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Hands off the Wheel: The Role of Law in the Coming Extinction of Human-Driven Vehicles

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HANDS OFF THE WHEEL

THE ROLE OF LAW IN THE COMING EXTINCTION OF HUMAN-DRIVEN VEHICLES

*Tracy Hresko Pearl**

"To our children's grandchildren, a horse may be as much of a curiosity as the buffalo is to us today . . . Some persons will feel badly about this, but the progress of civilization must not be checked for sentimental reasons. As for the horse, we can waste no sympathy on him. He has had his day, and it has been a good long day, too, and he will always live in history and be embalmed forever in poetry and art."

-N.Y. TIMES, June 10, 1894¹

"Since its introduction in the United States in 1895, the motor vehicle has been the most significant force shaping the development of modern American civilization."

-James J. Flink²

In 1905, angry mobs attacked automobiles in New York City at least thirteen times, throwing stones and committing other acts of violence in protest of this new method of travel.³ The mob violence became so intense during the summer that police officers had to be deployed to provide protection for motorists along several city thoroughfares.⁴ While the anger of these mobs may seem misplaced to modern eyes, it was understandable at the time. In less than a decade, city streets in the United States had changed drastically.⁵ The first 100 years of transportation in America had

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¹ Editorial, *The Passing of the Horse*, N.Y. TIMES, June 10, 1894.

² JAMES J. FLINK, AMERICA ADOPTS THE AUTOMOBILE, 1985-1910 2 (1970).

³ CLAY MCSHANE, THE AUTOMOBILE: A CHRONOLOGY OF ITS ANTECEDENTS, DEVELOPMENT, AND IMPACT 32 (1997).

⁴ FLINK, *supra* note 2, at 65-66.

⁵ CLAY MCSHANE & JOEL A. TARR, THE HORSE IN THE CITY: LIVING MACHINES IN THE NINETEENTH CENTURY 168 (2007).

been limited to horse travel and travel by foot.⁶ By the end of the 19th century, however, the number of methods of transportation had exploded.⁷ Suddenly, in addition to horse-drawn carriages and pedestrians, cities had steam trains, horsecars (a form of horse-drawn trams), electric trolleys, elevated trains, bicycles, and automobiles.⁸ This new mix of traffic increased the risk for city residents substantially, and it was this heightened risk, rather than a mere resistance to change, to which the protesters were responding:

Accidents involving horses were not unusual before the horsecar appeared on the scene, but they did not necessarily involve interactions between a quasi-technical device—the horse, its attachments, and raises—and the vulnerable human body. By the earliest years of the twentieth century, the mix of horse-drawn traffic, bicycles, cars, and pedestrians on city streets had become quite dangerous.⁹

Automobiles, as the newest—and arguably most novel—addition to this mix, were a natural focal point for citizen rage. One legal scholar writing at the time described them as “repulsive,” “a nuisance,” an “inconvenience,” and even a “veritable terror.”¹⁰ Whether this reputation was well-deserved was highly questionable at best, something citizens realized as time passed.¹¹

A little over 110 years later, citizens are again throwing rocks.¹² In December 2018, the *New York Times* reported that citizens of Chandler, Arizona had launched “nearly two dozen attacks” on driverless vehicles over the prior two years.¹³ Waymo, a prominent company involved in the development of fully autonomous vehicles, was testing autonomous vans in Chandler during that time period, and citizens were extremely unhappy.¹⁴ They slashed tires, pelted the vans with rocks, tried to run them off the road, screamed at them as they passed by, and even threatened test-riders with guns.¹⁵ These attacks seemed to be a reaction, at least in part, to the

⁶ See *id.* at 177.

⁷ *Id.* at 168.

⁸ *Id.*

⁹ *Id.*

¹⁰ H. B. Brown, *The Status of the Automobile*, 17 YALE L.J. 223, 225 (1908).

¹¹ Clay McShane & Joel Tarr, *The Decline of the Urban Horse in American Cities*, 24 J. OF TRANSPORT HIST. 177, 186 (2003).

¹² Simon Romero, *Wielding Rocks and Knives, Arizonans Attack Self-Driving Cars*, N.Y. TIMES, Dec. 31, 2018, <https://www.nytimes.com/2018/12/31/us/waymo-self-driving-cars-arizona-attacks.html>.

¹³ *Id.*

¹⁴ *Id.*

¹⁵ Ryan Randazzo, *A Slashed Tire, A Pointed Gun, Bullies on the Road: Why do Waymo Self-Driving Vans Get So Much Hate?*, AZ CENTRAL, Dec. 11, 2018,

killing of a female pedestrian by a self-driving Uber car in nearby Tempe, Arizona earlier in the year, and to other risks perceived to be associated with these vehicles.¹⁶ They may also have been a reaction to the potential of these vehicles to “unleash colossal changes in the American society . . . ranging from eliminating jobs for drivers to ceding control over mobility to autonomous vehicles.”¹⁷ “People are lashing out justifiably,” one journalist remarked, “There’s a growing sense that the giant corporations honing driverless technologies do not have our best interests at heart.”¹⁸

The rock-throwing in 1904 did not succeed in eliminating automobiles from U.S. roads. Quite the contrary. By 1908, a whopping 253 U.S. companies were manufacturing automobiles, and by 1912, New York had more motor vehicles than horse-drawn carriages.¹⁹ By 1912, “Ford [had] 7,000 dealerships in the United States, at least one in every town with a population of over 2,000.”²⁰ The transition from horse-drawn carriages to motor vehicles in U.S. cities had taken a mere ten years.²¹ The rock throwing of 2018 does not appear to be working, either. As of mid-2019, consumers in the U.S. can purchase semi-autonomous vehicles, and fully autonomous vehicles do not appear far behind.²² Indeed, the National Highway Traffic Safety Administration (NHTSA) recently stated that “the rapid development of emerging automation technologies means that partially and fully automated vehicles are nearing the point at which widespread deployment is feasible.”²³ IHS Automotive, moreover, has projected that there will be over fifty million self-driving cars on U.S. roads by 2035, and that “nearly all of the vehicles in use are likely to be self-driving cars or self-driving commercial vehicles sometime after 2050.”²⁴

In moments of profound societal change like these, citizens and legal scholars alike may be inclined to turn to lawmaking in an attempt to take control of the change, slow it down, or stop it from happening altogether. This is an inclination that

<https://www.azcentral.com/story/money/business/tech/2018/12/11/waymo-self-driving-vehicles-face-harassment-road-rage-phoenix-area/2198220002/>.

¹⁶ Romero, *supra* note 12.

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ MCSHANE, THE AUTOMOBILE, *supra* note 3, at 40.

²⁰ *Id.* at 45.

²¹ See MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 172-77.

²² See Tracy Hresko Pearl, *Compensation at the Crossroads: Autonomous Vehicles & Alternative Victim Compensation Schemes*, 60 WM. & MARY L. REV. 1827, 1839-41 (2019).

²³ NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., 2016 UPDATE TO PRELIMINARY STATEMENT OF POLICY CONCERNING AUTOMATED VEHICLES 1 (2016), http://www.aamva.org/NHTSADOTAutVehPolicyUpdate_Jan2016/.

²⁴ Press Release, IHS, Self-Driving Cars Moving into the Industry’s Driver’s Seat (Jan. 2, 2014), <http://press.ihs.com/press-release/automotive/self-driving-cars-moving-industrys-drivers-seat>.

I have explored in the autonomous vehicle context at some length in my work, noting in one paper that, since 2011, states have been rushing to pass laws and regulations pertaining to fully autonomous (Level 4 and 5) vehicles, even though such vehicles are not yet available to consumers and are likely several years away from market.²⁵ Unsurprisingly, this rush to legislation has resulted in hastily conceived and roughly drafted laws that are, thus far, both overly broad and unduly narrow.²⁶ It has also created a patchwork of inconsistent rules and regulations across the fifty states, a state of affairs that has been a source of tremendous concern to automobile manufacturers.²⁷

This current situation mirrors that at the turn of the twentieth century, as American society shifted from horses to automobiles. Connecticut passed the first motor vehicle law in U.S. history in 1901, but was quickly followed by other states and municipalities, all of whom attempted to manage this new form of technology in a variety of ways: licensure, changes to traffic patterns, and new transportation regulations, to name just a few.²⁸ By 1907, the number and varieties of state motor vehicle laws were so high that both the American Automobile Association and the automotive industry lobbied Congress “for a federal motor vehicle licensing and registration law, hoping to preempt state legislation,”²⁹ something that the automotive industry is doing yet again today in the autonomous vehicle context.³⁰

Psychologist Abraham Maslow once wrote, “I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail.”³¹ As legal scholars, our first response to emerging technology is often to propose new regulations, lobby for new statutes, draft amendments to existing ones, or even advocate for changes to our adjudicatory institutions, all in an effort to preemptively address issues—real or perceived—that we have identified. That has certainly been my own inclination as I have researched and written about autonomous vehicles over the last five years.³² However, after spending the last year studying the history of the transition between

²⁵ Tracy Hresko Pearl, *Fast & Furious: The Misregulation of Driverless Cars*, 73 N.Y.U. ANN. SURVEY OF AM. L. 19, 44-45 (2017).

²⁶ *Id.* at 47-67.

²⁷ *Id.* at 45-46.

²⁸ MCSHANE, THE AUTOMOBILE, *supra* note 3, at 28-39.

²⁹ *Id.* at 36.

³⁰ Pearl, *Fast & Furious*, *supra* note 25, at 45-46.

³¹ ABRAHAM H. MASLOW, THE PSYCHOLOGY OF SCIENCE 15-16 (1966).

³² See, e.g., Pearl, *Compensation at the Crossroads*, *supra* note 22, at 1876-89 (advocating for the creation of a victim compensation fund to serve as an alternative to the tort system in the handling of autonomous vehicle crash cases); Tracy Hresko Pearl, *Hands on the Wheel: A Call for Greater Regulation of Semi-Autonomous Cars*, 93 IND. L.J. 713, 738-51 (2018) (recommending both federal and state regulation of semi-autonomous vehicles); Pearl, *Fast & Furious*, *supra* note 25, at 67-71 (proposing changes to existing state autonomous vehicle).

horses and motor vehicle, and transportation history in the U.S. more generally, I have become convinced that legal scholars—and law and technology scholars, in particular—need to spend more time reflecting on larger and more abstract questions that we rarely address in law and technology scholarship: how and why massive societal transitions occur, how citizens cope with those changes, and what role law—be it statutory, regulatory, or common—should play in the process.

This paper argues that legal scholars have a tendency to overestimate the importance of law in moments of technology-driven, transformative societal change. Utilizing numerous examples of technology-driven societal change over the last century, but focusing on the transition from horses to automobiles in particular, I argue that law is only one vector of promoting safe adoption of new technologies. I also argue that hasty legislation or overzealous legal responses may, in fact, overly complicate or hinder that process in undesirable ways. While, on the one hand, statutory or regulatory product bans, time, place, and manner ordinances, and common law litigation have historically played an important role in technology-driven societal transformation, new economic incentives, changes in the convenience profile of older technologies, and evolving consumer preferences appear to play a far more significant role in achieving meaningful and lasting change. The importance of those latter three factors should provide law and technology scholars with some peace of mind. They suggest that the need to legislate and regulate proactively in response to emerging technology may be limited and that changes in, for instance, the insurance market and consumer behavior will solve many of the problems that we foresee. I predict, therefore, that these non-legal factors will be substantially more important than lawmaking in the transition between human-driven and fully autonomous vehicles in the coming decades, and that they will eventually lead to the extinction of human-driven vehicles on U.S. roads altogether.

In Part I of this paper, I describe the development of autonomous vehicles in the U.S. and argue that their entry onto the market will likely mirror the introduction of human-driven automobiles onto the market at the turn of the 20th century. In Part II, I explore the role of law in this transition. Namely, I describe how product bans, time, place, and manner ordinances, and common law litigation have contributed to the adoption of new products and to societal change. In Part III, I explore the corresponding role of reactions that do not involve law—new economic disincentives, changes in convenience profiles, and consumer preference—and argue that these factors play more significant roles during times of significant technology-driven societal change. In Part IV, I reflect upon the limited relevance of law during times of dynamic social change and draw broader conclusions about what those observations should mean for law and technology work more generally.

I. BACKGROUND

Autonomous vehicles, also known as driverless cars, “are those that do not require real-time human input to operate or navigate.”³³ Instead, these vehicles “use various sensors and computer software to collect and process information about the surrounding environment,”³⁴ and then use algorithms rather than driver decision-making to “maintain all aspects of the vehicle’s operation, such as navigating the best route to the intended destination, or directing that vehicle’s responses to hazards encountered during the trip.”³⁵ These algorithms are not static, but “learn” and improve over time:

[T]he software developed by manufacturers of these vehicles will not pre-define a vehicle’s response to . . . hazards. Rather, the software for autonomous vehicles will be given an ultimate goal by the manufacturer, such as (using an oversimplified example) “determine best response to impending collision,” and the vehicle will decide via algorithms what the best response to a given situation will be. Moreover, the computer will start learning from its environment the moment that vehicle leaves the sales lot, constantly running scenarios or experiments to determine possible outcomes based on the factors to which the vehicle is exposed. Based on its own analysis of data and outcomes, the computer’s algorithm, and thus the vehicle’s response, will continually change with a unique response to any situation the vehicle might encounter. The vehicle will also have the capacity to “learn” from other vehicles, and its algorithm will change to incorporate their responses to road situations.”³⁶

As discussed at greater length below, semi-autonomous vehicles are already available to consumers and on U.S. roads, with fully autonomous vehicles expected to arrive on the market within the next five to ten years.³⁷

A. Benefits of Autonomous Vehicles

Manufacturers, government agencies, and scholars believe that, by taking humans out of the proverbial driver’s seat and replacing them with sophisticated sensors and lightning-quick computers, autonomous vehicles can significantly reduce

³³ Kyle L. Barringer, *Code Bound and Down . . . A Long Way to Go and A Short Time to Get There: Autonomous Vehicle Legislation in Illinois*, 38 S. ILL. U. L.J. 121, 127 (2013).

³⁴ *Id.* at 122.

³⁵ Alfred R. Cowger, Jr., *Liability Considerations When Autonomous Vehicles Choose the Accident Victim*, 19 J. HIGH TECH. L. 1, 2 (2018).

³⁶ *Id.* at 2-3.

³⁷ See *infra* notes 59-65 and accompanying text.

the number of accidents, injuries, and fatalities on U.S. roads each year.³⁸ One scholar notes:

Traffic crashes are the primary cause of death of Americans ages fifteen to twenty-four. With the implementation of driverless cars, researchers predict fatality rates could ultimately fall to 1% of current rates. Even if autonomous vehicles constituted only 10% of total cars on the road, it would save 1,100 lives per year. With 90% penetration, the U.S. would save 21,700 lives and have 4.2 million fewer crashes.³⁹

Even if you remain skeptical that computers can outperform human drivers on the road, it is not a matter of dispute that autonomous vehicles, since they can neither drink nor text, have the potential to drastically reduce the amount of drunk and distracted driving that takes place in this country, both of which significantly contribute to the number of motor vehicle-related injuries and fatalities each year.⁴⁰

Autonomous vehicles have a number of other potential benefits, as well. They could turn daily commute time into “usable time” during which riders can work (thus

³⁸ See, e.g., Evan Ackerman, Study: Intelligent Cars Could Boost Highway Capacity by 273%, IEEE Spectrum, Jun. 8, 2016,

<https://spectrum.ieee.org/automaton/robotics/artificial-intelligence/intelligent-cars-could-boost-highway-capacity-by-273> (“I don’t care how good of a driver you are (or you think you are): your car, being for all practical purposes a robot, can digest a huge amount of data and make a decision about the best course of action to take in approximately the same amount of time it takes for you to move your foot from the gas to the brake.”); Google, *Google Self-Driving Car Project Monthly Report: May 2016*, GOOGLE, May 2016,

<https://static.googleusercontent.com/media/www.google.com/en//selfdrivingcar/files/reports/report-0516.pdf> (“Our self-driving cars are designed to see 360 degrees and not be distracted, unlike human drivers, who are not always fully aware of their surroundings.”); Adeel Lari *et. al.*, *Self-Driving Vehicles and Policy Implications: Current Status of Autonomous Vehicle Development and Minnesota Policy Implications*, 16 MINN. J. L. SCI. & TECH. 735, 750 (2015) (“By far the greatest implication referenced by those in the field is related to safety and convenience.”); National Highway Traffic Safety Administration, Preliminary Statement of Policy Concerning Automated Vehicles (2013) (“NHTSA is encouraged by the new automated vehicle technologies being developed and implemented by automakers and others. These technologies have the potential to reduce significantly the many thousands of fatalities and injuries that occur each year as a result of motor vehicle crashes.”).

³⁹ Neal Katyal, *Disruptive Technologies and the Law*, 102 GEO. L.J. 1685, 1688 (2014).

⁴⁰ Pearl, *Hands on the Wheel*, *supra* note 32, at 722-23.

enhancing productivity), read, sleep, or relax.⁴¹ They will give the elderly and people with physical and cognitive disabilities far greater and more convenient access to transportation, a significant benefit as our population ages.⁴² Autonomous vehicles also stand to double the capacity of roads and increase fuel efficiency, as they will likely to be able to drive much faster and much closer together than human-driven cars.⁴³ Lastly, autonomous vehicles will nearly eliminate the need for parking in dense urban areas where space is limited as they will be able to “drop their owners off at work and return home.”⁴⁴ In short, autonomous vehicles are “posed to be the next great transformative technology,” having a “significant impact on how we live, work, and use our time,” all while addressing “many enduring social needs”⁴⁵

B. Stage of Development

Vehicular autonomy is being developed and introduced to the consumer market in phases. In an attempt to describe the myriad vehicles being produced and sold during this evolution, NHTSA adopted a six-level measure of vehicular autonomy in 2016:⁴⁶

- Level 0: Vehicles without any form of automation.⁴⁷ A car without cruise control capabilities is an example of a Level 0 vehicle.
- Level 1: Vehicles with “function-specific automation” like cruise control.⁴⁸ The driver can cede authority over one control (such as acceleration, as in the case of cruise control), but must maintain physical control over all other driving tasks.⁴⁹

⁴¹ JOHN FRANK WEAVER, *ROBOTS ARE PEOPLE TOO: HOW SIRI, GOOGLE CAR, AND ARTIFICIAL INTELLIGENCE WILL FORCE US TO CHANGE OUR LAWS* 49 (2014).

⁴² J. Lutin, *et. al.*, *The Revolutionary Development of Self-Driving Vehicles and Implications for the Transportation Engineering Profession*, ITE J., July 2013, at 29.

⁴³ See David Levinson, *Climbing Mount Next: The Effects of Autonomous Vehicles on Society*, 16 MINN. J. L. SCI. & TECH. 787, 805-06 (2015); Bryant Walker Smith, *Managing Autonomous Transportation Demand*, 52 SANTA CLARA L. REV. 1401, 1410 (2012); John Markoff, *Google Cars Can Drive Themselves*, in *Traffic*, N.Y. TIMES, Oct. 9, 2010, <https://www.nytimes.com/2010/10/10/science/10google.html>.

⁴⁴ WEAVER, *supra* note 41, at 91.

⁴⁵ Leili Fatehi & Frank Douma, *Autonomous Vehicles: The Legal and Policy Road Ahead*, 16 MINN. J. L. SCI. & TECH. 615, 617 (2015).

⁴⁶ NAT’L HIGHWAY TRAFFIC SAFETY ADMIN, *FEDERAL AUTOMATED VEHICLES POLICY (FAVP)* 9 (2016).

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ *Id.*

- Level 2: Vehicles with “combined function automation,” meaning that they have “at least two primary control functions designed to work in unison to relieve the driver of control of those functions.”⁵⁰ In a Level 2 vehicle, the driver may be able to have her hands off the steering wheel and her feet off the pedals at the same time, but must still monitor the vehicle and be ready to retake control at all times.⁵¹ The Tesla Model S with Autopilot is an example of a Level 2 vehicle.
- Level 3: Vehicles with “limited self-driving automation.”⁵² Level 3 vehicles can both conduct all driving tasks and monitor the driving environment, “but the human driver must be ready to retake control of the vehicle when the automated system requests.”⁵³ Unlike a Level 2 vehicle, Level 3 vehicles do not require human driver supervision at all times, but do require a human driver to be ready to resume driving on short notice.⁵⁴
- Level 4: Vehicles with significant automation that can conduct all aspects of driving and do not require a human driver to retake control, but “can operate only in certain environments and under certain conditions.”⁵⁵ Unlike a Level 3 vehicle, Level 4 vehicles do not require human drivers to be ready to retake control, but they may not be able to be used safely “in certain types of extreme weather, on highways with significant amounts of construction, or on poorly marked roads,” to give just a few examples.⁵⁶
- Level 5: Vehicles with full automation that “can perform all driving tasks, under all conditions that a human driver could perform them.”⁵⁷ Human drivers need not ever control Level 5 vehicles and, in fact, these vehicles may lack driver control mechanisms like steering wheels and brake pedals altogether.⁵⁸

As of mid-2019, consumers in the U.S. have the option of purchasing (a) Level 0 and 1 non-autonomous vehicles and (b) semi-autonomous Level 2 vehicles. Some of these Level 2 vehicles, moreover—like Teslas with Autopilot—are developing over

⁵⁰ *Id.*

⁵¹ *Id.*

⁵² *Id.*

⁵³ *Id.*

⁵⁴ Pearl, *Hands on the Wheel*, *supra* note 32, at 718.

⁵⁵ NAT’L HIGHWAY TRAFFIC ADMIN., FAVP, *supra* note 46, at 9.

⁵⁶ Pearl, *Compensation at the Crossroads*, *supra* note 22, at 1838.

⁵⁷ NAT’L HIGHWAY TRAFFIC ADMIN., FAVP, *supra* note 46, at 9.

⁵⁸ See Justin Pritchard, *How Can People Safely Take Control From a Self-Driving Car?*, ASSOCIATED PRESS, Nov. 30, 2015, <http://bigstory.ap.org/article/84c6f179beb24f758a40acac1340ce78/how-can-people-safely-take-control-self-driving-car>.

time into Level 3 vehicles via frequent over-the-air updates to their operating systems, making them more akin currently to something like a Level 2.5 vehicle rather than a Level 2 or 3.⁵⁹ Level 3 vehicles are expected to come to market within the year, with Audi's 2019 A8 with Traffic Jam Pilot likely to be the first.⁶⁰ Level 4 vehicles are already being tested extensively on U.S. roads, but are not expected to be available to consumers within the next five years.⁶¹ The future availability of Level 5 vehicles is far more difficult to predict.⁶²

While Level 0 and 1 non-autonomous vehicles are currently far more common on U.S. roads, the number of level 2 vehicles likely numbers in the hundreds of thousands, if not very low millions.⁶³ This number, however, is expected to grow significantly in the coming years. Navigant Consulting has estimated that "by 2035, 75 percent of vehicles sold worldwide will have some degree of autonomous capability."⁶⁴ Another think tank projects that "nearly all of the vehicles in use are likely to be self-driving cars or self-driving commercial vehicles sometime after 2050."⁶⁵

C. Consumer Acceptance

Despite these optimistic projections, recent polling indicates that car manufacturers have not yet convinced Americans as to the merits of autonomous vehicles.⁶⁶ According to a 2018 Gallup poll, "[t]hree in four Americans indicate that

⁵⁹ Jonathan M. Gitlin, *Elon Musk Promises Big New Tesla Autopilot Upgrade, But is it Legal?* ARS TECHNICA, Dec. 10, 2018, <https://arstechnica.com/cars/2018/12/elon-musk-promises-autopilot-update-to-allow-for-no-driver-input-at-all/>.

⁶⁰ Arthur St. Antoine, *Driverless Cars: Where They Stand Now*, AUTOMOBILE, Jan. 4, 2019, <https://www.automobilemag.com/news/autonomy-levels-cars-driverless/>.

⁶¹ *Id.*

⁶² *Id.*

⁶³ See, e.g., Alex Luft, *Cadillac CTS Sales Increase 9 Percent to 2,442 Units in Q4 2018*, GM AUTHORITY, Feb. 20, 2019, <http://gmauthority.com/blog/2019/02/cadillac-cts-sales-numbers-figures-results-q4-2018/> (reporting over 2,000 Cadillac CTSs—which contain semi-autonomous "Super Cruise" technology sold during the fourth quarter of 2018); Evannex, *How Many Tesla Vehicles Have Been Delivered with Autopilot 1 and 2?*, INSIDE EVS, Jun. 23, 2018, <https://insideevs.com/news/338742/how-many-tesla-vehicles-have-been-delivered-with-autopilot-1-and-2/> (reporting that over 300,000 Teslas with Autopilot have been delivered to purchasers).

⁶⁴ Richard C. Balough, *Are Your Clients Ready for the Impact of Driverless Cars?*, BUS. L. TODAY, May 2016.

⁶⁵ IHS Press Release, *supra* note 24.

⁶⁶ Megan Brenan, *Driverless Cars are a Tough Sell to Americans*, GALLUP, May 15, 2018, <https://news.gallup.com/poll/234416/driverless-cars-tough-sell-americans.aspx>.

they would still own or lease a car that they personally drive once driverless technology becomes commonplace.”⁶⁷ Additionally, the polling showed that:

Although automobile manufacturers and technology companies are investing billions in making self-driving cars a common part of Americans’ daily lives, the public is generally taking a wait-and-see approach with these vehicles. Only 9% of Americans say they would use the technology immediately once it is certified by government auto-safety regulators, while 38% say they would wait a while and 52% would never want to use a driverless car.⁶⁸

Gallup theorizes that this skepticism of autonomous vehicles may arise out of sense of self-reliance and a love of driving among Americans.⁶⁹ A staggering 78% of people polled said that enjoy driving “a great deal” or “a moderate amount.”⁷⁰ Automakers, Gallup concludes, “will have to convince the public that not only is self-driving technology safe, but that the safety, environmental and other benefits it offers outweighs the pleasure people get from driving.”⁷¹

Other surveys have reached similar conclusions, finding that “a majority of drivers trust their own driving skills far more than they trust a computer.”⁷² At least one candidate for office has already capitalized on these fears for political purposes.⁷³ During a 2012 race for a Florida state senate seat, a Florida PAC called the Committee to Protect Florida ran an attack ad against the incumbent, Jeff Brandes, who had “supported bills that would allow autonomous, driverless cars on the roads in Florida.”⁷⁴ The ad “shows footage of a driverless Prius nearly striking an elderly woman, while a voiceover, also from an elderly woman, expresses concern over allowing such dangerous things on the street.”⁷⁵ Throughout the commercial, scary

⁶⁷ *Id.*

⁶⁸ *Id.*

⁶⁹ *Id.*

⁷⁰ *Id.*

⁷¹ *Id.*

⁷² Richard Read, *Would You Consider an Autonomous Car If It Came With a Deep Insurance Discount?*, CAR CONNECTION, Nov. 6, 2013, http://www.thecarconnection.com/news/1088225_would-you-consider-an-autonomous-car-if-it-came-with-a-deep-insurance-discount

⁷³ Alex Knapp, *Florida PAC Attacks Candidate for Supporting Driverless Cars*, FORBES, Aug. 13, 2012, <https://www.forbes.com/sites/alexknapp/2012/08/13/florida-pac-attacks-candidate-for-supporting-driverless-cars/#8bc7be05f1e2>.

⁷⁴ *Id.*

⁷⁵ *Id.*

headlines like “Driverless Cars for All: More Dangerous Than Driving” and “Will Driverless Cars *Really* Slow for Pedestrians” flash across the scene.⁷⁶

Car manufacturers have begun to strike back with ads of their own.⁷⁷ A 2019 commercial by BMW titled “Autonomous Driving - Nothing to Fear” shows a car driving through a dark, spooky forest that has to come to a sudden stop to avoid hitting a scary, wraith-like woman.⁷⁸ She staggers towards the car, opens the driver’s door, and then—in what is a supposed to be a comical twist in the plot— screams when she realizes no one is driving.⁷⁹ Soft, soothing music plays as a voiceover says “The future of driving. Nothing to be afraid of.”⁸⁰ A 2017 Intel commercial addresses consumer fear more directly as part of “multi-pronged trust initiative.”⁸¹

In the ad, James looks apprehensive, if not nervous, as he approaches a car that does not have a human driver behind the wheel. But—as you might expect in advertising—James quickly settles into his experience. As the vehicle circles back around, James exclaims, “Hey, yo, I’m keeping this.”⁸²

A voiceover describes Intel as “helping power autonomous cars you can trust, so we can all be fearless.”⁸³ Waymo took a more subtle approach in a 2018 commercial featuring riders in their autonomous vehicles yawning and even falling asleep.⁸⁴ The goal of the ad appears to be to convince consumers that autonomous vehicles are boring, not scary.⁸⁵ Whether or not these ads are actually changing public opinion about autonomous vehicles remains to be seen. What is clear, however, is that the American public’s reaction to autonomous vehicles mirrors the public’s reaction to the introduction of automobiles at the dawn of the 20th century.

⁷⁶ Peter Schorsch, *Attack Ad Against Jeff Brandes - ‘Those Darn Driverless Cars’*, YOUTUBE (Aug. 6, 2012),

https://www.youtube.com/watch?time_continue=6&v=NUuBXCEWOhc.

⁷⁷ See *infra* notes 78-85 and accompanying text.

⁷⁸ BMW Group, *Autonomous Driving-Nothing to Fear*, YOUTUBE (Mar. 7, 2019), <https://www.youtube.com/watch?v=wNAmxL25Bhk>.

⁷⁹ *Id.*

⁸⁰ *Id.*

⁸¹ Kirsten Korosec, *Watch LeBron James Nervously Ride in a Self-Driving Car*, FORTUNE, Oct. 9, 2017, <http://fortune.com/2017/10/09/lebron-james-self-driving-car/>.

⁸² *Id.*

⁸³ Funny Commercials, *Intel Commercial 2017 LeBron James Fearless*, YOUTUBE (OCT. 15, 2017), [HTTPS://WWW.YOUTUBE.COM/WATCH?V=DAZODE3GGDA](https://www.youtube.com/watch?v=DAZODE3GGDA).

⁸⁴ Waymo, *Early Rider Moments: “Is There No One Driving That Car?”*, YOUTUBE (Mar. 13, 2018), <https://www.youtube.com/watch?v=QqRMTWqhwzM>.

⁸⁵ See *id.*

D. Similarities to the Introduction of the Automobile

Clay McShane, a leading historian on the transition from horses to automobiles in the U.S., writes that “[t]he utilization of the urban horse as a living machine declined in the years around 1900, but the speed of its decline and substitution varied from function to function.”⁸⁶ In urban areas, where mass transit systems like trolleys and elevated trains were installed, “the change from horse-powered to electric-powered transit occurred with great rapidity,”⁸⁷ in roughly ten years in many places.⁸⁸ In rural areas and particular industries like freight delivery, “the transformation was far slower and is still incomplete.”⁸⁹

Automobiles were an integral part of the societal movement away from horses, and went from being a mere curiosity to a common consumer product surprisingly quickly. In 1896 in the UK, for instance, “[p]arliamentary laughter greet[ed] assertions that the horseless carriage [a common term for the automobile at the time] might someday rival the trolley.”⁹⁰ By 1901, however, states had begun enacting motor vehicle and licensing laws, and by 1913, “more cars than wagons and carriages [were] produced in the United States.”⁹¹ By 1920, a mere seven years later, so many people were driving automobiles that auto accidents were the ninth leading cause of death in the U.S., “surpassing suicide, measles and cirrhosis.”⁹²

This is not to say, however, that consumers embraced automobiles with open arms. As noted at the beginning of this article, in the early 1900s, mobs attacked automobiles throughout the country,⁹³ and scholars lamented the effects that they presumed automobiles were having on both drivers and passengers:

They have largely taken the place of traveling carriages with those who are desirous of speed, and are content with little more than a perfunctory view of the scenery, which, however, cannot be thoroughly “taken in” when running at a rate of over twelve miles an hour. To those who occupy or drive them, they are undoubtedly a fascinating amusement. The speed of which they are capable intoxicates and bewilders the senses, and deadens them to the dangers which surround the machine, and by a sudden mishap may turn it in the twinkling of an eye into a terrible ending of destruction.⁹⁴

⁸⁶ MCSHANE & TARR, *THE HORSE IN THE CITY*, *supra* note 5, at 165.

⁸⁷ *Id.*

⁸⁸ *Id.* at 172.

⁸⁹ *Id.*

⁹⁰ MCSHANE, *THE AUTOMOBILE*, *supra* note 3, at 23.

⁹¹ *Id.* at 46.

⁹² *Id.* at 56.

⁹³ *Id.* at 32.

⁹⁴ Brown, *supra* note 10, at 225.

Other members of the public formed “antispeed” organizations,⁹⁵ and many farmers in rural areas complained that “[s]peeding automobile tourists constituted a danger both to stock and to horse drawn traffic and raised clouds of dust that damaged crops and settled on farmhouses, barns, and washes hung out to dry.”⁹⁶ In some places in the U.S., the reaction to consumer adoption of the automobile was far more extreme:

[F]armers in the vicinity of Rochester, Minnesota, plowed up roads, making them unsuited to automobile travel but still passable by horse and carriage; local businessmen in Fayette County, Ohio, were warned by local farmers to expect a boycott should they dare to purchase automobiles, and the farmers there took to carrying guns and stretching barbed wire across country roads to halt speeding motorists; a session of the Farmers’ Institute in Marion, Indiana, passed a resolution asking that all automobiles be banned from using the public roads in the state; and the Farmers’ Club of Harlington, New Jersey, dissatisfied with that state’s liberal speed limits, unanimously adopted a resolution not to support any candidate for political office who owned an automobile.⁹⁷

While much of this ire was attributable to concerns about the safety of these vehicles, some of it was also likely a response to socioeconomic differences between automobile owners and citizens who were still using horses as their primary means of transportation. When automobiles first became available to consumers, they were so expensive that purchasers had “much higher than average incomes”:⁹⁸

[E]arly purchasers of motor vehicles were mainly moneyed businessmen, ranging from self-designated “capitalists” to dry-good merchants, but physicians and engineers were also well represented. The first twenty purchasers of Steamobiles [a form of steam-powered automobiles] at the Detroit salesroom of William E. Metzger in 1898-99 were listed as four capitalists, four physicians, two manufacturers, four merchants, one broker, one printer, one plumber, and three general businessmen.⁹⁹

Even ten years later, in 1910, the Chancellor of Syracuse University grumbled that young men were delaying marriage so that they could purchase automobiles.¹⁰⁰ “Class-conscious envy,” therefore, led many newspapers to “try to make capital out of class hatred” and hold up the automobile “as a means of oppression of the poor by the

⁹⁵ See FLINK, *supra* note 2, at 64.

⁹⁶ *Id.* at 67.

⁹⁷ *Id.* at 67-68.

⁹⁸ *Id.* at 70.

⁹⁹ *Id.* at 70-71.

¹⁰⁰ MCSHANE, THE AUTOMOBILE, *supra* note 3, at 42.

wealthy.”¹⁰¹ These socioeconomic tensions were alleviated significantly, however, when moderately-priced models like the Ford Model T became available to consumers,¹⁰² leading one scholar to muse:

One can only conjecture how much more rapidly automobile ownership would have become common among all segments of American society had cars been easier to purchase at an earlier date. The initial price of an automobile involved a staggering expenditure for the man of average means until well after 1910, and installment selling of automobiles did not become established until the 1920s . . . The fact that automobile ownership quickly became common among those segments of the population who could if, even at a great sacrifice, at any given point in time in the United States does suggest that the main motives that predisposed an individual to adopt the automobile were widely held in American society and that differently propensity to buy an automobile was mainly a function of financial ability.¹⁰³

Reading that passage, one cannot help but draw a comparison to autonomous vehicles. Up until Tesla and Nissan released moderately-priced models of their semi-autonomous vehicles between 2016 and 2018, Level 2 capabilities were only available to consumers in very high-end automobiles like the Tesla Model S with Autopilot (costing well over \$80,000),¹⁰⁴ and Cadillac CT6 with Super Cruise (retailing for over \$70,000).¹⁰⁵ When lower-priced models became available, demand skyrocketed. Within a day of Tesla taking reservations for its \$35,000 Model 3, for instance, the company had over 230,000 orders.¹⁰⁶ Given what happened with automobiles 100 years ago, it seems likely that support for autonomous vehicles will increase now that their semi-autonomous precursors are more affordable to the general public.

The transition from horse to automobile also “demanded a revolution in ancillary fields such as oil production and refining, machine tools and roadbuilding.”¹⁰⁷ As early

¹⁰¹ FLINK, *supra* note 2, at 65 (quoting *To Conciliate the Masses*, HORSELESS AGE, 10:266 (Sept. 10, 1902)).

¹⁰² *Id.* at 69-70.

¹⁰³ *Id.* at 73-74.

¹⁰⁴ U.S. News Cars, *2019 Tesla Model S*, U.S. NEWS CARS, Mar. 13, 2019, <https://cars.usnews.com/cars-trucks/tesla/model-s>.

¹⁰⁵ Michael Wayland, *Cadillac's Super Cruise-Equipped CT6 Sedan to Start at \$71,300*, AUTOMOTIVE NEWS, Sept. 1, 2017, <https://www.autonews.com/article/20170901/OEM06/170909973/cadillac-s-super-cruise-equipped-ct6-sedan-to-start-at-71-300>.

¹⁰⁶ David R. Baker, *Tesla Model 3 Reservations Top 232,000*, S.F. CHRON., Apr. 1, 2016, <https://www.sfgate.com/business/article/Tesla-Model-3-reservations-near-198-000-7223394.php>.

¹⁰⁷ MCSHANE, *THE AUTOMOBILE*, *supra* note 3, at xi.

as 1902, [i]t began to become apparent . . . that the higher speeds of motor vehicles caused undue wear on roads and that adequate automobile roads necessitated increased clearance and width.”¹⁰⁸ This required significant expenditures from states and local governments.¹⁰⁹ Parking and lack of repair shops were also serious issues.¹¹⁰ The public livery stables that heretofore had provided a storage place for horses typically would not accept motor vehicles, and the lack of repair facilities became a serious deterrent to buying automobiles.¹¹¹ It wasn’t until the end of the first decade of the 20th century that cities had adequately addressed these problems.¹¹² Rural areas took longer.¹¹³

Autonomous vehicles will also likely usher in significant changes in ancillary fields, and, interestingly, those changes may reverse many of those made in the early 1900s. For one thing, both parking and wide roads will no longer be necessary, particularly in urban areas, “as Level 5 [autonomous vehicles] could either pilot themselves to a remote area after use or, if part of an autonomous ride-share or taxi fleet, simply drop passengers off and pick up the next with no need to park.”¹¹⁴ This change in space usage could have dramatic consequences for cities:

Julia Thayne, Director of Urban Development at North American Center for Cities at Siemens, points out that “in Los Angeles County, for example, 14 percent (roughly 665 square miles or 13 City of San Franciscos) of all land is devoted to parked cars. 665 square miles! Can you imagine how many parks, houses, businesses, and public transit networks could be built on just a fraction of that land?” With the right policies in place, freeing up land (often brownfield) previously used for wider roads, surface parking lots, and parking structures could lead to denser city centers with additional green space and decrease the development of green fields and sprawl.¹¹⁵

Less desirably, autonomous vehicles could also increase urban sprawl, as commuters will arguably be more willing to live further away from their places of employment if they can use what would previously have been driving time to work, sleep, watch a

¹⁰⁸ FLINK, *supra* note 2, at 210.

¹⁰⁹ *Id.* at 210-11.

¹¹⁰ *See id.* at 216-17.

¹¹¹ *Id.*

¹¹² *See id.* at 216-31.

¹¹³ *See id.*

¹¹⁴ Arthur Harrington & Sarah Schenck, *The Driverless Horseless Carriage: Steering the Anticipated Environmental Impacts of Autonomous Vehicles*, NAT. RESOURCES & ENV’T, Spring 2017, at 24.

¹¹⁵ *Id.* (quoting Interview with Julia Thayne, Dir. of Urban Dev., N. Am. Ctr. for Cities at Siemens (Sept. 19, 2016)).

movie, or otherwise relax.¹¹⁶ It will also likely devastate employees of the trucking industry, one of the most populated occupations in over half of U.S. states, who may quickly find themselves replaced by an autonomous vehicle and thus out of a job.¹¹⁷ Whereas wealthy Americans employed chauffeurs as drivers for *both* horse-drawn carriages and automobiles, autonomous vehicles make that job superfluous.

II. THE ROLE OF LAW IN TECHNOLOGY-DRIVEN SOCIETAL TRANSFORMATION

In eras of significant social change, it is natural to expect, if not significant upheavals, at least extensive new developments in law, as well. As discussed above, moreover, lawmakers and legal scholars may have a tendency to turn to law as a primary method of controlling and guiding these changes.¹¹⁸ The history of changes brought about by technology, however, suggests that law may actually play a fairly limited role in shaping these changes, particularly as compared to non-legal factors such as economic incentives and consumer preference. Indeed, if one were to create a spectrum of responses to technology-driven transformations ranging from the “most intensively law-based” to “not law-based at all,” historical evidence suggests that responses on the non-law side are at least as powerful, if not more so, than those on the other. In this paper, I have included six distinct points along this spectrum: (1) statutory or regulatory product bans, (2) time, place, and manner restrictions, (3) common law litigation, (4) economic incentives, (5) convenience incentives, and (6) evolving consumer preferences. Figure 1 provides a visual depiction of this breakdown:



Fig. 1

A discussion of each of these points along the spectrum, and how they have shaped previous social transformations, is helpful in understanding what forces are likely to be the most influential in shaping and guiding American adoption of autonomous vehicles. This section explores the law-related responses.

A. *Statutory or Regulatory Product Bans*

Statutory or regulatory product bans—“governmental efforts to prohibit the sale or possession of specific products in an otherwise open market because of the

¹¹⁶ *Id.* at 25.

¹¹⁷ Elizabeth Arentz, *Driving Miss Lazy: Autonomous Vehicles, Industry, and the Law*, 12 OHIO ST. BUS. L.J. 221, 230-31 (2018).

¹¹⁸ See MASLOW, *supra* note 31, at 15-16.

product’s deleterious health impacts”—are arguably the harshest possible legal responses to transformative new technologies and are thus the most politically and legally fraught of the six kinds of responses discussed in this paper.¹¹⁹ They also have a long history in the United States:

During the Colonial Era, colonies enacted laws to prohibit the sale of adulterated bread and other “unwholesome provisions.” In 1888, the U.S. Supreme Court upheld a state ban on oleomargarine to protect the public’s health. New York City restricted lead paint for health-related reasons in 1959. In 1988, the federal Consumer Products Safety Commission (CPSC) banned lawn darts after the game caused thousands of injuries and several deaths.¹²⁰

More recently, product bans have been initiated to prohibit the sale of Buckyballs (tiny but powerful magnets that can be “stacked, aligned and extended to build forms and shapes that seem to defy gravity,” but that can also “sometimes find their way down the gullets of children” and cause severe injury or death),¹²¹ certain kinds of Kinder-brand chocolate eggs (“because the toy surprise inside can pose choking and aspiration hazards to children younger than 3 years of age”),¹²² Four Loko (a beverage approximately twice the size of a standard can of soda that contains an amount of alcohol equivalent to “five or six 12-ounce cans of beer,” “as much caffeine as two cups of coffee,” and “the stimulants guarana, taurine, and wormwood” and which “would cause a 225-pound man to achieve unlawful intoxication as defined by California’s traffic laws” after consuming a single can).¹²³

There is little question that federal, state, and local governments have the power to regulate and ban products that pose health hazards.¹²⁴ The federal government can do so as part of its commerce authority.¹²⁵ Interestingly, it can also use its tax and spend powers to achieve the same ends:

The power to set tax levels means Congress can discourage risky behavior, such as smoking, and reward health-promoting activities, such as physical exercise. Congress can similarly use its spending power to influence state lawmaking so long as its efforts are not unduly coercive

¹¹⁹ James G. Hodge & Megan Scanlon, *The Legal Anatomy of Product Bans to Protect the Public’s Health*, 23 ANNALS HEALTH L. 161, 179 (2014).

¹²⁰ *Id.* at 163-64.

¹²¹ Terry Carter, *Should This Toy Be Saved? A Newly Re-Energized Consumer Product Safety Commission is on a Mission. Some Wonder Whether It’s the Right One*, 99 A.B.A. J. 48, 49 (2013).

¹²² § 5:21. Novelties and party favors, Consumer Product Safety Information § 5:21.

¹²³ *Fiorini v. City Brewing Co., LLC*, 231 Cal. App. 4th 306, 310–11 (2014).

¹²⁴ Hodge & Scanlon, *supra* note 119, at 162, 172.

¹²⁵ *Id.*

upon states. To encourage states to change the drinking age, for example, Congress passed a law in 1984 that withheld highway funds from states that did not raise their legal drinking age from eighteen to twenty-one. The spending measure effectively banned alcohol use among eighteen to twenty-one year-olds even though the impetus was to prevent highway-related deaths and injuries due to alcohol use. Spending powers further allow Congress to indirectly regulate or ban products by determining which federal agencies or research products to fund.¹²⁶

Congress has also used these forms of authority to adopt acts forming executive agencies like the Food and Drug Administration (FDA) and the CPSC.¹²⁷ States, moreover, unlike the federal government, have broad authority under their police powers to regulate within their borders in the interests of public health and safety.¹²⁸

However, it is much less clear when an outright product ban—as opposed to some other form of regulation or restriction—is warranted.¹²⁹ A decision to ban a product must necessarily involve some balancing of product risks versus product benefits and also consideration of issues like personal liberty, jurisdictional differences, and political support. Two scholars, writing about this very issue, muse:

Against a backdrop of clear and objective governmental powers to proscribe harmful products are countervailing arguments grounded in law, policy, and ethics that influence the consideration and implementation of these bans. The use and efficacy of public health product bans are predicated on identifying and navigating a complex legal and political environment that simultaneously supports bans on one hand, and rejects them on the other.¹³⁰

Governmental entities tasked with issuing product bans, therefore, often become political targets and focal points for consumer dissatisfaction and can encounter “damned if they do, damned if they don’t” situations.¹³¹ The CPSC, for instance, “which is best known for keeping its eye out for hazardous children’s products, has been accused of overreaching and underregulation by opposing forces over the years.”¹³² The CPSC’s popularity surges in years, like 2007, in which product safety issues have received a great of attention.¹³³ That year, there were several prominent cases of toys manufactured in China being pulled from shelves due to highly leaded

¹²⁶ *Id.* at 173.

¹²⁷ *Id.* at 172.

¹²⁸ *Id.* at 174.

¹²⁹ *Id.* at 162.

¹³⁰ *Id.* at 163.

¹³¹ *See id.* at 181.

¹³² Carter, *supra* note 121, at 55.

¹³³ *Id.* at 50.

paint, along with a pet food scare involving melamine-tainted dog and cat food, also from China.¹³⁴ In other years, however, consumers have rejected “public sector paternalism.”¹³⁵ Efforts to limit consumption of soft drinks and other highly-sugared beverages by banning large container sizes “have been summarily rejected by many as “nanny” state interventions . . . even though empirical evidence and legal authority to institute the ban . . . may be sufficient.”¹³⁶

For product bans to be viable options, government officials must have strong political support.¹³⁷ Without it, potential bans are destined to fail early in the political process.¹³⁸ Even situations in which “political forces are neutral . . . may result in inaction.”¹³⁹ Securing favorable public opinion in advance of a product ban proposal by, for instance, providing the general public with a “strong public health rationale” or emphasizing that the ban will protect vulnerable populations such as minors, appears to be not only a wise, but also a necessary course of action.¹⁴⁰ Even then, as in the case of the largely unsuccessful attempts to ban large sodas, political support may be difficult to come by.¹⁴¹ Two legal scholars theorize that product bans may be most politically palatable to the general public “when used to address unwanted or involuntary risks, such as exposure to secondhand smoke in public places or formaldehyde used in temporary housing. Whenever consumers are unable to consciously accept the risks associated with a product, banning [it] may be appropriate.”¹⁴²

In addition to being politically fraught, product bans may be legally fraught, as well, and may even implicate thorny issues of constitutional law:

The government’s authority to ban products is broad, but it is not unlimited. Constitutional restrictions of government power and protection of individual rights may curtail government’s ability to simply ban a product that presents a health risk. Courts may invalidate state or local product bans, for example, that interfere with interstate commerce. The Dormant Commerce Clause . . . prohibits states and localities from passing regulations affecting interstate commerce.¹⁴³

¹³⁴ *Id.*

¹³⁵ Hodge & Scanlon, *supra* note 119, at 181.

¹³⁶ *Id.*

¹³⁷ *Id.*

¹³⁸ *Id.*

¹³⁹ *Id.*

¹⁴⁰ *See id.* at 170-71.

¹⁴¹ *Id.* at 181.

¹⁴² *Id.* at 171.

¹⁴³ *Id.* at 175.

Product bans can run afoul of the due process guarantees of the Fifth and Fourteenth Amendments, as well, if affected parties aren't provided with notice or a hearing before banning a product.¹⁴⁴ In short, to avoid legal pitfalls, these bans must be used judiciously and with a careful eye toward providing ample process and articulating a clear justification.¹⁴⁵

In the context of autonomous vehicles, states or the federal government could attempt a product ban in one of two ways. First, a jurisdiction could ban autonomous vehicles outright, arguing that they can never be as safe as a human-driven car or that some particular risk inherent in these vehicles is simply too high. One could imagine, for instance, a high-profile autonomous vehicle crash or hacking incident—particularly during the early years of their availability to consumers—leading to a groundswell of opposition to these vehicles. Politicians might be inclined to capitalize on this public outcry to score political points (or out of genuine safety concerns) by implementing a product ban. This would be a true nightmare scenario for the industry because it would eliminate the market for autonomous vehicles before the technology had a chance to prove itself. Fortunately, there does not appear to be much precedent for product bans of transformative new technologies in transportation. When the automobile first became available to consumers, for instance, virtually no jurisdictions banned them despite significant concerns on the part of the public about their safety, Mount Desert Island in Maine and the Nantucket Islands in Massachusetts being the only notable exceptions.¹⁴⁶ Similarly, we have not seen outright product bans in response to any new forms of transportation—ATVs, Segway scooters, hover boards, etc.—since.

Second, and on the flip side, states or the federal government might eventually attempt to ban human-driven cars. While, at first glance, this idea might seem extreme or even absurd from today's perspective, it is not difficult to conceive of how a ban on human-driven cars might come to be seen as a sensible course of action in coming decades. As I have discussed at length in earlier work, autonomous vehicles are expected to be significantly safer than their human-driven counterparts.¹⁴⁷ Studies show that “approximately 94% of all accidents are caused by human driver error and less than 6% are caused by product defects . . . [so] in a new system dominated by [autonomous vehicles], those numbers are likely to reverse.”¹⁴⁸ Additionally, as the technology improves, autonomous vehicles are likely to gain vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) capabilities, giving them

¹⁴⁴ *Id.* at 178.

¹⁴⁵ *Id.* at 143, 178.

¹⁴⁶ See Brown, *supra* note 10, at 225-26.

¹⁴⁷ See Pearl, *Compensation at the Crossroads*, *supra* note 22, at 1841-45; Pearl, *Hands on the Wheel*, *supra* note 32, at 722-23; Pearl, *Fast & Furious*, *supra* note 25, at 35-39.

¹⁴⁸ Carrie Schroll, *Splitting the Bill: Creating A National Car Insurance Fund to Pay for Accidents in Autonomous Vehicles*, 109 NW. U. L. REV. 803, 805 (2015).

the ability to “communicate” both with one another and with the road itself so that, for instance, information about risks up ahead in the road can be obtained well before a vehicle approaches them.¹⁴⁹ In this kind of environment, it may become the case that (a) autonomous vehicles are so overwhelmingly safer than human-driven vehicles that society is no longer tolerant of the comparative dangers posed by human-driven vehicles, and/or (b) human-driven vehicles become a logistical impediment to V2V or V2I technology such that it no longer makes sense to allow them to share the road with autonomous vehicles. At that point, a product ban might appear to be a wise choice.

However, a premature product ban of either type is likely to engender significant pushback from either (or both) industry or the general public. If the government were to ban autonomous vehicles, it would crush an industry that is already worth over \$50 billion in 2019 and that is expected to increase to over \$500 billion by 2026.¹⁵⁰ This would infuriate both traditional car manufacturers as well as tech companies, both of whom have autonomous vehicles in development.¹⁵¹ If the government were to ban *human-driven* vehicles prematurely, this would almost certainly raise a furious outcry from members of the public who prefer to drive their own vehicles, enjoy the act of driving, or otherwise desire the flexibility to choose the kind of vehicle they prefer. As I posit in an earlier piece, if the government acts too soon, its members may find themselves face-to-face with “a protester standing on the steps of the Capitol, holding up a steering wheel, and proclaiming, ‘From my cold, dead hands.’”¹⁵²

Indeed, since automobiles are so much more than mere products to most Americans, banning human-driven vehicles risks being not only politically and legally fraught, but culturally fraught as well. Since the inception of automobiles on U.S. roads, they have represented so much to so many people:

The automobile, a metaphor as well as a machine, meant more to Americans than just another transportation mode, a tool to reach the suburbs. Very early in its history it became what French social critic Henri Lefebvre has called “the epitome of possessions.” The automobile symbolized wealth and psychic liberation for an enormous number of groups within American society . . . The advent of the automobile and

¹⁴⁹ Barringer, *supra* note 33, at 123.

¹⁵⁰ Ed Garset, *Sharp Growth in Autonomous Car Market Value Predicted But May be Stalled by Rise in Consumer Fear*, FORBES, Aug. 13, 2018, <https://www.forbes.com/sites/edgarsten/2018/08/13/sharp-growth-in-autonomous-car-market-value-predicted-but-may-be-stalled-by-rise-in-consumer-fear/#2097c132617c>.

¹⁵¹ See Pearl, *Hands on the Wheel*, *supra* note 32, at 720-21.

¹⁵² Tracy Hresko Pearl, *They’re Coming for Your Cars....*, PRAWFSBLAWG, Nov. 21, 2016, <https://prawfsblawg.blogs.com/prawfsblawg/2016/11/theyre-coming-for-your-cars.html>.

government regulations of traffic took place in a culture that attached enormous emotional significance to the machine.¹⁵³

Another scholar remarks that, “[t]he American motorist is, or fancies himself to be, the spiritual descendant of the restless immigrant, the gold rusher, the Oregon Trail pioneer.”¹⁵⁴ Driving, in this view, “like voting and buying a house, is a fundamental and symbolic exercise of American liberty.”¹⁵⁵ Banning human-driven cars too early, therefore, would represent not only the end of an era, but the forced abandonment of deeply-held cultural norms, a reality that should deter even the most bullish supporters of autonomous vehicles from attempting such a ban.

B. Time, Place, and Manner Restrictions

Time, place, and manner restrictions are laws, regulations, or ordinances that place limitations on how or when a particular product can be used or how or when an individual can engage in a particular kind of activity. While typically discussed in a free speech context (in which significant constitutional questions arise), most time, place, and manner restrictions “are designed for such mundane government objectives as regulating traffic or preventing littering.”¹⁵⁶ While these kinds of restriction “may not be used to ban products entirely, they effectively outlaw them from certain zones,” typically “to curtail the prevalence of harmful products among minors or other vulnerable consumers.”¹⁵⁷ Many jurisdictions, for instance, prohibit the storage of fireworks within city limits,¹⁵⁸ and only permit authorized exhibitors to discharge or ignite them.¹⁵⁹ Similarly, some municipalities “use their licensing authority to ensure that outlets selling tobacco, alcohol, or fast food products are restricted from certain areas.”¹⁶⁰ Since time, place, and manner restrictions are not as draconian as product bans, they are also less likely to elicit significant political or social pushback.

¹⁵³ CLAY MCSHANE, *DOWN THE ASPHALT PATH: THE AUTOMOBILE AND THE AMERICAN CITY* 125 (1994).

¹⁵⁴ Addison Del Mastro, *Car Culture and Suburbia in the American Psyche*, THE AMERICAN CONSERVATIVE, Feb. 22, 2019, <https://www.theamericanconservative.com/urbs/car-culture-and-suburbia-in-the-american-psyche/>.

¹⁵⁵ *Id.*

¹⁵⁶ Kimberly K. Smith, *Zoning Adult Entertainment: A Reassessment of Renton*, 79 CAL. L. REV. 119, 122 (1991).

¹⁵⁷ Hodge & Scanlon, *supra* note 119, at 174-75.

¹⁵⁸ Romualdo P. Eclavea, *Explosions and Explosives* 31A AM. JUR. 2D EXPLOSIONS AND EXPLOSIVES § 16 (2019).

¹⁵⁹ See 11 OHIO JUR. 3D BUS. AND OCCUPATIONS § 142 (discussing R.C. 3743.65); N.M. Stat. Ann. § 60-2C-8.1 (West)(Effective March 17, 1999).

¹⁶⁰ Hodge & Scanlon, *supra* note 119, at 174.

Time, place, and manner restrictions are already extremely common in the transportation context. In addition to extensive motor vehicle codes placing time, place, and manner restrictions on automobiles, state governments often have time, place, and manner restrictions on pedestrians,¹⁶¹ motorcycles,¹⁶² bicycles,¹⁶³ golf carts,¹⁶⁴ roller skates and roller blades,¹⁶⁵ snowmobiles,¹⁶⁶ skateboards,¹⁶⁷ motorized wheelchairs,¹⁶⁸ all-terrain vehicles and dirt bikes,¹⁶⁹ sleds,¹⁷⁰ and even Segway scooters.¹⁷¹ These kinds of restrictions, moreover, date back to at least 1821, when New York imposed a speed limit on horses, “with laws against horse-racing going back to at least 1802,”¹⁷² although such restrictions were often difficult to enforce:

Horses on the street were subject to formal municipal control, but regulation seems to have played little effective role. There were speed limits, but those were nearly impossible to enforce, since there was no effective way to measure speed. Boston, to cite one example, passed speed regulations at least four times in the nineteenth century, a sign that the old ones had been forgotten, presumably because of non-enforcement.¹⁷³

Enforcement issues have presumably disappeared in more modern times with the advent of speedometers, radar guns, speed-monitoring aircraft, and traffic cameras.

As long as time, place, and manner restrictions don’t implicate speech, they usually receive what one scholar has deemed “relaxed scrutiny.”¹⁷⁴ Since strict scrutiny of these restrictions “would hamstring the government in its ability to pursue legitimate objectives,” in the absence of any possible First Amendment

¹⁶¹ See OR. REV. STAT. ANN. § 814.010 (West 1983); 75 PA. STAT. AND CONS. STAT. ANN. § 3544 (West 1977).

¹⁶² See 75 PA. STAT. AND CONS. STAT. ANN. § 3525 (West 2003); OR. REV. STAT. ANN. § 814.269 (West 1987).

¹⁶³ See DEL. CODE ANN. tit. 21, § 4197 (West 2017).

¹⁶⁴ See 75 PA. STAT. AND CONS. STAT. ANN. § 3594 (West 2015).

¹⁶⁵ See ALASKA STAT. ANN. § 28.05.015 (West 2018).

¹⁶⁶ See ALA. CODE § 32-5A-62 (West); OHIO REV. CODE ANN. § 4519.40 (West 2002).

¹⁶⁷ See OR. REV. STAT. ANN. § 814.600 (West 2011); DEL. CODE ANN. tit. 21, § 4198N (West 2008).

¹⁶⁸ See OR. REV. STAT. ANN. § 814.500 (West 1991).

¹⁶⁹ See D.C. CODE ANN. § 50-2201.04b (West 2018); KY. REV. STAT. ANN. § 189.515 (West 1990).

¹⁷⁰ DEL. CODE ANN. tit. 21, § 4195 (West 1987).

¹⁷¹ See TEX. TRANSP. CODE ANN. § 551.202 (West 2003); ALA. CODE § 32-19-1; MINN. STAT. ANN. § 169.212 (West 2002).

¹⁷² N.Y. AGRIC. & MKTS. LAW § 364 (McKinney).

¹⁷³ MCSHANE & TARR, *THE HORSE IN THE CITY*, *supra* note 5, at 54.

¹⁷⁴ Smith, *supra* note 43, at 122.

concerns, these kinds of laws typically receive little scrutiny.¹⁷⁵ Additionally, since they clearly fall well within a state's police powers, there is little other constitutional basis on which to challenge them.

The absence of legal concerns, however, does not mean that time, place, and manner restrictions are risk free. Much like product bans, there are risks inherent in passing these kinds of laws too early or too late. On the one hand, if these restrictions are imposed in the early stages of a product's development, they may be a response to *perceived* dangers or issues rather than real ones, or they may be ill-suited to how the product or activity evolves over time. For example, in late 2017, New York City prohibited the use of electric bikes ("e-bikes"), which were new to the consumer market, on public streets in response to safety complaints from city residents.¹⁷⁶ However, a mere six months later, the city was forced to reconsider after a backlash from multiple stakeholders:

Transit advocates bemoaned the decision as a step backwards for New York, hindering the city from embracing a mode of transport that's increasingly popular in cities worldwide. Meanwhile, immigrant rights groups argued that the regulation was particularly punitive to those who rely on e-bikes to make a living in the booming restaurant delivery industry; a recent flood of relatively cheaper e-bikes from China had allowed smaller businesses to invest in them. The city threatened fines of up to \$500 for the riders themselves, and fines starting at \$100 for businesses that employed workers who use or own them.¹⁷⁷

Therefore, on April 3, 2018, Mayor Bill de Blasio announced that he was lifting the previous regulations on e-bikes, and allowing them to be used on city streets at speeds under 20 miles per hour.¹⁷⁸ The initial restrictions, because they were passed early on in the product's history, were far too harsh and failed to contemplate how important the bikes would become to city commerce.

On the other hand, if jurisdictions wait too long to enact time, place, and manner restrictions, they may fail to mitigate risk in a timely way and thus fail to prevent what could have been avoidable injuries or deaths. In the first decade of the 20th century, for instance, Chicago made a franchise agreement with the city's mass transit companies that "enshrined late nineteenth-century beliefs about the

¹⁷⁵ *Id.*

¹⁷⁶ John Surico, *New York City Makes (Some) Space for E-Bikes*, CITYLAB, Apr. 6, 2018, <https://www.citylab.com/transportation/2018/04/new-york-city-makes-space-for-e-bikes/557396/>.

¹⁷⁷ *Id.*

¹⁷⁸ Sasha Lekach, *NYC Lifts Ban on Electric Bikes, But Hoverboards Still Illegal*, MASHABLE, Apr. 4, 2018, <https://mashable.com/2018/04/04/electric-bicycle-nyc-ban-ends/>.

profitability of mass transit and the necessity for separating ‘traction’ (the current term for all mass transit) from ‘politics.’”¹⁷⁹ As a result, the city was hesitant to regulate the L trains and trolleys that provided transportation to over 600,000 people per day throughout the city.¹⁸⁰ Tragically, this meant that the overcrowding that had become deadly on the L trains went almost entirely unchecked, to the outrage of the general public:

Mass transit in 1906 was a complex and emotionally charged issue . . . The public was angry . . . Reports of accidents proliferated—and crowding on street railways’ antique equipment always seemed to be the cause. Businessmen and small children alike met their paths when they were knocked from the bottom steps of overcrowded streetcars or were crushed between the trolley they rode and a passing vehicle as they clung to some precarious foothold. Bad track and sloppy operating procedures led to a number of fatal or near-fatal collisions. Between March 5 and April 25, 1906, Chicago streetcars killed 21 and injured 86, and the carnage continued into the fall. By the end of November, 132 Chicagoans would be killed.¹⁸¹

It wasn’t until a young girl in a dark red coat fell screaming from an overcrowded elevated train platform to her death thirty feet below, capturing the press’ and the public’s attention and sparking mass outrage that the city’s aldermen were finally willing to step in and enact regulations designed to make the city’s mass transit safer.¹⁸²

In the context of autonomous vehicles, states have already begun passing time, place, and manner restrictions. The District of Columbia’s current autonomous vehicle law, for instance, says that these vehicles may be operated on public roads if: (1) the vehicle “has a manual override feature that allows a driver to assume control of the autonomous vehicle at any time,” (2) the vehicle has a driver seated in the driver’s seat who can retake control immediately, and (3) the vehicle “is capable of operating in compliance with the District’s applicable traffic laws and motor vehicle laws and traffic control devices.”¹⁸³ While (presumably) well-intended, this appears to be a law, much like New York City’s original e-bike law, that was passed too early and with little understanding of the product:

Level 4 and 5 vehicles neither require human supervision nor have a way for humans to retake control, whereas [laws like the District of

¹⁷⁹ PAUL BARRETT, *THE AUTOMOBILE AND URBAN TRANSIT: THE FORMATION OF PUBLIC POLICY IN CHICAGO: 1900-1930* 33 (1983).

¹⁸⁰ *See id.* at 33-34.

¹⁸¹ *Id.* at 49-50.

¹⁸² *See id.* at 36-37, 56-57, 87-104.

¹⁸³ D.C. CODE ANN. § 50-2352 (West 2019).

Columbia’s] require at least one and, in some cases, both. Thus, Google’s [now Waymo’s] forthcoming Level 4 cars, which lack both a steering wheel and brakes will presumably be illegal to operate in the District of Columbia¹⁸⁴

Not surprisingly, therefore, two D.C. council-members have introduced a bill to amend this law to require significantly less human supervision and intervention during the operation of autonomous vehicles.¹⁸⁵

In the future, as autonomous vehicles grow in number on public roads, more time, place, and manner restrictions could be placed on human-driven vehicles. For instance, as vehicle-to-vehicle and vehicle-to-infrastructure communication becomes more common, human-driven vehicles without these capabilities might be required to drive only within designated lanes. Similarly, human-driven vehicles might become subject to lower speed limits than autonomous vehicles given that, due to faster response times, autonomous vehicles can drive safely much more closely to one another and much faster.¹⁸⁶ In sum, the different risk profiles of these two kinds of vehicles will likely necessitate some adjustment of our motor vehicle codes in ways that favor autonomous vehicles and disfavor human-driven vehicles, or, if public acceptance of autonomous vehicles lags behind the technology, vice versa.

C. Common Law Litigation

Common law litigation initiated by private individuals is always a potential response to new products.¹⁸⁷ In particular, common law negligence, products liability, and nuisance claims can be powerful tools in the hands of citizens who are either resistant to change or concerned about new (or at least newly perceived) risks or annoyances.¹⁸⁸ Unlike product bans and time, place, and manner restrictions, moreover, common law litigation does not involve affirmative government action and is thus typically insulated from political pressure and constitutional scrutiny.¹⁸⁹

¹⁸⁴ Pearl, *Fast & Furious*, *supra* note 25, at 64-65.

¹⁸⁵ 2019 Washington DC Legislative Bill No. 248, Washington DC Council Period Twenty-Three.

¹⁸⁶ WEAVER, *supra* note 41, at 178.

¹⁸⁷ See Kyle Graham, *Of Frightened Horses and Autonomous Vehicles: Tort Law and Its Assimilation of Innovations*, 52 SANTA CLARA L. REV. 1241, 1256 (2012).

¹⁸⁸ See *infra* notes 191-206 and accompanying text.

¹⁸⁹ See, e.g., Michael D. Axline, *The Limits of Statutory Law and the Wisdom of Common Law*, 38 ENVTL. L. REP. NEWS & ANALYSIS 10268, 10268 (2008) (“The common law, by contrast, is not subject to political pressures and bureaucratic inertia.”); Malia Reddick, *Merit Selection: A Review of the Social Scientific Literature*, 106 DICKINSON L. REV. 729, 729 (2002) (“Generally, judicial independence refers to the common law tradition of a judiciary that is institutionally immune from outside political pressures in the resolution of individual cases, whereas judicial

However, despite lacking the force of a product ban or of regulations, common law litigation—and sometimes the mere threat of litigation—can compel or at least strongly incentivize product manufacturers and/or product users to change their behavior.¹⁹⁰

The release of a new product onto the market may usher in a wave of lawsuits.¹⁹¹ The public may “exaggerate the harms associated with [the] innovation,” and target users as reprehensible citizens.¹⁹² Interestingly, however, “the initial cluster of lawsuits that surrounds an innovation may not resemble the claims that the device produces in its more mature state.”¹⁹³ Early lawsuits surrounding automobiles, for example, looked nothing like modern automobile cases.¹⁹⁴ Instead, “most early automobile cases involved claims that the sight or sound of a motor carriage caused a horse to take fright, resulting in injury either to the horse’s rider, the occupants of a carriage or wagon the horse had been towing, or the horse itself.”¹⁹⁵

Additionally, one legal scholar observes that “there exists a tendency, in early accidents that involve a novel device, to focus on the behavior of its consumers, whose conduct may be easier to map against prevailing standards of care than that of the product’s manufacturers.”¹⁹⁶ Emerging technology, by its very nature, may challenge existing standards of care—think the advent of private radio receiving sets that could broadcast weather reports to boats at sea and how they changed the standard of care for tugboats, as discussed by Learned Hand in the famous *TJ Hooper* case—and thus pose difficult questions about breach in negligence cases.¹⁹⁷ Focusing on user error instead is an easy way to circumvent having to address these issues.¹⁹⁸ Plaintiffs used this tactic in early automobile cases:

This “blaming the user” dynamic appeared during the dawn of the automobile. By any standard, early automobiles contained many serious defects. For example, the December 1, 1900 issue of *Scientific American* casually remarked upon the fact that “[m]any accidents have occurred on account of the tires becoming detached from the steering wheels of automobiles, and too much attention cannot be paid to this matter.” Yet even basic features of automotive technology were indefinite and difficult

accountability comports with democratic principles and allows the judiciary to be responsible to changed in public opinion.”).

¹⁹⁰ See *infra* notes 199-203 and accompanying text.

¹⁹¹ See Graham, *supra* note 187, at 1243-46.

¹⁹² *Id.* at 1256.

¹⁹³ *Id.* at 1243.

¹⁹⁴ See *id.* at 1243-46.

¹⁹⁵ *Id.* at 1246.

¹⁹⁶ *Id.* at 1260.

¹⁹⁷ *The TJ Hooper*, 60 F.2d 737, 739-40 (1932).

¹⁹⁸ See Graham, *supra* note 187, at 1260-61.

to critique during this era. This being the case, when problems appeared with early automobiles, it was not always possible to say with absolute certainty whether a breakage or other accident was due to defects in construction or improper operation. In these situations, the definite tendency was to assign fault to the user, rather than engage in a probing review of the technology. The sin of speeding received special scrutiny, being blamed for many early automobile accidents.¹⁹⁹

However, over time, new products, and particularly products that are disruptive of the status quo, may alter the public's view of older products and the risks and annoyances they create.²⁰⁰ As automobiles became increasingly popular during the early decades of the 20th century, for instance, people became increasingly intolerant of horses—and their accessories and outputs, in particular—even though horses had been the standard mode of transportation mere years before.²⁰¹ Two historians observe that “neighborhoods were increasingly intolerant of stables because of perceived risks of disease and fire. . . . Manure, which had once been a valuable by-product of street railway stables, now became largely a liability.”²⁰² The common law, not surprisingly, also changed over this time period:

The law of nuisance . . . evolved, making “that a nuisance, which was not.” Before 1890, manure piles were nuisances only if they could be seen or smelled, but when it was demonstrated that they served as a breeding ground for flies that carried a variety of diseases, the piles became nuisances and health hazards. Health boards required (or enforced old rules) that both manure piles and manure carts be covered, raising the cost of handling manure. Litigation about other stable sounds and smells increased, too. In other words, urban residents were becoming more and more sensitive to the presence of these animals as animals, as the living parts of the transportation system became as controversial as the mechanical.²⁰³

People's perception of the safety of horses changed over time, as well. In 1908, a legal scholar published a screed against automobiles in the Yale Law Journal, taking extreme issue with their safety:

In dry weather they raised a stifling cloud of dust and smoke; their engines produced a disturbing noise, and their speed frightened horses and rendered the roads so unsafe that it became a question whether they could be tolerated at all . . . As soon as their beauty and peculiar

¹⁹⁹ *Id.* (internal quotations and brackets omitted).

²⁰⁰ *See infra* notes 201-06 and accompanying text.

²⁰¹ MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 167-69.

²⁰² *Id.* at 168-69.

²⁰³ *Id.* at 167.

construction had lost their novelty, and the public had ceased to wonder at their speed, the spectacle of a dangerous and irresistible machine tearing through the streets of a village at thirty or forty miles an hour, raised a storm of indignation²⁰⁴

But, over time, the public's perception of the safety of automobiles changed, and data collected by the government began to suggest that early safety-related complaints about the automobile were unfounded and that, in fact, *horses* were more dangerous:

Gradually well kept statistics demonstrated that horses were not as safe as people had once thought; for example, per vehicle, horse transport killed more people than internal combustion engine travel would do later. (Machines do not bite or kick, or take flight at pieces of flying paper). While harnessed tame animals had once symbolized human progress, they now seemed atavistic in an age which was increasingly proud of its mechanization.²⁰⁵

Again, common law lawsuits followed, particularly against the street railway industry, which used horses to pull streetcars:

The street railway industry faced especially harsh problems of accident damage. Lawsuits often followed injuries with litigation becoming increasingly common as accidents multiplied in the late nineteenth century. Beneath this rise in litigation was the fundamental assumption that liberty and freedom entailed a right to physical integrity that accident and injury denied. Horsecar firms were especially vulnerable, perhaps because of their deep pockets. One street railway manager complained that they had become common game for accident hunters, and for “beats” of all kinds to try their fraudulent practices upon.²⁰⁶

The horse, which had once been the standard form of transportation in the U.S., had become a liability.

In the case of autonomous vehicles, it seems likely that citizens will challenge their safety in court, particularly in the early years of consumer access to Level 4 and 5 vehicles. Indeed, people may be less tolerant of accidents involving autonomous vehicles than they are of accidents involving human drivers, *even if autonomous vehicles are safer*. One scholar explains, “while it is true that self-driving technology will likely diminish roadway deaths, the vehicle technology will also be unavoidably imperfect. Furthermore, human beings are more inclined to forgive mistakes made

²⁰⁴ Brown, *supra* note 10, at 225-36.

²⁰⁵ McShane & Tarr, *The Decline of the Urban Horse*, *supra* note 11, at 186.

²⁰⁶ MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 168 (internal quotations omitted).

by humans than machines.”²⁰⁷ Additionally, much like what occurred in early automobile accident cases, it seems likely that early autonomous vehicle cases will focus on negligent use on the part of consumers rather than on thorny issues of product design or software programming.²⁰⁸ Over time, however, if autonomous vehicles are as safe as experts predict they will be, they may change the standard of care in the transportation sector and give rise to a new series of cases: those alleging that relying on a *human* to control a vehicle is negligent or that the risk created by human-driven cars on, say, residential roads is a nuisance. Society, in short, may grow increasingly intolerant of the higher risks and number of accidents caused by human-driven vehicles, and lawsuits will follow.

III. THE ROLE OF NON-LAW FACTORS IN TECHNOLOGY-DRIVEN SOCIETAL TRANSFORMATION

While lawmakers and attorneys may have a natural inclination to use law, regulations, and litigation to control or stymie significant social transformations—and may feel strongly that new laws, legal reforms, and lawsuits are, in fact, necessary to protect consumers—non-legal factors appear to have a far more significant and influential role in shaping societal adaption to disruptive products and the changes they usher in.²⁰⁹ Three factors, in particular, appear to be extremely influential: new economic incentives, convenience incentives, and evolving consumer preferences.²¹⁰ This section explores these non-legal factors.

A. *Economic Incentives*

Author and banker Herbert Prochnow famously said, “When money talks, there are few interruptions.”²¹¹ While consumers may initially balk at disruptive technologies, expressing great skepticism about their safety and desirability, changes to the profit margins of their business or impacts to their own personal finances may be exceptionally powerful incentives to adopt the very products about which they once grumbled.²¹² This was certainly the case with automobiles in the early twentieth century. While, for most businesses at the turn of the century, “transportation efficiency was defined by the capabilities of the horse-drawn wagon,” motor vehicles

²⁰⁷ Arentz, *supra* note 117, at 232.

²⁰⁸ *Id.* at 1270.

²⁰⁹ See MASLOW, *supra* note 31, at 15-16; see also *infra* notes _____ and accompanying text.

²¹⁰ See *infra* notes _____ and accompanying text.

²¹¹ Quotetab, *Herbert V. Prochnow Quotations*, QUOTETAB, <https://www.quotetab.com/quotes/by-herbert-v-prochnow#vTqUZ9FjX6dIMaEH.97>.

²¹² See *infra* notes 213-21 and accompanying text.

quickly changed the calculus.²¹³ Unlike horses, “motor vehicles did not need time to recuperate between loads.”²¹⁴ They also didn’t need to be fed grain (which was costly and had to be purchased regularly), and they didn’t get sick.²¹⁵ By 1913, therefore, *Munsey’s Magazine* observed that “the horse has become unprofitable. He is too costly to buy and too costly to keep.”²¹⁶

The automobile and electric streetcars and trolleys (which were built in cities around the same time period) also had a dramatic impact on property values because they allowed people to travel much further much faster. Henry Whitney, a Boston land speculator, for example, built an electric trolley connecting his “suburban landholdings in Brookline with downtown Boston.”²¹⁷ The results were dramatic:

Reports on the windfall profits that Whitney made on his property—he announced in 1891 that the value of Brookline real estate had increased by 20 million dollars over the previous five years—led to the rapid adoption of trolleys in other cities. Early trolley cars traveled at roughly double the speed of their living predecessors, quadrupling the land available for settlement within half hour of downtown.²¹⁸

Real estate interests, therefore, “became the strongest proponents of mechanization.”²¹⁹ Corporate insiders, seeing opportunities for more profit, pushed harder for more change, leading to an incredibly rapid transition:

The rapidity of this almost complete capital-intensive switchover from horse power to electric power—roughly ten years (1888-1902)—is startling, especially given the slow pace at which stationary engines had converted. Horsecars seemed too old-fashioned for cities that prided themselves on their modernity. Once the owners of street railways saw the possibilities of a low-cost form of mechanical power that was acceptable to the public, they switched immediately. If local firms did not convert, public pressure, in the form of grants to electrified competitions, forced them to do so rapidly. Trolleys allowed increases in route lengths, creating windfall real estate gains for corporate insiders.²²⁰

²¹³ Gijs P.A. Mom & David A. Kirsch, *Technologies in Tension: Horses, Electric Trucks, and the Motorization of American Cities, 1900-1925*, 42 TECH. & CULTURE 489, 495 (2001).

²¹⁴ *Id.* at 499.

²¹⁵ MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 169.

²¹⁶ *Id.* at 172 (quoting Herbert N. Casson, *The Horse Cost of Living*, MUNSEY’S MAG. 48 (Mar. 1913)).

²¹⁷ *Id.* at 171.

²¹⁸ *Id.*

²¹⁹ *Id.*

²²⁰ *Id.* at 172.

Largely absent from these decisions were concerns about safety; once consumers and businesspeople realized the tremendous economic gains that could be had from switching from horse to automobile, switching seemed to be an obvious choice, and any skepticism about motor vehicles that may have remained seemed to fall by the wayside.²²¹

Adoption of autonomous vehicles may follow a similar course. While, as discussed at length above, consumers currently express a great deal of fear and hesitation about fully driverless vehicles, polling suggests that economic considerations may eventually prevail. One study showed that only 20% of those surveyed “said that they’d be happy to let an autonomous car do the driving, no questions asked.”²²² What would it take to convince the remaining 80%? An economic incentive.²²³ The study showed that, “[w]hen presented with the possibility of an 80% reduction in their insurance premium, over one-third of respondents said they’d be ‘very likely’ to purchase an autonomous vehicle, and nearly all—90 percent—said that they’d at least consider the idea.”²²⁴ This possibility—that consumers will abandon human-driven cars for autonomous ones—seems so likely, in fact, that both the insurance industry and prominent investors have predicted “a scenario within twenty-five years where the personal auto insurance sector could shrink to 40% of its present size, bringing serious market issues, with evolving business models and new competition only increasing the intensity of the rapid change.”²²⁵

Experts also predict that autonomous vehicles will have significantly lower operating costs than human-driven vehicles.²²⁶ One scholar explains, “Fuel costs . . . should be lower, as autonomous vehicles are likely to be more efficient, both due to less congestion and to more optimized driving styles (ranging from smoother acceleration to various hypermiling techniques like drafting to reduce draft).”²²⁷ Autonomous vehicles also have the capacity to reduce congestion-related costs. Currently, human-driven automobiles “use only 8 percent of the road at most at any one time,” but autonomous vehicles could “at least double the percentage of the road used by cars because [due to their significantly faster response time] they can drive more closely together than human drivers, eliminating traffic jams completely.”²²⁸

²²¹ See McShane & Tarr, *The Decline of the Urban Horse*, *supra* note 11, at 187.

²²² Richard Read, *Would You Consider an Autonomous Car If It Came With a Deep Insurance Discount?*, CAR CONNECTION (Nov. 6, 2013), http://www.thecarconnection.com/news/1088225_would-you-consider-an-autonomous-car-if-it-came-with-a-deep-insurance-discount.

²²³ *Id.*

²²⁴ *Id.*

²²⁵ Arentz, *supra* note 117, at 235.

²²⁶ Smith, *supra* note 43, at 1410.

²²⁷ Levinson, *supra* note 43, at 805-06.

²²⁸ Weaver, *supra* note 41, at 178.

This benefit, in turn, means “more convenient travel and reductions in congestion, which currently costs Americans \$100 billion in wasted fuel and lost time, according to some reports.”²²⁹

Using an autonomous vehicle rather than driving may have other economic benefits, as well. U.S. workers, 80% of whom spent at least fifty minutes commuting each day, may be able to turn their commutes into productive work time.²³⁰ For attorneys and other people in occupations that charge an hourly rate, that could mean hundreds of extra dollars earned per day. Additionally, autonomous vehicles may cut down on errand-running, chauffeuring, and other tasks that can cost money and cut down on productivity:

Of the nearly 400 billion person-trips undertaken by U.S. drivers in 2008, almost forty-three percent were for personal and family-related purposes (such as shopping trips and trips for medical care). The frequency, duration, and timing of shopping, refueling, and chauffeuring trips may change as people find they can simply dispatch cars from the convenience of their home or office. In other words, as the time-cost of these trips approaches zero, demand for them is likely to increase. Recall that drivers, on average, appear to value their time even more than their gas; a thirty-minute, twenty-mile trip that costs eight dollars with one human occupant (the driver) would cost less than half that without any human occupants.²³¹

In sum, much like motor vehicles allowed people to reclaim time spent waiting for horses to rest and eat, autonomous vehicles will allow people to reclaim commute time almost entirely and put that time to more economically productive use.

Lastly, much like motor vehicles at the turn of the century, a societal shift away from human-driven cars and towards autonomous ones could have major economic benefits for the real estate industry by “increasing the acceptable commuting distance.”²³² Since commute time can be reclaimed in an autonomous vehicle, consumers may become more willing to move into the exurbs or even to a different city altogether.²³³ Much like it did in the early twentieth century, these benefits could lead to intense pro-autonomous vehicle lobbying efforts on the part of the real estate industry, which has much to gain from rapid adoption of these cars.

To be sure, not everyone will have an economic incentive to adopt autonomous vehicles or to push for mass societal acceptance and adaptation to this new

²²⁹ Lari *et. al.*, *supra* note 38, at 752.

²³⁰ Barringer, *supra* note 33, at 134-35.

²³¹ Smith, *supra* note 43, at 1410.

²³² *Id.* at 1417.

²³³ Levinson, *supra* note 43, at 804.

technology. The paid parking industry will likely go belly up, as autonomous vehicles will be able to drop their passengers off in front of their destination and then either return home, park outside of the city, or pick up another passenger.²³⁴ Additionally, “[t]he rise of autonomous vehicles could radically disrupt some industries or jobs and perhaps even drive them into extinction. This technology could eventually eliminate the jobs of taxi drivers, bus drivers, and truckers.”²³⁵ For everyone else, however, the comparative cost of owning and using a human-driven automobile, as compared to an autonomous one, may be a powerful incentive to make the switch.²³⁶

B. Convenience Incentives

Researchers have long called convenience, “one of the consumer’s greatest desires,” and shown through studies that convenience costs are a “crucial factor in shopping decisions.”²³⁷ One scholar, writing in the early 1960s, observed:

Convenience . . . may be described as ease in obtaining ultimate satisfactions. Dean Eugene J. Kelley, writing in the *Journal of Marketing*, uses the term “convenience costs,” to indicate all of the expenditures of leisure, money, and physical and nervous energy that consumers have to make to overcome frictions of time and distance during the process of acquiring satisfactions . . . Whatever these costs are called, they include such items as shopping time, parking fees, the frustration of dealing with hostile salespeople and the work of deciding what to buy. Kelley is convinced that these costs are becoming more and more important, along with the merchandise or price-tag costs, in a person’s decision as to where she will shop and which stores she will patronize.²³⁸

More recent studies have shown that convenience has time, space, and effort dimensions.²³⁹ The time dimension relates to the ability of consumers “to do two things at the same time, the necessity of waiting, the extent to which something is done quickly, and the ability to postpone something to a later time.”²⁴⁰ The space dimension relates to how far consumers have to travel to accomplish what they want, how out of the way from home and work their destination is, and the variety of things

²³⁴ See WEAVER, *supra* note 41, at 91.

²³⁵ Adam Thierer & Ryan Hagemann, *Removing Roadblocks to Intelligent Vehicles and Driverless Cars*, 5 WAKE FOREST J.L. & POL’Y 339, 358 (2015).

²³⁶ See *supra* notes 226-33 and accompanying text.

²³⁷ See Stanley C. Hollander, *Convenience, Not Status Symbols*, CHALLENGE, Oct. 1961, at 17.

²³⁸ *Id.*

²³⁹ Kenneth C. Gehrt & Laura J. Yale, *The Dimensionality of the Convenience Phenomenon: A Qualitative Reexamination*, 8 J. OF BUS. & PSYCHOL. 163, 172 (1993).

²⁴⁰ *Id.* (internal parentheses omitted).

that they can do at their destination once they are there.²⁴¹ The effort dimension relates “to the ability to minimize mess, whether a procedure is cumbersome, the extent to which packaging is handy, and the ability to minimize the amount of cash carried.”²⁴² All three of these dimensions factor heavily into consumer choice.²⁴³

Convenience was a driving force in the switch from horses to automobiles. Horses, while once the best and fastest mode of transportation, simply could not keep up with the huge convenience improvements offered by the automobile:

The reality is . . . that, for all of the horse’s critical roles as a flexible and evolving technology in the nineteenth-century city, it could not accommodate the requirements of the modern city. Some of the factors involved here are huge increases in freight and passenger traffic and city size and resulting demands for more speed, capacity, and endurance. No amount of breeding or nutritional improvement could alter the fact that the horse was still an animal with limits as a living machine operating in a rapidly growing built environment.²⁴⁴

Many of the economic disincentives for continued use of the horse had convenience consequences, as well: horses couldn’t be used for long periods of time without breaks for rest, food, and watering, and did not travel nearly as fast as automobiles, meaning that horse users had much longer travel times than automobile users, a time dimension issue of convenience.²⁴⁵ Horses also created bigger messes and required more care, implicating the effort dimension of convenience.²⁴⁶

One of the primary advantages of automated forms of technology are their high levels of convenience. By the middle of the 1900s, for example, newly automated appliances and products that arrived on the consumer market quickly replaced their human counterparts:

The gadgets that have replaced servants are not as ostentatious, but they may be much more convenient. They are available 24 hours a day, and they are a good deal cheaper, and they present no personality problems. So automatic dishwashers and vacuum cleaners have, to a very great extent, replaced the scullery maid, while prepared foods and kitchen appliances have replaced the hired cook.²⁴⁷

²⁴¹ *See id.* at 173.

²⁴² *Id.* at 174 (internal parentheses omitted).

²⁴³ *See id.* at 172-78.

²⁴⁴ MCSHANE & TARR, *THE HORSE IN THE CITY*, *supra* note 5, at 179.

²⁴⁵ *See supra* notes 214-16 and accompanying text.

²⁴⁶ MCSHANE & TARR, *THE HORSE IN THE CITY*, *supra* note 5, at 169.

²⁴⁷ Hollander, *supra* note 237, at 19.

Automated washing machines, in particular, were vastly more convenient than their hand-powered predecessors and freed up huge amounts of time for women who, prior to their invention, spent whole days during the week doing laundry.²⁴⁸ It should come as little surprise, then, that automated washing machines quickly became the go-to method for Americans to clean their clothes.²⁴⁹ The immense time-savings was impossible to resist even though automated washing machines were more expensive and, at least initially, more dangerous.²⁵⁰

While consumers may continue to insist that they love driving and would be hard-pressed to hand over their keys, therefore, history suggests that the conveniences offered by automated vehicles will not only win out, but will do so rapidly.²⁵¹ With commuting times in the U.S. steadily increasing over time, and a nearly universal hatred of sitting in traffic while behind the wheel, the average American may quickly decide that being able to recline in the backseat and sleep, work, or watch a movie is well worth the trade-off of whatever sense of satisfaction or freedom he or she gains from having a foot on the accelerator.²⁵² Moreover, if these cars can eventually be dispatched on their own to pick up milk from the supermarket, chauffeur older children to and from soccer practice, and refuel their tanks or obtain a supercharge, it is doubtful many Americans would turn down those substantial time-savings solely out of a nostalgic love of driving.²⁵³

Intriguingly, some jurisdictions have tried to capitalize on the significant relationship between convenience and human behavior in their policymaking. The city of Oslo, Norway, for example recently wanted to create a more environmentally-friendly and liveable city and reduce the carbon footprint of city residents.²⁵⁴ Automobiles were a natural target. Instead of going through the legal process required to ban cars within city limits, however, the city council decided on a simple, law-free plan of action: eliminating “all 650 on-street parking spots, and replace them with installation art and more public spaces”²⁵⁵ In the U.S., the City of Seattle has

²⁴⁸ ELAINE LANDAU, *THE HISTORY OF EVERYDAY LIFE* 24-25 (2006).

²⁴⁹ *See id.*

²⁵⁰ *See id.*

²⁵¹ *See supra* notes 244-50 and accompanying text.

²⁵² *See* Christopher Ingraham, *The Astonishing Human Potential Wasted on Commutes*, WASH. POST, Feb. 25, 2016,

https://www.washingtonpost.com/news/wonk/wp/2016/02/25/how-much-of-your-life-youre-wasting-on-your-commute/?noredirect=on&utm_term=.3058a3185a3c.

²⁵³ *See* Smith, *supra* note 43, at 1410.

²⁵⁴ Athlyn Cathcart-Keays, *Oslo's Car Ban Sounded Simple Enough. Then The Backlash Began*, THE GUARDIAN, Jun. 13, 2017,

<https://www.theguardian.com/cities/2017/jun/13/oslo-ban-cars-backlash-parking>.

²⁵⁵ *Id.*

tried a similar approach.²⁵⁶ City residents can certainly continue driving, but the inconvenience of trying to find parking will likely deter them. In Oslo, locals have already admitted to altering their behavior in light of this change.²⁵⁷ Years from now, lawmakers wishing to eliminate human-driven cars (and the human-caused accidents that follow) from public roads may wish to utilize a similar strategy. Limiting human-driven cars to a single lane, making the speed limit for human-driven cars 40 miles per hour lower than the speed limit for autonomous vehicles, or requiring human drivers to go through much more extensive and frequent testing in order to obtain and maintain a driver's license (and reducing DMV staff by 50% to increase wait times even further) would all likely have much the same effect of an outright product ban without the legal and constitutional headaches typically involved in the latter.

C. Consumer Preference

Economics and convenience may be driving factors in consumer activity, but there are also more intangible and subjective influences on consumer behavior.²⁵⁸ Forces as simple and pedestrian as wanting to be stylish, hip, or “modern,” or the seemingly perpetual human desire to “keep up with the Joneses” may exert intense pressure on individuals and, in turn, alter their behavior, particularly in the realm of product choice.²⁵⁹ Two economists explain:

[O]ne's well-being is determined not only by the intrinsic utility of her material consumption, but also by one's relative standing (status) in the society or in her peer group. In the economics literature, this notion is sometimes referred to as *the relative income hypothesis*, or as the phenomenon of *keeping up with the Joneses*, and is usually introduced to the models by postulating envious preferences on the part of the individuals . . . It is also evident that building the “relative position” concerns of individuals into economic models may well have far-reaching implications. There is in fact a sizable literature that demonstrates that this is precisely the case.²⁶⁰

²⁵⁶ SAMUEL I. SCHWARTZ, NO ONE AT THE WHEEL: DRIVERLESS CARS AND THE ROAD OF THE FUTURE 201-202 (2018).

²⁵⁷ See Cathcart-Keays, *supra* note 254.

²⁵⁸ See *infra* notes 259-85 and accompanying text.

²⁵⁹ See Efe A. Ok & Levent Kockesen, *Negatively Interdependent Preferences*, 17 SOC. CHOICE & WELFARE 533, 534 (2000).

²⁶⁰ *Id.*

Put more simply, “people’s choices often look like the choices made by those around them.”²⁶¹ This, in turn, is how fashions and trends in product choice arise and go on to influence even more consumer behavior of a similar type.²⁶²

Identifying why and how peer choices affect individuals is “notoriously difficult,” but there appear to be two factors influencing this causal relationship.²⁶³ First, studies have shown that people perceive that “assets purchased by others are of higher quality.”²⁶⁴ This phenomenon, called the “social learning” effect, reflects conventional wisdom that the grass always seems to be greener on the other side of the fence.²⁶⁵ Second, research also shows that “one’s utility from possessing an asset (or product) may depend directly on the possession of that asset (or product) by another individual.”²⁶⁶ Called the *social utility* effect, this phenomenon means that “preferences for products are, in part, based upon the social influence exerted by other individuals in the consumer’s social system.”²⁶⁷

Research also shows that consumers make product choices based on their desire to signal aspects of their identity.²⁶⁸ Two marketing experts explain:

An extensive body of research on identity signaling demonstrates that people use consumption to signal to themselves and others their beliefs, attitudes, and social identities. Various aspects of a product contain symbolic meaning and may convey a particular image, such as specific brand assertions and price . . . Specifically, research has shown that purchase decisions (*e.g.*, preferences for food, attire, and beauty products) and personal environments (*e.g.*, work, personal living spaces) signal information about the personalities, values, and habits of their owners.²⁶⁹

Consumers, in making purchasing decisions, therefore, have a strong tendency to choose products that “signal positive characteristics” like wealth, technological savviness, and “openness to new experiences.”²⁷⁰

²⁶¹ Leonardo Bursztyn, *et. al*, *Understanding Mechanisms Underlying Peer Effects: Evidence From a Field Experiment on Financial Decisions*, 82 *ECONOMETRICA* 1273, 1273 (2014).

²⁶² See Shelby H. McIntyre & Christopher M. Miller, *Social Utility & Fashion Behavior*, 3 *MARKETING LETTERS* 371, 371 (1992).

²⁶³ Bursztyn, *et. al*, *supra* note 261, at 1274.

²⁶⁴ *Id.*

²⁶⁵ *See id.*

²⁶⁶ *Id.*

²⁶⁷ McIntyre & Miller, *supra* note 262, at 372.

²⁶⁸ Deborah V. Thompson & Michael I. Norton, *The Social Utility of Feature Creep*, 48 *J. OF MARKETING RES.* 555, 556 (2011).

²⁶⁹ *Id.*

²⁷⁰ *Id.* at 557-58.

Social learning, social utility, and identity signaling were hugely significant factors in Americans' rapid adoption of the automobile in the first quarter of the 20th Century.²⁷¹ At first, automobile ownership was a powerful signal of wealth, and the news media did much to reinforce that message. In 1896, for example, "*Cosmopolitan* ran a photo of wealthy New Yorkers inspecting a car at a suburban country club. The earliest published magazine photo of a family in a car appeared in the popular leisure magazine, *Outing*, which captioned the photo 'Plaything of the Wealthy.'"²⁷² That same year, presidential candidates began campaigning in cars, "not just to increase mobility, but to prove their modernity."²⁷³

Popular culture quickly began reinforcing the idea that automobiles were a status symbol. The most popular song in 1905 was "In My Merry Oldsmobile" by Gus Edwards and contained the lyrics, "Come away with me Lucille . . . You can go as far as you like with me, in our merry Oldsmobile."²⁷⁴ In 1922, another popular song asserted, "You can't afford to marry me, if you can't afford a Ford."²⁷⁵ Two years later, in 1924, the cover of *Vogue Magazine* showed an automobile "customized as a fashion accessory," which was not particularly surprising given that car customization was a hot trend that year among rich Parisians.²⁷⁶ By that point, a full third of the advertisements in the popular and widely read *Saturday Evening Post* were ads by automobile companies,²⁷⁷ and horses had come to be seen as "a thing of the past," and a relic of "traditional rural life."²⁷⁸

Americans—rich and poor—responded to these messages in force and, if needed, scrimped, saved, and borrowed money to buy cars.²⁷⁹ In 1910, the same year that the Chancellor of Syracuse University observed that young men were putting off marriage so that they could save money to buy a car, the Reverend I.T. Lansing of Scranton, Pennsylvania, complained that Americans were spending more of their income on cars than "church work."²⁸⁰ This was, in fact, true for large numbers of people, many of whom were taking out second mortgages on their homes in order to purchase automobiles.²⁸¹ *Harper's* even ran an article about "small-town shopkeepers

²⁷¹ See *infra* notes 272-85 and accompanying text.

²⁷² MCSHANE, DOWN THE ASPHALT PATH, *supra* note 153, at 131.

²⁷³ *Id.* at 132.

²⁷⁴ MCSHANE, THE AUTOMOBILE, *supra* note 3, at 32.

²⁷⁵ *Id.* at 59.

²⁷⁶ *Id.* at 62.

²⁷⁷ *Id.* at 61.

²⁷⁸ MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 176, 179.

²⁷⁹ See *infra* notes 280-82 and accompanying text.

²⁸⁰ MCSHANE, THE AUTOMOBILE, *supra* note 3, at 42.

²⁸¹ See MCSHANE, DOWN THE ASPHALT PATH, *supra* note 153, at 133; FLINK, *supra* note 2, at 102-03.

who jacked up their prices to pay for new cars, ultimately bankrupting themselves.”²⁸²

By 1925, so many Americans had purchased automobiles that the auto industry produced its twenty-five millionth car and reached its saturation point—the point at which most cars sold were replacements rather than first-time purchases.²⁸³ This created a paradoxical situation:

[T]he automobile became simultaneously an item of unprecedented mass consumption as well as the most important symbol of status in American society. As a monumental example of the American tendency toward upward social leveling, the solution to this paradox, one seen at the time and ultimately true in fact, was that the use of the automobile as a status symbol would be restricted to the type of car one owned rather than automobile ownership per se. From the introduction of the innovation, it appeared that mass ownership of motor vehicles was both desirable and inevitable. Like many other modern items of material culture, such as the telephone and the radio, the advantages of automobile ownership to each individual were enhanced as the innovation became more widely adopted.²⁸⁴

Once nearly everyone had automobiles, the next step in keeping up with the Joneses was having a nicer, newer, and bigger one than everyone else. One researcher, who had studied family snapshots of this era discovered that many families emphasized their wealth in photos by standing next to new cars.²⁸⁵ Some families even resorted to camera trickery: “even the amateur family snapshots . . . used low, frontal camera angles that exaggerated the size of the car, especially the hood and the engine underneath”²⁸⁶

Much like the switch from horse to car, the switch from human-driven to autonomous vehicles will likely involve a significant “cultural component” that plays a strong role in influencing consumer preference.²⁸⁷ While, at first, some percentage of the population may cling to driving their own vehicles out of fear, an enjoyment of driving, or even some curmudgeonly instinct to push against forces of change, both consumer theory and history indicate that, as people see their friends and neighbors purchasing newer, more modern, more highly automated vehicles, they will feel

²⁸² MCSHANE, DOWN THE ASPHALT PATH, *supra* note 153, at 133.

²⁸³ *Id.* at 63-64.

²⁸⁴ FLINK, *supra* note 2, at 103-04.

²⁸⁵ MCSHANE, DOWN THE ASPHALT PATH, *supra* note 153, at 132.

²⁸⁶ *Id.*

²⁸⁷ See MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 179.

inclined to do so, as well.²⁸⁸ Indeed, studies show that choosing products with more features than others “can be an effective strategy in cultivating others’ positive impressions, conferring social benefits beyond inferences of wealth and regardless of the specific product features.”²⁸⁹ What better way to reap those social benefits than by purchasing not only a new car, but one that can chauffeur you as you relax in the backseat while lesser mortals are still stuck behind the wheel?

IV. THE LIMITED RELEVANCE OF LAW DURING TIMES OF PRODUCT-DRIVEN SOCIAL CHANGE

Legal scholars standing on the cusp of significant social change may feel a sense of anxiety that the law has fallen behind technology or that our legal institutions are not yet prepared for what is coming. This has certainly been true in the realm of legal scholarship about autonomous vehicles, in which scholars have frequently said things like, “With the [autonomous vehicle] technology rapidly developing, the legal field needs to respond,”²⁹⁰ and “[t]he advent of autonomous driverless vehicles presents a plethora of new and unique legal issues, which will need to be analyzed to facilitate the adequate transition of this new technology to the marketplace.”²⁹¹ I myself have written, “the stakes are extremely high and the time extremely limited.”²⁹² While scholars may be right in specific contexts—there is indeed a great need for greater governmental oversight of the safety of both semi-autonomous and fully autonomous vehicles prior to their arrival on the market, for example—the history of the transition from horse to car suggests that, on a broader scale, law is a limited force in times of product-driven social change. As discussed at length above, non-law factors like economic incentives, convenience incentives, and consumer preference are likely to be primary drivers of product-driven societal transformation and may solve many of the foreseeable problems without a need for lawmaking or other forms of legal action. If autonomous vehicles wind up being overwhelmingly safer than human-driven ones, for example, we may worry in advance about having to ban human-driven cars on public roads and the political fight that might entail. But, by the point at which that issue is relevant, consumer preference may have fixed the problem: nearly everyone may already be driving an autonomous vehicle. After all, no jurisdiction banned the use of horses in the early decades of the 20th century, and yet, by the middle of that century, horses had been virtually eliminated from U.S. roads.

²⁸⁸ See *supra* notes 279-85 and accompanying text; see also Rachael Roseman, *When Autonomous Vehicles Take Over the Road: Rethinking the Expansion of the Fourth Amendment in a Technology-Driven World*, 20 RICH. J.L. & TECH. 3, 11 (2014).

²⁸⁹ Thompson & Norton, *supra* note 268, at 555.

²⁹⁰ Roseman, *supra* note 288, at 11.

²⁹¹ Jeremy Levy, *No Need to Reinvent the Wheel: Why Existing Liability Law Does Not Need to Be Preemptively Altered to Cope with the Debut of the Driverless Car*, 9 J. BUS. ENTREPRENEURSHIP & L. 355, 357 (2016).

²⁹² Pearl, *Compensation at the Crossroads*, *supra* note 22, at 1833.

At the point at which autonomous vehicles become the norm on U.S. roads, law may have *some* role to play in the transition—the role of “clean-up crew”—or it may have very little role to play at all. Many jurisdictions in the U.S., for instance, never banned the use of horses on public roads.²⁹³ In New York, “[o]ne can [still] become licensed to steer horse carriages through the streets of Manhattan having had no prior experience handling horses anywhere.”²⁹⁴ Other cities did enact horse-drawn carriage bans.²⁹⁵ By the time these bans were put into place, however, either they were no longer needed (one would be hard pressed to find horse-drawn carriages driving down New York City streets anywhere outside of Central Park despite New York City’s lack of a ban) or they were no longer controversial.²⁹⁶ To the contrary, by the time jurisdictions started banning horses on public roads, “owners, riders, the public, and regulators were all anxious to get rid of the horse, not only because of its limitation as a machine but also because of the externalities it produced—manure, “typhoid flies,” and dead horses—had become intolerable in the modern city.”²⁹⁷ In this way, law was merely codifying something that had already happened rather than trying to control the transition from the front end; it was, as one scholar has put it, “a reinforcing expression of social norms.”²⁹⁸ Once everyone had switched to automobiles as their primary form of transportation, all that was left for law to do was deal with the few straggling curmudgeons who still clung on to the reins (hence the “clean-up crew” analogy). This wasn’t perceived as “nanny state” intervention; instead, it was seemingly a political non-event. Indeed, I cannot find a single research article or historical account of public resistance to horse bans in the mid- to late 20th century.

In much the same way, human-driven cars on U.S. public roads may not end with the proverbial bang, but with the proverbial whimper.²⁹⁹ Ultimately, it may be private consumer choices rather than law that “shape[s] the outcome of public policy and planning,”³⁰⁰ much like it did during the transition from horses to automobiles.³⁰¹

²⁹³ See Katherine Hutchison, *Should They Go the Way of the Horse and Buggy? How the New York City Horse-Drawn Carriage Industry Has Survived Thirty Years of Opposition*, 17 ANIMAL L. 171, 177 (2010).

²⁹⁴ *Id.*

²⁹⁵ *Id.* at 179.

²⁹⁶ See MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 165 (discussing how non-law-related forces eventually resulted in the “nearly full substitution of other technologies for the horse”).

²⁹⁷ MCSHANE & TARR, THE HORSE IN THE CITY, *supra* note 5, at 172.

²⁹⁸ Lindsay F. Wiley, *Sugary Drinks, Happy Meals, Social Norms, and the Law: The Normative Impact of Product Configuration Bans*, 46 CONN. L. REV. 1877, 1888 (2014).

²⁹⁹ See T.S. ELIOT, *The Hollow Men*, in COLLECTED POEMS 1909-1952, 79-82 (1963).

³⁰⁰ BARRETT, *supra* note 179, at i-ii.

³⁰¹ See *supra* notes 210-89 and accompanying text.

This should provide us all with some reassurance that the political establishment and legal community need not—and, in fact, cannot—solve all problems in advance. The coming transition from human-driven to autonomous vehicles will evolve and shape itself as it goes, and law, in turn, will evolve and shape itself, as well, likely in ways that we cannot anticipate now at the very start of that transition. As one historian has observed, “The rhetoric of late nineteenth-century judges promoted the idea that the law rests on timeless principles, removed from vacillating, ephemeral, and self-interested social norms. But the law was deeply rooted in temporal values, ever changing, even if its practitioners could not so conceive it.”³⁰²

The history of the horse-to-automobile transition also points to more creative ways—both law and non-law- related—that law and policymakers can influence the kind of changes they wish to achieve. As discussed at greater length above, initiatives aimed at decreasing the convenience of using a particular kind of product (e.g., eliminating parking spaces) or at increasing the cost associated with using it (e.g., increasing licensing fees or tolls) can do much to shape consumer choice and product use.³⁰³ Similarly, efforts to heighten the perception that a particular kind of product or activity is “cool,” modern, or “on-trend” may increase demand or participation, whereas creating the perception that a product or activity is old-fashioned (but not “vintage”), “basic,” or uncool may have the opposite effect.³⁰⁴ These kinds of initiatives have the benefit of being powerful agents of change without having to navigate the complex world of lawmaking and politics.³⁰⁵

Finally, history also suggests that the best way to solve a product-related problem is to change *humans* rather than regulate the product. These human behavioral changes, moreover, may be just as influential—if not more so—than statutes and regulations in enhancing product safety. Prior to the introduction of the automobile, for example, children often played in the streets. That habit became a deadly one at the turn of the century, and, by 1918, auto accidents were a leading cause of death for children in certain areas of the country.³⁰⁶ Even the President’s car was a hazard. In 1913, President Woodrow Wilson’s car hit a young messenger boy. (Wilson and his chauffeur then accompanied the boy to a nearby hospital, where the President promised to buy him a new bike).³⁰⁷ While safety crusaders insisted that more government regulation of automobiles was needed, behavioral changes on the part of children and their parents appear to have been far more impactful than law

³⁰² RANDOLPH E. BERGSTROM, *COURTING DANGER: INJURY AND LAW IN NEW YORK CITY, 1870-1910* 195 (1992).

³⁰³ See *supra* notes 211-59 and accompanying text.

³⁰⁴ See *supra* notes 258-89 and accompanying text.

³⁰⁵ See *supra* notes 211-59 and accompanying text.

³⁰⁶ See MCSHANE, *THE AUTOMOBILE*, *supra* note 3, at 54; see also MCSHANE, *DOWN THE ASPHALT PATH*, *supra* note 153, at 188-91.

³⁰⁷ MCSHANE, *THE AUTOMOBILE*, *supra* note 3, at 46.

in reducing the number of child fatalities on the road.³⁰⁸ One historian observed that “it was not hard to figure out that children, probably the biggest losers in the rise of traffic, needed new habits. Traffic forced parents to confine children to the home or subject them to strict traffic discipline at an early age.” The solution to the problem was not to ban automobiles from residential areas or regulate them even further, it was to teach children to “look both ways” before they crossed the street, a solution we’re still using today.³⁰⁹

V. CONCLUSION

The United States is on the cusp of a major product-driven social transformation. Fully autonomous (Level 4) vehicles are currently being tested on U.S. roads, and semi-autonomous (Level 2) vehicles are already available to consumers. These vehicles are expected to radically change transportation in this country in the coming decades by improving highway safety significantly, turning commuting time into productive time, and increasing the accessibility of cars to the elderly and differently abled. While consumers are currently highly suspicious of these vehicles, experts predict that the majority of vehicles on public roads will be autonomous by 2035, and that nearly all vehicles on the road will be autonomous by 2050.

As we enter into this period of change, citizens, politicians, and legal scholars have worried that our laws and legal system have lagged behind the development of this new technology. Many have proposed passing new laws or regulations in an effort to take greater control of the transition from human-driven to autonomous vehicles or out of a hope to solve problems that are predicted to arise in the coming decades. This desire to legislate in advance has resulted in poorly drafted laws and inconsistent rules and regulations across the fifty states.

What virtually no legal scholar or politician has done as of yet is explore the remarkably similar product-driven transition that the U.S. experienced at the start of the 20th century when citizens switched from horses to automobiles, and ask what lessons can be learned from that time period and the role that law played in it. This has been a significant oversight. What that time period demonstrates is that, in eras of product-driven social change, law often plays a fairly limited role during the transition, especially as compared to other, non-legal forces of change. This should provide some reassurance that a rush to regulate autonomous vehicles is unnecessary and point to other avenues of influencing consumer choice and behavior.

There is a spectrum of reactions to product-driven social change ranging from “most intensively law-based” reactions at one end to reactions that are not law-based at all on the other end. Along that spectrum, there are six distinct vectors of change:

³⁰⁸ MCSHANE, DOWN THE ASPHALT PATH, *supra* note 153, at 188-89.

³⁰⁹ *Id.* at 188.

(1) product bans, (2) time, place, and manner restrictions, (3) common law litigation, (4) economic incentives, (5) convenience incentives, and (6) consumer preference. Understanding each of these points along the spectrum, and how they have shaped previous social transformations, is helpful in understanding what forces are likely to be the most influential in shaping and guiding American adoption of autonomous vehicles.

Statutory or regulatory product bans are government efforts to prohibit sale or possession of particular types of products, typically out of health and safety concerns. Products bans are among the most extreme form of legal responses to new technologies and are often politically or legally fraught. While both the federal and state governments clearly have the legal power to regulate and ban products that pose health hazards, product bans are unlikely to be successful or long-lasting in the absence of significant political support and a favorable public opinion. While the government could attempt to ban autonomous vehicles or, decades from now, human-driven vehicles, both of these possibilities seem extremely unlikely and unnecessary. Destroying the market for autonomous vehicles would have serious economic consequences for the automotive and tech industries, and banning human-driven cars will likely become unnecessary over time as consumers will likely transition to autonomous vehicles on their own.

Time, place, and manner restrictions are laws that place limitations on how or when a particular kind of product can be used. These may include zoning ordinances, safety regulations, and licensure requirements. While these kinds of laws are not as harsh as product bans and are thus less likely to elicit significant political pushback, there are risks inherent in passing these kinds of laws too early or too late in a product's development or adoption. Passed too early, these kinds of laws risk over-regulating a product and squelching the market. Early laws may also be a response to risks that are merely *perceived* by lawmakers rather than to the *actual* risk profile of a given product. Passed too late, however, and lawmakers may fail to mitigate risk in a timely and effective way and thus fail to prevent injuries and deaths that could have been avoided. Lawmakers, therefore, should proceed extremely carefully in contemplating and passing these kinds of laws.

Common law litigation is always a likely response to new products, particularly those that stand to lead to significant social change. Private individuals concerned about the risks or annoyances associated with new products have the power to bring common law negligence, products liability, and nuisance claims against product manufacturers, designers, or users. Indeed, history has shown that the public has a tendency to exaggerate harms associated with innovative new products and often bring an initial wave of lawsuits that looks nothing like lawsuits brought later when the technology is better understood. However, as transformative products disrupt the status quo over time, the public's view of older products often changes, and common law litigation can shift from targeting the newer product to attacking the old. Several

years into the transition to automobiles, for instance, consumers were increasingly intolerant of horses. These new societal views, in turn, often change the common law, the legal perception of the standard of care, and what constitutes a nuisance.

Economic incentives are a powerful, non-legal vector of social change. New products are often cheaper to use, increase productivity significantly, and may have positive externalities for other industries like real estate. When this is true, consumers often quickly adopt these new products in spite of reservations about issues like safety that they might have. The existence of economic incentives also means that few laws or regulations may be needed to compel consumers to switch to safer, more modern, or otherwise more socially desirable products.

Similarly, convenience incentives are extremely significant factors in consumer choice. Products that offer more convenience on time, space, or effort dimensions are likely to be exceedingly popular with buyers, and may again supersede hesitations that they might have about new and novel technologies. The importance of convenience factors also offers an interesting possibility for law and policymakers: by making a particular kind of product more inconvenient to use, the government can shape consumer choice without ever regulating that product directly. Eliminating parking spaces, for example, is an excellent way to deter the use of private automobiles without actually regulating private automobiles.

Finally, consumer preference, though subjective and often difficult to measure, is an extremely powerful influence on individuals. Research has repeatedly shown that consumers are likely to buy products that their friends and neighborhoods have also bought, and that they are highly motivated to making purchasing decisions that signal positive things about their identity. In the context of transformative products, this means that, despite what are often significant initial reservations about those products, consumers will purchase them as they see people around them doing the same. This can lead to extremely rapid adoption of transformative products, as in the case of automobiles in the early 20th century. It is likely that autonomous vehicles will experience a similar phenomenon.

If autonomous vehicles are as safe and productivity-enhancing as experts predict that they will be, the government might be motivated to push human-driven vehicles to extinction as quickly as possible, out of public health concerns if nothing else. At this point in our history, however, doing so would likely result in significant political and cultural pushback. Polls have repeatedly shown that the general public is extremely skeptical about the safety of driverless cars, and many people tout their love of driving as a significant reason they will never purchase one. Trying to legislate or regulate too early and too heavily, therefore, would be a serious mistake. Similarly, trying to regulate fully autonomous vehicles themselves at this early stage is an inherently risky prospect as these vehicles are evolving rapidly over time and are not yet available to consumers.

If, however, we take a more cautious approach to using law to influence or control this transition, it is likely that economic incentives, convenience incentives, and consumer preference will solve many of these problems on their own and lead to a transition that is quicker and more painless than we might anticipate. While autonomous vehicles may seem novel and vaguely frightening now, most consumers will likely change their minds when it becomes apparent how much time they will regain and money they will save by using them, not to mention how much safer studies will likely show them to be. More importantly, as their friends, colleagues, and neighbors begin purchasing autonomous vehicles in greater numbers, the social pressure to purchase one may become fairly intense. This was precisely what happened when Americans switched from horses to automobiles, leading to a transition that was remarkably fast, particularly in urban areas.

In the end, therefore, law might be most effective as a tool that carefully codifies new social and cultural norms after a period of product-driven social transformation, rather than as a tool that tries to drive it. Law, in this perspective, is valuable as a means of *completing* a transition rather than tightly controlling it. In the case of autonomous vehicles, law can be the cautious referee allowing greater numbers of autonomous vehicles onto the track, but allowing the race to proceed largely unimpeded. In the case of human-driven vehicles, moreover, law can—and will likely be—the checkered flag waving at the end of a long and storied race.