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Who's Driving That Car?: An Analysis of Regulatory and Potential Liability Frameworks for Driverless Cars

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WHO'S DRIVING THAT CAR?: AN ANALYSIS OF REGULATORY AND POTENTIAL LIABILITY FRAMEWORKS FOR DRIVERLESS CARS

Abstract: Driverless, or autonomous, cars are being tested on public roadways across the United States. For example, California implemented a new regulation in 2018 that allows manufacturers to test driverless cars without a person inside the vehicle, so long as the manufacturers adhere to numerous requirements. The emergence of these vehicles raises questions about accident liability and the reach of state regulation regarding driverless cars. To address these questions, it is beneficial to look at the liability framework for another artificial intelligence system, such as surgical robots. This Note will explore possible frameworks of liability before arguing in support of further regulation of driverless cars and hypothesize that the liability for driverless car accidents will likely shift from the driver to the manufacturer.

INTRODUCTION

On March 18, 2018, in Tempe, Arizona, Elaine Herzberg was walking her bicycle across Mill Avenue where it intersects with Curry Road.[1] Further down the street, a vehicle was traveling autonomously at about forty miles per hour in a forty-five miles per hour zone.[2] The vehicle struck and killed Ms. Herzberg, marking the first known pedestrian death caused by self-driving technology, despite the presence of a human safety driver at the wheel of the autonomous vehicle.[3] Tempe police released a video of the safety driver distracted and without her hands hovering above the wheel as many safety drivers are instructed to do.[4] The police, however, stated that

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[1] *See* Troy Griggs & Daisuke Wakabayashi, *How a Self-Driving Uber Killed a Pedestrian in Arizona*, N.Y. TIMES (Mar. 21, 2018), https://www.nytimes.com/interactive/2018/03/20/us/self-driving-uber-pedestrian-killed.html [https://perma.cc/2R7M-BE2J] (discussing an accident where a woman was killed by an autonomous car in Arizona, where there is limited regulation of autonomous vehicles); Daisuke Wakabayashi, *Self-Driving Uber Car Kills Pedestrian in Arizona, Where Robots Roam*, N.Y. TIMES (Mar. 19, 2018), https://www.nytimes.com/2018/03/19/technology/uber-driverless-fatality.html [https://perma.cc/8LAN-QH5K] [hereinafter Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*] (describing an accident where an autonomous vehicle, with a test driver in the front seat, hit a pedestrian, at the fault of the vehicle).

[2] Griggs & Wakabayashi, *supra* note 1.

[3] Griggs & Wakabayashi, *supra* note 1; Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1.

[4] *See* Griggs & Wakabayashi, *supra* note 1 (discussing a driverless car accident where pedestrian was struck and killed by driverless car).

the driver was not in the wrong, and that the car itself was to blame for this accident.[5] This accident brought safety concerns regarding driverless cars into fruition and reminded the public that driverless cars remain an experimental venture.[6]

Prior to this tragic accident, driverless cars had a relatively positive track record, despite a few accidents that were deemed the fault of humans.[7] For example, in November 2017, Las Vegas put a driverless shuttle vehicle on the road after a successful controlled trial.[8] Despite the vehicle's success during the testing stages, the shuttle crashed within hours of going on the road.[9] After the accident and subsequent investigation, the police indicated that the person, who was driving the semi-automatic truck that crashed into the shuttle, was at fault.[10] The prospect of widespread driverless cars has garnered promises of increased efficiency and safety, in addition to decreased traffic.[11] These positives, however, are coupled with public concerns of ethical and safety issues, particularly in light of the Tempe accident.[12]

Even prior to the accident in Tempe, there was widespread concern about giving driverless cars the power to make life-altering decisions when

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[5] *Id.*

[6] *See* Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1 (discussing how technology companies will have to prove to the public that autonomous vehicle technology is safe).

[7] *See* Griggs & Wakabayashi, *supra* note 1 (explaining this was the first known pedestrian death associated with autonomous vehicles); Hayley Tsukayama, *A Driverless Bus Got into a Crash During Its First Day on the Job*, WASH. POST (Nov. 9, 2017), https://www.washingtonpost.com/news/innovations/wp/2017/11/09/a-driverless-bus-got-into-a-crash-on-its-first-day/?utm_term=.68e5ade87c9f [https://perma.cc/KQ9D-RU6W] (providing details of an accident where a driverless shuttle in Las Vegas got into a crash, not at the fault of the vehicle, within hours of being on the road).

[8] Tsukayama, *supra* note 7; *see* Todd Spangler, *Self-driving Cars Programmed to Decide Who Dies During a Crash*, DETROIT FREE PRESS (Nov. 23, 2017), https://www.usatoday.com/story/money/cars/2017/11/23/self-driving-cars-programmed-decide-who-dies-crash/891493001/ [https://perma.cc/V257-C5WZ] (discussing how autonomous vehicles' programming must make split second decisions regarding who will be injured in the event of a crash).

[9] Tsukayama, *supra* note 7.

[10] *See* Regina Garcia Cano, *Las Vegas Launches Driverless Shuttle Bus. It Gets in a Crash Less Than Two Hours Later*, ASSOCIATED PRESS (Nov. 9, 2017), http://nationalpost.com/news/world/self-operating-shuttle-bus-crashes-after-las-vegas-launch [https://perma.cc/4BXT-RR9A] (reporting on an accident that occurred when a driverless shuttle in Las Vegas got into an accident after only hours of being on the road for the first time); Tsukayama, *supra* note 7 (explaining that a spokesperson for the autonomous car's manufacturer stated that the system functioned the way it was intended to).

[11] Cadie Thompson, *The 3 Biggest Ways Self-Driving Cars Will Improve Our Lives*, BUS. INSIDER (June 10, 2016), http://www.businessinsider.com/advantages-of-driverless-cars-2016-6 [https://perma.cc/F92E-3BKJ] (describing several benefits to widespread use of driverless cars).

[12] *See* Spangler, *supra* note 8 (expressing concern about ethical dilemmas and regulatory issues that often arise with talk of driverless cars); Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1 (noting safety concerns with autonomous technology).

faced with the prospect of a crash.[13] Some feel uncomfortable with a computer program making a split-second decision that could choose between harming its passenger or the surrounding cars.[14] In order to combat this dilemma or other malfunctions, California law used to require a person to be in the driver's seat of a driverless vehicle just in case they needed to take over.[15] But, in February 2018, just prior to the Tempe accident, the California legislature joined with other states and passed a law that no longer requires people to be in a driverless car during road tests.[16]

This change in regulation is significant because it eliminates the potential for people to mitigate in an instance where the driverless car malfunctions or the car faces a "trolley problem" scenario.[17] The trolley problem is a hypothetical, ethical dilemma that involves making a decision where both options will lead to third party harm.[18] Alternatively, removing people from driverless cars also eliminates the potential for people to make a hazardous situation worse by interfering with the autonomous vehicle's program-

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[13] Spangler, *supra* note 8.

[14] *Id.*; *see* Mark Remy, *Variations of the Trolley Problem*, NEW YORKER (Dec. 4, 2017), https://www.newyorker.com/humor/daily-shouts/variations-of-the-trolley-problem [https://perma.cc/95N4-KY3U] (discussing the "trolley problem" and other ethical and moral dilemmas). The ethical dilemma discussed above is commonly compared to "The Trolley Problem." Spangler, *supra* note 8. The Trolley Problem poses a situation where a person is walking along train tracks and sees a runaway trolley. Remy, *supra*. The trolley is headed for five people; however, they see a lever that would change the direction of the trolley so that it is only in the direction of one person. *Id.* This forces the person to choose between two bad outcomes. *Id.*

[15] CAL. CODE REGS. tit. 13, § 227.34 (amended 2018); *see* Johana Bhuiyan, *Driverless Cars Can Operate in California as Early as April*, RECODE (Feb. 26, 2018), https://www.recode.net/2018/2/26/17053898/driverless-cars-self-driving-california-dmv-remote-operated-autonomous-testing [https://perma.cc/NP7C-MX4T] (discussing a change in a California Department of Motor Vehicles (DMV) regulation allowing for public testing of autonomous vehicles without people in the car); Aarian Marshall, *Fully Self-Driving Cars Are Really Truly Coming to California*, WIRED (Feb. 26, 2018), https://www.wired.com/story/california-self-driving-car-laws/ [https://perma.cc/R529-WBJZ] (reporting on California's new 2018 regulation that details a process where autonomous vehicles can be tested without a person in the car).

[16] CAL. CODE REGS. tit. 13, § 227.38 (2018); *see* Bhuiyan, *supra* note 15 (discussing how the new California law requires that there be a remote operator of the vehicle who is ready to takeover the vehicle with a remote control as needed throughout the testing process); Marshall, *supra* note 15 (explaining how Arizona has no regulatory framework regarding self-driving cars while California has an entire regulatory system). Arizona does not have any set regulations regarding driverless cars and Arizona Governor Doug Ducey wants state agencies to take "any necessary steps" in support of driverless car testing. Marshall, *supra* note 15.

[17] *See* Bhuiyan, *supra* note 15 (using a chart to explain the decreased amount of human intervention on driverless car testing); Remy *supra* note 14 (explaining the trolley problem and how it creates an ethical dilemma); Spangler, *supra* note 8 (explaining how driverless cars can yield a no-win situation that arises from the vehicle being programmed in advance and with the inability to make ethical snap-decisions).

[18] *See* Remy, *supra* note 14 (describing the trolley problem as a moral dilemma); *supra* note 14 and accompanying text.

ming.[19] The decision to remove drivers from the wheel differentiates autonomous vehicles from other existing forms of artificial intelligence, such as surgical robots, which by design, require surgeons to operate the machinery and mitigate any damages caused by the robot.[20] Surgical robots have been in use for over twenty years, and while the case law is limited, they serve as an analogous example of litigation regarding artificial intelligence.[21] Surgical robots are not completely autonomous and require the control of surgeons, who are additionally available to perform regular surgery on the patient if the robot malfunctions.[22] An analysis and comparison of surgical robots and driverless cars will help determine whether regulating driverless cars brings this technology in the right direction regarding mitigation and liability litigation concerns.[23]

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[19] *See* CAL. CODE REGS. tit. 13, § 227 (allowing driverless cars to operate without a person inside the vehicle); Bhuiyan, *supra* note 15 (charting change in human intervention in driverless cars); Andrew J. Hawkins, *California Green Lights Fully Driverless Cars for Testing on Public Roads*, THE VERGE (Feb. 26, 2017), https://www.theverge.com/2018/2/26/17054000/self-driving-car-california-dmv-regulations [https://perma.cc/4H5Z-MX8L] (discussing the implications of California's fully autonomous car regulation and how it will positively impact driverless car companies).

[20] *See* CAL. CODE REGS. tit. 13, § 227.38 (allowing driverless cars to be tested without a person behind the wheel). *Compare* Hawkins, *supra* note 19 (explaining how California's new 2018 regulation no longer requires a person to be inside the car while it is being tested), *with How Does da Vinci Robotic Surgery Work?*, UNITY POINT HEALTH, https://www.unitypoint.org/cedarrapids/services-how-does-it-work.aspx [hereinafter *da Vinci Robotic Surgery*] (explaining how the da Vinci robotic system works when performing a surgery).

[21] *See* Mracek v. Bryn Mawr Hosp., 363 Fed. App'x 925, 926 (3d Cir. 2010) (discussing the burden of proof required for a plaintiff to prove malfunction versus doctor negligence); Brown v. Griffin, 505 S.W.3d 777, 778 (Ky. Ct. App. 2016) (explaining the necessity of expert testimony in surgical robot cases); Taylor v. Intuitive Surgical, Inc., 389 P.3d 517, 526–28 (Wash. 2017) (discussing strict liability and the standards for unavoidably unsafe products); Eliza Strickland *Autonomous Robot Surgeon Bests Humans in World First*, SPECTRUM (May 4, 2016), https://spectrum.ieee.org/the-human-os/robotics/medical-robots/autonomous-robot-surgeon-bests-human-surgeons-in-world-first [https://perma.cc/94RX-T6ZU] (discussing how surgical robots might have a similar trajectory to autonomous vehicles in that they start with the surgeon retaining a lot of control, and eventually become completely autonomous); *see also da Vinci Robotic Surgery*, *supra* note 20 (explaining how the da Vinci robotic system works when performing a surgery). The da Vinci is a surgical robot model that provides surgeons with a very magnified view of their patient and makes it possible for surgeons to operate in extremely small incisions. *da Vinci Robotic Surgery*, *supra* note 20. This makes recovery for patients more comfortable as their incisions are not as large. *Id.*

[22] *See Mracek*, 363 Fed. App'x at 926 (discussing how the surgeon converted a surgical robot surgery to a laparoscopic one when the robot malfunctioned); *Taylor*, 389 P.3d at 521 (describing how the surgeon in this case turned the surgical robot procedure into a traditional one when the robot malfunctioned); Strickland, *supra* note 21 (explaining how surgical robots currently embody the general concept of "supervised autonomy" by assisting surgeons rather than performing full operations for them).

[23] *See Mracek*, 363 Fed. App'x at 926 (discussing the burden of proof required for a plaintiff to prove malfunction versus doctor negligence); *Brown*, 505 S.W.3d at 778 (explaining the necessity of expert testimony in surgical robot cases); *Taylor*, 389 P.3d at 526–28 (discussing strict liability and the standards for unavoidably unsafe products); *da Vinci Robotic Surgery*, *supra* note

This Note will explore the viability and implications of truly autonomous cars, where people are not required to be inside, by comparing driverless cars with surgical robots.[24] Part I of this Note will discuss the background of autonomous vehicles, and how they are regulated in the United States, in addition to surgical robots and their liability framework.[25] Part II will conduct a comparison between surgical robots and driverless cars, focusing in particular on their levels of autonomy, mitigation implications, safety classifications, and expertise of the operators.[26] Part III will argue that providing a regulatory framework for driverless cars, while it has some drawbacks, is beneficial to society as a whole and is a step towards people's full enjoyment of the potential of driverless cars.[27] It will additionally argue that adopting strong driverless car regulations, like California's, will create a more clear liability litigation framework for driverless cars.[28]

I. THE MECHANICS: AN OVERVIEW OF RELEVANT HISTORY, REGULATIONS, AND LIABILITY FRAMEWORKS

As engineers get closer to finalizing driverless car models for the general public's use, questions about how these cars will change the current system of the roads loom.[29] Since driverless cars have not been publicly implemented, there is no relevant legal doctrine or case law that provides insight into the liability framework of autonomous vehicles.[30] It is therefore

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20 (describing a leading surgical robot system); Ashely Halsey III, *When Driverless Cars Crash, Who Gets the Blame and Pays the Damages?*, WASH. POST (Feb. 27, 2017), https://www.washington post.com/local/trafficandcommuting/when-driverless-cars-crash-who-gets-the-blame-and-pays-the-damages/2017/02/25/3909d946-f97a-11e6-9845-576c69081518_story.html?utm_term=.8d11 0073deb8 [https://perma.cc/EU5S-YC3U] (discussing the liability concerns regarding driverless car accidents and the numerous potential liable parties); Marshall, *supra* note 15 (explaining California's new 2018 regulation allowing driverless cars to be tested on public roads without a person inside); Spangler, *supra* note 8 (describing how autonomous vehicles must make fast decisions on the road that can have serious consequences on passengers and pedestrians); Clive Thompson, *Cities Without Signs*, N.Y. TIMES (Nov. 8, 2017), https://www.nytimes.com/interactive/2017/11/ 08/magazine/tech-design-autonomous-future-cars-100-percent-augmented-reality-policing.html [https://perma.cc/4HUC-SV4K] (describing what the roads might look like if all cars were autonomous).

[24] *See infra* notes 29–223 and accompanying text.

[25] *See infra* notes 29–123 and accompanying text.

[26] *See infra* notes 124–176 and accompanying text.

[27] *See infra* notes 177–206 and accompanying text.

[28] *See infra* notes 207–223 and accompanying text.

[29] *See* Spangler, *supra* note 8 (discussing ethical concerns about self-driving cars being programmed in advance to avoid certain things and not others); Thompson, *supra* note 23 (explaining how driverless cars might reduce accidents, improve traffic, and lead to more efficient fuel use).

[30] *See* Halsey, *supra* note 23 (discussing who might be liable when a driverless car gets into an accident, whether it be the car owner, manufacturer, or software developer); Yuki Noguchi, *Self-Driving Cars Raise Questions About Who Carries Insurance*, NPR (Apr. 3, 2017), https:// www.npr.org/sections/alltechconsidered/2017/04/03/522222975/self-driving-cars-raise-questions-

important to look at the legal doctrine applicable to other artificial intelligence to provide clarity for how the U.S. courts may decide who is liable when autonomous vehicles are involved.[31] This Part will discuss the history and current overview of autonomous cars, outline the legal doctrine of surgical robots, and briefly summarize liability case law for cars in general.[32]

A. A Brief History of Autonomous Technology

Robert Whitehead created the self-propelled torpedo in the 1860s, which was one of the first recorded uses of semi-autonomous technology.[33] Over time, semi-autonomous technology has evolved and, today, car companies have now gone so far as to create cars that park and brake themselves.[34] This technology, known as "driver-assist," utilizes sensors and

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about-who-carries-insurance [https://perma.cc/Q3KN-MVMC] (contemplating liability concerns of autonomous vehicles from an insurance perspective and which parties will hold the insurance when driverless cars become available to the public).

[31] *See* Halsey, *supra* note 23 (explaining the lack of clarity regarding driverless car liability); Noguchi, *supra* note 30 (explaining how driverless car accidents that have occurred in the testing phase have left questions unanswered about the insurance scheme for autonomous vehicles); Strickland, *supra* note 21 (explaining how surgical robots and driverless cars used to be similarly autonomous but driverless cars are now more autonomous than surgical robots).

[32] *See infra* notes 29–123 and accompanying text.

[33] E.W. Jolie, *A Brief History of U.S. Navy Torpedo Development*, S.F. MAR. NAT'L PARK ASS'N (Sept. 15, 1978), https://maritime.org/doc/jolie/part1.htm#page003 [https://perma.cc/HL8K-HSEU]; Marc Weber, *Where to? A History of Autonomous Vehicles*, COMPUT. HISTORY MUSEUM (May 8, 2014), http://www.computerhistory.org/atchm/where-to-a-history-of-autonomous-vehicles/ [https://perma.cc/4CDM-SCN9] (describing the history of autonomous vehicles including various propellers, airplanes, and automobile technology that has led to the autonomous automobile). Torpedoes are weapons used in combat that are sent to shoot down enemy targets. *See* Jolie, *supra*. The "self-propelled torpedo" was primarily used for defending naval ports and attacking by surprise. *Id.* This invention paved the way for boats and other motorized vehicles to develop automated steering. *Id.* In 1914, Lawrence Sperry was known to create the first successful autopilot in an airplane. William Scheck, *Lawrence Sperry: Genius on Autopilot*, HISTORYNET (Nov. 2014), http://www.historynet.com/lawrence-sperry-autopilot-inventor-and-aviation-innovator.htm [https://perma.cc/X9WQ-URPV]. Autopilot on airplanes today controls various aspects of flights, such as heading, altitude, course, speed, and more, without the pilot manually controlling each of these components. Melody Kramer, *Q&A With a Pilot: Just How Does Autopilot Work?*, NAT. GEO. (July 18, 2013), https://news.nationalgeographic.com/news/2013/07/130709-planes-autopilot-ask-a-pilot-patrick-smith-flying-asiana/ [https://perma.cc/87QU-B5RE]. These types of systems, however, still require the pilot to look over the controls and perform other functions involved with flying a plane. *Id.* Similar autopilot systems called "cruise control," where the driver does not have to press the gas pedal in order to control the speed of the car, have since been implemented for automobiles, however the driver must manually steer and brake the vehicle. Ishan Daftardar, *How Does the Cruise Control System in Cars Work?*, SCIENCE ABC (June 24, 2016), https://www.scienceabc.com/innovation/what-is-cruise-control-system-cars-work.html [https://perma.cc/5TGL-PFJW].

[34] Weber, *supra* note 33; *see* Doug Newcomb & Alex Colon, *The Best Driver-Assist Cars of 2018*, P.C. MAG. (Jan. 18, 2017), https://www.pcmag.com/article2/0,2817,2485278,00.asp [https://perma.cc/6VRX-KD79] (evaluating cars with driver assist features and explaining those features,

cameras on the car to detect where other cars are on the road, and can even select good parallel parking spots.[35] While these conveniences are helpful to drivers, the driver still maintains control over the vehicle and is able to intervene while the car performs these functions.[36]

Additionally, throughout history, many engineers have not only tried to create semi-autonomous vehicles, but have also tried to create fully autonomous vehicles that could almost drive themselves.[37] A few versions of these "driverless cars" were created in the early 20th century, however, these models relied on devices such as magnets or tracks to control the vehicles, as opposed to the fully autonomous cars that are being worked on today.[38] The first idea for a vehicle that could travel without direct human supervision came in 1925, and was put to test by Houdina Radio Control.[39] Houdina Radio Control controlled their "driverless car" by using radio technology in a regular car behind the "driverless car" model.[40] Next, in the 1950s, rather than using radios, Radio Corporation of America ("RCA") used electrical impulses to drive vehicles remotely.[41] RCA vehicles operated on "smart roads," which would give the vehicle above it electronic directions for steering, acceleration, and braking.[42] These roads were created in Princeton, New Jersey and Lincoln, Nebraska with the hope that roads across the coun-

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including blind spot assistance, lane departure prevention, forward collision prevention, active cruise control, and automated parking).

[35] Newcomb & Colon, *supra* note 34.

[36] *See* Aaron Turpen, *How Self-Parking Car Technology Works: The First Step to Autonomous Vehicles*, NEW ATLAS (Nov. 29, 2016), https://newatlas.com/how-self-parking-works/46684/ [https://perma.cc/2A98-UDTD] (describing in detail how self-parking car technology works utilizing sensors and navigational technology).

[37] *See* John Patrick Pullen, *You Asked: How Do Driverless Cars Work?*, TIME (Feb. 24, 2015), http://time.com/3719270/you-asked-how-do-driverless-cars-work/ [https://perma.cc/8JZF-YL39] (evaluating the current status of driverless cars, what their future looks like, and the types of equipment that will help driverless cars be the most successful); *Self-Driving Cars Explained*, UNION OF CONCERNED SCIENTISTS (Jan. 26, 2017), https://www.ucsusa.org/clean-vehicles/how-self-driving-cars-work#.Wk1N9lQ-eu4 [https://perma.cc/3TXR-CQK3] (explaining various technical features of driverless cars, including the general software design, radar and satellite technology, and more).

[38] *The Road to Driverless Cars: 1925–2025*, ENG'G (July 15, 2016), https://www.engineering.com/esignerEdge/DesignerEdgeArticles/ArticleID/12665/The-Road-to-Driverless-Cars-1925–2025.aspx [https://perma.cc/D28T-9N5E] [hereinafter *Road to Driverless Cars*] (explaining the history of autonomous vehicles that has led up to the present prospect of driverless cars).

[39] *'Phantom Auto' Will Tour City*, MILWAUKEE SENTINEL (Dec. 8, 1926), https://news.google.com/newspapers?id=unBQAAAAIBAJ&sjid=QQ8EAAAAIBAJ&pg=7304,3766749 [https://perma.cc/SJ8H-GHQW] (reporting on the phantom auto car that will run without a person inside the car and will be controlled externally); *Road to Driverless Cars*, *supra* note 38.

[40] *Road to Driverless Cars*, *supra* note 38.

[41] *Id.*

[42] *See id.* (discussing how electrical impulses could power a car that had sensors to detect the impulses in the road).

try could implement this system.[43] Unfortunately, this RCA system never took off, and did not become more widespread.[44]

   Modern self-driving car models are primarily guided by navigation systems and are a product of advancements in radar and computer software.[45] The first essential components are the navigation systems, which work like a map program, with the car deciding the best route while considering traffic data and other factors.[46] Additionally, these cars have radar, cameras, and lasers that help detect other vehicles, additional obstacles, and any other changes that might occur on the car's route.[47] For example, one of the most notable features of Google's self-driving car is a rotating light and radar sensor on top of the vehicle that detects potential hazards.[48] Driverless cars will function best when all other cars on the road utilize the same technology, allowing the cars to "talk" to each other.[49] When driverless cars are the only cars on the road, they can operate and "think" at a faster level than people, presumably making them more efficient and safe.[50] Finally, these vehicles are equipped with a computer program that turns the information gathered from these systems into actions such as steering, accelerating, or braking.[51] In sum, driverless cars are a function of a combination of many parts working together.[52]

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   [43] *Id.*

   [44] *Id.*

   [45] *See* Victoria Woollaston, *How Do Google's Driverless Cars Work?*, ALPHR (Apr. 4, 2016), http://www.alphr.com/cars/7038/how-do-googles-driverless-cars-work [https://perma.cc/B5UV-E2ZQ] (explaining how Google's 2016 driverless car model works).

   [46] *See id* (describing how global positioning systems (GPS) guide Google's driverless car).

   [47] *Id.*

   [48] *Id.*; *see* Skye Gould & Danielle Muoio, *Here's How Waymo's Brand New Self-Driving Cars See the World*, BUS. INSIDER (Jan. 18, 2017), http://www.businessinsider.com/how-does-googles-waymo-self-driving-car-work-graphic-2017-1 [https://perma.cc/B52C-5F64] (describing the technology behind Waymo's driverless cars, including their satellite and radar technology). This satellite operates by shooting lasers so that the car can detect what's around it. Gould & Muoio, *supra*.

   [49] *Pullen*, *supra* note 37; *see* Gould & Muoio, *supra* note 48 (detailing Waymo's driverless car initiative); Woollaston, *supra* note 45 (describing Google's 2016 driverless car model). The majority of accidents that have occurred with driverless cars that are currently on the road have been ruled the fault of the human driver as opposed to the driverless car. Alex Davies, *Google's Self-Driving Car Caused Its First Crash*, WIRED (Feb. 29, 2016), https://www.wired.com/2016/02/googles-self-driving-car-may-caused-first-crash/ [https://perma.cc/G9Y3-AEFA] (reporting that despite a record of accidents that were at fault of others, Google's driverless car was the cause of its first crash).

   [50] *See* Davies, *supra* note 49 (explaining how the first seventeen crashes of Google's driverless cars were due to human error).

   [51] Gould & Muoio, *supra* note 48; Woollaston, *supra* note 45.

   [52] *See* Gould & Muoio, *supra* note 48 (explaining how different companies work together to create each component of Waymo's driverless car); Woollaston, *supra* note 45 (describing different components of driverless cars).

Currently, some self-driving cars have already been introduced for testing purposes, but remain unavailable for purchase to the public.[53] This, however, has not prevented numerous accidents involving driverless cars from occurring.[54] In February 2016, a Department of Motor Vehicles (DMV) report in California indicated that one of Google's driverless cars was the cause of another autonomous crash, due to a last minute lane change.[55] Despite this accident, Google has continued to study, test and create new models of driverless cars.[56] Their results conclude that, while the majority of the accidents its cars were involved in were due to human error, there have been incidents where driverless cars have been at fault.[57] Driverless car accidents have also occurred in Pittsburgh, a city where testing of autonomous vehicles is permitted.[58] One accident involved a model created by Argo, a company backed by Ford, and another involved an autonomous Uber.[59] While engineers do their best to improve the technology of self-driving cars, it still has not been perfected, as evidenced by the Tempe, Arizona accident.[60] The results of Google's study also help predict that self-driving cars will be the most effective when they are the only vehicles on

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[53] *See* CAL. CODE REGS. tit. 13, § 227 (requiring manufacturers to abide by regulations to test driverless vehicles); Tsukayama, *supra* note 7 (citing numerous crashes involving driverless cars that were being tested by manufacturers).

[54] *See* Davies, *supra* note 49 (describing a recent crash involving one of Google's autonomous vehicles); Andrew J. Hawkins, *Ford-Backed Self-Driving Car Involved in an Accident That Sent Two People to the Hospital*, THE VERGE (Jan. 10, 2018), https://www.theverge.com/2018/1/10/16875066/argo-ai-self-driving-car-crash-pittsburgh-ford [https://perma.cc/4RA5-9Q96] (explaining an accident that occurred in Pittsburgh involving a driverless car).

[55] Davies, *supra* note 49.

[56] *See* Gould & Muoio, *supra* note 48 (explaining how Google is continuing to release new autonomous vehicles into the markets in California and Arizona); *see also* Davies, *supra* note 49 (explaining Google's dilemma of wanting to perfect the vehicles while also quickly getting them on the market).

[57] *See* Tsukayama, *supra* note 7 (explaining how human intervention behind the wheel of some driverless cars has caused accidents, rather than the driverless car themselves).

[58] Aaron Aupperlee, *Uber's Fleet of Self-Driving Cars in Pittsburgh Back on Road After South Side Crash*, TRIBUNE LIVE (Sept. 18, 2017), http://triblive.com/local/allegheny/12748396-74/ubers-fleet-of-self-driving-cars-grounded-in-pittsburgh-after-crash [https://perma.cc/4EW7-S9AY] (describing a driverless car crash that occurred in Pittsburgh that was not deemed the fault of the driverless vehicle).

[59] Hawkins, *supra* note 54. In the Argo model's accident, a truck driven by a human driver was at fault after going through a red light and ramming into it. *Id.*

[60] *See* Davies, *supra* note 49 (quoting Google's program director for their driverless car program who states that it is a challenge to weigh making the cars as perfect as possible with getting them on the market soon to prevent further human error behind the wheel); Griggs & Wakabayashi, *supra* note 1 (reporting that the driverless car was at fault in the Tempe, Arizona accident); Tsukayama, *supra* note 7 (explaining how driverless car models have yet to be deemed perfect, although there are arguments that they are safer than the cars that are on the road now); Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1 (reporting that despite having an emergency backup driver, the Uber driverless car hit a pedestrian causing the company to halt vehicle testing across the country).

the road, which would allow them to communicate with each other without human interference.[61] But, this creates a liability problem, as the cars themselves cannot be sued if their programing makes a wrong decision.[62] This liability problem, however, is not unique to driverless cars and additionally extends to other uses of artificial intelligence to help execute tasks formerly performed solely by people.[63]

B. How Some States Regulate Driverless Cars

California serves as a relevant example of a state that has consistently regulated its driverless car industry and has an entire regulatory code dedicated to the operation of testing driverless cars.[64] In contrast, other states such as Arizona, have much less driverless car regulation pertaining to manufacturer testing.[65] Arizona presently has an executive order in place that allows for the testing of driverless cars on public roads and only requires that the car has liability insurance and the person in charge of it has a driver's license.[66] California, however, recently shifted its regulation to more closely resemble that of states like Arizona by allowing driverless cars to operate without a person in the car in enumerated circumstances.[67]

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[61] *See* Pullen, *supra* note 37 (discussing how people cannot process data or information as quickly as driverless cars can, and how such cars will be able to efficiently "talk" to each other on the road); Thompson, *supra* note 23 (explaining how driverless cars can recognize signals and quickly process information).

[62] *See* Halsey, *supra* note 23 (questioning who would be sued if a driverless vehicle crashed); Noguchi, *supra* note 30 (discussing insurance implications of driverless cars and how the cars themselves might be able to shed light on who was at fault).

[63] *See Robotic Surgery and the Huge Risk of Legal Liability*, MOS MED. REC. REVS. (Mar. 6, 2017), http://www.mosmedicalrecordreview.com/blog/2017/03/robotic-surgery-and-the-risk-of-legal-liability.html [https://perma.cc/AU49-D9E8] (discussing how robotic surgery can subject hospitals and doctors to increased legal liability); *see also* Halsey *supra* note 23 (explaining a possible standard by which driverless car liability might be held to); Noguchi, *supra* note 30 (discussing insurance concerns with driverless cars).

[64] *See* Bhuiyan, *supra* note 15 (noting that California law requires an employee of a manufacturer to have remote access to a driverless vehicle in the case of an emergency); Marshall, *supra* note 16 (detailing the requirements for the new California 2018 regulation).

[65] Ottavia Zappala, *Why Automakers Flock to Arizona to Test Driverless Cars*, ARIZ. REP. (Dec. 26, 2017), https://www.usatoday.com/story/money/cars/2017/12/26/why-automakers-flock-arizona-test-driverless-cars/981840001/ [https://perma.cc/EG98-U7BT] (discussing how the lack of regulations in Arizona provide more lenient conditions for companies to test their autonomous vehicles).

[66] Zappala, *supra* note 65.

[67] *Id.*; *see* Daisuke Wakabayashi, *California Scraps Safety Driver Rules for Self-Driving Cars*, N.Y. TIMES (Feb. 26, 2018), https://www.nytimes.com/2018/02/26/technology/driverless-cars-california-rules.html [https://perma.cc/4ES7-3RG5] [hereinafter Wakabayashi, *California Scraps Safety Driver Rules*] (discussing various details of California's DMV regulation, which no longer requires a person in the driver's seat to take over in the event of an emergency but requires companies to control test vehicles remotely).

On February 26, 2018, California adopted a new administrative law regarding the regulation of driverless car testing in their state that allows autonomous vehicles to be tested without a person inside.[68] Additionally, the legislature created new regulations regarding both manufacturers and employees who are actually testing the vehicles without being inside.[69] California law lists numerous circumstances where there need not be a driver inside the vehicle whatsoever, but generally does require that there be a test driver in the car at all times.[70] In order for a manufacturer to test their driverless vehicle without a test driver present, they must first submit an application for a Manufacturer's Testing Permit and then meet the other requirements for testing driverless cars in the State of California.[71] Additionally, the new 2018 regulation lays out several specific requirements regarding the design and technology behind the driverless car that must also be met in order to drive without a test driver.[72] The new 2018 regulations also require the manufacturer of the driverless car have a "law enforcement interaction plan," which would make it possible for first responders to interact with the driverless car to help regulate traffic and in case of an emergency.[73] Finally, the manufacturer must maintain a training program for its remote operators and provide information regarding the program and what it entails.[74] Thus far, this California law only applies to test drivers as California does not allow personal driverless cars yet.[75] California additionally kept regulations that had been in place prior to the recent change in legislation.[76] For example, California law sets strict guidelines regarding who can act as an auton-

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[68] *See* CAL. CODE REGS. tit. 13, § 227 (explaining the circumstances under which driverless cars can be tested in the state of California).

[69] *Id.* § 227.04 (describing the necessary steps that manufacturers and their employees must take to test their driverless car on public roads).

[70] *See id.* § 227.38 (describing the necessary training, qualifications, and standards that manufacturers must uphold to test their autonomous vehicles with people inside of the car).

[71] *Id.*

[72] *Id.* First, the manufacturer must certify that they have given "written notification" to the jurisdiction where they will be operating that includes: (1) the design of the driverless vehicles; (2) which public roads the driverless vehicle will be tested on; (3) the first day that testing will take place; (4) days and times that the vehicles will be tested on jurisdiction's roads; (5) quantity and type of vehicles being tested; and (6) contact information for the individual tester and manufacturer of the driverless vehicle. *Id.* Additionally, a few technical requirements have been specified so other vehicles and remote operators can communicate with the vehicle being tested. *Id.*

[73] *Id.* § 227.38(e). The regulation notes that this plan is not static and should be reviewed and changed, as needed, on a regular basis. *Id.*

[74] *Id.* § 227.38(f). The trainings must include instruction on technologically advanced language and the "automated driving system," including emergency protocols. *Id.*

[75] *See id.* § 227.38 (applying regulation to manufacturing companies only).

[76] *See id.* (describing the necessary steps that a manufacturer must undergo in order to test a driverless vehicle without a person in the car); Wakabayashi, *California Scraps Safety Driver Rules*, *supra* note 67 (discussing how California DMV regulations have changed to no longer require a person in the car during driverless car testing).

omous vehicle test driver.[77] Additionally, there are numerous checks regarding a potential autonomous vehicle test driver's driving history.[78]

C. Surgical Robots and Their Liability Framework

Surgical robots have revolutionized medical care for patients by allowing surgeons to be less invasive, work in smaller areas, and be more precise than when performing the same surgery by hand.[79] Surgical robots assist medical surgeons and are used as a tool to make more precise cuts and incisions in the patient.[80] As surgical robots have been in existence for more than a decade, there has been limited litigation involving mistakes in surgeries performed by surgical robots.[81] While different from a truly autonomous machine, surgeons still hand over some control to the robots and subject

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[77] *Id.* §§ 227.02(c), 227.32. An autonomous vehicle test driver must (1) monitor the vehicle; (2) be in a position to control it if necessary; (3) work for the manufacturer; (4) obey all traffic laws and regulations, unless breaking the law would further promote safety; and (5) familiarize him or herself with the vehicle and its technology to ensure safety. *Id.* § 227.32.

[78] *See id.* § 227.34. The potential driver's vehicle, license number, and other information must be submitted to the DMV. *Id.* Additionally, the driver must receive an Autonomous Vehicle Testing Program Test Vehicle Operator Permit. *Id.* Moreover, the test driver must have been licensed for at least three years, cannot have any more than one "point" on their license, cannot have been the "at-fault driver" in a collision that resulted "in injury or death of any person," cannot have been found driving under the influence for ten years prior to their application, and must have completed the "autonomous vehicle test driver training program." *Id.*

[79] *da Vinci Robotic Surgery*, *supra* note 20; *see What Is Robotic Surgery?*, UCLA HEALTH, https://www.uclahealth.org/robotic-surgery/what-is-robotic-surgery [https://perma.cc/V49M-HV3C] (discussing how surgical robots allow surgeons to be more precise when performing urological, gynecological, cardiothoracic, and more general surgical procedures, and how when working properly, surgical robots cause less trauma, less scaring, and promote a faster recovery time); *What Is Robotic Surgery?*, ROBOTIC SURGERY CTR. NYU LANGONE HEALTH, https://med.nyu.edu/robotic-surgery/physicians/what-robotic-surgery [https://perma.cc/FXH6-P5BA] (explaining how robotic surgery works at NYU Langone Hospital). Surgical robots are expensive, averaging $1.5 million per machine. Reuters, *Rise of the Surgical Robot and What Doctors Want*, FORTUNE (July 28, 2016), http://fortune.com/2016/07/28/surgical-robot-development-intuitive-surgical-medtronic-google/ [https://perma.cc/E7AE-UU2Q]. These robots are becoming increasingly popular, however, and most top U.S. hospitals utilize this advancement. *Id.* Additionally, they are preferred by many doctors who say that they reduce fatigue and give more control when operating. *Id.*

[80] *da Vinci Robotic Surgery*, *supra* note 20; Reuters, *supra* note 79. Robotic surgeries are additionally known to offer minimally invasive options to patients. *da Vinci Robotic Surgery*, *supra* note 21. Patients of robotic surgeries, on average, have spent less time recovering in the hospital following robotic surgery. *Id.*

[81] *See* Mracek v. Bryn Mawr Hosp., 363 Fed. App'x 925, 927 (3d Cir. 2010) (finding that a surgical robot malfunctioned while performing surgery); Taylor v. Intuitive Surgical, Inc., 389 P.3d 517, 521 (Wash. 2017) (same); Homa Alemzadeh et al., *Adverse Events in Robotic Surgery: A Retrospective Study of 14 Years of FDA Data*, 11 PLoS ONE 1, 1 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4838256/ [https://perma.cc/S27C-LQ3G] (analyzing fourteen years of surgeries using surgical robots and finding that 1.4% of the 10,624 surgeries resulted in deaths, 13.1% resulted in patient injuries, and 75.9% of surgeries resulted in a device malfunction).

themselves to the possibility that the robot could make an error during surgery.[82] Surgical robots are a good comparison to driverless cars because of this relinquished control, the potential for surgeons to mitigate damages, and their liability structure.[83]

Current case law indicates that liability claims arising from surgical robots have included claims against the surgeons, the manufacturers of the robot, and the hospitals where the surgeries are performed.[84] When a mistake is made, it is often difficult to determine which party made the mistake or where the liability should fall because of the complexities of the device.[85] Therefore, the case law regarding surgical robots focuses a lot on expert testimony, the duty to warn, and negligence by the controlling surgeon.[86]

In 2017, in *Taylor v. Intuitive Surgical, Inc.*, the Supreme Court of Washington decided the manufacturer of a surgical robot model known as the da Vinci System was liable for its robot's surgical mistake.[87] A doctor with fifteen years of experience performed a robotic prostatectomy on the plaintiff, but the plaintiff's body mass index (BMI) vastly exceeded the recommended BMI for this type of surgery.[88] The surgeon nonetheless continued the surgery, causing serious complications.[89] Because of these complications, the surgeon converted the procedure to an open surgery and finished the surgery without the surgical robot.[90] After the surgery, however, the plaintiff had a poor quality of life due to these complications and even-

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[82] *See Mracek*, 363 Fed. App'x at 927 (finding a surgical robot malfunctioned while performing surgery); *Taylor*, 389 P.3d at 521 (same). *See generally* Alemzadeh, *supra* note 81 (conducting research regarding the instances where surgical robots caused injury or death and analyzing what the overall impact of these surgical robots has been).

[83] *See Mracek*, 363 Fed. App'x at 927 (describing how surgeon intervened when a robot malfunctioned during surgery); *Taylor*, 389 P.3d at 521 (same); Strickland, *supra* note 21 (discussing how surgical robots might have a similar trajectory to autonomous vehicles).

[84] *See Mracek*, 363 Fed. App'x at 926 (describing a claim against a surgical robot manufacturer); Brown v. Griffin, 505 S.W.3d 777, 778 (Ky. Ct. App. 2016) (describing a claim against a hospital and the manufacturer of the surgical robot used by that hospital); *Taylor*, 389 P.3d at 524 (explaining, for warning purposes, that the hospital, rather than the doctor, is considered the robot's buyer).

[85] Alemzadeh, *supra* note 81, at 2. It is sometimes difficult to figure out exactly what went wrong during a botched robotic surgery as detailed records are not always kept. *Id.* at 16. It is additionally difficult to distinguish human error from machine error, especially because human error is not always reported. *Id.*

[86] *See Mracek*, 363 Fed. App'x at 926 (explaining the standards for both expert testimony and the duty to warn in surgical robot cases); *Brown*, 505 S.W.3d at 782 (same); *Taylor*, 389 P.3d at 521 (discussing the potential negligence of a surgeon who performed surgery on a patient with a body mass index over the recommended limit).

[87] *See Taylor*, 389 P.3d at 521 (describing how a surgical robot malfunctioned during a surgery, requiring the doctor to perform an open surgery instead).

[88] *Id.* at 520–30.

[89] *Id.*

[90] *Id.* at 521.

tually passed away as a result.[91] In a complex analysis, the court looked at a number of relevant issues including the duty to warn, differing negligence standards, superseding causes, and mitigation of damages.[92] The court determined that the manufacturer of the da Vinci System did not satisfy their duty to warn the hospital by warning the doctor operating the "unavoidably unsafe" surgical robot.[93] Additionally, the court took a strict liability approach for the analysis because, although the product was considered "unavoidably unsafe," there was a failure to warn the hospital about the product.[94] Strict liability is normally applied to products liability cases in the way that the product was designed or created whereas negligence cases often occur when referring to the actual use of the product by the user.[95] The court additionally held that it was proper for the trial court to give jury instructions about the surgeon's superseding negligence and failure to mitigate.[96]

In 2016, in *Brown v. Griffin*, the Court of Appeals of Kentucky decided a medical malpractice suit brought by a patient against her surgeon and the hospital for a botched surgical robot procedure.[97] An important issue discussed in this case was the need for expert testimony to help the jury determine who was at fault and what standards to apply.[98] The plaintiff attempted to argue that an expert witness was not necessary to prove a breach of care

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[91] *Id.*

[92] *Id.* at 520–30.

[93] *See id.* at 527. The learned intermediary doctrine is a legal framework that allows manufacturers of "unavoidably unsafe" medical products to satisfy their duty to warn patients by warning the doctors who will be using the products instead. *Id.* The manufacturer has an additional duty to warn the hospital to whom they sold their medical equipment, which cannot be satisfied by warning the doctor. *Id.* at 525.

[94] *Id.* at 527. The court defines an unavoidably unsafe product as one where, "in the present state of human knowledge, are quite incapable of being made safe for their intended and ordinary use." *Id.* at 526. The court goes on to state that unavoidably unsafe products should be marketed and labeled as such. *Id.* If these products follow these rules, then they are not subject to a strict liability standard in analyzing their use. *Id.*

[95] *See* Patrick H. O'Neill, Jr., Note, *Unavoidably Unsafe Products and the Design Defect Theory: An Analysis of Applying Comment K to Strict Liability and Negligence Claims*, 15 WM. MITCHELL L. REV. 1049, 1050 (1989) (explaining how Comment K affects strict liability and negligence claims, and providing background on the strict liability legal theory). The policy rationale behind the strict liability standard is that the manufacturer or creator of a product is in a better position to protect the public against this product, and therefore the rule encourages them to prevent any potential harm. *Id.*

[96] *Taylor*, 389 P.3d at 529–30.

[97] *Brown*, 505 S.W.3d at 778–79. The surgery performed was a total laparoscopic hysterectomy with a left salpingo-oophorectomy and evaluation of the right ovary. *Id.* at 779. The surgeon defendant inspected the pelvis prior to the surgery. *Id.* During the procedure, however, the plaintiff sustained an injury that went unnoticed for days and required multiple surgeries to correct. *Id.*

[98] *See id.* at 781 (discussing whether expert testimony was necessary to explain the complicated issues that arose during the robotic surgery).

so long as the surgeon testified in a deposition.[99] The court disagreed with the plaintiff because a reasonable jury could not infer the standard of care required for a surgeon operating the machine[100] The court further reasoned that the lack of discernable evidence indicating the surgeon's negligence also supported the need for expert testimony.[101]

Similarly, six years earlier, in *Mracek v. Bryn Mawr Hospital*, in the U.S. Third Circuit Court of Appeals, a patient sued the manufacturer of the surgical robot, the surgeon, and the hospital for an injury associated with robotic surgery.[102] The court held that the patient could not establish a claim for strict liability or breach of warranty without an expert report or expert testimony.[103] These cases highlight the importance of expert testimony in situations where it is difficult for a lay juror to understand the facts due to the complexity of the surgical procedure, the level of required medical expertise, and the complexity of the robot itself.[104] Additionally, the need for experts in these cases illustrates the difference in knowledge between surgeons and lay people, as the majority of jurors have not attended medical school nor do they know how to perform surgery.[105]

Both product liability and design defect claims are also common in surgical robot litigation.[106] In 2011, in *O'Brien v. Intuitive Surgical, Inc.*, the U.S. District Court for the Northern District of Illinois dismissed claims involving pancreatectomy complications that were allegedly caused by the da Vinci surgical robot's defective design.[107] A design defect claim is a strict

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[99] *Id.*

[100] *Id.* at 782–83.

[101] *Id.*

[102] *See Mracek*, 363 Fed. App'x at 927. The plaintiff underwent a prostatectomy aided by a da Vinci Surgical Robot. *Id.* at 926. He claimed that during the surgery the system malfunctioned, causing the surgical team and the da Vinci representative to make failed attempts to make the system operational. *Id.* The surgeon opted to use laparoscopic equipment for the rest of the surgery instead of the robot as planned. *Id.* The plaintiff then suffered multiple additional injuries and was left to recover in the hospital for days following the procedure. *Id.*

[103] *Id.* at 927.

[104] *See id.* (explaining the necessity of expert testimony in surgical robot cases); *Brown*, 505 S.W.3d at 782–83 (explaining how surgical robot litigation is complex and would need expert testimony for juries to understand).

[105] *See How Do You Become a Surgeon?*, Top Master's in Healthcare Admin., https://www.topmastersinhealthcare.com/faq/how-do-you-become-a-surgeon/ [https://perma.cc/2RQK-HV8Y] (explaining the many steps necessary to become a surgeon, which include getting an undergraduate degree, going to medical school, and attending a residency program). *See generally Mracek*, 363 Fed. App'x at 927 (explaining how expert testimony can help jurors understand the complexity of surgical robots); *Brown*, 505 S.W.3d at 782–83 (discussing importance of expert testimony).

[106] *See* O'Brien v. Intuitive Surgical Inc., No. 10 C 3005, 2011 WL 3040479, at *1 (N.D. Ill. July 25, 2011) (dismissing a complaint because it failed to state that the manufacturer proximately caused the patient's injuries).

[107] *Id.*

liability claim and, therefore, the plaintiff was required to prove that the manufacturer proximately caused the malfunction that led to the injuries.[108] This required the plaintiff to prove that the machine, rather than the doctor, caused the injury.[109] Since the plaintiff failed to prove proximate cause, the case was dismissed in favor of the manufacturer.[110] This case highlights the difficulty of proving causation, especially when artificial intelligence and human oversight are intertwined.[111]

In addition to products liability, the use of surgical robots also raises the question of vicarious liability.[112] In each of the cases above, the plaintiffs brought suit against the doctor, the manufacturer, and the hospitals where these surgeries are performed, despite the fact that some doctors retain independent contractor status with the hospital.[113] When a doctor is classified as an independent contractor, they are not considered an employee, but the hospital can still be held liable for their negligence.[114] In addition to the liability concerns that these cases raise, they also highlight the way in which surgeons are able to mitigate the damages caused by the surgical ro-

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[108] *Id.* Proximate causation occurs when a party acts in a way that causes the injury, with no intervening cause, and without the action the injury would not have occurred. *Proximate Cause*, BLACK'S LAW DICTIONARY (10th ed. 2014).

[109] *O'Brien*, No. 10 C 3005, 2011 WL 3040479, at *1.

[110] *Id.*

[111] *See Mracek*, 363 Fed. App'x at 927 (discussing the need for plaintiffs to show that the defendant did in fact cause their injuries).

[112] *See* Jessica S. Allain, Comment, *From Jeopardy! to Jaundice: The Medical Liability Implications of Dr. Watson and Other Artificial Intelligence Systems*, 73 LA. L. REV. 1049, 1052, 1064–65 (2013) (discussing the implications of vicarious liability and how multiple parties can be responsible for the injuries that occur during one instance). Vicarious liability is where one individual can be held responsible for the acts of another individual through the principle of agency. *Id.* Common vicarious liability situations include employee and employer relationships, such as hospitals and doctor relationships. *See id.*

[113] *See* Clark v. Southview Hosp. & Family Health Ctr., 628 N.E.2d 46, 48 (Ohio 1994) (holding that hospitals can be held strictly liable for the negligence of their employed physicians); Allain, *supra* note 112, at 1062 (discussing liability for physicians and patients). An independent contractor relationship generally differs from an employer and employee relationship because, typically, a person or institution who hires an independent contractor is shielded from being held vicariously liable. *See Clark*, 628 N.E.2d at 48 (explaining that, because employers of independent contractors do not generally exhibit any control over the contractor, liability typically does not follow). There are certain instances, however, where hospitals who hire doctors as independent contractors can still be held liable for the actions of physicians when "(1) the hospital made representations leading the plaintiff to believe that the negligent physician was operating as an agent under the hospital's authority, and (2) the plaintiff was thereby induced to rely upon this ostensible agency relationship." *Id.* (quoting Albain v. Flower Hosp., 553 N.E.2d 1038, 1040 (Ohio 1990)).

[114] *See Clark*, 628 N.E.2d at 48 (stating that there are instances where a hospital can be held liable for the actions of a doctor even when they maintain independent contractor status (quoting *Albain*, 553 N.E.2d at 1040).

bots.[115] Putting aside concerns with liability, without the surgeons overseeing the surgery and having the ability to perform open surgery in the event of a malfunction, the people undergoing surgery could be put at risk.[116]

This analysis of surgical robots is helpful because it outlines the potential liability framework that could apply to driverless cars.[117] Even so, it is also important to briefly look at how liability is currently determined for normal car accidents.[118] In normal accidents, it is much easier to determine if the cause of the accident is either the car or one of the people involved.[119] Further, it is somewhat straightforward in these accidents to determine whether or not the drivers exercised reasonable care during the accident.[120] On the other hand, driverless cars are not so straightforward as they leave a liability gap when the computers that control the cars are forced to make a decision that they are not programed to make.[121] It is difficult to determine who is responsible for an unforeseeable event that is left to the judgment of a computer, as opposed to a human.[122] While there is a negligence standard

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[115] *See Mracek*, 363 Fed. App'x at 926 (describing how the surgeon immediately changed his surgery technique in response to the surgical robot's malfunction); *Taylor*, 389 P.3d at 521 (explaining how the surgeon was able to perform the surgery without the malfunctioning robot).

[116] *See Mracek*, 363 Fed. App'x at 926 (describing how the surgeon changed the type of surgery he was performing in response to the surgical robot's malfunction); *Taylor*, 389 P.3d at 521 (explaining how the surgeon performed an open surgery immediately after the surgical robot malfunctioned).

[117] *See* Strickland, *supra* note 21 (explaining how surgical robots' development might mimic that of autonomous vehicles by becoming more autonomous overtime).

[118] *See Car Accidents and Negligence: When You Are Liable for Another Person's Driving*, NOLO (Dec. 16, 2015), https://www.nolo.com/legal-encyclopedia/car-accidents-negligence-when-you-29731.html?utm_source=nolo-content&utm_medium=nolo&utm_campaign=nolo-related-products [https://perma.cc/F339-8KDT] [hereinafter *Car Accidents and Negligence*] (explaining how fault and liability are determined in car accident situations); Allister R. Liao, *Car Accidents and Police Reports*, NOLO, https://www.nolo.com/legal-encyclopedia/car-accidents-police-reports.html [https://perma.cc/SV2E-G83S] (discussing the importance of filing a police report during an accident to initiate an insurance claim).

[119] *Compare* Jeffery K. Gurney, Note, *Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Cars*, 2013 U. ILL. J.L. TECH. & POL'Y 247, 248 (arguing that the manufacturers of autonomous vehicles should be the ones liable for accidents occurring in autonomous mode), *with Car Accidents and Negligence*, *supra* note 118 (explaining how fault is determined for a regular car accident).

[120] *See Car Accidents and Negligence*, *supra* note 118 (describing how negligence and reasonable care analyses can help determine the legal cause of a car accident). Negligence and reasonable care are the standards often applied to car accidents. *Id.*

[121] *See* Spangler, *supra* note 8 (discussing some of the ethical dilemmas that arise from driverless cars making their own decisions); Tsukayama *supra* note 7 (discussing some of the processes in which computers are left to independently exercise their own judgment).

[122] *See* Gurney, *supra* note 119, at 257 (discussing some of the problems that arise with different kinds of driverless car passengers); Halsey, *supra* note 23 (proposing a potential framework for driverless car negligence); Noguchi, *supra* note 30 (explaining how driverless cars pose many questions for the insurance industry); Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1 (discussing that it is difficult for driverless car systems to predict the behavior of hu-

for the decision making of humans, no such standard currently exists for computers.[123]

II. THE CROSSOVER: COMPARING SURGICAL ROBOTS WITH DRIVERLESS CARS

Driverless cars and surgical robots are similar because they both employ, to some capacity, artificial intelligence.[124] The liability structure and method of operation of surgical robots helps shed light on the liability implications of California's new 2018 regulation.[125] This Section will compare surgical robots and driverless cars by analyzing the types of people who use each technology, how much control is retained by the users of each technology, and how each fits into the unavoidably unsafe framework.[126]

A. Who Uses the Technology?

Driverless cars and surgical robots are similar in that those who are using the mechanism are not the ones who have created the machine, nor are they likely to fully understand its mechanics.[127] For surgical robots, doctors who used to perform these surgeries "open," or without the robots, are now controlling robots to perform these surgeries in a less invasive way.[128] While many young doctors are now exposed to surgical robot training dur-

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mans); *see also* W. Jonathan Cardi, *Reconstructing Foreseeability*, 46 B.C. L. REV. 921, 922 (2005) (describing how foreseeability in recent times is framed as a duty or obligation).

[123] *See* Halsey, *supra* note 23 (questioning how the potential liability structure of driverless cars will affect the current system).

[124] Gurney, *supra* note 119, at 257 (arguing that manufacturers should maintain liability of driverless cars); Halsey, *supra* note 23 (discussing the liability concerns regarding driverless car accidents and the numerous potential liable parties); *What Is Robotic Surgery?*, *supra* note 79 (explaining how robotic surgery works).

[125] CAL. CODE REGS. tit. 13, § 227 (2018); *see* Gurney, *supra* note 119, at 257 (discussing manufacturers' liability for driverless car accidents and malfunctions); Halsey, *supra* note 23 (explaining potentially liable parties in driverless car situations); *What Is Robotic Surgery?*, *supra* note 79 (describing how robotic surgery works).

[126] *See infra* notes 127–176 and accompanying text.

[127] *See da Vinci Robotic Surgery*, *supra* note 20 (explaining how a surgical robot performs the instructing surgeon's commands, which it receives through hand and foot controls); Pullen, *supra* note 37 (discussing how people can relinquish control to driverless cars, which allows people to be taken to different destinations with no effort on their part).

[128] *See Exploring Surgery Options: Open vs. Minimally Invasive*, BEAUMONT (Mar. 31, 2017), https://www.beaumont.org/health-wellness/blogs/exploring-surgery-options-open-vs-minimally-invasive [https://perma.cc/W8ZZ-Q7TS] (comparing and contrasting traditional surgery with robotic surgery and outlining the various advantages and disadvantages of each). Open surgery is performed through a large, open cut in the skin. *Id.* Open surgery is the traditional approach, however, compared to newer innovations, it is now associated with "longer hospital stays[,] longer recovery[,] more pain[,] larger scars[, and] higher risks of complications such as bleeding and infection." *Id.*

ing medical school, more practiced surgeons did not receive this education in school and thus were in need of further training.[129] Therefore, surgeons are typically required to undergo specialized technical training in order to operate surgical robots.[130] Similarly, because driverless cars are not being sold to the public yet, generally, the only training programs in place are for safety test drivers.[131] Under California's new 2018 regulation, the manufacturers' employees that control the driverless cars are also required to undergo a technical training program.[132] In Arizona, however, a company called Waymo, formerly operating under Google's driverless car initiative, is spearheading the first public testing of driverless cars.[133] This is part of their initiative to make driverless cars more widespread across the country.[134] Waymo's public trial, called the "early rider" program, is for residents of Phoenix, Arizona and has a limited number of driverless cars on the road.[135] There is no mention of any official training program for those selected to participate in the "early rider" program.[136] This is in compliance with Arizona law given that it has no requirement for training test drivers.[137]

While driverless cars and surgical robots are similar in that those using the machinery are not initially familiar with the technology, the sophistication of those using each system are quite different.[138] Surgeons who operate

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[129] *Doctor Training Required*, SETON, https://www.seton.net/medical-services-and-programs/surgical-services/robotic-surgery/about-robotic-surgery/doctor-training-required/ [https://perma.cc/Q9U4-2EC6] (explaining the training required for doctors to operate a da Vinci Surgical System).

[130] *Id.* The da Vinci Surgical System requires technical training for all surgeons that use it. *Id.*

[131] *See* Fionnuala O'Leary, *Here's How Apple Is Training Their Self-Driving Car Engineers*, WONDER HOW TO (Apr. 21, 2017), https://driverless.wonderhowto.com/news/heres-apple-is-training-their-self-driving-car-engineers-0177226/ [https://perma.cc/S76U-34N2] (stating that experiments are still being conducted on driverless cars). Additionally, California's DMV regulation provides guidelines for training qualifications that test drivers must undergo. *See* CAL. CODE REGS. tit. 13, § 227.34 (explaining the process that a test driver must complete in order to be able to test a driverless car).

[132] *See* CAL. CODE REGS. tit. 13, § 227.34 (discussing the necessary qualifications and trainings that a manufacturer must undergo in order to test its vehicle without a person in the car).

[133] *See Waymo FAQ*, WAYMO, https://waymo.com/faq/ [https://perma.cc/F2AH-7S3U] (explaining that Waymo's driverless cars are currently being tested on public roads without any people in them).

[134] *Id.*

[135] *Early Riders*, WAYMO, https://waymo.com/apply/ [https://perma.cc/U8HG-MVYG]. The "early riders" program is only currently offered in the Phoenix-metropolitan area and interested parties are told to apply to the limited spots. *Id.* There is no mention of a training program on Waymo's website. *See Waymo FAQ*, *supra* note 133 (discussing the details of Waymo's driverless car program).

[136] *See Early Riders*, *supra* note 135 (explaining the application process for participating in the Waymo Early Rider program).

[137] Zappala, *supra* note 65.

[138] *Compare Early Riders*, *supra* note 135 (explaining how any person can apply to their program to test driverless cars), *with Doctor Training Required*, *supra* note 129 (describing the many years of education necessary in order for a person to become a surgeon).

using robots, such as the da Vinci system, have extensive medical knowledge beyond just the operation of the machine.[139] Doctors attend four years of medical school, complete a residency, and have continuous education throughout their careers.[140] During some surgeries, the robot does not do its job properly and the surgeon is forced to complete the surgery using a different technique without its help.[141] The surgeons' vast knowledge of how to perform surgery assists in damage control when a surgical robot does not function properly.[142] Alternatively, driverless cars are meant to be used by all people, just as regular cars are today.[143] In order to drive a regular vehicle, a person must be above a certain age, hold a learner's permit for a certain period of time, and pass both a written and driving test.[144] Yet, this becomes more complicated when factoring in the robot, because the robot is essentially supposed to do the entirety of the driving on its own.[145] This yields the question of whether a person who does not have a driver's license can "operate" a driverless car by themselves.[146] Depending on which direction legislation and technology goes, at some point in time, there might not be a requirement for passengers of driverless cars to be trained, and therefore a practical application of a driverless car could be to permit those without driver's licenses to use these cars.[147] Looking specifically at the new

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[139] *See How Do You Become a Surgeon?*, *supra* note 105 (describing the requirements for becoming a surgeon).

[140] *Id.*

[141] *See* Mracek v. Bryn Mawr Hosp., 363 Fed. App'x 925, 926 (3d Cir. 2010) (discussing how many hospital staff members were unable to get the surgical robot to perform properly after it malfunctioned); Taylor v. Intuitive Surgical, Inc., 389 P.3d 517, 521 (Wash. 2017) (explaining that the surgical robot malfunctioned during surgery).

[142] *See Mracek*, 363 Fed. App'x at 926 (discussing the surgeon's decision to perform laparoscopic surgery after the robot malfunctioned); *Taylor*, 389 P.3d at 521 (explaining how the surgeon mitigated the damage of the surgical robot by performing open surgery after its malfunction).

[143] *See Early Riders*, *supra* note 135 (explaining how any person can apply to Waymo's early rider program to test driverless cars).

[144] *See Driving Age by State*, VIRTUAL DRIVE, http://www.vdriveusa.com/resources/driving-age-by-state.php [https://perma.cc/D7PH-3AFA] (listing how old one must be in each state in order to obtain a learner's permit and describing the necessary steps to get a license); *You Can Do It! How to Pass A DMV Driving Test on Your First Attempt*, DRIVING TESTS (June 17, 2018) https://driving-tests.org/beginner-drivers/you-can-do-it-how-to-pass-a-dmv-driving-test-on-your-first-attempt/ [https://perma.cc/3ABK-G26E] (providing tips for written and road driving tests).

[145] *See* Jennifer Bradley, *Will You Need a Driving License in the Age of Self-Driving Cars?*, BBC NEWS (July 31, 2017), http://www.bbc.com/news/technology-40570592 [https://perma.cc/FDL8-PJ5L] (hypothesizing that people will still need their drivers licenses when using driverless cars to be able to take over in the case of an emergency or malfunction); Pullen, *supra* note 37 (discussing a potential for a person to take over a driverless vehicle).

[146] *See* Bradley, *supra* note 145 (discussing drivers' licenses in the age of driverless cars).

[147] *See* Srikanth Saripalli, *Are Self-Driving Cars the Future of Mobility for Disabled People?*, THE CONVERSATION (Oct. 5, 2017), http://theconversation.com/are-self-driving-cars-the-future-of-mobility-for-disabled-people-84037 [https://perma.cc/A76W-MV9C] (discussing how driverless cars could provide transportation for disabled people who would not otherwise be able to

California 2018 regulation, it seems that by allowing manufacturers to test drive their cars without people inside, the regulation lays the foundation for this type of transportation to exist.[148] Legislatures will have to weigh the utility of transporting people who are unable to drive by themselves with the safety concern of the driverless car malfunctioning, forcing the passenger of the car to take the wheel.[149]

B. Exerting Control

For both surgical robots and driverless cars, there is some element of people relinquishing control and entrusting artificial intelligence to perform dangerous and complicated tasks.[150] Despite this, an important difference between surgical robots and driverless cars is the amount of control the operators of each technology retain.[151] The surgeons operating surgical robots maintain more control than the users of driverless cars.[152] What makes driverless cars such a novel legal issue is the fact that people retain little to no control of the day-to-day operations of the cars, which makes the calculation of liability complex.[153] With surgical robots, there are potentially two main causes of error when injury occurs: (1) the doctor made an error before or during the operation of the surgical robot, or (2) the surgical robot malfunctioned and did not operate in the way it was supposed to.[154] There-

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operate a vehicle); *Self-Driving Cars Explained*, *supra* note 37 (describing how driverless car software works). For testing purposes, however, when there is a passenger in the front seat, they can take over the car in the event of an emergency. Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1.

[148] *See* CAL. CODE REGS. tit. 13, § 227 (stating that you do not need a person inside a driverless car in order to test it, under certain circumstances).

[149] *See Doctor Training Required*, *supra* note 129 (discussing training of surgeons for surgical robots); Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1 (describing an accident between a pedestrian and a driverless car).

[150] *See da Vinci Robotic Surgery*, *supra* note 20 (discussing the hand and foot controls that surgeons use to operate the surgical robot); *Self-Driving Cars Explained*, *supra* note 37 (explaining how, ideally, when people use a driverless car, they should not be required to take control of the vehicle); *What Is Robotic Surgery?*, *supra* note 79 (analogizing a surgical robot to a video game, where the surgeon controls the robot remotely).

[151] *Compare Self-Driving Cars Explained*, *supra* note 37 (explaining how people should have to do very little to operate a driverless car), *with What Is Robotic Surgery?*, *supra* note 79 (describing how a robotic system is similar to a video game, where the surgeon is required to move buttons to control the surgical robot).

[152] *Compare Self-Driving Cars Explained*, *supra* note 37 (explaining how people should be able to operate a driverless car without much effort), *with da Vinci Robotic Surgery*, *supra* note 20 (discussing the hand and foot controls that surgeons use to operate the surgical robot).

[153] *See* Halsey, *supra* note 23 (discussing a potential liability structure for driverless cars that includes the car determining the accident's causation); *Self-Driving Cars Explained*, *supra* note 37 (describing how people do little to control driverless vehicles).

[154] *See Mracek*, 363 Fed. App'x at 925 (stating that the plaintiff brought claims against both the manufacturer for products liability, and against the hospital for the surgeon's negligence dur-

fore, whether it be the surgeon operating the robot or the engineer who designed the robot, there are clear parties that the plaintiff can assign blame to.[155]

The difficulty with driverless cars is both the lack of human control and the heavy reliance on computer software and programming done ahead of time.[156] A potential problem that needs to be addressed is who is at fault when a driverless car faces something that its programming does not account for, including ethical dilemmas such as the trolley problem.[157] It may be difficult to figure out a tangible party to assign blame to, depending upon both the legal standard and the situation at hand.[158] If the standard is merely negligence, and the driverless car was programmed to perform the tasks that it would be reasonably expected to, then the programmer would likely not be at fault, so long as the instance was unforeseeable.[159] At the same time, a strict liability approach could also be taken, which would make the manufacturer liable regardless of foreseeability.[160]

An additional consideration regarding the machine operators' control is the speed at which an accident occurs during the operation of a surgical robot versus a driverless car accident.[161] As evidenced by the relevant case law,

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ing the surgery); Brown v. Griffin, 505 S.W.3d 777, 781 (Ky. Ct. App. 2016) (explaining that the plaintiff brought charges against the hospital and surgeon for the surgeon's negligence during a surgery involving a surgical robot).

[155] *Mracek*, 363 Fed. App'x at 925 (explain that the charges the plaintiff brought against both the hospital and the manufacturer of the robot); Brown v. Griffin, 505 S.W.3d at 781 (describing the plaintiff's charges against the hospital and surgeon).

[156] *See* Pullen, *supra* note 37 (explaining how a GPS, a radar system, and an information synthetizing system are all critical to turning a regular car autonomous); *Self-Driving Cars Explained*, *supra* note 37 (discussing how sensors, software controlling navigation, and driving are important features of autonomous cars).

[157] *See* Simson Garfinkel, *Hackers Are the Real Obstacle for Self-Driving Vehicles*, MIT TECH. REV. (Aug. 22, 2017), https://www.technologyreview.com/s/608618/hackers-are-the-real-obstacle-for-self-driving-vehicles/ [https://perma.cc/9294-DURG] (explaining how the nature of self-driving vehicles' computer software could lead to cyber-attacks, forcing vehicles to perform certain acts without the consent of the manufacturer or passenger); Patrick Lin, *The Ethics of Autonomous Cars*, THE ATLANTIC (Oct. 8, 2017), https://www.theatlantic.com/technology/archive/2013/10/the-ethics-of-autonomous-cars/280360/ [https://perma.cc/A7UH-4X7P] (discussing how self-driving cars will have to act with judgment to make decisions about how to react in an emergency situation); Spangler, *supra* note 12 (explaining how autonomous cars will often face ethical dilemmas that mimic the trolley problem); *supra* note 14 and accompanying text.

[158] *See* Halsey, *supra* note 23 (discussing the difficulties of assigning fault in autonomous vehicle crashes).

[159] *See id.* (suggesting that in order to determine the fault of a driverless car, it would be important to analyze if the driverless car was reasonable in its action, meaning that either a person at the wheel or another autonomous vehicle would not have done differently in the situation).

[160] *See* Allain, *supra* note 112, at 1067 (explaining states choose to pursue either a strict liability or negligence approach for product liability cases).

[161] *See* Alex Davies, *The Very Human Problem Blocking the Path to Self-Driving Cars*, WIRED (Jan. 1, 2017), https://www.wired.com/2017/01/human-problem-blocking-path-self-driving-cars/ [https://perma.cc/M2TC-ZWNU] [hereinafter Davies, *The Very Human Problem*] (highlighting

surgeons often have time to correct the mistakes of a surgical robot.[162] On the other hand, during a car accident that only takes a few seconds to occur, there is very little time to correct a driverless car's mistake.[163] Another issue that arises is the extent to which the jury will be able to make a technical, factual determination of who was responsible.[164] Both the Kentucky Court of Appeals in 2016, in *Brown v. Griffin*, and the Third Circuit Court of Appeals in 2011, in *Mracek v. Bryn Mawr Hospital*, placed a strong emphasis on the necessity of expert testimony to prove that the surgical robot caused the injury.[165] While the courts discussed the complex nature of the cases, they did not discuss whether it was caused by their medical or artificial intelligence issues.[166] Unlike surgery, however, driving a car is something done by many, which yields the question of whether expert testimony would be necessary for autonomous vehicle cases because of the familiarity of most jurors with driving cars in general.[167] But *driverless* car cases, however, are more complex because many jurors might not understand the technical code of the software

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the difficulties people face in intervening quickly in an emergency accident situation that a driverless car might face); *What Is Robotic Surgery?*, *supra* note 79 (discussing how surgeons maintain control the entire time they operate a surgical robot).

[162] *See Mracek*, 363 Fed. App'x at 927 (explaining how, when a surgical robot malfunctioned, the surgeon continued the procedure using the laparoscopic technique); *Taylor*, 389 P.3d at 521 (discussing how a surgeon mitigated the damage caused by a surgical robot that malfunctioned and completed the surgery using the traditional, open, method); *How Do You Become a Surgeon?*, *supra* note 105 (explaining the necessary education required to become a surgeon); *see also What Is Robotic Surgery?*, *supra* note 79 (explaining how surgeons need to control surgical robots the entire time they are using one during a surgical procedure).

[163] *See* Davies, *The Very Human Problem*, *supra* note 161 (describing how people are essentially "useless" in emergency situations regarding semi-autonomous vehicles because of distractibility and slow response time).

[164] *See Mracek*, 363 Fed. App'x at 927 (explaining the use of expert testimony in surgical robot cases); *Brown*, 505 S.W.3d at 782–83 (describing the necessity of expert testimony to establish the standard of care for surgical robot cases); Halsey, *supra* note 23 (describing a potential framework for the liability of driverless cars).

[165] *See Mracek*, 363 Fed. App'x at 927 (describing the importance of expert testimony in cases regarding robots); *Brown*, 505 S.W.3d at 782–83 (establishing that expert testimony is necessary for establishing the standard of care necessary for cases regarding surgical robots).

[166] *See Mracek*, 363 Fed. App'x at 927 (explaining the potential for juror confusion in complex litigation, such as surgical robots); *Brown*, 505 S.W.3d at 782–83 (emphasizing the importance of expert testimony in surgical robot cases).

[167] *See Expert Witnesses on Liability in Autonomous Vehicle Cases*, HG LEGAL RES., https://www.hg.org/article.asp?id=46691 [https://perma.cc/22YT-J35Q] [hereinafter *Expert Witnesses on Liability*] (predicting a rise in expert testimony in jury trials for autonomous vehicle cases because of the complexity of the technology); Jerry Hirsch, *253 Million Cars and Trucks on U.S. Roads; Average Age Is 11.4 Years*, L.A. TIMES (June 9, 2014), http://www.latimes.com/business/autos/la-fi-hy-ihs-automotive-average-age-car-20140609-story.html [https://perma.cc/H3TD-7DHW] (citing that in 2014, there were 253 million cars on the road in the United States).

embedded in these cars and how this software actually commands the car to perform different tasks.[168]

C. Safety and Warnings

Unavoidably unsafe products have strict rules about warning those who will use the product about its dangers.[169] A product that is "unavoidably unsafe" is one that is unable to be made safe for its "intended and ordinary use."[170] Surgical robots are classified as unavoidably unsafe and thus carry with them a duty to warn.[171] Driverless cars would likely have the same classification.[172] A driverless car, by virtue of being a car, puts its users in a somewhat harmful position, as cars can travel fast and have the potential of getting into an accident.[173] Therefore, it will be important for the manufacturers of driverless cars to provide ample warnings to all parties that will potentially be aboard a driverless car.[174] But it is unclear whether driverless cars require more warnings than standard cars.[175] If other states follow California's approach and implement a regulatory framework for driverless cars, it could mean that when driverless cars become available to the public, user warnings will be required by law because of their potential classification as unavoidably unsafe.[176]

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[168] *See Expert Witnesses on Liability*, *supra* note 167 (describing how expert witnesses are important in cases regarding autonomous vehicles because of the judge and jury's potential confusion).

[169] *See Taylor*, 389 P.3d at 528 (discussing the necessity of warnings for products deemed unavoidably unsafe).

[170] *Id.* at 526.

[171] *See id.* at 528 (classifying surgical robots as unavoidably unsafe). If a product is deemed unavoidably unsafe, then it is not held to the strict liability standard that most other products liability cases use, so long as there was adequate warning from the manufacturer of the product to the buyer. *Id.*

[172] *See id.* (defining unavoidably unsafe products); *see also* Olivia Solon, *Who's Driving? Autonomous Cars May Be Entering the Most Dangerous Phase*, THE GUARDIAN (Jan. 24, 2018), https://www.theguardian.com/technology/2018/jan/24/self-driving-cars-dangerous-period-false-security [https://perma.cc/4WBY-9GGY] (discussing some of the dangers of autonomous vehicles).

[173] *See* Solon, *supra* note 172 (expressing some safety concerns regarding driverless cars).

[174] *See Taylor*, 389 P.3d at 528 (discussing that case law dictates that products deemed unavoidably unsafe must have adequate warnings); Solon, *supra* note 172 (noting how autonomous vehicles are risky and have notable dangers).

[175] *See Taylor*, 389 P.3d at 528 (describing necessary warnings for unavoidably safe products); Solon, *supra* note 172 (detailing the dangers of autonomous vehicles).

[176] *See* CAL. CODE REGS. tit. 13, § 227 (outlining the requirements for testing driverless cars in the State of California); Bhuiyan, *supra* note 15 (explaining California's new allowance of completely autonomous cars to be tested); Mark Geistfeld, *Why the Next Person Hit by a Driverless Car Might Not Be Able to Sue*, TIME (Mar. 30, 2018), http://time.com/5221393/uber-autonomous-vehicle-death-settlement/ [https://perma.cc/4EJR-RMUY] (discussing the potential for users of driverless vehicles to waive their torts rights, just as many do for vaccines and other risky ventures).

III. Hitting the Road: How States Should Handle Regulation and Liability of Driverless Cars

The example of surgical robots can assist in analyzing the future liability structure for driverless cars.[177] There are, however, distinct differences in the way that these two machines operate that are important to consider from a legal perspective.[178] California's change in regulation in 2018 that allows manufacturers to test driverless cars without a person in the car is a positive step towards creating efficiency, and the decision's benefits outweigh its detriments.[179] Despite the many similarities between surgical robots and driverless cars, they differ in their requirement for a human operator, making it more important that those creating and testing driverless cars are regulated to insure their products are safe and work properly.[180] Additionally, California's new 2018 regulation is different than other deregulated states' regulations as it creates requirements manufacturers must meet in order to test their driverless cars without people inside them.[181] It lays out extensive guidelines and steps that manufacturers need to take in order to be approved to test their driverless vehicles without people, which will help ensure safety and be helpful in establishing a liability framework.[182] This Section will argue that all states should adopt detailed regulations pertaining to driverless cars because it provides clear guidelines for manufacturers to follow

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[177] CAL. CODE REGS. tit. 13, § 227 (2018). *See generally* Mracek v. Bryn Mawr Hosp., 363 Fed. App'x 925, 925–27 (3d Cir. 2010) (holding that a plaintiff must produce clear evidence of injury to avoid summary judgment); Brown v. Griffin, 505 S.W.3d 777, 777–83 (Ky. Ct. App. 2016) (holding that expert testimony is necessary for juries to understand surgical robot cases); Taylor v. Intuitive Surgical, Inc., 389 P.3d 517, 517–30 (Wash. 2017) (holding that manufacturers have a duty to warn about their unavoidably unsafe products).

[178] *Compare Self-Driving Cars Explained*, *supra* note 37 (explaining the mechanics behind self-driving cars), *with What Is Robotic Surgery?*, *supra* note 79 (describing how a surgical robots are used to perform surgery).

[179] *See* CAL. CODE REGS. tit. 13, § 227. *Compare* Thompson, *supra* note 11 (discussing the many benefits of driverless cars, such as improved fuel efficiency and traffic), *with* Solon, *supra* note 172 (explaining how driverless cars will likely go through a period of growing pains when they are first implemented).

[180] *See Mracek*, 363 Fed. App'x at 925–27 (holding that plaintiff must produce clear evidence of injury to avoid summary judgment); *Brown*, 505 S.W.3d at 777–83 (holding that expert testimony is necessary for juries to understand surgical robot cases); *Taylor*, 389 P.3d at 517–30 (holding that manufacturers have a duty to warn about their unavoidably unsafe products). *Compare Self-Driving Cars Explained*, *supra* note 37 (explaining the mechanics behind self-driving cars), *with What Is Robotic Surgery?*, *supra* note 79 (describing how surgical robots are used to perform surgery).

[181] *See* Bhuiyan, *supra* note 15 (explaining California's new 2018 regulation allowing completely autonomous vehicles to be tested on roads); Zappala, *supra* note 64 (discussing Arizona's limited regulations regarding driverless cars and how they attract companies who wish to test driverless cars there).

[182] *See* CAL. CODE REGS. tit. 13, § 227.38 (providing guidelines for manufacturers to test their vehicles on public roads, holding them accountable for these tests).

leading to greater road safety and shifting liability to manufacturers.[183] It will additionally argue that allowing driverless cars on the road without people will help alleviate traffic, create more efficiency, and positively impact the environment.[184]

A. The Importance of Providing Clear, Detailed Regulations

California's new 2018 regulation is positive in that it provides a solid structural framework for the future regulation of driverless cars in the public market.[185] This framework puts a large burden on the manufacturers to ensure that their vehicles are safe, their operators are well-trained, and the general public is protected from vehicle testing.[186] For example, the California 2018 regulation mandates that the remote operators of the driverless cars are trained extensively and technically before the manufacturer's vehicles can see the road.[187] The California 2018 regulation's guidelines could lay foundation for future training programs for riders of driverless cars and therefore, similar regulations should be adopted by other states.[188] When considering the recent autonomous vehicle accident that occurred in Tempe, Arizona that killed a pedestrian, it is important to note that Arizona has very limited regulation of driverless car testing.[189] The idea of a training program is supported by the surgical robot framework, as surgeons who operate surgical robots are required to go through additional trainings in order to use these machines.[190] While implementing a training program for all future riders of driverless cars certainly has its limitations in practice, holding the manufacturers, at a minimum, to these standards will increase safety and help hold manufacturers legally accountable for their mistakes.[191] Perhaps if there was a

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[183] *See infra* notes 185–206 and accompanying text.

[184] *See infra* notes 207–223 and accompanying text.

[185] *See* CAL. CODE REGS. tit. 13, § 227.38 (discussing the necessary steps manufacturers must take in order to test driverless vehicles without a person inside).

[186] *See id.* (creating strict guidelines for manufacturers).

[187] *See id.* (discussing the training required by those who are in charge of operating and controlling the vehicle from outside).

[188] *See id.* (creating a comprehensive list of regulations and procedures for driverless vehicle testing).

[189] *See* Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1 (explaining how Arizona is a state with little autonomous car regulation, as opposed to other states such as California, with extensive regulations); Zappala, *supra* note 65 (explaining that Arizona only requires that the person in charge of the vehicle have insurance).

[190] *See* CAL. CODE REGS. tit. 13, § 227 (explaining that the manufacturer employed operators of autonomous vehicles must be trained); *Doctor Training Required*, *supra* note 129 (explaining that surgeons must be trained in order to operate surgical robots on top of their medical training); Reuters, *supra* note 79 (describing surgical robots' place in hospitals and noting that doctors working there are trained specially to use them).

[191] *See* Halsey, *supra* note 30 (explaining the complexities involved in figuring out who will be responsible in the case of a driverless vehicle accident).

mandatory training program in place in Tempe, the driver would have been
better prepared to change the course of the vehicle or would have been
more attentive at the wheel.[192] Despite this, it is important to note that the
accident was deemed to be at the fault of the vehicle, not the driver and that
driverless cars are still in the testing phase.[193]

Other states should adopt detailed regulations for driverless car testing
and use California's new 2018 regulation as an example.[194] By holding
manufacturers to high standards, the California 2018 regulation puts the
burden on the manufacturers to account for any concerns that may arise, as
they are in the best position to internalize these costs.[195] The manufacturers
of driverless cars are sophisticated individuals who were able to create
complex machines, whereas the future users of driverless cars are average
people with no specialized knowledge.[196] Additionally, when driverless cars
are likely classified as unavoidably unsafe, regulation can encourage and
help manufacturers adequately warn future driverless car patrons.[197] If a
person purchases a driverless car for their own use and properly maintains
it, it would be unfair to fault them for any accidents when the vehicle is
supposed to independently drive itself.[198] Instead, California's approach
puts the responsibility on the manufacturer, forcing them to adjust their pro-
tocol to fit within the preexisting institutions.[199] For example, California's
2018 regulation puts the responsibility on the manufacturer to make driver-
less cars accessible for first responders in case of an emergency, which will

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[192] *See* CAL. CODE REGS. tit. 13, § 227 (outlining training requirements for test drivers in the
state of California); Bradley, *supra* note 145 (highlighting that driverless cars are still very much
in the testing phase); Griggs & Wakabayashi, *supra* note 1 (explaining that the Tempe crash was
the fault of the driverless car and that driverless cars remain in the testing phase); Wakabayashi,
Self-Driving Uber Car Kills Pedestrian, *supra* note 1 (describing the Tempe accident and explain-
ing how Arizona has very limited driverless car regulations).

[193] *See* Griggs & Wakabayashi, *supra* note 1 (describing how the driverless car in the Tempe
crash caused the accident and that driverless cars have not been perfected).

[194] *See* CAL. CODE REGS. tit. 13, § 227 (laying a framework for future regulations regarding
driverless vehicles); Wakabayashi, *California Scraps Safety Driver Rules*, *supra* note 67 (discuss-
ing how driverless cars can defy "human boundaries")

[195] *See* CAL. CODE REGS. tit. 13, § 227 (providing clear regulations for manufacturers to abide
by in order to test driverless cars publicly).

[196] *See id.* (creating specific regulations for manufacturers who want to test driverless vehi-
cles); *Early Riders*, *supra* note 134 (explaining how anyone can sign up to be an early rider, with
limited availability); Hirsch, *supra* note 167 (discussing how there were 253 million cars in the
road in 2014).

[197] *See Taylor*, 389 P.3d at 528 (defining unavoidably unsafe products); Solon, *supra* note 172
(describing some of the dangers of autonomous vehicles).

[198] *See* O'Neill, *supra* note 95 (discussing the strict liability framework and its history).

[199] *Id.*

help create a smoother, safer transition when driverless cars are eventually sold to the public.[200]

The approach of putting the majority of liability on the manufacturers of the vehicle is somewhat different from surgical robot litigation, which typically will spread liability across numerous parties.[201] The fact that surgical robots are operated by highly sophisticated surgeons, whereas driverless cars are intended to be used by ordinary people, creates an important legal distinction.[202] The parties often include the manufacturer of the robot, the hospital, and the operating surgeon.[203] In addition to surgeons' sophistication and specialized knowledge, their retained control regarding the robot makes it difficult to tell who was at fault in a situation, and therefore plaintiffs often list both as parties when they sue.[204] This differs from a situation where two driverless cars get into an accident where there are no people operating either vehicle.[205] The liability would most likely fall to the manufacturer whose car was at fault as it should, unless one of the owners of the driverless car failed to maintain their vehicle properly or otherwise proximately caused the accident.[206]

B. Allowing Cars to Drive Themselves

By allowing manufacturers to test driverless cars without people inside, California is setting the stage for driverless cars to operate autonomously when they become available to the public.[207] There are many bene-

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[200] *Compare* CAL. CODE REGS. tit. 13, § 227 (outlining comprehensive regulations for driverless car testing), *with* Zappala, *supra* note 65 (explaining how the Arizona governor signed an order only requiring driverless car testers to hold insurance).

[201] *See Mracek*, 363 Fed. App'x at 926 (deciding claims brought against the hospital and manufacturer of surgical robot); *Brown*, 505 S.W.3d at 778 (deciding claims brought against the hospital and surgeon); *Taylor*, 389 P.3d at 520 (deciding claims brought against the hospital and manufacturer of the surgical robot).

[202] *Compare Self-Driving Cars Explained*, *supra* note 37 (discussing a person's limited role in the operation of a driverless car), *with What Is Robotic Surgery?*, *supra* note 79 (explaining how a surgical robot requires the operating surgeon to use buttons to control the robot remotely, similar to a video game).

[203] *See Mracek*, 363 Fed. App'x at 926 (describing the plaintiff's claims against the hospital and surgical robot manufacturer); *Brown*, 505 S.W.3d at 778 (discussing the plaintiff's claims against the hospital and surgeon); *Taylor*, 389 P.3d at 520 (explaining the plaintiff's claims against the hospital and surgical robot manufacturer).

[204] *See* Alemzadeh, *supra* note 81, at 16 (discussing the difficulty in figuring out what occurred during surgical robot error).

[205] *See* Pullen, *supra* note 37 (discussing how two driverless cars might interact with each other).

[206] *See* Wakabayashi, *California Scraps Safety Driver Rules*, *supra* note 67 (discussing manufacturers' liability in driverless car accidents); *supra* note 10 and accompanying text.

[207] *See* CAL. CODE REGS. tit. 13, § 227 (laying out a training program for employees of manufacturers who will be in charge of remotely controlling the testing of fully autonomous vehicles);

fits to taking this approach, including creating more efficiency.[208] For example, a driverless car can drop off one person at location A and then drive itself somewhere else to pick up a different person from location B.[209] This could decrease the number of cars on the road, which would be beneficial to reduce traffic and environmental degradation.[210] Driverless cars could also become a method of transportation for those otherwise unable to drive.[211] This has the potential to greatly improve the quality of life for people who could not drive a car prior to this innovation.[212]

Despite this potential, allowing cars to drive themselves does leave open the question of the ability level someone must have in order to ride in a driverless car.[213] For example, problems could arise due to driverless cars' inability to orient an exiting passenger, such as a child dropped off at the wrong location, or a blind person unable to see their surroundings.[214] New regulations can address these issues and others that may arise as driverless cars become available to the public.[215]

During surgical robot procedures, many lives have been saved by surgeons who were able to operate normally when a surgical robot malfunc-

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Bhuiyan, *supra* note 15 (explaining how California's new 2018 regulation allows fully autonomous vehicles to be tested on the road).

[208] *See* Thompson, *supra* note 11 (discussing the ways that driverless cars can benefit and improve people's lives).

[209] *See* Wakabayashi, *California Scraps Safety Driver Rules*, *supra* note 67 (describing the benefits of self-driving cars as "not be[ing] limited by human boundaries").

[210] *See Maximizing the Environmental Benefits of Autonomous Vehicles*, PHYS.ORG (Feb. 15, 2018), https://phys.org/news/2018-02-maximizing-environmental-benefits-autonomous-vehicles.html [https://perma.cc/K948-NDEV] (discussing some of the benefits of driverless cars, including environmental and traffic advantages).

[211] *See* Bradley, *supra* note 145 (explaining the necessity for people to take control in the case of an accident involving a driverless car); Saripali, *supra* note 147 (discussing how disabled people might need further assistance regarding driverless cars, but how they would still be helpful).

[212] *See* Saripali, *supra* note 147 (explaining how driverless cars could tremendously benefit disabled people).

[213] *See* CAL. CODE REGS. tit. 13, § 227 (allowing cars to be tested without drivers in the state of California); Bradley, *supra* note 145 (discussing how it is not uncommon for people to have to take control during a driverless car accident); Saripali, *supra* note 147 (explaining how driverless cars might not be enough for disabled people as they would need additional assistance in their operation); *Self-Driving Cars Explained*, *supra* note 37 (explaining how self-driving cars can help drive people around who might not be able to drive otherwise).

[214] *See* Gurney, *supra* note 119, at 256–57 (explaining that a person who is disabled may greatly benefit from the use of a driverless car, but will likely be unable to intervene when the car malfunctions, which creates safety concerns); Saripali, *supra* note 147 (explaining how driverless cars would require further assistance for disabled people to operate, but still benefit them overall).

[215] *See* Gurney, *supra* note 119, at 256–57 (explaining how a person with disabilities could benefit from using a driverless car but would also face safety risks regarding their inability to intervene if the vehicle malfunctioned); Saripali, *supra* note 147 (explaining the simultaneous benefits and safety concerns regarding people with disabilities using driverless cars).

tioned.[216] The surgeons were able to react quickly and mitigate the damages caused by the robot.[217] Very differently, California's new 2018 regulation does not require that any person be inside a driverless car, therefore eliminating the possibility for an expert to take over from inside the vehicle during a malfunction.[218] But, unlike surgery, in many instances it would be impossible for a human to intervene to prevent an accident that happens in mere seconds.[219] In other circumstances, however, where no accident occurred, it could be possible for a person to step in and drive the vehicle if the driverless function of the car stopped working.[220] This is an additional concern regarding the passengers' requisite ability level.[221] While these are important concerns, they can be addressed through regulation and special programs when driverless cars are offered to the public.[222] Overall, allowing driverless cars to operate without a person in the car has more benefits than it does detriments, so long as there are clear guidelines for when this is appropriate, as this will promote safety and clarity for those testing driverless cars.[223]

CONCLUSION

Advancements in artificial intelligence have been plentiful in the past few decades. Robots and other forms of artificial intelligence have been created in order to help people improve their livelihood and safety. Driver-

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[216] *See* Herb Greenberg, *What Happens When the Surgical Robot Malfunctions?*, CNBC (Mar. 19, 2013), https://www.cnbc.com/id/100565260 [https://perma.cc/UDP5-57NW] (discussing instances where surgeons stepped in when a surgical robot malfunctioned).

[217] *Id.*

[218] *See* CAL. CODE REGS. tit. 13, § 227; Wakabayashi, *California Scraps Safety Driver Rules*, *supra* note 67 (explaining how California's new law no longer requires manufacturers of driverless cars to conduct tests with people inside the vehicle).

[219] *See* Wakabayashi, *Self-Driving Uber Car Kills Pedestrian*, *supra* note 1 (recognizing that there are some circumstances where a car crash occurs too quickly for a person to intervene and mitigate).

[220] *See* Gurney, *supra* note 119, at 256–57 (describing a hypothetical situation where a person could have intervened with a malfunctioning driverless car had they been able to); Bradley, *supra* note 145 (discussing how people sometimes have to take over a driverless vehicle to avoid an accident).

[221] *See* CAL. CODE REGS. tit. 13, § 227 (allowing California to test drive autonomous vehicles without a person inside the vehicle but requiring someone overseeing the testing to have a license); Gurney, *supra* note 119, at 256–57 (describing a hypothetical situation regarding a disabled person unable to take control of a malfunctioning autonomous vehicle).

[222] *See* Greenburg, *supra* note 216 (discussing instances where surgeons stepped in when a surgical robot malfunctioned).

[223] Wakabayashi, *California Scraps Safety Driver Rules*, *supra* note 67 (predicting that the implementation of driverless cars will likely shift the liability from the driver to the manufacturer in the event of a crash). *Compare* Thompson, *supra* note 11 (discussing the many benefits of driverless cars, such as improving fuel efficiency and lessening traffic), *with* Solon, *supra* note 172 (explaining how driverless cars will likely experience problems when they are first implemented).

less cars in particular are designed to elevate people from driving long distances, reduce the number of accidents on the road, and prevent dangerous drunk driving. Driverless cars are slowly being tested and perfected, and will soon be in the market for the lay person to purchase. California instated a new regulation in 2018 that now allows manufacturers to test their driverless cars without any passengers in the car, so long as they follow a series of rules. The impact of this rule, and other questions regarding the future liability framework of driverless cars, can be answered by looking at how the law handles the liability of surgical robots.

Driverless cars and surgical robots are similar because they both utilize artificial intelligence in an industry that previously relied strictly on human intelligence. Surgical robots, however, are still much more reliant on people than driverless cars. Surgeons can quickly mitigate the damage caused by a surgical robot malfunction by going in and conducting surgery in a more traditional manner. People, however, might not always be able to prevent an accident by manually operating a driverless car. Additionally, the sophistication of surgeons and their retained control over the surgical robots make them more likely to become a party in a liability suit, as opposed to a lay person who owns a driverless car. California's statute sets the stage for manufacturers to internalize the costs of creating the safest vehicles, and therefore forces them to face the burden in the case of a lawsuit. California's approach to regulating driverless cars differs from other states such as Arizona. In the wake of the accident in Tempe Arizona, it will be interesting to see if Arizona joins California in providing pro-consumer safety regulations for their driverless car testing program.

If other states follow California in their regulation of driverless cars, it could possibly slow down the creation of driverless cars, as it is potentially putting more liability and pressure on manufacturers. Driverless cars, however, appear to be the way of the future. They can create efficiency, change people's quality of life, and foster positive impacts on the environment. Driverless cars will soon be available to the public, and only time will tell if other states will follow California's steps towards regulation and how future liability will be structured.

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