The Case of the Autonomous Vehicle

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I. INTRODUCTION

The first successful internal combustion motor car was developed by German engineer Karl Friedrich Benz.[1] As the owner of the Benz Patent Motorwagen, he is regarded by some as the inventor of the first automobile.[2] In 1888, he first drove the car in public in Mannheim, Germany.[3] It had a

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Cite as 61 ATENEO L.J. 759 (2017).

1. Karl Benz, *available at* http://www.karlbenz.com (last accessed Jan. 31, 2017) & Famous Inventors, Karl Benz, *available at* http://www.famousinventors.org/karl-benz (last accessed Jan. 31, 2017).
2. *Id.*
3. *Id.*

top speed of 16 kilometers per hour and some sources say that in a public demonstration, the vehicle crashed.[4] In another public demonstration, it has been said that the vehicle also crashed.[5] As pointed out by Chris Urmson, former head of Google's Self-Driving Car Project[6] —

> [f]or the last 130 years, we've been working around the least reliable part of the car, the driver. We've made the car stronger. We've added seatbelts, we've added air bags, and in the last decade, we've actually started trying to make the car smarter to fix that bug, the driver.[7]

Things, however, are starting to change with a new invention that will revolutionize land transportation — the driverless car. A driverless car, or more formally called an autonomous vehicle, is one that is capable of steering, braking, and accelerating without real-time human input.[8] For purposes of this Article, this technology is distinguished from cars with driver assistance systems, which are built into already existing cars.[9] On the one hand, driver assistance systems still require a driver who is in full control and can intervene at any time by overriding the system.[10] On the other hand, driverless or automated driving allows cars to parallel park themselves or drive on cruise control.[11] Urmson said that instead of working around the

4. Mercedes Benz, When will there finally be a vehicle that no longer has to be pulled by horses?, *available at* www.mercedes-benz.com.au/content/australia/mpc/mpc_australia__website/en/home_mpc/passengercars/home/passenger_cars_world/heritage/125years/1886.html (last accessed Jan. 31, 2017).

5. The Robinson Library, Karl Benz, *available at* www.robinsonlibrary.com/technology/motor/motor/benz.htm (last accessed Jan. 31, 2017).

6. Alistair Barr, Bloomberg, Google's Self-Driving Car Project Is Losing Out to Rivals, *available at* https://www.bloomberg.com/news/articles/2016-09-12/google-car-project-loses-leaders-and-advantage-as-rivals-gain (last accessed Jan. 31, 2017).

7. Chris Urmson, How a driverless car sees the road, *available at* https://www.ted.com/talks/chris_urmson_how_a_driverless_car_sees_the_road/transcript?language=en (last accessed Jan. 31, 2017).

8. Bryant Walker Smith, *Automated Vehicles Are Probably Legal in the United States*, 1 TEX. A&M L. REV. 411, 419 (2014).

9. *Id.* at 432.

10. *Id.*

11. Damien A. Riehl, Bench and Bar of Minnesota, Car Minus Driver: Autonomous vehicles driving regulation, liability, and policy, *available at* mnbenchbar.com/2016/10/car-minus-driver (last accessed Jan. 31, 2017).

problem of the human driver, Google decided to eliminate it completely through its self-driving car.[12]

While the concept of autonomous vehicles has been around for quite some time, one of the first major events that jumpstarted its development was held by the Defense Advanced Research Projects Agency (DARPA), an agency of the United States (U.S.) Department of Defense, on 13 March 2004.[13] DARPA organized the DARPA Grand Challenge where 15 autonomous vehicles were made to race through a 142-mile course (approximately 228 kilometers) between California and Nevada.[14] Unfortunately, none of the vehicles finished the course and the vehicle that traveled the farthest completed only 7.5 miles (approximately 12 kilometers).[15] In the next year, DARPA held the second Grand Challenge where five out of the 195 vehicles that joined the challenge completed the 132 mile-course in southern Nevada.[16] Considering the outcome of the first event that was held only the previous year, this achievement was astounding and showed just how quickly the technology for autonomous cars developed in a span of a year.[17]

Eleven years later, the technology for autonomous vehicles has gone a long way. Google started the Google Self-Driving Car Project in 2009 and, since then, the project now called "Waymo" has self-driven more than two million miles around the U.S.[18] In October 2016, a driverless car was tested in public for the first time in the United Kingdom (U.K.)[19] and in the same year, the Ford Motor Company (Ford) announced that it intends to deliver

12. Alex Davies, Google's Plan to Eliminate Human Driving in 5 Years, *available at* https://www.wired.com/2015/05/google-wants-eliminate-human-driving-5-years (last accessed Jan. 31, 2017).

13. Defense Advanced Research Projects Agency, The DARPA Grand Challenge: Ten Years Later, *available at* www.darpa.mil/news-events/2014-03-13 (last accessed Jan. 31, 2017).

14. *Id.*

15. *Id.*

16. *Id.*

17. *Id.*

18. Waymo, Journey, *available at* https://waymo.com/journey (last accessed Jan. 31, 2017).

19. Rob Davies, *Self-driving car tested for first time in UK in Milton Keynes*, GUARDIAN, Oct. 11, 2016, *available at* https://www.theguardian.com/technology/2016/oct/11/self-driving-car-first-uk-test-milton-keynes-driverless-lutz-pathfinder (last accessed Jan. 31, 2017).

fully autonomous vehicles that can "operate without a steering wheel, gas[,] or brake pedal" by 2021.[20]

II. THE PROBLEM

The major problem that developers of autonomous vehicles wish to solve is road safety. According to the World Health Organization, about 1.25 million people die each year as a result of road traffic crashes.[21] It is the top cause of mortality among young people 15 to 29 years of age.[22] Studies also show that the major cause of motor vehicle accidents is not environmental factors like bad roads, poor lighting, or bad weather, but humans.[23] According to the Traffic Safety Facts[24] released by the US Department of Transportation's National Highway Traffic Safety Administration, 32,675 people were killed while 2.3 million people were injured in motor vehicle crashes in U.S. roadways in 2014.[25] Of the total number of fatalities, 31% of motor vehicle crashes were related to alcohol-impaired driving.[26] Approximately 10% of the fatalities involved accidents with distracted driving.[27] Moreover, at least two percent died in crashes that reportedly involved drowsy drivers.[28]

20. The Ford Motor Company MediaCenter, Ford Targets Fully Autonomous Vehicle for Ride Sharing in 2021; Invests in New Tech Companies, Doubles Silicon Valley Team, *available at* https://media.ford.com/content/fordmedia/fna/us/en/news/2016/08/16/ford-targets-fully-autonomous-vehicle-for-ride-sharing-in-2021.html (last accessed Jan. 31, 2017).

21. World Health Organization, Road traffic injuries, *available at* http://www.who.int/mediacentre/factsheets/fs358/en (last accessed Jan. 31, 2017).

22. *Id.*

23. Bryant Walker Smith, the Center for Internet and Society at Stanford Law School, Human Error as a Cause of Vehicle Crashes, *available at* cyberlaw.stanford.edu/blog/2013/12/human-error-cause-vehicle-crashes (last accessed Jan. 31, 2017).

24. U.S. Department of Transportation National Highway Traffic Safety Administration, 2014 Crash Data Key Findings, *available at* https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812219 (last accessed Jan. 31, 2017).

25. *Id.*

26. *Id.*

27. *Id.*

28. *Id.*

Experts say that autonomous vehicles can make roads safer[29] by replacing a human driver with a robot driver, which does not get intoxicated, distracted, or drowsy. Developers can also program these vehicles to abide by traffic rules,[30] possess reaction times quicker than the average human,[31] and optimize them in order to use roads more efficiently.[32] Roadway engineers estimate that only five percent of roadway capacity is used on a typical highway which can usually accommodate a maximum of 2,200 human-driven vehicles per lane per hour.[33] Since autonomous vehicles should be safer and better able to measure their surroundings, they will be able to drive closer and faster to each other, thus being able to utilize road space more efficiently.[34] In Metro Manila, where traffic is a serious problem and is estimated to cost the country three billion pesos a day,[35] this will certainly be a welcome development. By easing congestion, autonomous vehicles will make land travel safer, increase productivity, and improve quality of life.

III. CURRENT LEGISLATION

Bryant Walker Smith, Assistant Professor at the University of South Carolina School of Law, concluded that current law in the U.S. probably does not prohibit automated vehicles, citing the basic legal principle followed in the U.S. that what is not prohibited is permitted.[36] In the Philippines, the same conclusion can be drawn since Philippine courts have recognized the rule in statutory construction that "what is not expressly or impliedly prohibited by law may be done, except when the act is contrary to morals, customs[,] and

29. Alissa Walker, Will self-driving vehicles really make cities safer?, *available at* www.curbed.com/2016/9/21/12991696/self-driving-cars-safety-usdot (last accessed Jan. 31, 2017).

30. The Future of Human Evolution Website, The FHE Team, Disruptive Technologies: Driverless Cars, *available at* futurehumanevolution.com/todays-technology/disruptive-technologies-driverless-cars (last accessed Jan. 31, 2017).

31. Noah J. Goodall, *Ethical Decision Making During Automated Vehicle Crashes*, 2424 J. TRANSP. RES. BOARD 58, 60 (2014).

32. Ronald Bailey, The Moral Case for Self-Driving Cars, *available at* http://reason.com/archives/2014/07/28/the-moral-case-for-self-drivin (last accessed Jan. 31, 2017).

33. *Id.*

34. *Id.*

35. *Metro Manila traffic costing Philippines P3 billion a day*, PHIL. STAR, Sep. 16, 2015, *available at* www.philstar.com/headlines/2015/09/16/1500512/metro-manila-traffic-costing-philippines-p3-billion-day (last accessed Jan. 31, 2017).

36. Smith, *supra* note 8, at 414 (citing United States v. Gourde, 440 F.3d 1065, 1081 (9th Cir. 2006) (U.S.)).

public order."[37] This is reinforced by the principle followed in criminal law, *nullum crimen, nulla poena sine lege* — no act constitutes a crime unless it is made so by law.[38]

The absence of a law prohibiting autonomous vehicles is, however, understandable. Similar to other emerging technologies, lawmakers are unable to predict what new technological advancements may develop. Hence, they could not have prohibited something that they did not know will exist.[39] In order to create some certainty with regard to the legality of autonomous vehicles, and also to assist in the development of the technology by ensuring its safety, some states in the U.S. have issued legislation in relation to the development of autonomous vehicles.[40]

In 2011, Nevada was the first State in the U.S. to adopt a law which regulated how the technology was to be tested and sold.[41] To date, seven other States — California, Florida, Louisiana, Michigan, North Dakota, Tennessee, and Utah — and Washington D.C., have followed suit.[42] In September 2016, the U.S. Department of Transportation released its Federal Policy on Automated Vehicles which included a 15-point "safety assessment" to ensure the safe design, development, testing, and deployment of automated vehicles by manufacturers and developers.[43]

The Department of Transport of the U.K. conducted a regulatory review and, in a summary report and action plan issued on 11 February 2015, concluded that existing legislation in the U.K. does not prohibit the testing

37. Manila Electric Co. v. Public Service Commission, 60 Phil. 658, 661 (1934).

38. Villareal v. People, 664 SCRA 519, 529 (2012).

39. Smith, *supra* note 8, at 414.

40. *Id.* at 500-07.

41. National Conference of State Legislatures, Autonomous Self-Driving Vehicles Legislation, *available at* http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx (last accessed Jan. 31, 2017). *See also* Alex Davies, Self-Driving Cars Are Legal, But Real Rules Would Be Nice, *available at* https://www.wired.com/2015/05/self-driving-cars-legal-real-rules-nice (last accessed Jan. 31, 2017).

42. National Conference of State Legislatures, *supra* note 41.

43. U.S. Department of Transportation, Federal Automated Vehicles Policy, *available at* https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf (last accessed Jan. 31, 2017). *See also* U.S. Department of Transportation, Fact Sheet: Federal Automated Vehicles Policy Overview, *available at* https://www.transportation.gov/sites/dot.gov/files/docs/DOT_AV_Policy.pdf (last accessed Jan. 31, 2017).

of automated vehicles.[44] Thus, with the view of becoming the prime location for the development of autonomous vehicles in the world and being "at the forefront of technology for new forms of transport, including autonomous and electric vehicles,"[45] one who wishes to test autonomous vehicles in the U.K. is not limited to a certain geographical area or test center, and does not need to obtain any certificate or permit, nor is he or she required to provide a surety bond, provided that they arrange for the appropriate insurance.[46]

The Vienna Convention on Road Traffic of 1968 (Convention),[47] an international treaty, lays down the standards of road traffic in order to promote road safety and requires that "[e]very moving vehicle or combination of vehicles shall have a driver."[48] It defines a driver as "any person who drives a motor vehicle or other vehicle (including a cycle)[.]"[49] In 2014, the United Nations Economic and Social Council agreed upon an amendment to the Convention to allow the operation of autonomous vehicles, provided that a manual override operation is made available.[50] While the Convention will again need to be amended in order to allow the full operation of autonomous vehicles, this development is seen as a positive step towards the acceptability of this new technology.

Autonomous vehicles are now a reality and it is only a matter of time before they are sold on the market. The transition from human-driven cars to driverless cars, however, will be a tricky one especially if the legal and regulatory framework remains outdated. In this Article, some of the issues

44. GOV.UK, Department of Transport, The Pathway to Driverless Cars, *available at* https://www.gov.uk/government/publications/driverless-cars-in-the-uk-a-regulatory-review (last accessed Jan. 31, 2017).

45. Elizabeth Alexandra Mary Windsor, Queen of the United Kingdom, Queen's Speech 2016, Remarks at the House of Lords, Houses of Parliament, Parliament Square, Westminster, London (May 18, 2016) (transcript *available at* https://www.gov.uk/government/speeches/queens-speech-2016 (last accessed Jan. 31, 2017)).

46. GOV.UK, *supra* note 44.

47. Vienna Convention on Road Traffic, *opened for signature* Nov. 8, 1968, 1042 U.N.T.S. 17.

48. *Id.* art. 8, ¶ 1.

49. *Id.* art. 1 (v).

50. U.N. Econ. & Soc. Council, *Report of the sixty-eighth session of the Working Party on Road Traffic Safety*, at 9, U.N. Doc. ECE/TRANS/WP.1/145 (Apr. 17, 2014).

brought about by the development of autonomous vehicles and how the law plays a role in addressing these challenges will be discussed and analyzed.

IV. CHALLENGES

Aside from the need to keep up with the constant changes of technology, legislators need to be aware of and understand how current laws impact the development of the technology and decide whether there is a need to change and adapt.

A. Physical Safety

Studies predict that autonomous vehicles will only lessen the amount of car crashes[51] and not eliminate them completely.[52] Thus, manufacturers of these vehicles are faced with the task of programming an automated vehicle to make decisions that would reduce damages when a crash is inevitable.[53] This is where the difficulty lies. Noah J. Goodall, a research scientist for the Virginia Transportation Research Council, identified the problem of pre-programmed behavior in autonomous vehicles —

> One major disadvantage of automated vehicles during crashes is that, unlike a human driver who can decide how to crash in real time, an automated vehicle's decision of how to crash was defined by a programmer ahead of time. The automated vehicle can interpret the sensor data and make a decision, but the decision itself is a result of logic developed and coded months or years ago. This process does not pose a problem in cases in which a crash can be avoided [—] the vehicle selects the safest path and proceeds. If, however, injury cannot be avoided, the automated vehicle must decide how best to crash. This decision quickly becomes a moral one[.][54]

How to determine who gets hurt, injured, or killed, when these become unavoidable, is a moral conundrum which experts have attempted to answer by exploring different moral and ethical theories. Should an autonomous car be programmed to always protect its passengers even if it means swerving and hitting other people? What if it might need to swerve and hit a child? Considering the number of unpredictable scenarios and outcomes of a car accident, certain car crashes will involve very complicated ethical decisions.[55]

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51. Goodall, *supra* note 31, at 58.

52. *Id.* at 60.

53. *Id.* at 59.

54. *Id.* at 60.

55. *Id.* at 58.

The most common scenario described in this ethical debate is the "trolley problem"[56] proposed by philosophers Philippa Foot and Judith Jarvis Thomson — imagine that a person controls a train that is about to run over five people on a track.[57] To save these five people, the person can divert the train to a track where it will hit one individual.[58] Should the person actively divert the train, he or she will kill that individual who otherwise would have survived if the person did not do anything in order to save the five people from harm.[59] If one only looks at the numbers, then the answer is straightforward.[60] Five people should be allowed to live instead of one.[61] The answer, however, is not that simple.[62] Even if letting five people live instead of one may sound better, some will argue that there is a difference between actively killing someone and letting someone die.[63] Thus, diverting the train and killing one person may arguably be worse than letting the train continue on its course.[64] What if the train was actually about to hit five children and, instead of killing them, the person diverts the train to hit an old man? Will that make a difference in what is right or wrong?

If one accepts the argument that actively killing someone is worse than letting someone die, this means that in the event of a crash, an autonomous vehicle should choose to harm its passengers if it had to choose between swerving and hitting an innocent bystander on a sidewalk and crashing into a large truck on its path. In the same way, it should also choose to run over a child who may have suddenly crossed the road running, instead of swerving and hitting other people or hurting its passengers.

One can argue that the chances of anyone having to ever face these kinds of no-win scenarios are highly unlikely.[65] As pointed out by Patrick Lin, however, that is not the point given that

56. Patrick Lin, The Ethics of Autonomous Cars, *available at* www.theatlantic.com/technology/archive/2013/10/the-ethics-of-autonomous-cars/280360 (last accessed Jan. 31, 2017).

57. *Id.*

58. *Id.*

59. *Id.*

60. *Id.*

61. *Id.*

62. Lin, *supra* note 56.

63. *Id.*

64. *Id.*

65. *Id.*

> [p]rogrammers [will still] need to instruct an automated car on how to act for the entire range of foreseeable scenarios, as well as lay down guiding principles for unforeseen scenarios. [Thus,] programmers will need to confront this decision, even if [ ] human drivers never have to in the real world.[66]

In this case, the issue arises — regardless of the likelihood that a no-win scenario will happen, will society accept these decisions? When an individual reacts to a particular situation, it is based on instinct which the law and society can condone.[67] If an autonomous vehicle, however, is programmed several years prior to react a certain way depending on particular circumstances, will the law and society still condone these decisions or will they see this as homicide? More importantly, who gets to determine the decisions an autonomous vehicle should make?

In a survey conducted to determine how individuals felt about automated vehicles, researchers found that "respondents might be prepared for autonomous vehicles programmed to make utilitarian moral decisions in situations of unavoidable harm."[68] These even included instances where the greater good meant sacrificing its own passenger or owner.[69] Nevertheless, the study also found that while most wished others to travel in their utilitarian automated cars, less wanted to buy utilitarian automated cars themselves.[70] Thus, most people agree that a utilitarian automated car will contribute to the greater good and that humanity, as a whole, should use them.[71] Personally, however, they would not.[72] This was because they did not want an automated car to sacrifice its passenger when they were the passenger.[73]

A solution to this problem may be through another emerging field in robotics — the concept of an autonomous moral agent wherein robots are

66. *Id.*

67. *Id.*

68. Jean-François Bonnefon, Azim Shariff, & Iyad Rahwan, arXiv, Cornell University Library, Autonomous Vehicles Need Experimental Ethics: Are We Ready for Utilitarian Cars? at 8, *available at* https://arxiv.org/pdf/1510.03346v1.pdf (last accessed Jan. 31, 2017).

69. *Id.*

70. *Id.* at 6.

71. *Id.* at 6 & 8.

72. *Id.*

73. *Id.* at 8.

programmed to make moral decisions.[74] By doing this, an "artificial morality [that] shifts some of the burden for ethical behavior away from designers and users, and onto the computer systems themselves"[75] is created. In programming an automated car as an artificial moral agent, developers do not have to anticipate every possible scenario an automated car may encounter; instead, they should develop an artificial moral agent that is able to evaluate each scenario it is faced with and determine which action is ethically appropriate.[76] In programming robots this way, experts have illustrated two strategies — a top-down approach and a bottom-up approach.[77]

V. APPROACHES

A. Top-Down Approach

Through the top-down or rational approach, moral principles and theories are programmed into the robot as algorithms and used as rules for the selection of ethically appropriate actions.[78] In this approach, developers "directly instruct the automated system how to behave in a variety of circumstances."[79]

The basic issue anent this approach, however, is that there are conflicting moral principles and theories, and that there is a need to make room for exceptions. Thus, an autonomous moral agent programmed to follow rules will need software that can manage situations in the event rules conflict and can take into consideration acceptable exceptions.[80] As pointed out above, however, what is acceptable is itself an issue and something that is yet to be determined.

74. Colin Allen, et al., *Artificial Morality: Top-down, Bottom-up, and Hybrid Approaches*, 7 ETHICS & INFO. TECH. 149, 149 (2005).

75. *Id.*

76. *Id.*

77. *Id.* at 149-53.

78. *Id. See also* WENDELL WALLACH & COLIN ALLEN, MORAL MACHINES: TEACHING ROBOTS RIGHT FROM WRONG 93 (2009).

79. Goodall, *supra* note 31, at 61.

80. WENDELL WALLACH & COLIN ALLEN, MORAL MACHINES: TEACHING ROBOTS RIGHT FROM WRONG 85-86 (2009).

B. Bottom-Up Approach

In the bottom-up approach, rules or moral theories are not imposed upon the robot.[81] Instead, a machine is programmed to learn and is placed in an environment where appropriate behavior by the robot is rewarded.[82] Google applies this approach as its driverless cars go on the road and record everything it sees as data and lets its algorithm figure out the rules on its own.[83] Experts compare the bottom-up approach to a young child who acquires his or her moral education in a social context and eventually identifies which behaviors are appropriate and inappropriate without being given a specific theory.[84]

The disadvantage of this kind of approach is that learning can be a slow task since it involves "trial and error — learning from mistakes and unsuccessful strategies."[85] Moreover, "[i]f not carefully designed, [the driverless car may] risk emulation of how humans behave rather than what they believe."[86] This is a concern because, as pointed out by Goodall, "[e]thics addresses how humans ought or want to behave, rather than how they actually behave, and artificial intelligence techniques should capture ideal behavior."[87]

C. Hybrid Approach

In an effort to make up for the deficiencies of each strategy, experts suggest a hybrid approach which makes use of both the top-down and bottom-up approaches.[88] In developing an automated car as an autonomous moral agent, a hybrid approach may be the best solution because both approaches may be used to address the deficiencies of the other approach.[89] In his Ethical Vehicle Deployment Strategy,[90] Goodall proposes developing

81. Goodall, *supra* note 31, at 62.

82. WALLACH & ALLEN, *supra* note 80, at 79-80.

83. Tom Vanderbilt, Let the Robot Drive: The Autonomous Car of the Future is Here, *available at* http://www.wired.com/2012/01/ff_autonomouscars (last accessed Jan. 31, 2017).

84. WALLACH & ALLEN, *supra* note 80, at 99-101.

85. *Id.* at 114.

86. Goodall, *supra* note 31, at 62.

87. *Id.*

88. WALLACH & ALLEN, *supra* note 80, at 117-18.

89. Goodall, *supra* note 31, at 63.

90. *Id.*

automated cars as moral agents in three phases, which is applied as the technology becomes available.[91] The process is as follows:

1. First Phase

The first phase, called the rational ethics phase, applies the top-down approach where developers of automated vehicles, lawyers, transportation engineers, and ethicists should agree on a standard of rules that should be programmed on the automated car.[92] The rules should only cover basic scenarios which everyone agrees to.[93] Goodall includes some suggestions of these rules such as injuries over death, property damage over injury, and protection of vulnerable users over other types of users.[94]

In situations wherein the rules do not specify a behavior, such as when two alternatives each result in similar injuries, Goodall suggests the use of a safety metric based on "expertise from ethicists and from existing research."[95] He suggests that as a possible starting point, the safety metric may include "value-of-life estimates, [which is] used in medicine[ ] and the identification of organ transplant recipients, in which a complex moral decision must have numerical basis."[96] If all else fails and the automated car is unable to make a decision, the car should stop and avoid.[97]

2. Second Phase

Any set of rules programmed into the automated car, however, is insufficient to cover all possible scenarios that an automated car will encounter.[98] To address this insufficiency, the bottom-up approach is utilized as part of Goodall's second phase which he calls the hybrid rational and artificial intelligence approach.[99] In this phase, the robot learns how to make ethical decisions when faced with certain scenarios through machine learning techniques.[100] Goodall suggests training a "neural network ... on a

91. *Id.* at 63-64.

92. *Id.* at 63.

93. *Id.*

94. *Id.*

95. Goodall, *supra* note 31, at 63.

96. *Id.*

97. *Id.*

98. *Id.*

99. *Id.*

100. *Id.*

combination of simulation and recordings of crashes and near crashes, with human feedback on the ethical response."[101] To ensure that the automated car maintains reasonable behavior and does not develop behavior characteristic of an extremist, Goodall emphasizes the importance of boundaries and how the rule system in the first phase should remain.[102] Developers must ensure that the learning approach is used on machines only for scenarios which are not covered by the rules in the first phase.[103]

3. Third Phase

In the last phase of the vehicle deployment strategy, the aim is to learn from the actions of the automated car and to determine the rationale behind the decisions it has made.[104] In an automated car crash, an understanding of why the automated car crashed is important because it helps in improving the programming of the automated car.[105] This becomes especially critical if the automated car acted unexpectedly.[106] It is necessary to understand how the data was analyzed so that programmers can fix or adjust the software to ensure it does not happen again.[107] Neural networks, however, are incapable of explaining how it decides.[108] It is not easy to simply trace back the steps taken and see what went wrong.[109] Rather, it can be difficult to determine how a neural network arrived at a certain decision.[110]

Nonetheless, computer scientists have taken steps to comprehend the decision-making process of neural networks by developing methods of producing rule-based explanations from neural networks.[111] To do this, the "process essentially translates a neural network's internal knowledge into a set of symbolic rules, which can then be expressed as a natural language."[112]

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101. Goodall, *supra* note 31, at 63.

102. *Id.*

103. *Id.*

104. *Id.*

105. *Id.*

106. *Id.*

107. Goodall, *supra* note 31, at 63.

108. *Id.*

109. *Id.*

110. *Id.*

111. *Id.*

112. *Id.* (citing Alan B. Tickle, et al., *The Truth Will Come to Light: Directions and Challenges in Extracting the Knowledge Embedded Within Trained Artificial Neural*

Goodall cautions, however, that the rules produced will not accurately explain or represent every decision, and some rules may still be too intricate to comprehend.[113] Nevertheless, it is a significant step towards understanding the logic behind neural networks and the decisions made by automated cars.[114]

Through the hybrid approach, automated vehicles can hopefully make the best possible decision which causes the least amount of harm. In order to do this, the aim is that automated vehicles will consider not only the physical environment surrounding the potential crash but also human values and morals like compassion and understanding. This way, automated vehicles may be justified as the best solution to improving road safety and, even if control is given up to a robot, it contains a human element that understands the complexities of life and has the capacity to suitably address them.

If the above approach is successful, determining responsibility for a car crash will be much easier. This leads to the next question — who is liable in the event of a car crash caused by an autonomous vehicle?

VI. LIABILITY

In February 2016, Google had its first driverless car accident to which it admitted responsibility.[115] While Google's autonomous vehicles have had accidents in the past, these were caused by other cars driven by other drivers — humans.[116] This first driverless car accident was between Google's Lexus-model autonomous vehicle and a public transit bus.[117] Google reported that its autonomous vehicle detected the bus but predicted that the latter would let the former pass.[118] According to Google's report, its autonomous vehicle was preparing to make a right turn and "[a]fter waiting for some other vehicles to pass, [Google's] vehicle, still in autonomous mode, began angling

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Networks, 9 IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS 1057, 1057-68 (1998)).

113. Goodall, *supra* note 31, at 63.

114. *Id.*

115. Chris Ziegler, A Google self-driving car caused a crash for the first time, *available at* www.theverge.com/2016/2/29/11134344/google-self-driving-car-crash-report (last accessed Jan. 31, 2017).

116. *Id.*

117. Chris Isidore, CNN Money, Google's self-driving car at fault in accident, *available at* money.cnn.com/2016/02/29/autos/google-self-driving-car-accident (last accessed Jan. 31, 2017).

118. *Id.*

back toward the center of the lane at around [two miles per hour (mph)] and made contact with the side of a passing bus traveling at 15 mph."[119] In Google's report to the State of California's Department of Motor Vehicles, it stated that the test driver of Google's vehicle saw the bus approaching but also believed that the bus would allow the autonomous vehicle to pass.[120] In admitting that its vehicle was partially responsible for the accident, Google qualified in its February 2016 Google Self-Driving Project Monthly Report that trying to predict each other's movements is a normal part of driving.[121]

A. Quasi-delict

Under Philippine law, the driver and the registered owner of a private vehicle may be held liable in the event of a car accident if the requirements under Article 2176 of the Civil Code are met, which provides that "[w]hoever by act or omission causes damage to another, there being fault or negligence, is obliged to pay for the damage done. Such fault or negligence, if there is no pre-existing contractual relation between the parties, is called a quasi-delict[.]"[122]

In applying the above provision, jurisprudence has laid down the following requisites:

(a) Damage suffered by the plaintiff;

(b) Fault or negligence of defendant; and

(c) Connection of cause and effect between the fault or negligence of defendant and the damage incurred by the plaintiff.[123]

The Supreme Court has defined negligence as "the failure to observe for the protection of the interest of another person that degree of care,

119. Google Self-Driving Car Project Monthly Report: February 2016, *available at* www.google.com/selfdrivingcar/files/reports/report-0216.pdf (last accessed Jan. 31, 2017).

120. State of California Department of Motor Vehicles, Report of Traffic Accident Involving an Autonomous Vehicle submitted by Google Auto LLC, *available at* https://www.dmv.ca.gov/portal/wcm/connect/3946fbb8-e04e-4d52-8f80-b33948df34b2/Google_021416.pdf?MOD=AJPERES (last accessed Jan. 31, 2017).

121. Google Self-Driving Car Project Monthly Report: February 2016, *supra* note 119.

122. An Act to Ordain and Institute the Civil Code of the Philippines [CIVIL CODE], Republic Act No. 386, art. 2176 (1950).

123. Guillang v. Bedania, 588 SCRA 73, 84 (2009) (citing Dy Teban Trading, Inc. v. Ching, 543 SCRA 560, 571 (2008)).

precaution, and vigilance which the circumstances justly demand, whereby such other person suffers injury."[124] Thus, a driver may be held liable for damages in the event of a car accident if it is proven that the damage or injury suffered by the victim was due to the fault or negligence of the driver.

The basis for holding the owner of the vehicle liable is based on two articles in the Civil Code. The first article involves a situation when the owner of the vehicle is in the car with the driver when the accident happened. Article 2184 provides that "[i]n motor vehicle mishaps, the owner is solidarily liable with his driver, if the former, who was in the vehicle, could have, by the use of the due diligence, prevented the misfortune."[125]

In *Chapman v. Underwood*,[126] the Supreme Court explained that the rationale behind this provision is that the owner of a vehicle should not permit his driver to violate the law in the performance of negligent acts especially after seeing the acts and having reasonable opportunity to stop him.[127]

Under this basis, can the owner of an autonomous vehicle be held liable in the event of an accident? The above provision may find application to driver assistance systems since the human still has the opportunity to intervene in the driving of the vehicle and, thus, remains in ultimate control. However, once the technology for autonomous vehicles reaches the level in which it no longer has even the supervision of a human, the above provision can no longer apply because the owner will not have the ability to prevent the accident.

The second article in the Civil Code holds the owner liable even when he or she is not in the vehicle based on the principle of vicarious liability. Article 2180 of the Civil Code provides —

> The obligation imposed by Article 2176 is demandable not only for one's own acts or omissions, but also for those of persons for whom one is responsible.
>
> ...
>
> Employers shall be liable for the damages caused by their employees and household helpers acting within the scope of their assigned tasks, even though the former are not engaged in any business or industry.[128]

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124. *Guillang*, 588 SCRA at 85.

125. CIVIL CODE, art. 2184.

126. Chapman v. Underwood, 27 Phil. 374 (1914).

127. *Id.* at 376-77 (1914).

128. CIVIL CODE, art. 2180.

The Supreme Court has clarified that the above provision refers to the registered owner of the vehicle and not just the actual owner, maintaining that "the registered owner of the motor vehicle is considered as the employer of the tortfeasor-driver, and is made primarily liable for the tort committed by the latter under Article 2176, in relation with Article 2180, of the Civil Code."[129] In explaining the rationale behind the rule, the Supreme Court discussed the principle behind the registration of a motor vehicle.[130] It explained that the law requires the registration of a motor vehicle for the benefit of the public, such that in the event of an accident where the victim is unable to positively identify the actual owner or driver of the vehicle, he or she can still fix responsibility on a definite individual — the registered owner.[131] This, however, does not prevent the registered owner from claiming indemnity from the actual owner the amount he or she may be required to pay for damages.[132]

Since autonomous vehicles will operate without any human input, the registered owner of a vehicle, or the driver, can arguably claim that he or she is not liable on the basis of a quasi-delict. Who then can the victim claim from? Is there basis in the Philippine legal system to hold the registered owner of an autonomous vehicle liable in the event of a car crash even though he or she can prove that she did not act negligently?

There are instances where the law imposes liability upon an individual even without fault. For example, under Article 2183 of the Civil Code, the owner is responsible for any damages that his animal may cause —

> The possessor of an animal or whoever may make use of the same is responsible for the damage which it may cause, although it may escape or be lost. This responsibility shall cease only in case the damage should come from *force majeure* or from the fault of the person who has suffered the damage.[133]

Can Philippine legislation for autonomous vehicles be likened to legislation for animals and make its registered owner liable for its actions? If technology succeeds in applying the hybrid approach to autonomous vehicles where it is shown that it made the best possible decision causing the least amount of harm, can this fall under the defense of *force majeure*?

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129. Filcar Transport Services v. Espinas, 674 SCRA 117, 128 (2012) (emphasis omitted).

130. *Id.* at 125-26 (citing Erezo, et al. v. Jepte, 102 Phil. 103, 108 (1957)).

131. *Id.*

132. *Erezo, et al.*, 102 Phil. at 106-07.

133. CIVIL CODE, art. 2183.

Enacting legislation, which makes the registered owner of an autonomous vehicle liable in case of a crash, will benefit victims of accidents and remain consistent with the whole purpose of motor vehicle registration. This, however, may also discourage individuals who do not want to be held liable for situations which they do not have control over from purchasing autonomous vehicles. As expressed previously, social acceptability of autonomous vehicles is crucial. If individuals refuse to utilize autonomous vehicles, then its benefits would be unavailing.

B. Product Liability

A common view in resolving the issue of liability in the case of accidents involving autonomous vehicles is resorting to product liability law. This is because, while a regular car crash usually results from a human driver's action or inaction, a car crash by an autonomous vehicle will most likely result from its manufacture or design. This means that with the use of autonomous vehicles, the liability for car accidents will shift from the registered owner of the vehicle or the driver to the manufacturer, and will fall within the ambit of product liability laws. Thus, the development of autonomous vehicles will make product liability laws more relevant to transportation law.

Article 97 of the Consumer Act of the Philippines provides —

> Any Filipino or foreign manufacturer, producer, and any importer, shall be liable for redress, independently of fault, for damages caused to consumers by defects resulting from design, manufacture, construction, assembly and erection, formulas and handling and making up, presentation[,] or packing of their products, as well as for the insufficient or inadequate information on the use and hazards thereof.[134]

Applying the above provision, if an autonomous vehicle gets into a car accident wherein the vehicle itself was at fault, the victim may hold the manufacturer, producer, or importer of the autonomous vehicle liable.[135] The fact that the liability extends to the importer is especially crucial considering that companies who manufacture or produce autonomous vehicles may not be doing business in the Philippines and, hence, are beyond the jurisdiction of Philippine courts.

A product, however, is only considered "defective" when it does not offer the safety rightfully expected of it, taking relevant circumstances into consideration, including but not limited to:

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134. The Consumer Act of the Philippines [Consumer Act of the Philippines], Republic Act No. 7394, art. 97 (1992).

135. *See generally* Consumer Act of the Philippines, art. 97.

(a) presentation of product;

(b) use and hazards reasonable expected of it; [and]

(c) the time it was put into circulation.[136]

The provision explicitly states that the liability for damages is considered "independently of fault,"[137] imposing a strict liability upon manufacturers, producers, and importers.[138] Thus, all that is necessary for a victim to claim damages is to prove "that that product is defective or unreasonably dangerous and that he [or she] suffered damage as a result of the defect or danger posed by the product."[139] Notably, this is another law in Philippine jurisdiction wherein a person may be held liable for damages notwithstanding the absence of fault.

Whether or not an autonomous vehicle "does not offer the safety rightfully expected of it"[140] is a matter that courts will need to determine. If an autonomous vehicle is faced with a no-win scenario and it inevitably kills or injures an innocent bystander, is the manufacturer, producer, or importer civilly liable for damages or will *force majeure* extend as a defense?[141] Can the registered owner of the vehicle be held liable for negligence?[142] If the passenger of the autonomous vehicle is injured as a result of a crash, can they claim civil damages or will the doctrine of assumption of risk[143] or *caveat emptor*[144] apply?

The strict liability imposed serves to protect consumers by encouraging manufacturers, producers, and importers to take extra measures to ensure

136. Consumer Act of the Philippines, art. 97.

137. *Id.*

138. Edgardo P. Cruz, Consumer Protection: Beyond Lip Service, *available at* http://ca.judiciary.gov.ph/index.php?action=mnuactual_contents&ap=j7080 (last accessed Jan. 31, 2017).

139. *Id.*

140. Consumer Act of the Philippines, art. 97.

141. CIVIL CODE, art. 2183.

142. *Filcar Transport Services*, 674 SCRA at 128-29.

143. The doctrine of assumption of risk may be used as a complete defense in negligence cases. TIMOTEO B. AQUINO, TORTS AND DAMAGES 200 (2005).

144. Under the doctrine of *caveat emptor* or "let the buyer beware," "the consumer has no warranty of the quality or safety of the goods he buys. He cannot recover from the seller or manufacturer for defects in the product that render it unfit for ordinary purposes unless the latter acted fraudulently or misrepresented the quality of his goods." Cruz, *supra* note 138.

that their products are safe.[145] Experts, however, criticize that imposing strict liability may stifle innovation and discourage investment in the development of the technology.[146] In the Philippines, although companies may not manufacture autonomous vehicles, imposing strict liability may discourage companies from importing autonomous vehicles into the country.

VII. PRIVACY

Before, the focus of privacy protection was directed at the more "'classic' dimensions of privacy [—] [ ]body, home, and correspondence[ ][.]"[147] Hence, much focus was placed on ensuring physical boundaries, setting distances, and avoiding contact.[148] With technology, however, the physical boundaries have become less relevant and the focus has diverted to the protection of personal data.[149] This is especially relevant with regard to the use of autonomous vehicles.

In order to operate, autonomous vehicles are equipped with sensors and tracking devices.[150] This is necessary because the vehicle needs to know exactly where it is, where it needs to go, and what is around it. Thus, autonomous vehicles will necessarily gather a wealth of information on a user's daily activities.

The amount of data that an autonomous vehicle will possess will have huge potential value for marketing and other services. It will know where a person lives, where he or she works, and what his or her most frequented destinations are. The information held by an autonomous vehicle will have such a high commercial value and it is likely that manufacturers will want to exploit it. There is, however, no way of controlling it. What would this mean from the perspective of a person's right to privacy?

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145. *Id.*

146. Paula Herbig & James Golden, *Innovation and Product Liability*, 23 INDUS. MKT. MGMT. 245, 246 (1994).

147. Bart W. Schermer, *Surveillance and Privacy in the Ubiquitous Network Society*, 1 AMSTERDAM L. F. 63, 71 (2008) (citing P. BLOCK, HET RECHT OP PRIVACY (2002)).

148. Schermer, *supra* note 147 (citing JUDITH WAGNER DECEW, IN PURSUIT OF PRIVACY: LAW, ETHICS AND THE RISE OF TECHNOLOGY 12 (1997)).

149. Schermer, *supra* note 147.

150. Urmson, *supra* note 7.

In the Philippines, the right to privacy is protected under the Data Privacy Act of 2012[151] which likewise regulates the processing of personal information. One of the most commonly used principles used by data gatherers in order to justify the processing of personal data is consent. Under the law, however, consent must be

> freely given, specific, informed indication of will, whereby the data subject agrees to the collection and processing of personal information about and/or relating to him or her. Consent shall be evidenced by written, electronic[,] or recorded means. It may also be given on behalf of the data subject by an agent specifically authorized by the data subject to do so.[152]

While the above requirement is quite strict, whether or not it is complied with is another issue. This problem is already seen with the websites people visit or the smartphone applications consumers download after merely clicking to agree to the terms and conditions without actually reading the text. The fault, however, is not solely with the consumers. Oftentimes, the terms and conditions are lengthy and vague but consumers nonetheless accede without knowing or understanding what he or she has consented to for the sake of convenience. This brings about the danger that if consumers are not careful, it will become less obvious how, why, when, and where their personal data is processed. More alarmingly, it will become less clear as to who is in control of or who has access to this data. Considering the amount of personal information an autonomous vehicle will possess, consumer protection becomes a paramount issue which regulators need to address.

Aside from affecting the right to privacy of its passengers and owners, autonomous vehicles will also inevitably encroach upon the privacy of innocent bystanders. Autonomous vehicles will be equipped with high-technology cameras and global positioning systems that will allow it to record its surroundings and to keep track of its location. Thus, it will possess personal data not only regarding its passenger but also on other people who are around it. This is an even bigger issue since these people will not have given their consent to the processing of their personal data. On one hand, the law does not provide these individuals with a remedy to enforce their right to privacy. On the other hand, the recording may be necessary for an autonomous vehicle if it is to keep a record of its activities in the event a car

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151. An Act Protecting Individual Personal Information in Information and Communications Systems in the Government and the Private Sector, Creating for this Purpose a National Privacy Commission, and For Other Purposes [Data Privacy Act of 2012], Republic Act No. 10173, (2012).

152. *Id.* § 3 (b).

crash happens and there becomes a need to review the past events. With this in mind, how should the pursuit of safer motor vehicle travel be balanced with the protection of one's privacy?

Lastly, the system of an autonomous vehicle is also a concern of cybersecurity as it becomes susceptible to hacking. If a hacker gains access to the information possessed by the autonomous vehicle, it will compromise the safety of its passengers since he or she will know sensitive information about them. It also brings back the issue on liability and who will be responsible if a hacker successfully interferes with the system of the autonomous vehicle and causes an accident.

VIII. CONCLUSION

The goal is to find the necessary balance in the law wherein developers are not overexposed to liability because this would lead to a chilling effect on innovation.[153] At the same time, the law should also not underexpose it to liability because this would undermine the functions of the law, namely the prevention of accidents and compensation to victims.[154]

With regard to one's right to privacy, consumer protection and data privacy laws in this jurisdiction are currently inadequate to address issues of privacy brought about by new technologies. Lawmakers have to take extra measures to ensure that the personal data of consumers are protected. Furthermore, current laws do not provide a right to execute immediate measures to remedy the illegal collection of personal information and prevent the breach of privacy from occurring.

Autonomous vehicles will revolutionize the motor vehicle industry. These vehicles can significantly alter the way people live their lives. How the Philippines and the rest of the world react to this technology is crucial. If not acted upon properly, the world stands to lose an invention that can save lives and significantly change the way people live for the better. As the world waits in anticipation of what this technology may bring, what remains certain is that an exciting and interesting road lies ahead.

153. European Commission, Guidelines on Regulating Robotics (A Report for the Project RoboLaw) at 63, *available at* www.robolaw.eu/RoboLaw_files/documents/robolaw_d6.2_guidelinesregulatingrobotics_20140922.pdf (last accessed Jan. 31, 2017).

154. *Id.*