize innovation in this area.

V. CONCLUSION

Autonomous vehicles will be on the road sooner than you think. Currently, programmers are grappling with the issue of how their vehicles should be programed to act in no-win scenarios. Based on most of the ethical views discussed in this paper, the programmers should program their autonomous vehicles with a rule that protects the occupants in the vehicle when faced with no-win scenarios. Unfortunately, what is ethically correct does not always match with what is the best legal decision. Here, under the law, holding autonomous vehicles owners strictly liable under some form of agency is the

[264] *Id.* at 478.

[265] *Id.*

best legal decision and it would incentivize the proper ethical decision when programing these vehicles. This is because it would cause autonomous vehicle manufacturers to pressure their programmers to create autonomous vehicle that would be proper agents to their owners. Meaning that in no-win scenarios, they would protect the occupants in the vehicle because agents must act in their principles' best interest. Furthermore, holding autonomous vehicle owners strictly liable would further incentivize the adoption of this new incredible technology, which has the potential to save thousands of lives on American roadways and benefit society overall.