A Future without Human Driving

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ABSTRACT

Cities, especially those lacking a well-functioning public transport system, have long had a love-hate relationship with privately owned cars. On the one hand, cars allow a massive influx of people into cities from the surrounding areas. This inflow helps cities maintain their economic vitality and social relevance. On the other hand, there are massive prices to pay. Congested traffic means a slow commute, which is both unpleasant and wasteful. Furthermore, car parking is enormously expensive in terms of physical space and financial cost. Worse still is the cost in life and limb that car accidents cause. Small wonder that commentators have called for the complete removal of cars from cities or that many cities have taken up the initiative of banning cars from their centers. Autonomous Vehicles (AV) hold the promise of a "gentler, kinder" car, which will allow more individual passengers to get to their desired destinations faster, more comfortably, and more safely than they do now. We have two goals in this paper: first, to present the technology in its transition from the drawing board into mainstream use while outlining current trends in emerging technologies regulation (AVs included); and second, to suggest that AVs hold particular promise in the urban context. Here, we look into AV regulation in more detail, discussing the social impact and legal considerations that should be addressed as we move forward to the future with (or without) human driving.

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INTRODUCTION

Car driving has changed little in several generations. Today's car may be safer and more comfortable than the passenger cars of our parents and grandparents, but most salient features remain unchanged: the basic design, the core model of private ownership and insurance, speed, and even cost.[1] The nearing autonomous vehicle (AV)[2] revolution carries the promise of the most comprehensive change to the passenger car in over a century. The precise details, however, are unclear, prompting commentators to wonder: "Will people overcome their fear of 'driverless' vehicles?";[3] More broadly, "Are we headed for an autonomous utopia or

1. The average price of a new car in 2013 ($27,424) was very close to the average price in 1970 ($22,929), when adjusted for inflation. *See* STACY C. DAVIS & ROBERT G. BOUNDY, TRANSPORTATION ENERGY DATA BOOK 264 (37th ed. 2019), https://info.ornl.gov/sites/publications/Files/Pub116893.pdf [https://perma.cc/KFU4-5FFE]. On the rise in commute times in the United States, see Joe Pinsker, *Yes, Rush-Hour Traffic Is Getting Worse*, THE ATLANTIC (Aug. 26, 2015), https://theatlantic.com/business/archive/2015/08/rush-hour-traffic-commute/402418/ [https://perma.cc/66NU-A52Y].

2. Autonomous Vehicles (AV) are also known as driverless or self-driving cars—both terms commonly relating to vehicles that do not need human input to operate. In this paper, we will use the term Autonomous Vehicles given that it better reflects the issues we highlight.

3. AAA's annual automated vehicle survey (2018) found that seventy-one percent of people are afraid to ride in fully self-driving vehicles. Surveys also found that almost two-thirds of airline passengers would be unlikely to fly in a pilotless plane. Such concerns are likely to slow down the use of AVs until public confidence builds up, as was the case for the 'driverless elevator' and human car

driverless dystopia?";[4] And even, "What if autonomous cars just never happen?"[5]

We have been considering the potential implications of the so-called revolution for some time, both as scholars of public law, technology, and comparative law and as longtime drivers licensed in multiple jurisdictions. We are neither technophiles nor Luddites. We have little knowledge of the technical developments concerning AVs, but we have no significant objection to their introduction. We will admit, however, a general dislike for city driving and a wish for the introduction of more efficient transportation options. With this paper, we try to extrapolate from past lessons as to the future of human car driving. Our starting point is the optimistic assumption that, in several years, AVs will become a viable alternative transportation model for people who currently own and drive private cars.[6]

This paper is presented in four parts. In Part I, we outline current trends of emerging technologies—venturing into *Alvin Toffler* territory[7]—in trying to assess the practical impact of AVs, mainly the expected dramatic decrease in the human operation of cars. We also discuss some of the challenges and fears related to AV policy. In Parts II and III, we draw on public law (as well as socioeconomic and cultural implications) to suggest that a decrease in human car driving would be a good thing for our society, though it may also prove a less fortunate development. Building on the lessons we learned from significant shifts in the past centuries, we offer insights and suggestions for potential regulatory changes in Part IV.

We have taken a small detour to avoid tedious discussions about the levels of AV developments, AV definitions, and current regulatory initiatives.[8] We choose

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drivers. *See, e.g.*, *Three in Four Americans Remain Afraid of Fully Self-Driving Vehicles*, AAA NEWSROOM (Mar. 14, 2019), https://newsroom.aaa.com/2019/03/americans-fear-self-driving-cars-survey/ [https://perma.cc/BQ3Q-BCUQ]; Hannah Boland, *Pilotless Planes Could be Flying Soon but Public Fears Must be Overcome, Says Airbus*, THE TELEGRAPH (June 18, 2019) https://www.telegraph.co.uk/technology/2019/06/18/pilotless-planes-could-flying-soon-overcoming-public-fears-obstacle/ [https://perma.cc/HR23-ZUNF]; Steve Henn, *Remembering When Driverless Elevators Drew Skepticism*, (NPR Planet Money Morning Edition broadcast July 31, 2015) https://www.npr.org/2015/07/31/427990392/remembering-when-driverless-elevators-drew-skepticism [https://perma.cc/S4ZU-3N2T]; Louis Anslow, *Forget Self-Driving Car Anxiety: In the Early Days Human Drivers were the Fear*, TIMELINE (Nov. 3, 2016), https://timeline.com/forget-self-driving-car-anxiety-in-the-early-days-human-drivers-were-the-fear-55a770262c10 [https://perma.cc/RTX7-4XF6].

4. *See* Kurt Kohlstedt, *Crash Course: Are We Headed for an Autonomous Utopia or Driverless Dystopia?*, 99% INVISIBLE (Apr. 12, 2017), https://99percentinvisible.org/article/crash-course-headed-autonomous-utopia-driverless-dystopia/ [https://perma.cc/3Z3A-FFLT].

5. *See* Raphael Orlove, *What If Autonomous Cars Just Never Happen?*, JALOPNIK (Nov. 28, 2017), https://jalopnik.com/what-if-autonomous-cars-just-never-happen-1820778692 [https://perma.cc/S7TP-ZLUE].

6. *See* Mark Harris, *The Future of Driving Is Now a Gold Rush*, WIRED (Dec. 21, 2016), https://www.wired.com/2016/12/the-future-of-driving-is-now-a-gold-rush/?mbid=synd_digg#.plaje1nq6 [https://perma.cc/CYS9-AGEM].

7. Alvin Toffler is an American writer who made futurism more legitimate and mainstream. *See Alvin Toffler*, WIKIPEDIA, https://en.wikipedia.org/wiki/Alvin_Toffler [https://perma.cc/HN86-LAWP].

8. There are important regulatory AV initiatives in the US at both the federal and state level. *See e.g.*, U.S. DEPARTMENT OF TRANSPORTATION, AUTOMATED DRIVING SYSTEMS 2.0: A VISION FOR SAFETY (2017), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf. [https://perma.cc/3D4H-HJ6K]; and the more recent U.S. DEPARTMENT OF TRANSPORTATION, PREPARING FOR THE FUTURE OF TRANSPORTATION: AUTOMATED VEHICLES 3.0 (2018), https://www.transportation.

instead to highlight briefly other points and to provide a broader perspective on some of the issues already discussed in recent papers.[9] In the final count, the following issues may appear little more than sentimental concerns and, when all factors are considered, pose as no more than speed bumps on the road to AV. The car is the star. That's been true for well over a century."[10] Much of it is because the car is so convenient, and convenience, "along with American history, culture, rituals, and man-machine affection, hide[s] the true cost and nature of cars."[11] But we urge regulators to, at the very least, bear them in mind in the coming decades, especially as reasons to gradually introduce a ban on human driving.

One issue is social, cultural, and historic in nature. It concerns the importance of *the car* not just on a practical but on a symbolic level. If we think of the car, on a functional level, then, as one commentator observes: "[c]onsidering the constant fatalities, rampant pollution, and exorbitant costs of ownership, there is no better word to characterize the car's dominance than insane."[12] While we are sympathetic to the evaluation, certainly in dense urban areas, this may not be so clearly the case in other parts of the country. But the issue is more symbolic in nature. A car, to paraphrase Freud, is not just a car,[13] and so we think factors of history, culture, habit, and convention will likely slow down the public acceptance of limiting human driving.

A *second issue* concerns the *human* aspect of *human* driving. Some will find our argument self-defeating, so please bear with us. Much of what makes driving objectively dangerous and irritating to drivers is the human operation of cars. Thus, eliminating human driving from the equation will likely make the experience more pleasant and efficient. But it will also make the experience less human and less social, and we *humans* need to be active and interactive. Noted Dutch psychologist D. J. Van Lennep wrote in 1969:

> I drive exactly the way *I am*. My style of driving is not determined by my more or less quickly reacting to the stimuli of a so-called outer-world, but by the manner in which I actively take part in the road situation while I observe the

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gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf [https://perma.cc/JY8R-MEUZ]. There are numerous legislation initiatives in the United States. One of the first AV laws was introduced in Nevada. *See* Nev. Assemb. B. 69, 79th Sess. 2017 (Nev. 2018). For recent discussions regarding self-driving legislation at the United States House of Representatives, see *Self-Driving Vehicle Legislation: Hearing on H.R 2448 Before the Subcomm. on Digital Commerce and Consumer Protection of the H. Comm. On Energy and Commerce*, 115 Cong (2017).

9. *See, e.g.*, Kyle L. Barringer, *Code Bound and Down . . . A Long Way to Go and A Short Time to Get There: Autonomous Vehicles Legislation in Illinois*, 38 S. ILL. U. L. J. 121 (2013); Tracy Hresko Pearl, *Fast & Furious: The Misregulation of Driverless Cars*, 73 N.Y.U. ANN. SURV. AM. L. 19 (2017).

10. *See* Edward Humes, *The Absurd Primacy of the Automobile in American Life*, THE ATLANTIC (Apr. 12, 2016), https://www.theatlantic.com/business/archive/2016/04/absurd-primacy-of-the-car-in-american-life/476346/, [https://perma.cc/96HL-J47U].

11. *Id.*

12. *Id.*

13. The original phrase, attributed to Sigmund Freud is: "Sometimes a cigar is just a cigar."

> established significations of the traffic signs, signals, and so on, and of myself give those meanings to the possibilities which offer themselves to me as an active member of this form of social life.[14]

But it's not just about *us*, the drivers. Driving is rarely a private experience. As John Donne famously wrote in 1624: "No man is an island entire of itself; every man is a piece of the continent, a part of the main."[15] Modern psychology strongly supports these notions.[16] Driving permits are likely the most widely held government-issued license (even if the figures show some decline), and the requirements for qualification are set—especially in the United States—at a fair and inclusive level.[17] This makes driving one of the most widely shared human experiences, a communal one that occurs when drivers share public roads. In driving, people meet, interact with, and accommodate a huge range of other drivers: young and old, novice and experienced, patient and impetuous.

Recent psychological research has identified a series of driving styles—ranging from the anxious to the distracted, from the careful to the risk-taking, fast-driving, and angry driver. Research has also found a host of factors influencing driving styles, including personality, as well as cognitive, attitudinal, and demographic variables such as age and gender.[18] These typologies have many implications. Individuals' driving characteristics have a major impact on every facet of driving—from fuel efficiency[19] to driving safety.

Therefore, the road serves as a modern-day societal "melting pot" where people of all walks of life meet—whether they like it or not.[20] And, while they all share a basic goal—driving the road efficiently and safely—people have different views and assessments on what this means. As we share the road, we have to account for the judgement calls of other drivers. For example, meeting all

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14. D. J. van Lennep, *The Psychology of Driving a Car*, *in* PHENOMENOLOGICAL PSYCHOLOGY: THE DUTCH SCHOOL 217, 222 (Joseph. J. Kockelmans ed., 1987).

15. John Donne, *Meditation XVII*, *in* DEVOTIONS UPON EMERGENT OCCASIONS AND SEVERAL STEPS IN MY SICKNESS 108–09 (1624).

16. "Human beings are social animals, and the tenor of someone's social life is one of the most important influences on mental and physical health. Without positive, durable relationships, both minds and bodies can fall apart." *Social Life?*, PSYCHOLOGY TODAY, https://psychologytoday.com/us/basics/social-life [https://perma.cc/8MCV-95N2] (last visited July 10, 2019).

17. *See* Natalie Guevara, *Getting Your Driver's License Is Most Difficult In Washington*, SEATTLE PI (Jan. 30, 2019), https://seattlepi.com/seattlenews/article/Driver-s-license-Washington-most-difficult-cost-13574357.php [https://perma.cc/KM6K-4ZYF].

18. *See* Mario Alberto Trógolo, Franco Melchior & Leonardo Adrián Medrano, *The Role of Difficulties in Emotion Regulation on Driving Behavior*, 6(1) J. BEHAV., HEALTH & SOC. ISSUES 107, 108–09 (2014).

19. One study argues that "total gasoline use would fall by 17%–26% if all drivers behaved like the most efficient individuals." Karl W. Dunkle Werner, Driver Behavior and Fuel Efficiency 1 (Apr. 5 2013) (undergraduate honors thesis, University of Michigan) https://deepblue.lib.umich.edu/bitstream/handle/2027.42/98892/karldw.pdf?sequence=1&isAllowed=y [https://perma.cc/G4RY-NUFQ].

20. For a critical evaluation of the "melting pot" concept, see Heike Paul, *E Pluribus Unum?: The Myth of the Melting Pot, in* THE MYTHS THAT MADE AMERICA: AN INTRODUCTION TO AMERICAN STUDIES 257–310 (2014).

personality types on the road introduces us to, inter alia: *the very strict*, by-the-book driver who must keep in-lane and at-speed-limit and will show her annoyance if you stray from the rules; *the multitasker*, who can weave through lanes while texting, shaving, and applying makeup; *the gentle soul*, who lets other cars overtake him; and *the alpha male*, who must show everyone who is boss on the road. Each is driving a fast-moving, heavy piece of equipment.

Moreover, for many drivers, entering the car provides a release from their actual, face-to-face personae. To some, driving a car is an empowering experience—which explains why so many Americans prefer cars that match their personality over their immediate vehicular needs. Monster trucks, off-road capacities, aggressive furnishings, and dramatic colorations are all par for the course. At the same time, entering these mechanical pods also provides—at least for now, when technologies like dashboard cameras and tracking devices ("black boxes") are uncommon in privately owned cars—some measure of anonymity. This means that drivers dare act when behind the wheel (or when anonymously *online*) in ways that would be socially unacceptable in personal interactions. Whether it is the car or the small likelihood of being identified and held accountable, there is a lot of acting out on the road.

And yet traffic functions reasonably well. One reason is that drivers mostly obey traffic law, if only because they understand the danger of accidents.[21] Second, both cars and roads are built with "tolerance" for some automotive mishandling and bad judgment while driving. They are better built and have more safety features than ever before, which helps correct human error.

A *third issue* concerns the wider societal—specifically democratic and egalitarian—aspect of *human* driving. With the current state of the world, it is very difficult to avoid all three of the following: driving in person, driving on public roads, and sharing the road with a great many drivers, each bringing her temperament and views of traffic law and the condition of the road. In other words, in real life, most of us drive ourselves and, when we do so, have to share the road with anyone (who wants to do so) and everyone (for whom the road is open).

True, some people cannot drive for financial or health reasons, while others are rich or important enough to be chauffeured at all times. Addressing a conference of car dealers in January 2014, Hillary Clinton "confessed" that she hasn't driven a car in nearly two decades.[22] But this is exceptional. Most of us are occasionally driven by others, but seemingly few people in the West employ a full-time driver,

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21. *See* Dana Yagil, *Drivers and Traffic Laws: A Review of Psychological Theories and Empirical Research*, *in* TRAFFIC AND TRANSPORT PSYCHOLOGY: THEORY AND APPLICATION (Geoffrey Underwood ed., 2005), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.528.6758&rep=rep1&type=pdf [https://perma.cc/WJ9D-8PAR].

22. "'One of the regrets I have about public life is that I can't drive anymore,' Clinton said in a speech at the National Automobile Dealers Association (NADA) meeting in New Orleans. 'The last time I actually drove a car myself was 1996.' She joked, 'My husband thinks that's a blessing, but he's the one who should talk.'" Stephanie Condon, *Hillary Clinton Hasn't Driven a Car Since 1996*, CBS NEWS (Jan. 27, 2014), https://cbsnews.com/news/hillary-clinton-hasnt-driven-a-car-since-1996/ [https://perma.cc/RVN3-8YHZ].

whether for cultural or financial reasons. Even high-ranking officials and company executives mostly drive themselves. In doing so, we physically share a road, but we also share a human experience. We need to follow the same rules that apply to everyone, and we need to understand and accommodate the driving abilities and phobias of others. Driving is an ongoing socialization project for adults. It is a unique manifestation of the ideas that we are "not alone"—that the law applies to all.

There are rare times, perhaps very late at night or very early in the morning, when roads are essentially empty, and you can drive unrestrained by the driving of others: choose your cruising speed, driving style, and ride to your heart's content. But for the most part, being rich and famous—even having a private chauffeur—does not exempt one from the banal discomforts of driving—such as seeing and being seen by other people. Some might not enjoy this exposure,[23] but being merely rich and famous is not enough to exempt them from it—you need to be very rich or mega-important. If you are a head of state, the road will be cleared for you. If you are mega-rich, you might use helicopters as frequently as possible. If you are Elon Musk, you might invent your own way.[24]

But it is precisely Musk's "icky" given reason for avoiding this exposure, his dislike of "sharing space" with people when using public transportation,[25] that makes the continued shared use of roads (though clearly not as physically close an interaction) so important. The fact is that modern liberal democracies rarely demand that citizens be physically present and interact with one another: most countries do not have compulsory military service[26] or mandatory voting,[27] and they are happy to let people interact with authorities by mail, phone or online. You may need to present yourself if you want to obtain government licenses or certificates, but it is both legal and possible—in this age of home delivery—for a person to become a total recluse.[28]

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23. *See* Natasha Brown, *20 Pics of Celebs Stuck in Traffic (That They're Clearly Not Happy About)*, HOTCARS (Dec. 22, 2018), https://hotcars.com/pics-of-celebs-stuck-in-traffic-that-theyre-clearly-unhappy-about/ [https://perma.cc/U9P3-L2ZD]. Tinted windows tend to do the trick.

24. *See* Eillie Anzilotti, *Elon Musk's Tunnel Through L.A. Just Happens to Go from His House to His Office, World Changing Ideas*, FAST COMPANY (Nov. 29, 2017), https://fastcompany.com/40500593/elon-musks-tunnel-through-l-a-just-happens-to-go-from-his-house-to-his-office [https://perma.cc/M4XM-TRU2] ("The Boring Company could ease L.A.'s traffic problems, especially for one very special commuter.").

25. "Musk revealed he's no great fan of mass transit. The whole sharing space with other humans thing? It's kind of icky." Aarian Marshall, *Elon Must Reveals his Awkward Dislike of Mass Transit*, *Transportation*, WIRED (Dec. 14, 2017), https://wired.com/story/elon-musk-awkward-dislike-mass-transit/ [https://perma.cc/UT8K-74T5].

26. *See Conscription*, WIKIPEDIA (July 9, 2019), https://en.wikipedia.org/wiki/Conscription [https://perma.cc/T3E5-E9BY].

27. *See Compulsory Voting*, WIKIPEDIA (July 8, 2019), https://en.wikipedia.org/wiki/Compulsory_voting [https://perma.cc/X633-ZNQJ].

28. Indeed, this is a well-documented phenomenon in Japan. *See Pictures of Life in Isolation: Japan's Hikikomori*, NAT'L GEOGRAPHIC (Feb. 14, 2018), https://www.nationalgeographic.com/photography/proof/2018/february/japan-hikikomori-isolation-society/ [https://perma.cc/QE57-3TXX].

Moreover, people go to great lengths to limit and minimize their contact with other people. If given the choice, people opt to live alone[29] and in suburbia;[30] they prefer to commute alone;[31] and they tend to dislike open-space workplaces.[32] Mass transportation often allows for greater privacy, but at a price—trains, ocean liners, and airplanes, all offer "classes" of travel privilege.[33] Such measures provide the government with more income, which it can put to good use; And given the growing income disparities[34] accentuating economic differentiation, some people want to increase their physical isolation and are willing to pay for it. But it is far from clear that enabling for-pay seclusion in public spaces is the best public policy.

If the state regulates AVs in a way that bans the current form of driving, it will increase the separation of individuals. Many will welcome the privacy and comfort this will enable, but atomization further increases the troubling decline in social contacts. Our intuition is that most people would not like to live in

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29. Note the rise in single person households in Europe. Eurostat, *Rising Proportion of Single Person Households in the EU* (June 7, 2018), https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20180706-1?inheritRedirect=true [https://perma.cc/8QQN-XRZX].

30. The result of design choices is a status quo of default isolation. "[I]n America we have settled on patterns of land use that might as well have been designed to prevent spontaneous encounters, the kind out of which rich social ties are built." David Roberts, *How Our Housing Choices Make Adult Friendships More Difficult*, VOX (Dec. 27, 2018), https://vox.com/2015/10/28/9622920/housing-adult-friendship [https://perma.cc/3P8P-7A26].

31. *See, e.g.*, Earl J. Ritchie, *Driving to Work Alone Is a Costly Habit, So why do We Keep Doing it?*, FORBES (June 16, 2016), https://www.forbes.com/sites/uhenergy/2016/06/16/driving-to-work-alone-is-a-costly-habit-so-why-do-we-keep-doing-it/#60d9c33ea25d [https://perma.cc/E8LZ-RVNQ]; Mike Lloyd, *A US Survey Finds Most People Prefer Driving Alone*, NEWS 1130 (June 23, 2015), https://www.citynews1130.com/2015/06/23/a-us-survey-finds-most-people-prefer-driving-alone/ [https://perma.cc/9E9Y-RYJ4]; Richard Florida, *The Great Divide in How Americans Commute to Work*, CITYLAB (Jan. 22 2019), https://www.citylab.com/transportation/2019/01/commuting-to-work-data-car-public-transit-bike/580507/ [https://perma.cc/EZ3T-GZBW]; Emily Badger, *The Lonely American Commute*, WASH. POST (August 15, 2015), https://www.washingtonpost.com/news/wonk/wp/2015/08/14/the-lonely-american-commute/ [https://perma.cc/AY9H-9KPR].

32. *See* Katharine Schwab, *Everyone Hates Open Offices. Here's Why They Still Exist*, FAST COMPANY (Jan. 15, 2019), https://fastcompany.com/90285582/everyone-hates-open-plan-offices-heres-why-they-still-exist [https://perma.cc/Z2SF-8D64]. Remarkably, open offices actually *reduce* face-to-face interaction by about seventy percent and increase email and messaging by roughly fifty percent. *See* Katharine Schwab, *Here's the Final Nail in the Coffin of Open Plan Offices*, FAST COMPANY (July 19, 2018), https://fastcompany.com/90204593/heres-the-final-nail-in-the-coffin-of-open-plan-offices [https://perma.cc/GP7W-DVDJ] (reporting on a 2018 Harvard Business School study).

33. Airport class separation reached a new level when the first private terminal in the United States opened in Los Angeles in 2017. *See* Tanza Loudenback, *I Visited the Private Terminal at LAX Where Rich People Pay Upwards of $4,500 to Skip the Lines and Pull Up to Their Planes in BMWs, and it Made Me Feel Like a Billionaire, Executive Life*, BUSINESS INSIDER AUSTRALIA (Dec. 29 2018), https://businessinsider.com.au/private-suite-lax-terminal-wealthy-travelers-photos-tour-2018-10 [https://perma.cc/HM8D-M34T] ("It's the first private terminal at a major US airport, but similar models exist at airports in London; Munich; Frankfurt, Germany; and Dubai, United Arab Emirates. My first impression was that it's intimate and isolated, in the best way.").

34. At least in the United States. For international comparisons, see Joe Hasell, *Is Income Inequality Rising Around the World?*, OUR WORLD IN DATA (Nov. 19, 2018), https://ourworldindata.org/income-inequality-since-1990 [https://perma.cc/R3QA-YJTC].

complete isolation, with all our physical needs met by machines,[35] so it is likely that people in most countries[36] will try to maintain social contacts, even if they are very selective about them. But it seems that, like the need to take vitamins, most people are aware of their benefit, know how they can be naturally obtained, but still fail to get a sufficient daily dose. People are increasingly lonely,[37] and loneliness is increasingly considered an epidemic.[38] With human contact now becoming a "luxury good,"[39] we are likely to see solutions provided by businesses, rather than the traditional—and mostly free—opportunities for social contact.[40] The social contact provided by cars is not a panacea, but eliminating it—and the need to interact with "the other"—is surely not a positive step.

I. TALKIN' BOUT A REVOLUTION

A. Regulating Emerging Technologies

Recent developments have stirred both interest in and concern about emerging technologies. Several countries have addressed expected changes by offering amendments to their laws. The Obama administration, for example, published reports on emerging technologies surveying artificial intelligence (AI) and automation potential.[41] The Canadian government invested millions of dollars in its

35. On this premise—and what happens when the machines fail—see the classic dystopian science fiction novella, E. M. FORSTER, THE MACHINE STOPS (1909).

36. Admittedly, some countries—notably, Japan—present more challenging social difficulties. *See*, *e.g*. Norimitsu Onishi, *A Generation in Japan Faces a Lonely Death*, N.Y. TIMES (Nov. 30, 2017), https://nytimes.com/2017/11/30/world/asia/japan-lonely-deaths-the-end.html [https://perma.cc/VB4K-GYN6] ("there are an estimated 4,000 'lonely deaths' in 'the world's most rapidly aging society . . . .").

37. *See* Rhitu Chatterjee, *Americans Are a Lonely Lot, and Young People Bear The Heaviest burden*, NPR (May 1, 2018), https://npr.org/sections/health-shots/2018/05/01/606588504/americans-are-a-lonely-lot-and-young-people-bear-the-heaviest-burden [https://perma.cc/XB9W-HXFY].

38. *See* Katie Hafner, *Researchers Confront an Epidemic of Loneliness*, N.Y. TIMES (Sept. 5, 2016), https://nytimes.com/2016/09/06/health/lonliness-aging-health-effects.html [https://perma.cc/UQ2J-HBH2] ("Researchers have found mounting evidence linking loneliness to physical illness and to functional and cognitive decline.").

39. *See* Nellie Bowles, *Human Contact is Now a Luxury Good*, N.Y. TIMES (Mar. 23, 2019), https://nytimes.com/2019/03/23/sunday-review/human-contact-luxury-screens.html [https://perma.cc/KGW2-PRWT] ("Screens used to be for the elite. Now avoiding them is a status symbol.").

40. *See*, *e.g*., Laura Entis, *The Big Business of Loneliness*, VOX (May 6, 2019), https://www.vox.com/the-highlight/2019/4/29/18511580/loneliness-co-living-coworking-friend-app-tribe-wework [https://perma.cc/28AF-JKVC] ("Coworking spaces, friendship apps, and adult dorms are selling human connection.").

41. *See* U.S. EXECUTIVE OFFICE OF THE PRESIDENT, PREPARING FOR THE FUTURE OF ARTIFICIAL INTELLIGENCE, 5–6 (2016), https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf [https://perma.cc/M6FZ-J8KT]; U.S. EXECUTIVE OFFICE OF THE PRESIDENT, ARTIFICIAL INTELLIGENCE, AUTOMATION, AND THE ECONOMY (2016), https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-Intelligence-Automation-Economy.PDF [https://perma.cc/7BNX-877M]. *See also* U.S. EXECUTIVE OFFICE OF THE PRESIDENT, THE NATIONAL ARTIFICIAL INTELLIGENCE RESEARCH AND DEVELOPMENT STRATEGIC PLAN, 3 (2016), https://nitrd.gov/pubs/national_ai_rd_strategic_plan.pdf [https://perma.cc/GB5E-PQ53].

"digital future,"[42] and Canadian scholars offered changes to AV regulation,[43] recommending a registration scheme for advanced systems.[44] In the United Kingdom, the House of Lords appointed a Select Committee "to consider the economic, ethical and social implications of advances in artificial intelligence."[45] The committee published its final report in April 2018, which asserted that the UK is in a strong position to become a leading country in AI development, offered several recommendations to mitigate AI risks, and provided policy suggestions.[46] The EU also produced several policy papers considering emerging technology potential.[47] Japan,[48] China,[49] Singapore,[50] Australia,[51] Israel[52] and

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42. CAN. DEP'T OF FINANCE, BUILDING A STRONG MIDDLE CLASS: BUDGET 2017, 104 (Mar. 22, 2017), budget.gc.ca/2017/docs/plan/budget-2017-en.pdf [https://perma.cc/SNS2-DLP5]. The 2018 budget reinforces Canada's commitment to AI research. *See* CAN. DEP'T OF FINANCE, EQUALITY + GROWTH: A STRONG MIDDLE CLASS, 85, 93 (Feb. 27, 2018) https://www.budget.gc.ca/2018/docs/plan/budget-2018-en.pdf [https://perma.cc/54L5-TFDP]. *See also* Aviv Gaon & Ian Stedman, *A Call to Action: Moving Forward with the Governance of Artificial Intelligence in Canada*, 56 ALTA. L. REV. 1137 (2019).

43. *See* Matthew E Castel & Jean-Gabriel Castel, *The Impact of Artificial Intelligence on Canadian Law and Legal Profession*, 46 THE ADVOCATES' QUARTERLY 34 (2016) [hereinafter The Impact of AI on Canadian Law]; Jean-Gabriel Castel & Matthew E Castel, *The Road to Artificial Super- Intelligence: Has International Law a Role to Play?*, 14 CAN. J.L. TECH. 1 (2016).

44. *See id*. Similar ideas for registration technology were raised in regard to 3D printing. *See* Shlomit Yanisky-Ravid & Kenneth S Kwan, *3D Printing the Road Ahead: The Digitization of Products When Public Safety Meets Intellectual Property Rights—A New Model*, 38 CARDOZO L. REV. 921 [hereinafter Yanisky-Ravid & Kwan].

45. SELECT COMM. ON ARTIFICIAL INTELLIGENCE, AI IN THE UK: READY, WILLING AND ABLE?, 2017–19, HL 100, at 2 (U.K.), publications.parliament.uk/pa/ld201719/ldselect/ldai/100/100.pdf publications.parliament.uk/pa/ld201719/ldselect/ldai/100/100.pdf [https://perma.cc/RND6-CZBL] [hereinafter AI in the U.K. report].

46. *Id*. at 126–38.

47. *See*, *e.g., Commission Proposal for the European Parliament, the Council, the European Economic and Social Comm. And the Comm. Of the Regions*, *A Digital Single Market Strategy for Europe*, COM (2015), 192 final (May 6, 2015). *Commission Proposal for the European Parliament, the Council, the European Economic and Social Comm. And the Comm. Of the Regions*, *Digitising European Industry Reaping the full benefits of a Digital Single Market*, COM (2016), 180 final (Apr 19, 2016); *Commission Proposal for the European Parliament, the Council, the European Economic and Social Comm. And the Comm. Of the Regions*, *Building a European Data Economy* (2017), 9 final (Jan. 10, 2017); Claire Bury, *Mid-Term Review of the Digital Single Market Strategy (DSM) – a Good Moment to Take Stock*, EUROPEAN COMM.: DIGITAL SINGLE MARKET (May 10, 2017), ec.europa.eu/digital-single-market/en/content/mid-term-review-digital-single-market-dsm-good-moment-take-stock [https://perma.cc/35UY-GR2Q]; Press Release, European Parliament, Robots: Legal Affairs Comm. Calls for EU-wide rules (Jan. 12, 2017), europarl.europa.eu/news/en/news-room/20170110IPR57613/robots-legal-affairs-committee-calls-for-eu-wide-rules [https://perma.cc/6YQA-UEVU]. The committee approved MEP Mady Delvaux's report. *See Draft Rep. of the Comm. On Legal Affairs on Motion for a European Parliament Resolution with Recommendations to the Commission on Civil Law Rules on Robotics* (May 31, 2016), https://www.europarl.europa.eu/doceo/document/JURI-PR-582443_EN.pdf [https://perma.cc/D5HH-BJKD].

48. *See* Press Release, The Ministry of Economy, Trade and Industry, Robotics Policy Office is to be Established in METI (July 1, 2015), meti.go.jp/english/press/2015/0701_01.html (as part of Japan's "Robotic Revolution" a Robotic Policy Office is to be established under the Ministry of Economy, Trade and Industry); *see also* THE HEADQUARTERS FOR JAPAN'S ECONOMIC REVITALIZATION, NEW ROBOT STRATEGY: JAPAN'S ROBOT STRATEGY (2015), meti.go.jp/english/press/2015/pdf/0123_01b.pdf. In 2017, the New Energy and Industrial Technology Development Organization, which is a government

other countries have invested and are investing resources in emerging technologies and have introduced regulatory changes as well.

Future policy challenges include developing rules that can assist in decision making processes, anticipating programs that may eventually be able to make certain decisions for us. Investing resources in decision making technology is an important goal for governments.[53] Advanced programs may eventually make vital decisions that can affect life, such as the decision to shoot a "hostile" target by automated drones or for AVs to choose between hitting a pedestrian or crashing into a tree.[54] Indeed, these decisions, while similar, are different in many

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organization and plays an important role in Japan's economic and industrial policies, published a report on AI policy: STRATEGIC COUNCIL FOR AI TECHNOLOGY, ARTIFICIAL INTELLIGENCE TECHNOLOGY STRATEGY (2017), http://www.nedo.go.jp/content/100865202.pdf [https://perma.cc/448E-6EBJ].

49. On July 20, 2017, the China State Council issued guidelines on AI development as part of the "Next Generation Artificial Intelligence Development Plan" (China AI Plan). According to the press release, the Chinese government is going to focus on promoting trans-boundary research to connect AI with other areas (such as cognitive science, psychology, mathematics, and economics), developing a common technology system based on algorithms, data, and hardware, creating innovation platforms, and training more AI professionals. *See* Press Release, The State Council of the People's Republic of China, China issues guideline on artificial intelligence development (July 20, 2017), english.gov.cn/policies/latest_releases/2017/07/20/content_281475742458322.htm [https://perma.cc/2X5X-XFK5].

50. The Singapore National Research Foundation (NRF) announced a 150 million Singaporean dollar investment over the next five years into a new national program to enhance the AI research in Singapore. *See* Press Release, The Singapore National Research Foundation, AI Singapore (Nov. 07, 2018), nrf.gov.sg/programmes/artificial-intelligence-r-d-programme [https://perma.cc/6HNX-VXFQ].

51. A recent policy paper by the National Transport Commission outlines possible legislation changes concerning automated and self-driving cars. See AUSTL. NATIONAL TRANSP. COMMISSION, CHANGING DRIVING LAWS TO SUPPORT AUTOMATED VEHICLES (2017), ntc.gov.au/Media/Reports/(E5695ACE-993C-618F-46E1-A876391B8CD9).pdf [https://perma.cc/Y48N-RVK6.]; *see also*. AUSTRALIAN GOVERNMENT, INNOVATION AND SCIENCE AUSTRALIA, AUSTRALIA 2030 PROSPERITY THROUGH INNOVATION: A PLAN FOR AUSTRALIA TO THRIVE IN A GLOBAL INNOVATION RACE (2017), https://www.industry.gov.au/sites/g/files/net3906/f/May%202018/document/pdf/australia-2030-prosperity-through-innovation-full-report.pdf [https://perma.cc/GN3D-KCCE].

52. The Science and Technology Committee at the Knesset (Israel Parliament) held a discussion on AI developments on June 4, 2018. Prior to the discussion, the Knesset's Research and Information Center published a special report titled "Information on the topic of 'AI'. *See* ROY GOLDSMITH, THE ISRAELI KNESSET, RESEARCH AND INFORMATION CENTER, INFORMATION ABOUT AI, (June 3, 2018), knesset.gov.il/mmm/data/pdf/m04227.pdf [https://perma.cc/FA53-7XMR].

53. *See* Joel Tito, *Destination Unknown: Exploring the Impact of Artificial Intelligence on Government* (Centre for Public Impact, Working Paper, 2017), publicimpact.blob.core.windows.net/production/2017/09/Destination-Unknown-AI-and-government.pdf [https://perma.cc/PZ85-TQ7R].

54. This consideration is an old ethical question named the Trolley Problem, which goes as follows: You see a runaway trolley moving toward five tied-up (or otherwise incapacitated) people lying on the tracks. You are standing next to a lever that controls a switch. If you pull the lever, the trolley will be redirected onto a sidetrack, and the five people on the main track will be saved. However, there is a single person lying on the side track. You have two options: Do nothing and allow the trolley to kill the five people on the main track or Pull the lever, diverting the trolley onto the side track where it will kill one person. Which is the more ethical option? *See Trolley Problem*, WIKIPEDIA, https://en.wikipedia.org/wiki/Trolley_problem [https://perma.cc/E4LF-4BLF] (last updated August 8, 2019); Judith Jarvis Thompson, *The Trolley Problem*, 94 YALE L.J. 1395 (1985). If we cannot find a way to solve the problem, we can't program the solution.

ways. There is a near consensus internationally that "kill" decisions should always be reserved for humans.[55]

It is reasonable to assume that advanced systems will be integrated into programs that are affecting our day-to-day lives such as: airplanes, cars, and various means of transportation (including smart drone delivery); controlling home elevators, cleaning, and heating functions; tracking our moves and caring for us. Certain professions such as doctors, lawyers and accountants (all of whom are currently heavily regulated) will change or adapt in concert with these changes.

In the tech policy debate, there are voices arguing that no regulation is needed since "[AV] technology has the potential to dramatically improve safety on our nation's roadways . . . ."[56] However, "safer than human driving" is not good enough.[57] Governments should set basic rules for advanced systems and, even more urgently, establish how to regulate current technology.

A comprehensive proposal that has emerged recently in this area is that of establishing an independent oversight body—a National Algorithm Safety Board. The Board would have three primary duties: "planning oversight, continuous monitoring by knowledgeable review boards using advanced software, and a retrospective analysis of disasters."[58] Anyone seeking to develop and deploy a major new algorithmic system would be required to submit an algorithm impact statement to the Board. These statements would include "[s]tandard questions about who the stakeholders are, and what the impacts might be," which would "ensure that implementers think carefully about potential problems and then propose reasonable solutions."[59]

Being transparent with the Board in advance of deployment would help to minimize concerns about having later to decode the algorithm and its built-in values. It may also be prudent to require black-box testing before approval. Continuous monitoring would follow the initial approval and would be undertaken by knowledgeable inspectors. This ongoing oversight is similar in theory to the idea of safety inspections in food processing facilities. This would be possible and meaningful because the Board would approve the algorithm before it is delivered to the market. It would also inspect and test the algorithm through its continuous

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55. Ryan Calo, *Artificial Intelligence Policy: A Primer and a Road Map*, 51 U.C. DAVIS L. REV. 399, 415-17 (2017) (Calo); *see also* Heather M Roff & Richard Moyes, *Meaningful Human Control, Artificial Intelligence and Autonomous Weapons*, article36.org/wp-content/uploads/2016/04/MHC-AI-and-AWS-FINAL.pdf [https://perma.cc/GB8Z-Y4Z5] (paper prepared for the Informal Meeting of Experts on Lethal Autonomous Weapons Systems, U.N. Convention on Certain Conventional Weapons, 2016); Pascale Fung, *Robots with Heart*, 313 SCI. AM. 60 (2015).

56. *Self-Driving Vehicle Legislation*: *Hearing on H.R before the Subcomm. On Digital Commerce and Consumer Protection*, 115th Cong. 6–8 (2017) (opening statement of Greg Walden, Chairman of the Subcomm. On Digital Commerce and Consumer Protection).

57. Calo, *supra* note 55.

58. Ben Shneiderman, The Dangers of Faulty, Biased, or Malicious Algorithms Requires Independent Oversight, 113 PROCEEDINGS NAT'L ACAD. SCI.13538, 13539 (2016), pnas.org/content/113/48/13538.full.pdf, [https://perma.cc/DTX6-WTGU]

59. *Id.*

monitoring program. The Board could then work with the algorithm's owner (or any other responsible parties) in order to conduct inquiries and investigations into any harms that are caused.[60]

A different set of policies should be developed to address privacy concerns. Privacy, or the lack thereof, has become a significant concern as people have become more involved on the Internet over the past two decades. We now perform many of our day-to-day activities via the Internet, from using social networks to post pictures (that can pinpoint our exact location) to buying products on Amazon and using GPS-based applications to drive. All these applications and online systems use our data. This availability of data is what enables technological development: machine learning cannot function without access to data. However, the fact that data are so important to the development of advanced programs does not mean that we should not find ways to secure the use of our data and reserve *some* level of privacy.

The acceleration of emerging technologies will play an essential role in the privacy discussion. Two main issues threaten our privacy: pattern recognition and access to data.[61] AI technology can identify patterns that humans cannot. These capabilities, which we can expect to improve in the future, pose a significant risk to our privacy and threaten to diminish it almost entirely, making everything public to some extent. Even if we allow AI to use information that is shared freely, such as grocery lists or locations, AI pattern recognition might reveal sensitive information about us.[62] This technology, however, could also be used for positive purposes such as security and safety.[63]

Another concern is with access to data and how we prioritize data. Simply put, the ability of algorithms to find solutions to an issue is dependent upon the availability and quality of the data they can access. Data can reflect biases and inequality. Thus, regulating the amount of data, the quality of the data, and the priority

60. Matthew U. Scherer, *Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies* , 29 Harv J L. & Tech. 353, 394 (2016) (Another example presented by Matthew Scherer. Scherer argues for the creation of what he calls an Artificial Intelligence Development Act to be administered by a government agency that can certify and label AI systems as safe).

61. Calo, *supra* note 55, at 420–25.

62. Calo, *supra* note 55, at 421; *see also* Tal Zarsky, *Transparent Predictions*, 4 U. ILL. L. REV. 1503 (2013). Recently, Israel Private Protection Authority (PPA) has examined the broadcasting companies and streaming services in Israel (including Netflix). Following the investigation, PPA published its opinion concluding that the information gathered by the broadcasting companies could, potentially, reveal sensitive information about viewers and is considered "data" under the Privacy Act and regulations. In consequence, PPA instructed the companies to secure the information, and to ask for the viewer's consent for collecting data. *See* ISR. PRIVATE PROTECTION AUTHORITY, STATEMENT CONCERNING VIEWERS DATA BY TELEVISION COMPANIES (April 22, 2018), gov.il/he/Departments/news/_1tv_supervision [https://perma.cc/ZT47-68MJ].

63. Ryan Calo, *Can Americans Resist Surveillance?*, 83 U. CHI. L. REV. 23 (2016); *see also* Calo, *supra* note 55, at 417 (observing that "[i]f everyone in public can be identified through facial recognition, and if the 'public' habits of individuals or groups permit AI to derive private facts, then citizens will have little choice but to convey information to a government bent on public surveillance.").

with which organizations can access data are paramount.[64] Given that governments control vast amounts of data, the decision of access is first and foremost a policy question.[65]

From a public policy perspective, governments should adopt guidelines and regulations that designate the usage of data for specific causes, provide restrictions to preserve the privacy of their citizens, and define the scope of fair data usage.[66] In addition, big datasets may also affect the economy: as data are the fuel of emerging technology development, data are worth a lot of money, and therefore governments can leverage data as a means of funding.[67]

The *EU General Data Protection Regulation* (*GDPR*), which came into force in May 2018,[68] is the most coherent attempt to regulate data. However, there are some difficulties with the *GDPR*. First, it seems that many experts in the industry do not understand some of the rules relating to the usage of data.[69] Second, the *GDPR* is forcing companies to explain the algorithms and AI decision process, which is not always possible.[70] Machine Learning algorithms are designed to "think on their own" by developing new methods and approaches for a given task.[71]

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64. Amanda Levendowski, *How Copyright Law Can Fix Artificial Intelligence's Implicit Bias Problem*, 93 WASH. L. REV. 579 (2018).

65. We are aware of the risks and challenges posed by mega companies such as Google, Facebook, Apple, Amazon, or Microsoft, for example. These companies hold the key to significant amount of data that can affect—in positive or negative ways—the development of technology and our privacy. As part of developing an effective AI policy, governments ought to consider if and how to regulate this so-called "private" data.

66. This issue raises subsequent questions regarding the way in which governments can incentivize organizations to use data for public good. Providing free access to government data for specific organizations or companies could prove to be a good policy.

67. Castel & Castel, *supra* note 43, at 48. The Castels address privacy concerns in Canada, stating that "[n]either the federal nor the provisional or territorial legislation addresses directly the situation of AI machines as collectors, recipients or users of personal information which defines by Personal Information Protection and Electronic Documents Act, S.C 2000, c.5, s.2(1) as 'information about an identifiable individual.'" They proposed an interesting suggestion. *Id.* at 49 ("Before AI machines are sold . . . robotic engineers and programmers should be required to insert in their software an algorithm with a code of conduct that contains Canadian privacy standards and instructions to respect any personal information that they have acquired."). Easier said than done. One of the most complex issues is how to create ethical rules and standards for AI and robots.

68. Council Regulation 2016/679 of Apr. 27, 2016, On the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Advancement of Such Data, and Repealing Directive 95/46/EC, 2016 O.J. (L 119/1) (GDPR).

69. *See id.* at. Art. 22. "Automated individual decision-making including profiling."

70. Cliff Kuang, *Can A.I. Be Taught to Explain Itself?*, NY. TIMES (Nov. 21, 2017), https://www.nytimes.com/2017/11/21/magazine/can-ai-be-taught-to-explain-itself.html?hp&action=click&pgtype=Homepage&clickSource=story-heading&module=mini-moth&region=top-stories-below&WT.nav=top-stories-below [https://perma.cc/87E9-2SAX].

71. *See* David Lehr & Paul Ohm, *Playing with the Data: What Legal Scholars Should Learn about Machine Learning*, 51 U.C. DAVIS L. REV. 653 (2017).

B. Regulating Autonomous Vehicles

1. *Likelihood*: Autonomous Vehicles Will Be Regulated

In theory, design and manufacture of AVs could be left to the goodwill (and judgment) of the private sector and to the discretion and liberty of individuals. In reality, this is very unlikely.

A good starting point is *the transition process*. In human history, especially in the progressive eras of the late nineteenth and early twentieth centuries, we find many examples of technological innovations that proved such an advancement in terms of benefit and efficiency that they made then-existing products seem obsolete, even redundant, bringing about their decline or complete disappearance. Consider, for example, how when it comes to prerecorded music, we have shifted from records to compact disks to MP3, or the fact that, as one website delicately states: "[w]ith the introduction of the light bulb in 1879, candlemaking began to decline."[72]

The actual transitions were, in fact, significantly more complex. Records took several decades until they were standardized at 78 rpm by 1925.[73] And, the spread of electricity was significantly slowed down by the need to physically install electric wiring.[74] Conversely, the incandescent light bulb, the change, that "has driven down electricity demand in American homes, saving consumers money and cutting greenhouse gas emissions"[75] was driven by regulation, not market forces.[76]

A more pertinent example is the move from horse to motor power. You might intuit that the change was eagerly and speedily embraced, but that was not the case.[77] The horse "pretty much ruled 19th century urban life and rural culture in

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72. *See e.g. History*, NATIONAL CANDLE ASSOCIATION, www.candles.org/historywww.candles.org/history [https://perma.cc/6QH2-YEEU] (last visited Aug. 9, 2019).

73. The precise value shifted because some places used AC supply at 60 hertz, others at 50 hertz. *See* PETER COPELAND, MANUAL OF ANALOGUE AUDIO RESTORATION TECHNIQUES (2008).

74. Which was a decades-long effort. By 1920, thirty-five percent of urban and suburban homes in America had electricity; by World War II the number reached ninety percent. *See* PAUL BOGARD, THE END OF NIGHT: SEARCHING FOR NATURAL DARKNESS IN AN AGE OF ARTIFICIAL LIGHT 22 (2013) ("Still, it wasn't until FDR's insistence on the Rural Electrification Act of 1936 that electric light began to reach many areas of the rural United States, and not until well into the 1950s could one reasonably say most Americans enjoyed the benefits of electricity."); *see also Consequences of Edison's Lamp*, NAT'L MUSEUM AM. HIST., https://americanhistory.si.edu/lighting/19thcent/consq19.htm [https://perma.cc/BSF2-76VX] (last visited Aug. 9, 2019).

75. Nadja Popovic, *America's Light Bulb Revolution*, N.Y. TIMES (Mar. 8, 2019), https://nytimes.com/interactive/2019/03/08/climate/light-bulb-efficiency.html [https://perma.cc/44HE-JB45].

76. The U.S. Congress established national light bulb efficiency standards in 2007, joining a clear international trend. *See id.*; DONNA GREEN & LIZ MINHIN, SCREW LIGHT BULBS: SMARTER WAYS TO SAVE AUSTRALIANS TIME AND MONEY (2010). *But see* Sean Hollister, *The Incandescent Light Bulb Isn't Dead: Reports Were Greatly Exaggerated*, THE VERGE (Jan. 1, 2014), https://www.theverge.com/2014/1/1/5263826/the-incandescent-light-bulb-isnt-dead [https://perma.cc/J6ZD-WURE].

77. "The relative slowness of the transition is striking. Theoretically, the use of horse powers was obsole[te] as soon as Watt invented the high-pressure steam engine at the end of the eighteenth century . . . . Industrial catalogs suggest that some stationary applications of horses lasted to as late as 1920, some forty years after light internal combustion and electrical motors became available. The disappearance took more than a century because horses in many cases were preferable to steam engines

both Europe and North America." It took motor vehicles "nearly 50 years to dislodge the horse from farms, public transport and wagon delivery systems throughout North America. Contrary to public perception, the transition was not smooth or inevitable. Nor was it exclusively beneficial."[78]

It is too early to tell whether the upcoming transition from human driving to AVs will have broader implications than the shift from horse to motor power, but it is surely going to be much more complex, and likely more expensive and faster. It is clear that "[a]t the heart of technology transitions lie complex processes of social and industrial dynamics,"[79] and given the significance of the potential shift from privately owned and driven cars to AVs, it makes good sense, as a matter of public policy, to plan, prepare, coordinate, regulate, the efforts of private and public sectors.

But even if the process of developing and manufacturing AVs is to remain mostly the domain of the private sector, we expect AVs to be regulated simply because the stakes are too high: the vitality of vehicles in the modern economy, the danger that vehicles pose to life and property, and the complexity of the AVs systems are all contributing factors to our assumption that governments are likely to intervene to ensure the success of the project, on at least three levels.

First, we expect governments to regulate any potentially *dangerous product*, and a long list of government agencies do just that.[80] The process is far from perfect: some industries enjoy perhaps too much influence in the regulatory process,[81] and, in some cases, regulation does not anticipate, but rather reacts to, a problem after it manifests itself.[82] But by and large such regulation is quite

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for light or portable applications." *See* CLAY MCSHANE & JOEL A. TARR, THE HORSE IN THE CITY: LIVING MACHINES IN THE NINETEENTH CENTURY 166–67 (2007).

78. *See* Andrew Nikiforuk, *The Big Shift Last Time: From Horse Dung to Car Smog*, THE TYEE (Mar. 6, 2013), https://thetyee.ca/News/2013/03/06/Horse-Dung-Big-Shift/ [https://perma.cc/94SQ-WGHG] (interviewing historian Ann Norton Greene and relying on her book, HORSES AT WORK). Norton Greene argues that "[t]he transition from animal to automotive power would prove to be gradual, complicated, and troubling. Assertions of its inevitability are misleading and irrelevant." For a similar conclusion and a wider explanation of how the car won over all other alternatives, see Benjamin K. Sovacool, *Early Modes of Transport in the United States: Lessons for Modern Energy Policymakers*, 27 POL'Y & SOC'Y 411 (2009).

79. *See* Jean-François Mercure, *An Age Structured Demographic Theory of Technological Change*, 25 J. EVOLUTIONARY ECON. 787, 787 (2015).

80. Calo, *supra* note 55; *see also* Gaon & Stedman, *supra* note 42.

81. Although some industries enjoy more autonomy than others. *See* Brian Naylor, *Not Just Airplanes: Why The Government Often Lets Industry Regulate Itself*, MPR (Apr. 4, 2019), https://mprnews.org/story/2019/04/04/npr-faa-is-not-alone-in-allowing-industry-to-self-regulate [https://perma.cc/W33J-YXPD]. *See also Regulatory Capture May Be Responsible for Boeing's Recent Problems*, ECONOMIST (Mar. 23, 2019), https://economist.com/business/2019/03/23/regulatory-capture-may-be-responsible-for-boeings-recent-problems [https://perma.cc/KS2R-HNAH].

82. This has been the case for electric scooters, which have risen from the ground up. *See* Kate Manuso, *The Rise of Electric Scooter Regulations*, REG. REV. (Jan. 3, 2019), https://theregreview.org/2019/01/03/mancuso-electric-scooter-regulations [https://perma.cc/SXF9-ZX2A]. But are scooters a realistic, relevant solution to all our traffic problems, and can they compete with Avs? *See* Gabriel Henry J. Lopez, *Micromobility is The Future of Vehicles*, MEDIUM (Apr. 21, 2019), https://medium.com/

efficient and well-supported by the public.[83]

Cars seem like an easy case. There is already extensive regulation of the automotive industry, especially in view of the dangers that human operated cars pose to life and limb.[84] Thus there is surely no reason to wait for ex-post-facto litigation over damage that AVs have caused. We fully expect government regulators—of their own accord or under public pressure—not to permit AVs to enter the open road and interact with people (passengers, pedestrians or fellow drivers) until they are proven safe. Nonetheless, the prospect of sharing the road with self-driving machines, intelligent but still dangerous, is not a palatable premise to the public. [85]

Is there an interference with individual choice—that of driving one's private car at all times, on all public roads? Yes. And more on this below, but suffice it to say, for now, that this is a limited interference with individual rights (at least when it does not preclude freedom of movement); and it does not fully prescribe individual behavior (such as mandating the use of seat belts or crash helmets).

Second, there is also justification for government regulation in the more mundane and prevalent condition of daily driving—regulation is necessary to allow the most efficient use of the road. Such regulation coordinates the operation of individuals drivers, ensuring that the greatest number of people can make the choice to drive without causing too much discomfort to each other. One does not need to be a staunch supporter of government regulation to accept this rationale and see *cars* as a clear case for such coordinative regulation.[86]

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datadriveninvestor/micromobility-is-the-future-of-vehicles-220c2c0c9b0 [https://perma.cc/VM3K-5HBY]. *See also* Laura Blikk, *Electric Scooters Aren't a Transportation Revolution Yet*, CITYLAB (Apr. 19, 2019), https://citylab.com/transportation/2019/04/electric-scooter-micromobility-transportation-revolution/587440 [https://perma.cc/FAY5-YYY2].

83. Americans generally support safety regulation much more than they do government regulation of business. *See Section 2: Views of Government Regulation*, PEW RES. CENTER (Feb. 23, 2012), https://people-press.org/2012/02/23/section-2-views-of-government-regulation [https://perma.cc/3MWD-Y23W].

84. The modern era of vehicle safety regulation in the United States started with a Senate hearing on the federal role in traffic safety prompted by the troubling vehicular fatality rate, and came to fruition with the legislation of the National Traffic and Motor Vehicle Safety Act of 1966, Pub. L. No. 89–563 (1966), the Highway Safety Act, Pub. L. No. 89–564 (1966) and the formation of the National Highway Traffic Safety Administration, see Federal-Aid Highway Act of 1970, Pub. L. 91–605 (1970). *See* GLENN C. BLOMQUIST, THE REGULATION OF MOTOR VEHICLE AND TRAFFIC SAFETY 1, 10–12 (1988); *see also* Jerry L. Mashaw & David L. Harfst, *Regulation and Legal Culture: The Case of Motor Vehicle Safety*, 5 YALE J. ON REG. 257 (1987).

85. Although there have already been fatalities, sporadically. *See List of Self-Driving Car Fatalities*, WIKIPEDIA, https://en.wikipedia.org/wiki/List_of_self-driving_car_fatalities [https://perma.cc/7U2N-ZKGE] (last updated Aug. 9, 2019).

86. *Cf.* M. C. Shumiatcher, *The Purpose of Traffic Laws*, FEE (Aug. 1, 1973), https://fee.org/articles/the-purpose-of-traffic-laws/https://fee.org/articles/the-purpose-of-traffic-laws/ [https://perma.cc/2UHF-NHZZ] ("[L]iberty is the freedom of the individual — of every person — to make full use of his faculties and move where he wishes, when he wishes, how he wishes — so long as he does not harm other persons when he does so. This principle is more clearly understandable in the case of our use of motor vehicles than almost anywhere else . . . Here, the law enters upon its appropriate role."). It is harder to defend the more extreme, and fortunately, now rare case where government reacts to a shortage in critical supplies with a rationing policy. *Cf.* George Parker & James Blitz, *Government Prepares to Ration Ferry Space Under No-deal Brexit*, FINANCIAL TIMES (Dec. 4, 2018), https://ft.com/

Governments regulate behavior when drivers are sharing the road, and, for the most part, such regulation provides a fair and equitable playing field for all. We are talking about *traffic regulation*.[87] In a perfect world, all drivers would drive carefully and respect all fellow drivers. In reality, governments must clarify not only who can use the roads, but also when, where, and how they can use them. It seems very likely that a technology can be developed that would allow AVs to share the road with the much-less-perfect human drivers. But this would be a very inefficient use of AVs, whose great advantage is their ability to communicate with—and react to—each other much better than human-driven cars. This is why it makes more sense, from a public policy perspective, to leave AVs alone on roads, especially the most congested and dangerous ones.[88]

Current codes are complex schemes planned for human drivers of cars, taking into account both mechanical constraints and human limitations. AVs will likely still have physical constraints, but they will not get drunk, tired, or unfocused. AVs will have better sensory perceptions than humans, and they would probably communicate with each other electronically, while people, like ships at sea, navigate by sight and signaling.[89] Also, AVs do not share human reaction time, hesitation, or fears, and cannot be threatened by fines or incarceration.

The options, as we see them, are essentially two: if regulators allow AVs to share the road with human drivers, both "populations" will be subject to the same traffic code, essentially curtailing the capacities and capabilities of AVs. If regulators clear roads or lanes for AVs only, a new code would have to be adopted. There is no doubt that it is the role of governments to regulate the use of roads, and the task will be especially necessary and complex if AVs and human drivers are allowed to share the roads. Maybe regulators will turn to the early day "red flag laws," which required all self-propelled vehicles in some jurisdictions to be led by a pedestrian waving a red flag to warn bystanders of the vehicle's approach and assist horse-drawn carriages to pass safely.[90]

Third, there is another form of coordinative regulation that may be called for: one that would ensure that all the different AV models developed by private

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content/9e3bda3a-f720-11e8-af46-2022a0b02a6c [https://perma.cc/QX6J-QJT6] ("Theresa May's cabinet [was] drawing up plans to ration space on ferries carrying vital supplies to Britain, as ministers prepare[d] for a no-deal Brexit that could leave supermarket aisles devoid of some foods.").

87. Defined as "[a] prescribed rule of conduct for traffic; a rule intended to promote the orderly and safe flow of traffic." *Traffic Regulation*, BLACK'S LAW DICTIONARY (11th ed. 2019).

88. *Cf.* Niv Elis, *By 2040, People Won't Be Allowed to Drive on Israel's Roads*, JERUSALEM POST (July 5, 2016), https://jpost.com/Business-and-Innovation/Tech/By-2040-people-wont-be-allowed-to-drive-on-Israels-roads-459514 [https://perma.cc/7YZD-A3Z5] (the reason, explains the Ministry of Transport's chief scientist, is "because people make many more mistakes than machines, and we think that autonomous vehicles will dramatically reduce the number of fatalities from car accidents."). *See* Pearl, *supra* note 9 at 10.

89. Although these days people are relying more and more on advanced navigation systems that tell us what to do or where to turn just like a friend or a colleague would.

90. *See What Autonomous Vehicles Can Learn From the Horse & Carriage*, JUST IMAGINE: AURECON GROUP (Feb. 15, 2016), https://justimagine.aurecongroup.com/autonomous-vehicles-are-here-already-but-there-is-no-fast-track-to-progress/# [https://perma.cc/B9XA-A5P9].

manufacturers can communicate with each other safely and effectively. This can only be done if the government establishes—or requires manufacturers to agree upon—specific technological standards. There are two reasons for this: *first*, without such government action, each manufacturer will likely develop its own models, standards, technical specifications, each competing for market acceptance and dominance. Letting the market have its say is not advisable in this context. *Second*, only government involvement in the standardization will overcome antitrust concerns, that would otherwise apply, should competitors attempt to coordinate trade standards. In fact, it is likely that such standards would have to be agreed on internationally, so that all car manufacturers can efficiently offer the same products everywhere.[91] Russian scientists are already convinced that AVs developed in calm and sunny environments will not cope with Moscow's chaotic roads, bad weather, and drivers with reckless habits.[92] The experience of the cellular industry suggests that standards are set by national regulators but often on the basis of the recommendations of professional and international organizations.[93]

In other words: even if governments regulate each AV model as it is developed and produced, it is very likely that both government and industry will support, if not outright demand, competing firms to cooperate and agree to common technological standards, likely exempting competing firms from antitrust limitations. The reason is not just financial—developing competing standards is costly, and not practical. It is likely that one industry standard will prevail, but again for the matter of assuring public safety, AVs will need to be able to effectively understand, or better still, efficiently communicate with other AVs on the road.

It is not the first time, nor is it likely the last. Although some transitions needed little or no official involvement, such as the shift from records to mp3s, in this case, it seems that official involvement is necessary for a streamlined shift. This notion is reinforced when we look at a previous transition in transport: the shift from horses to cars.

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91. As cellphone manufacturers can. Meanwhile, carmakers still have to produce left- and right-hand side steering wheels, *see Left- and Right-Hand Traffic*, WIKIPEDIA, https://en.wikipedia.org/wiki/Left-_and_right-hand_traffic [https://perma.cc/8VK5-Z6D5] (last updated Aug. 10, 2019), like the fifteen types of electrical outlet plugs currently in use around the world. *See Plug & Socket Types*, WORLDS STANDARDS, https://worldstandards.eu/electricity/plugs-and-sockets [https://perma.cc/K3LR-CKHE] (last updated Nov. 27, 2018).

92. *See* Annie Gaus, *Moscow is a Terrifying City for Drivers. So What if a Car Doesn't Have One?*, GUARDIAN (Jan. 3, 2018), https://theguardian.com/technology/2018/jan/02/moscow-russia-self-driving-car-challenge-hackathon [https://perma.cc/9SK5-YKK5]. It is likely that financial incentives will address such concerns. That said, experience shows that many products are developed with some biases, intentional or not. *See*, *e.g.*, James Vincent, *Gender and Racial Bias Found in Amazon's Facial Recognition Technology (Again)*, THE VERGE (Jan. 25, 2019), https://theverge.com/2019/1/25/18197137/amazon-rekognition-facial-recognition-bias-race-gender [https://perma.cc/FC4B-4NUR].

93. On establishing international guidelines and regulations for limiting exposure to non-ionizing radiation, see *International Guidelines on Non-Ionizing Radiation*, THE ISRAELI NATIONAL INFORMATION CENTER FOR NON-IONIZING RADIATION (Jan. 17, 2016), https://tnuda.org.il/en/international-guidelines-non-ionizing-radiation [https://perma.cc/5SK8-Y6LM].

2. In Support of Automated Vehicles

There are two powerful sets of rationales which suggest that if widespread use of AVs proves technologically and economically feasible,[94] it is likely to happen and to displace most human driving. Government regulation and stewardship of this process will be essential to ensure industry cooperation, coalescing into one efficient solution, and establishing public trust in AVs.

a. Human Driven Is Simply Bad Policy

The first set of rationales concerns the shortcomings of the current model—privately-owned cars, driven by humans, especially in congested urban areas. We focus on three concerns:

First, humans suffer in life and limb from traffic accidents. Speaking for the U.S. Supreme Court, Justice White presented in a landmark 1983 case the need for safety regulations in cars and the difficulty to set them: "The development of the automobile gave Americans unprecedented freedom to travel, but exacted a high price for enhanced mobility. Since 1929, motor vehicles have been the leading cause of accidental deaths and injuries in the United States."[95] Since the 1970s, the long-term trend has been that of marked decrease in traffic deaths. This is attributed, among other things, to increased use of seat belts and child safety seats, better safety features in cars, improved road construction, and the efforts to reduce drinking and driving. Yet the years since 2013 have seen a troubling reversal of this trend.[96] Researchers suggest that "speeding, drug and alcohol impaired driving, distracted driving and failure to wear seat belts all continue to contribute to motor vehicle fatalities even as vehicles and roadways become safer."[97]

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94. *But see* Julie Bort, *An Engineer at Uber's Self-Driving-Car Unit Warns that It's More Like "a Science Experiment" Than a Real Car Capable of Driving Itself*, BUSINESS INSIDER (Apr. 19, 2019), https://businessinsider.com/uber-self-driving-car-is-like-science-experiment-insider-says-2019-4 [https://perma.cc/L36T-42CW].

95. *See* Motor Vehicles Mfr. Ass'n v. State Farm Mutual Auto. Ins. Co., 463 U.S. 29, 32–33 (1983) (adding that "[i]n 1966, Congress decided that at least part of the answer lies in improving the design and safety features of the vehicle itself. But much of the technology for building safer cars was undeveloped or untested. Before changes in automobile design could be mandated, the effectiveness of these changes had to be studied, their costs examined, and public acceptance considered").

96. Vehicle fatalities have declined steadily in the U.S. since the 1970s – peaking at over 55,000 in 1969 and declining to 33,561 in 2012—but have since climbed back to over 40,000 per year. *See* Rebecca M. Cunningham et al., *The Major Causes of Death in Children and Adolescents in the United States*, 379 NEW ENG. J. MED. 2468, 2470–71 (2018); *Vehicle Deaths Estimated at 40,000 for Third Straight Year*, NATIONAL SAFETY COUNCIL, https://nsc.org/road-safety/safety-topics/fatality-estimates [https://perma.cc/A48X-7MYD] (last visited Aug. 10, 2019); Susannah Locke, *You're Less Likely to Die in a Car Crash Nowadays – Here's Why*, VOX, https://vox.com/2014/4/2/5572648/why-are-fewer-people-dying-in-car-crashes [https://perma.cc/5PJ7-GJKK] (last updated Apr. 6, 2014).

97. *See* David Schaper, *Even as Cars Get Safer, Traffic Fatalities Still High*, NPR (Aug. 22, 2018), https://npr.org/2018/08/22/640829988/even-as-cars-get-safer-traffic-fatalities-still-high [https://perma.cc/H5KC-YGWF].

Currently, car accidents result in unnecessary injuries and deaths. In fact, ninety-four percent of all serious accidents involve human error.[98] Research has shown that computer drivers lead to fewer accidents than human drivers: "the computer is simply a better driver than a human."[99] For example, in the United States alone, the mortality rate for human driver related deaths is over 40,000, or about 110 people per day; this is the equivalent of a daily mid-size commercial airplane crash.[100] In 2017, reports indicate that over 4.5 million people were seriously injured in car accidents caused by human error,[101] and ninety-four percent of all serious accidents involve human drivers related factors. In 2018, the estimated cost to society in the United States alone was over $413 billion.[102] Globally, that number was 1.35 million and the leading cause of death for people between the ages of five to twenty-nine.[103] If only because "the computer is simply a better driver than a human," limiting human driving seems good policy.

Second, driving is uncomfortable. This factor could potentially be significantly alleviated through the use of AVs. Although a minority of people enjoy driving "a great deal,"[104] people may prefer the adventure of driving in an open road

98. PREPARING FOR THE FUTURE OF TRANSPORTATION, *supra* note 8, at 3. Of fatal crashes, 11,000 involved drinking and driving, 10,000 involved speeding and 3,500 involved distracted drivers.

99. *See* Matt Vella, *Why You Shouldn't Be Allowed to Drive*, TIME (Feb. 25, 2016), https://time.com/4236980/smart-cars-and-why-you-shouldnt-be-allowed-to-drive/?iid=toc_022516 [https://perma.cc/87CG-NGAH]. For an even more forceful example, see Kevin Roose, *Driving Should be Illegal*, SPLINTER NEWS (May 10, 2015), https://splinternews.com/driving-should-be-illegal-1793851503 [https://perma.cc/N35D-DT95].

100. Americans have a 1 in 114 chance of dying in a car crash, and a 1 in 9,821 chance of dying in air and space transport incidents. "That's almost three times better chances than you meeting your fate by choking on food." *See* Aric Jenkins, *Which Is Safer: Airplanes or Cars?*, FORTUNE (July 20, 2017), https://fortune.com/2017/07/20/are-airplanes-safer-than-cars [https://perma.cc/8ZE5-99NZ].

101. *Id.*

102. *See Motor Vehicle Deaths in U.S. Again Top 40,000*, INS. J. (Feb. 16, 2018), https://insurancejournal.com/news/national/2018/02/16/480956.htm [https://perma.cc/3FJ2-83NG]. The number and types of motor vehicle crash deaths differ widely among the states. *See Fatality Facts 2017: State by State*, THE INSURANCE INSTITUTE FOR HIGHWAY SAFETY (Dec. 2018), https://iihs.org/iihs/topics/t/general-statistics/fatalityfacts/state-by-state-overview; Richard Florida, *The Geography of Car Deaths in America*, CITYLAB (Oct. 15, 2015), https://www.citylab.com/transportation/2015/10/the-geography-of-car-deaths-in-america/410494/ [https://perma.cc/9ECJ-43SF].

103. *See* GLOBAL STATUS REPORT ON ROAD SAFETY 2018 (World Health Organization, 2018), https://www.who.int/violence_injury_prevention/road_safety_status/2018/en [https://perma.cc/6QQ6-7HEG]. In the U.S., injury deaths from motor vehicle crashes is the leading cause of death, followed by firearms and suffocation. *See* Cunningham et. al., *supra* note 96, at 2469.

104. A reported thirty-four percent of American drivers say they enjoy driving "a great deal." Forty-four percent say they enjoy being behind the wheel "a moderate amount." Thirteen percent say they don't enjoy driving much and eight percent say they do not enjoy driving at all. *See* Megan Brenan, *83% of U.S. Adults Drive Frequently; Fewer Enjoy It a Lot*, GALLUP (July 9, 2018), https://news.gallup.com/poll/236813/adults-drive-frequently-fewer-enjoy-lot.aspx [https://perma.cc/XV8C-VNVZ]. There, are, of course, some people who actually suffer from car and driving related phobias. *See*, *e.g.*, PETER E. MARSH & PETER COLLETT, DRIVING PASSION: THE PSYCHOLOGY OF THE CAR? (1987); *Driving phobia*, WIKIPEDIA, https://en.wikipedia.org/wiki/Driving_phobia [https://perma.cc/E8H6-DLRY] (last updated July 29, 2019); Andrei Zakhareuski, *6 Key Steps to Help You Get Over the Fear of Driving*, DRIVING TESTS, /https://driving-tests.org/beginner-drivers/get-over-fear-of-driving/ [https://perma.cc/4MPT-YQV4] (last visited May 1, 2019); Lisa Fritscher, *Tips for Surviving a Road Trip With Claustrophobia*,

environment rather than the necessity of a long, stressful, bumper-to-bumper urban commute. "Driving is the most stressful way to commute."[105] Who could possibly object to AVs taking over this chore from humans, and do we really have a choice?[106]

Third, beyond human discomfort, one cannot ignore the enormous economic waste caused by the daily urban commute of privately owned, human-driven cars, which could potentially be alleviated with the use of AVs. One aspect is that the commute itself takes a heavy toll.[107] Yet, despite flexible work hours and locations,[108] commute times have not improved.[109] For example, New-Yorkers have the nation's longest average commute at 34.7 minutes,[110] while people in Rio de

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Very Well Mind, https://verywell.com/road-trips-with-claustrophobia-2671708 [https://perma.cc/U7UW-MQ4B] (last visited Sep. 13, 2018); *Phobias: Car travel*, PEGASUS NLP, https://pe2000.com/phobia-what/pho-car [https://perma.cc/L26L-FLA6] (last visited Aug. 10, 2019); *see also* Dan Albert, *Driverless cars are coming. We'll miss the thrill of the ride*, VOX (June 21, 2019), https://vox.com/the-highlight/2019/6/11/18655716/driverless-cars-thrill-of-driving-dan-albert [https://perma.cc/8VQ8-2M79] (explaining why people enjoy the thrill of danger that human driving involves: "Driving is dangerous, and we like it that way. We may never love driverless cars the way we love the recklessness of being behind the wheel.").

105. "Driving is the most stressful way to commute." Kelsey Campbell-Dollaghan, *The Best Ways to Get to Work, According to Science*, GIZMODO (Sept. 30, 2015), https://gizmodo.com/the-best-ways-to-get-to-work-according-to-science-1733796033 [https://perma.cc/XQ2J-9EVX]; *See* Annette Schaefer, *Commuting Takes Its Toll*, SCENTIFIC AMERICAN, Oct. 1, 2005, https://scientificamerican.com/article/commuting-takes-its-toll/ [https://perma.cc/8NTY-XKKM]; Haslam McKenzie, *The Socio-economic Impacts of Long-Distance Commuting on People and Communities*, *in* LABOUR FORCE MOBILITY IN THE AUSTRALIAN RESOURCES INDUSTRY: SOCIO-ECONOMIC AND REGIONAL IMPACTS 11 (Fiona M. Haslam McKenzie ed., 2016). On the importance of free time see ROBERT E. GOODIN ET AL., DISCRETIONARY TIME: A NEW MEASURE OF FREEDOM (2008).

106. For a comprehensive and persuasive case to this effect, see S. VAN THEMSCHE, THE ADVENT OF UNMANNED ELECTRIC VEHICLES: THE CHOICES BETWEEN E-MOBILITY AND IMMOBILITY (2016).

107. *See* Campbell-Dollaghan, *supra* note 105; *see also* Annette Schaefer, *supra* note 105; McKenzie, *supra* note 105, at 11.

108. *See*, *e.g.*, Jana Kasperkevic, *Do People Even Work 9-to-5 Anymore?*, MARKETPLACE.ORG (May 28, 2018), https://marketplace.org/2018/05/28/why-do-keep-using-9-5 [https://perma.cc/JMB9-XES5]; Eric Morgan, *Whatever Happened to the 9 to 5?*, INC (Dec. 2, 2015), https://inc.com/eric-morgan/whatever-happened-to-the-9-to-5.html [https://perma.cc/8K3A-SQFH]; Matt Byrom, *The Death of the Workday: Is 9 to 5 Working Obsolete*?, BUSINESS, https://business.com/articles/the-death-of-the-workday-is-9-to-5-working-obsolete [https://perma.cc/L5H5-QBYC] (last visited Feb. 22, 2017).

109. *See* Pinsker, *supra* note 1, ("The average American commuter wastes 42 hours a year thanks to congested roads, and that number is only expected to go up as the economy improves further."); Gabriela Saldivia, *Stuck in Traffic? You're Not Alone. New Data Show American Commute Times are Longer*, NPR (Sep. 20, 2018), https://npr.org/2018/09/20/650061560/stuck-in-traffic-youre-not-alone-new-data-show-american-commute-times-are-longer [https://perma.cc/8B7X-RAHK]. Add to this the time spent finding parking. *See* Bob Glanz, *The Real Price of Parking: Quantified*, FYBR (Apr. 29, 2018), https://fybr.com/the-real-price-of-parking-quantified [https://perma.cc/VTD2-WUNR]; Graham Cookson & Bob Pishue, *The Impact of Parking Pain in the US, UK and Germany: Searching for Parking Costs Drivers Billions a Year*, INRIX (July 11, 2017), http://www2.inrix.com/research-parking-2017 [https://perma.cc/8TTE-UC3Z].

110. *See* Jeff Desjardins, *Visualizing the Average Commute Time in U.S. States and Cities*, VISUAL CAPITALIST (Apr. 1, 2018), https://visualcapitalist.com/average-commute-u-s-states-cities [https://perma.cc/S2BD-GKWH].

Janeiro, Brazil, have commute times of over 86 minutes.[111] Although public transportation[112] has proven to reduce car dependency in many countries, it does not seem to shorten commute times.[113] Furthermore, the issue seems moot in the United States, where a comprehensive move to public transportation is not really on the table.[114]

AVs promise to provide a safer and faster commuting experience than human-driven vehicles. Not only do computers interact and act more quickly, efficiently, and reliably than humans, but also AVs are more comfortable, work conducive, private, and cheaper. [115] AVs will be more private in occupancy than current public transportation, holding only a few people at a time. Also, AVs promise to be cheaper than driving a privately owned or rented car, including purchase price and insurance, or even hiring a human-driven taxi, Uber, or limousine.

The discussion above focused on problems stemming from human-driven commutes, including traffic congestion, the discomfort of long drives, and the loss of personal and professional time. But there is also a major opportunity loss. Carrying only a single commuter per day, many cars lie idle during the owner's

111. *See* Dan Barraclough, *The Best and Worst Cities for Commuting*, EXPERT MARKET, https://www.expertmarket.com/focus/research/best-and-worst-cities-for-commuting [https://perma.cc/UTK5-WTPR] (last visited Aug. 10, 2019)*; see also* Tim Stenovec, *The 20 Cities With the Longest Commutes in the World*, BUSINESS INSIDERS (Oct. 5, 2015), https://businessinsider.com/the-15-cities-with-the-longest-commutes-in-the-world-2015-10 [https://perma.cc/Q2BL-M68D].

112. City design may also play a role. Research suggests that city size and spatial clustering are important determinants of commuting time. *See* Lara Engelfriet & Eric Koomen, *The Impact of urban form on commuting in large Chinese cities*, 45(5) TRANSPORTATION 1269, 1270 (2018).

113. In Canada, public transport proved not to shorten commute times. *See* Murtaza Haider, *Public transit is better, but cars are faster*, GLOBE & MAIL , https://theglobeandmail.com/opinion/public-transit-is-better-but-cars-are-faster/article12893839 [https://perma.cc/A89B-567E] (last updated Apr. 3, 2018). This seems to be true in many cities around the world. *See Commute Time by Public Transit*, MOOVIT TRANSIT, https://moovitapp.com/insights/en/Moovit_Insights_Public_Transit_Index-commute-time [https://perma.cc/S5T9-QGA5] (last visited Aug. 10, 2019); *see also* Mike Maciag, *Riding Transit Takes Almost Twice as Long as Driving*, GOVERNING.COM (Feb., 2017), https://governing.com/topics/transportation-infrastructure/gov-transit-driving-times.html [https://perma.cc/5VQF-CFE8]. (If transit systems want to attract more riders, they need to find ways to speed up the journey to work. See how the times compare in your metro area).

114. While the U.S. does spend money on public transportation, it has been mostly a failure so far. Some of the reasons are economic (such as suburban sprawl); others are political (such as the view of public transit as welfare). While there is some improvement in public transportation, it is unlikely to be the adopted solution all across the nation. *See* Joseph Stromberg, *The Real Reason American Public Transportation is Such a Disaster*, VOX (Aug. 10, 2015), https://vox.com/2015/8/10/9118199/public-transportation-subway-buses [https://perma.cc/3VGK-QU63].

115. *See* Adele Peters, *It Could Be 10 Times Cheaper to Take Electric Robo-Taxis Than to Own a Car By 2030*, FAST COMPANY (May 30, 2017), https://fastcompany.com/40424452/it-could-be-10-times-cheaper-to-take-electric-robo-taxis-than-to-own-a-car-by-2030 [https://perma.cc/Z42T-A278]. (A new report predicts that we're on the edge of an incredibly rapid transition to an entirely new transportation system–where it will be so much cheaper and easier to not own a car, you'll get rid of it as soon as you can.). For an interesting mixed-model experiment, see Joseph Stromberg, *These startups Want to Do for Buses what Uber did for Taxi Rides*, VOX (July 7, 2015), https://vox.com/2015/7/7/8906027/microtransit-uber-buses [https://perma.cc/U4RF-7Z7D].

work day[116]: it is estimated that cars sit idle about ninety-two percent of the time, which makes it "the world's most underutilized asset." When all costs are accounted for "from fuel to insurance to depreciation, the average car owner in the U.S. pays $12,544 a year for a car that puts in a mere 14-hour workweek."[117] Cars also occupy precious parking space in congested inner cities. Car-sharing is just one case-use for idle cars.[118] Parking lots can also be repurposed and more efficiently used.[119] Parking is not only a major financial burden to drivers,[120] but is a real challenge for major urban areas.

Cities welcome a daily influx of people. And people enter cities to work or consume the goods and services that major urban areas provide, such as shopping, cultural or sporting events, et cetera. Mass commute into city centers promotes economic vitality and civic relevance. The availability of the commute is also good for the permanent residents of the city: it makes city life more vibrant—and probably keeps housing prices (and resident density) from exploding. For example, mass daily commutes into New York City's borough of Manhattan almost double the population size, from 1.6 to 3.1 million.[121] Many other major cities

116. *See* Paul Barter, "*Cars Are Parked 95% of the Time*". *Let's Check!*, REINVENTING PARKING (Feb. 22, 2013), https://reinventingparking.org/2013/02/cars-are-parked-95-of-time-lets-check.html [https://perma.cc/ZMZ8-5Z5S].

117. "Drive an SUV? Tack on another $1,908.14." *See* Humes, *supra* note 10.

118. "Instead of letting your car just sit there, you can share it with other people and let your car pay for itself without an ounce of inconvenience." Renting out your car while you do not need it is the model of such companies as car2go. *See What is lease-sharing?*, CAR2GO, https://www.car2go.com/US/en/ [https://perma.cc/SJ7F-X5G4] (last visited Aug. 11, 2020).

119. *See*, *e.g.*, Feargus O'Sullivan, *Why Grocery Store Parking Lots Are Disappearing in London*, CITYLAB (May 11, 2016), https://citylab.com/equity/2016/05/london-is-replacing-parking-lots-with-apartments/482298 [https://perma.cc/YBL4-K32R]. And not just imagine: repurpose parking lots! *See* Eillie Anzilotti, *The Newest Hot Coworking Space Costs Just $2.25 an Hour, Because It Is a Parking Spot*, FAST COMPANY (Apr. 30, 2019), https://fastcompany.com/90342223/the-newest-hot-coworking-space-costs-just-2-25-an-hour-because-it-is-a-parking-spot, [https://perma.cc/AKG9-5EBB] ("WePark shows that in cities like San Francisco, coworking is unaffordable to many, and the sheer volume of free space allocated to parked cars could be put to much better use.").

120. For data on how expensive parking can be in cities around the world (topped by New-York, Sydney and London) see GLOBAL PARKING INDEX, PARKOPEDIA (2017) https://parkopedia.com/static/reports/global_parking_index2017-parkopedia.pdf [https://perma.cc/GLM9-58Y6]. Applications show that there is revenue to be made in renting out private parking spaces. *See* Rachel Koning Beals, *There's No Scarcity of Parking Spaces — What's Lacking Is Sharing*, MARKET WATCH (April 1, 2017), https://marketwatch.com/story/theres-no-scarcity-of-parking-spaces-whats-lacking-is-sharing-2017-03-29 [https://perma.cc/TVB3-7YMU].

121. *See* Leanna Garfield, *This Mesmerizing GIF Shows How Manhattan doubles in Size During the Daily Commute*, BUSINESS INSIDER (May 11, 2018), https://www.businessinsider.com/manhattan-gif-commute-travel-patterns-2018-5 [https://perma.cc/7793-JDEK]. Why is this important? *See* Barbara Speed, *Cities' Productivity is Proportional to their Size – Unless they're British* CITY METRIC (Feb. 27, 2015), https://www.citymetric.com/business/cities-productivity-proportional-their-size-unless-theyre-british-782 [https://perma.cc/GT9Z-EY3S] (summarizing an OECD study that found that doubling the size of a city generally increases its productivity per capita by 2%–5%). *See also* Shlomo Angel & Alejandro M. Blei, *The Productivity of American Cities: How Densification, Relocation, and Greater Mobility Sustain the Productive Advantage of Larger U.S. Metropolitan Labor Markets*, 51 CITIES 36 (2016).

experience a similar rise of daytime "commuter adjusted population[s]."[122]

This population influx comes at a price. For commuters, getting into the cities may be time consuming and stressful.[123] For cities, traffic jams are a concern beyond physical gridlock[124] and pollution.[125] A surprisingly relevant 1963 report estimated that sixty-eight percent "of downtown Los Angeles consists of streets, freeways and parking facilities."[126] In 2017, parking lots in Los Angeles occupied over seventeen million square meters of land, which is the equivalent of nearly 1,400 soccer fields.[127] A 2018 report suggested that the cities of both Seattle and Des Moines have 1.6 million parking spaces, a per household figure of over five in the former and 19.4 in the latter. In Seattle, that space has a replacement cost[128] of $35.8 billion, which is about $118,000 per household. In New York, with

122. *See* Emily Badger, *The Most Important Population Statistic That Hardly Gets Talked About*, CITYLAB, (May 30, 2013), https://www.citylab.com/transportation/2013/05/most-important-population-statistic-hardly-ever-gets-talked-about/5747/ [https://perma.cc/VQM2-4AFL] ("Do you know your city's 'commuter-adjusted population'?"). For example, Tel-Aviv, Israel's economic and cultural center, which lies at the heart of the Dan metropolitan area claims a stunning rise in population from 400,000 residents to one million, through 600,000 daily commuters. It is estimated that only thirty-nine percent of people employed in Tel-Aviv live in the city, the rest—257,000 people—are commuters. In comparison only twenty-three percent of people employed in Jerusalem, Israel's capital and seat of government, are commuters. *See Transportation*, TEL AVIV YAFO https://www.tel-aviv.gov.il/en/Live/Transportation/Pages/default.aspx [https://perma.cc/A5G7-93WB] (last visited Aug. 10, 2019); Guy Nardi, *Jerusalem Fails to Attract Commuters*, GLOBES (May 13, 2018), https://en.globes.co.il/en/article-jerusalem-fails-to-attract-commuters-1001235904 [https://perma.cc/24YS-QCNJ].

123. *See e.g.*, Patrick McGeehan*, For Many N.J. Transit Commuters, Last Year's 'Summer of Hell' Is Now*, N.Y. TIMES (Aug. 3, 2018), https://nytimes.com/2018/08/03/nyregion/nj-transit-summer-of-hell-path.html [https://perma.cc/DG8C-WYZX].

124. Can cities alleviate the boredom of slow traffic? In Mexico City a theater company offers 58 second performances during red lights. *See* Joebill Munoz, *Correction: Mexico City-Traffic Ballet story*, AP NEWS (July 31, 2018), https://www.apnews.com/454dc01f81374ba9a048660c9009e139 [https://perma.cc/F23N-QFV2]. Is there money to be made? Perhaps in advertising. *See* Zachary Crockett, *The Hottest Advertising Trend of 2018? Billboards*, THE HUSTLE (Nov. 30, 2018), https://thehustle.co/billboard-advertising [https://perma.cc/8SBG-NXVW]; Daniel C. Vock, *Along Stretches of Highway, States Eye New Ad Opportunities*, GOVERNING (June 25, 2018), https://governing.com/topics/transportation-infrastructure/gov-highway-advertising.html [https://perma.cc/9MLD-GSVW].

125. *See* Jennifer Hermes, *How Traffic Jams Affect Air Quality*, ENVTL. LEADER (Jan. 5, 2012), https://environmentalleader.com/2012/01/how-traffic-jams-affect-air-quality/ [https://perma.cc/NZ92-EULW].

126. *See Mass Transit vs. Private Cars*, CQ RESEARCHER (Apr. 24, 1963) https://library.cqpress.com/cqresearcher/document.php?id=cqresrre1963042400 [https://perma.cc/MR4K-P3SJ]. Things have not changed much since then. *See* Charlie Gardner, *We are the 25%: Looking at Street Area Percentages and Surface Parking*, OLD URBANIST (Dec. 12, 2011), http://oldurbanist.blogspot.com/2011/12/we-are-25-looking-at-street-area.html [https://perma.cc/T257-9NW6].

127. *See* Adele Peters, *See Just How Much of a City's Land is Used for Parking Spaces*, FAST COMPANY (July 20, 2017), https://fastcompany.com/40441392/see-just-how-much-of-a-citys-land-is-used-for-parking-spaces [https://perma.cc/4J2Y-BAES].

128. Replacement cost is the actual cost to replace an item or structure at its pre-loss condition. *See Replacement Value*, WIKIPEDIA, https://en.wikipedia.org/wiki/Replacement_value [https://perma.cc/QPD4-RNRR].

around 1.9 million parking spots, the per-household cost is a mere $6,570.[129] The cost of maintaining both parking spaces and road infrastructure is hefty, and not unique to the United States.[130]

Various solutions to this problem include reducing the number of parking spots,[131] eliminating free street parking,[132] and boosting mass transit and shared ridership. Shared ridership could include taxis, services such as Uber and Lyft,[133] or AVs.[134] Crowded cities have also tried to limit the volume of car traffic that can enter their centers. These may well be necessary and justified but they likely make the commute even more arduous,[135] especially when good alternatives are not provided. For example, some cities, such as New York, have an increased charge for permission to enter the city by car during rush hour, and some countries, such as Israel, pay off drivers not to do so.[136] In Beijing, the city uses lotteries with random, arbitrary criteria, to limit some cars from entering congested cities.[137] Fifteen major cities have already banned cars from entering city centers,

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129. *See* Adele Peters, *Here's How Much Space U.S. Cities Waste on Parking*, FAST COMPANY (July 17, 2018), https://fastcompany.com/90202222/heres-how-much-space-u-s-cities-waste-on-parking [https://perma.cc/39CL-T5N8].

130. *See* Muthukumar Kumar, *The Mobility Space Report: How Much Space do Car Parks Take Up in our Cities*, GEO AWESOMENESS (July 9, 2017), https://geoawesomeness.com/how-much-space-do-cars-take-up-in-our-cities-the-mobility-space-report/ [https://perma.cc/RQ5B-WSQ3].

131. For example, cities can reduce parking spots by eliminating parking minimums, *i.e.*, the rules that say any developers need to include a certain amount of parking with any new building. *See* Peters, *supra* note 129.

132. In favor of underused for-pay garages. *See* Peters, *supra* note 129. *See also* Joseph Stromberg, *Why Free Parking is Bad for Everyone*, VOX (June 27, 2014), https://vox.com/2014/6/27/5849280/why-free-parking-is-bad-for-everyone [https://perma.cc/GE4Z-SQJH].

133. *See* Brad Plumer, *Cars Take Up Way Too Much Space in Cities. New Technology Could Change That*, VOX, https://vox.com/a/new-economy-future/cars-cities-technologies [https://perma.cc/2V27-X9E7] (last updated Sep. 26, 2016); *see also* David Roberts, *Shared Vehicles Could Make Our Cities Dramatically More Livable*, VOX (July 28, 2016), https://vox.com/2016/7/28/12294214/shared-vehicles-livable-cities [https://perma.cc/8NLW-PPTU].

134. "The trick is figuring out how to redesign cities accordingly." San-Francisco, for example, is actively preparing. *See* Plumer, *supra* note 133.

135. Think, for example, or carpool lanes. Carpool lanes may be an efficient traffic solution, but the effort to coordinate the drive and join other riders makes the experience closer to that of public transportation than to the single-driver-private-car experience. *Cf.* J.C. Torres, *Carpooling Can Cut Traffic Congestion by 75%, MIT study*, SLASH GEAR (Jan. 3, 2017), https://slashgear.com/carpooling-can-cut-traffic-congestion-by-75-mit-study-03469717/ [https://perma.cc/WBS2-WEMW].

136. For recent examples *cf.* Winnie Hu, *Over $10 to Drive in Manhattan? What We Know About the Congestion Pricing Plan*, N.Y. TIMES (Mar. 26, 2019), https://nytimes.com/2019/03/26/nyregion/what-is-congestion-pricing.html [https://perma.cc/A6LB-FJP2] (The price of entering Manhattan could reach as much as $25 for some drivers); Lior Gutman, *Israel Tests an Incentive-Based Program to Fight Traffic Jams*, CALCALIST (Apr. 23, 2019), https://www.calcalistech.com/ctech/articles/0,7340,L-3760942,00.html [https://perma.cc/L9NU-HAUE] (Participants could make up to $555 by avoiding entering urban areas during rush hours).

137. *See*, e.g., Owen Guo, *Want to Drive in Beijing? Good Luck in the License Plate Lottery*, N.Y. TIMES (July 28, 2016), https://nytimes.com/2016/07/29/world/asia/china-beijing-traffic-pollution.html [https://perma.cc/NG9G-4EJK]. Another policy set in Beijing in 2019 gives non-Beijing license plate cars twelve permits per year to enter the city, with each permit effective for seven days. *See also* Du

either in specific areas and at specific times or completely.[138] These may look more equitable, but they are very onerous on commuters.[139] AVs likely hold the promise of the best of all worlds: an efficient, private commute without need for parking or human drivers.

So why should driving be left in human hands? As one commentator phrased it: "[c]ars are dangerous. Riding in a car is the single most dangerous discretionary activity that I do nearly every day."[140] What is at issue is the sheer power of cars and the fragility of human discretion. The question at hand is not whether you trust your doctor to diagnose you correctly, or whether you think the President is the person with the best judgment to have the authority to launch nuclear weapons,[141] but rather whether you are willing to trust virtually every person in the country[142] with a license to pilot a massive metal machine weighing on average 4,000 pounds[143] and muscling an average of 190 horse power.[144]

Cars are likely the most powerful and easily accessible machine with the greatest destructive potential. In most years on record, more people die in the United

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Juan, *Capital Will Strictly Control Cars not from Beijing*, CHINA DAILY (June 16, 2018), http://chinadaily.com.cn/a/201806/16/WS5b244a9fa310010f8f59d4a0.html [https://perma.cc/XC36-2EKN].

138. For an overview, *see* Aria Bendix, *15 Major Cities Around the World that are Starting to Ban Cars*, BUSINESS INSIDER (Jan. 12, 2019), https://businessinsider.my/cities-going-car-free-ban-2018-12/ [https://perma.cc/RE3X-NK27]

139. Criticism may stem from the fact that most solutions seem like a tax. *Cf.* Avi Waksman, *The Solution to Israel's Traffic Problem: Tax Those Who Drive at Peak Hours*, HA'ARETZ (Sep. 27, 2018), https://haaretz.com/israel-news/business/the-solution-to-israel-s-traffic-problem-tax-those-who-drive-at-peak-hours-1.6511493 [https://perma.cc/H8FB-L3VP]. (Israeli economist proposes to replace vehicle taxes—which are very heavy in Israel—with levies based on where and when you're on the road, and with how many passengers you're carrying).

140. David M. Perry, *Guns Now Kill More People than Cars Do*, PACIFIC STANDARD (Jan. 9, 2019), https://psmag.com/social-justice/guns-now-kill-more-people-than-cars-do [https://perma.cc/9F29-A58L].

141. *Cf.* Mike Moor, *Nuclear weapons: Whose Finger Do You Want on the Button?*, CHICAGO TRIBUNE (Mar. 28, 2016), http://chicagotribune.com/news/opinion/commentary/ct-nuclear-weapons-trump-cruz-putin-perspec-0329-20160328-story.html [https://perma.cc/CSE5-FMUY]; Zamir Akram, *Minutes from Doomsday*, THE EXPRESS TRIBUNE (Dec. 17, 2017), https://tribune.com.pk/story/1586040/6-minutes-from-doomsday [https://perma.cc/X5CV-3RWL].

142. Despite the decline in numbers (more on this *infra*), most Americans still have drivers' licenses. The rate was eighty-seven percent of the driving-age population (age 16 and over) in 2009, according to *Highway Finance Data Collection*, U.S. DEPT. OF TRANSP.: FEDERAL HIGHWAY ADMINISTRATION: POLICY AND GOVERNMENT AFFAIRS (2009), https://fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter4.cfm [https://perma.cc/KXA2-XFQ6]. Thus, it is fair to note the near universality of driver licenses possession among adults in Western nations - which is one of the reasons why the drivers' licenses often serve as a major official document of identification.

143. *See* Danny Hakim, *Average U.S. Car Is Tipping Scales At 4,000 Pounds*, N.Y. TIMES (May 5, 2004), http://nytimes.com/2004/05/05/business/average-us-car-is-tipping-scales-at-4000-pounds.html [https://perma.cc/3V7P-VKYK]; *What Is the Average Weight of a Car?*, REFERENCE, https://reference.com/vehicles/average-weight-car-e7e452a5a7eb7a7c [https://perma.cc/R86F-VTJ8] (last visited Aug. 11, 2019).

144. *See* Jeff Forbes, *How Many Horsepower Is There in a Typical Car?*, QUORA (Apr. 20, 2017), https://quora.com/How-many-horsepower-is-there-in-a-typical-car. Coincidentally, an average horse weighs 1,201 lbs. *What Is the Average Weight of a Horse?*, REFERENCE, https://reference.com/pets-animals/average-weight-horse-f6c8d369301a94a3 [https://perma.cc/VSQ6-3E7Z] (last visited Aug. 11, 2019).

States by vehicles than by guns.[145] Moreover, cars have also proven highly destructive in terrorist vehicle-ramming attacks.[146] But as discussed above, most traffic accidents are not the result of machine failure or malfunction but rather the error in human judgment.[147] Why would drivers not prefer the option of fully mechanized driving if it were proved safe and efficient?

b. Reading the Tea Leaves—Human Driven Cars Are on the Decline

Data suggest that the age of human driving, especially in congested urban areas, is on the decline, and AVs provide one of the most promising options for the future.[148] For a start, some experts believe that sales of fossil fuel-powered internal combustion engine vehicles peaked in 2018.[149] Indeed, "[a]fter more than 50 years of steady increases, driving in America is now on the decline."[150] "Annual per-capita automobile travel declined by 600 miles from 2003 to 2014 with decreases greatest among young adults."[151]

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145. It is noteworthy that thirty-nine percent of American households report owning at least one gun, a much lower rate than drivers' licenses. *See* Taylor Cox, *American Gun Ownership, By The Numbers*, BENZINGA (Oct. 9, 2017), https://www.benzinga.com/general/education/17/10/10152165/american-gun-ownership-by-the-numbers [https://perma.cc/T873-GNQT]; *see also Motor Vehicle Fatality Rate in U.S. by Year*, WIKIPEDIA https://en.wikipedia.org/wiki/Motor_vehicle_fatality_rate_in_U.S._by_year [https://perma.cc/2QTG-MCY9] (last updated July 13, 2019).

146. This "poor man's bomb" has been increasingly used to horrid effect in recent years. *See Vehicle-Ramming Attack*, WIKIPEDIA, https://en.wikipedia.org/wiki/Vehicle-ramming_attack [https://perma.cc/9A9Q-A7C7] (last updated Aug. 6, 2019); Holly Yan, *Vehicles as Weapons: Muenster Part of a Deadly Trend*, CNN (Apr. 7, 2018), http://edition.cnn.com/2017/03/22/world/vehicles-as-weapons/index.html [https://perma.cc/Y65Y-YV58].

147. *See* Bryant Walker Smith, *Human Error as a Cause of Vehicle Crashes*, STANFORD LAW SCHOOL: THE CENTER FOR INTERNET AND SOCIETY (Dec. 18, 2013), http://cyberlaw.stanford.edu/blog/2013/12/human-error-cause-vehicle-crashes [https://perma.cc/LTN7-TAEV]; Marc Green & John Senders, *Human Error in Road Accidents*, VISUALEXPERT (2013), https://www.visualexpert.com/Resources/roadaccidents.html [https://perma.cc/ND69-XSQU]; Azam Haghi et al., *Assessment of Human Errors in Driving Accidents; Analysis of the Causes Based on Aberrant Behaviors*, 11 LIFE SCI. J. 414 (2014).

148. Consider the effect on flying. As it seems, people do not like to travel by air, and recent studies suggest that AV could provide an alternative to commercial flights. *See* Stephen Ruce & Scott Winter, *People Hate Flying, and it Could Lead to the Demise of the Airline Industry*, FAST COMPANY (June 17, 2019), https://fastcompany.com/90364437/people-hate-flying-and-it-could-lead-to-the-demise-of-the-airline-industry?partner=feedburner&utm_source=feedburner&utm_medium=feed&utm_campaign=feedburner+fastcompany&utm_content=feedburner [https://perma.cc/8ZRP-WZML].

149. *See* Kristin Houser, *Demand for Combustion Engine Cars may have Peaked in 2018*, FUTURISM (Dec. 31, 2018), https://futurism.com/the-byte/combustion-engine-cars-peaked-2018 [https://perma.cc/EZK6-TCMK].

150. *See 4 Reasons Why Americans Are Driving Less*, TRAFFIC SCHOOL ONLINE, https://trafficschoolonline.com/blog/americans-driving-less [https://perma.cc/T7G2-LYME] (last visited Aug. 11, 2019).

151. Noreen C. McDonald, *Trends in Automobile Travel, Motor Vehicle Fatalities, and Physical Activity: 2003–2015*, 52 AM. J. PREVENTIVE MED. 598 (2017). *See also Americans Driving Down Their Driving Miles: We May Be Witnessing a Historic Change in Our Driving Habits*, SCI. AM. (Jan. 14, 2014), https://scientificamerican.com/article/americans-driving-down-their-driving-miles/ [https://perma.cc/4LM9-VKZY]; *cf.* David Schaper, *Record Number Of Miles Driven In U.S. Last Year*, NPR (Feb. 21, 2017), https://npr.org/sections/thetwo-way/2017/02/21/516512439/record-number-of-miles-driven-in-u-s-last-year [https://perma.cc/BK4F-B58U].

Additionally, research shows that the percentage of people with a driver's license decreased in America between 2011 and 2014, across all age groups. For people aged sixteen to forty-four, that percentage has been decreasing steadily since 1983. This trend is most pronounced among teenagers: only 24.5% of sixteen-year-olds had a license in 2014, down from 46.2% in 1983; among nineteen-year-olds, the figure was 69% in 2014, compared with 87.3% in 1983. The number of driver's license holders also declined in adults twenty to fifty-four over the same period, in smaller but still significant measures. Only among older adults, fifty-five and over, do the researchers observe a rise in driver's licenses between 1983 and 2014. It is also suggested that driving, in terms of the total distance driven per person, has peaked in the United States in 2004; by 2013 it had decreased by nine percent.[152] It is possible that the actual number of people who would have been happy to give up their licenses is much higher, but they are held back by the absence of efficient alternatives to self-driving (such as public transport); for now, at least, owning a driver's license is almost a precondition for employment in much of the United States.[153]

Finally, as noted earlier, cities have realized the shortcomings of the private automobile for decades—the wasted space taken up by roads and car parks, the pollution of the combustion engine, the traffic congestion, the damage that accidents inflict on people and property—and have been rolling out elaborate regulatory schemes, limiting the use of single-rider, private cars. The problem is that people need to reach the inner cities.

Since the 1980s, architects, city planners, environmentalists, and transportation engineers have raised the idea of re-planning cities to eliminate the use of automobiles.[154] By 2015, two authors said, "now we have an army of supporters, and cities everywhere are showing that it is a mistake to give over cities to the car. We all know that cars are useful, but when cities are built to depend on them it becomes clear that cars are good servants but bad masters."[155]

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152. *See* Julie Beck, *The Decline of the Driver's License: Fewer People of All Ages Are Getting Them, and It's Not Quite Clear Why*, THE ATLANTIC (Jan. 22, 2016), https://www.theatlantic.com/technology/archive/2016/01/the-decline-of-the-drivers-license/425169/ [https://perma.cc/5XK7-P94G]; *see also* Tim Henderson, *Why Many Teens Don't Want to Get a Driver's License*, PBS (Mar. 6, 2017), https://pbs.org/newshour/nation/many-teens-dont-want-get-drivers-license [https://perma.cc/G9KR-WHGK].

153. *Cf.* Alana Semuels, *No Driver's License, No Job*, THE ATLANTIC (June 15, 2016), https://theatlantic.com/business/archive/2016/06/no-drivers-license-no-job/486653 [https://perma.cc/2W96-JPXV]. *See also* Stephanie Georgopulos, *5 Things I've Learned As An Adult With No Driver's License*, CRACKED.COM (Jan. 4, 2016), http://cracked.com/blog/5-harsh-realities-being-adult-who-doesnt-drive [https://perma.cc/ENG6-7QRY].

154. Two examples are MOSHE SAFDIE, THE CITY AFTER THE AUTOMOBILE: AN ARCHITECT'S VISION (1997); PETER NEWMAN & JEFFREY R. KENWORTHY, CITIES & AUTOMOBILE DEPENDENCE: A SOURCEBOOK (1990).

155. *See* PETER NEWMAN & JEFFREY KENWORTHY, THE END OF AUTOMOBILE DEPENDENCE: HOW CITIES ARE MOVING BEYOND CAR-BASED PLANNING xi (2015); *see e.g.*, similarly, SAMUEL I. SCHWARTZ, STREET SMART: THE RISE OF CITIES AND THE FALL OF CARS (2015).

What this suggests is that AVs, should they fulfill their promise, would be met with some enthusiasm from professionals concerned with city planning and traffic, a younger generation less enthusiastic about driving,[156] and most likely an auto industry that will have an opportunity to reinvent itself in the twenty-first century.

3. A Few Words of Caution

a. Fear of the Machine

There are various psychological biases that make people wary of fully trusting machines, preferring to optimistically trust their own judgment and that of their fellow man. These biases are likely to slow the arrival of AI-based medical diagnostics, even if a machine is proven to diagnose better than a human medical professional. This means, for example, that people will likely insist on dramatically higher auto safety rates with AVs than with human driving.

Throughout our history, humans have sought ways to improve our living and working conditions through technological innovation. In each generation, some people embraced the prospect of change while others reacted with concern. The upcoming technological revolution of AVs, an impressive step in a chain of innovation that began with the invention of the wheel, seems to raise an unusual sense of discomfort, perhaps because of the use of artificial intelligence. How are we to react? Some people have proposed answers:

> Euphoric utopians in Silicon Valley . . . see in this the key to solving all the major problems of our time, when a wish-granting artificial general intelligence . . . will make our lives easier, and maybe even eternal – in the form of an upload to the cloud, as some pundits believe. Apocalypticists, who – like the Oxford philosopher Nick Bostrom - are often European, fear the seizure of power by superintelligent machines and the end of humanity.[157]

Assuming a majority of voters are persuaded to give AVs a chance,[158] and looking beyond some individuals' insistence on driving themselves, one can raise several legitimate concerns that should be taken into account:

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156. Or, at least, less enthusiastic about owning a car and commuting. *See*, *e.g.*, Mary Wisniewski, *Why Americans, Particularly Millennials, Have Fallen out of Love with Cars*, CHICAGO TRIBUNE (Nov. 12, 2018), https://chicagotribune.com/business/ct-biz-young-adults-cars-attitudes-20181106-story.html [https://perma.cc/CP3Q-W3KU].

157. *See* THOMAS RAMGE, WHO'S AFRAID OF AI?: FEAR AND PROMISE IN THE AGE OF THINKING MACHINES 6 (2019).

158. Other assumptions likely will have to made, including the assumption that voters are asked to give AV a chance, that public outcry still matters, and that tech companies are not 'too big' to be interfered with. In this tenor, *see* VIVEK WADHWA & ALEX SALKEVER, THE DRIVER IN THE DRIVERLESS CAR: HOW OUR TECHNOLOGICAL CHOICES WILL CREATE THE FUTURE (2017); Matthew Yglesias, *The Push to Break Up Big Tech, explained*, VOX (May 3, 2019), https://vox.com/recode/2019/5/3/18520703/big-tech-break-up-explained [https://perma.cc/M6CW-SRAH].

First, some people fear machines, especially ones that claim to have "artificial intelligence," competing with human competence not only on a physical but also a mental level. It is not just Luddites who feel uncomfortable with current technology.[159] Indeed, it would be dangerous to underestimate the concerns (and voting power) of people who do not "believe" (or at least, trust) science—or scientists—these days.[160]

Second, headline news in recent years has brought to the fore not only the vast number of jobs already lost to "machines," but also entire sectors of human occupation disappearing in the future.[161] They further note the social challenges, stating that "we are not heading for a jobless future anytime soon," although "we do need to prepare for deep structural changes that appear inevitable," including new, non-standard forms of employment.[162] In other words: you may have good reason to fear that the machines (here, AVs) will take away jobs—replacing taxi, Uber, bus and truck drivers on land, pilots and captains in air and sea, and possibly decreasing total car production.[163] Truth be told there is little we can do to stop the technological revolution[164] so we better "enjoy

159. "Our relationship to technology has become complex, a mixture of adulation, dependency, frustration, and rage . . . all its various associated frustrations – traffic, crowds, herding, waiting; one's sense of being merely a small cog in a huge machine, of having to rely absolutely upon systems that are not absolutely reliable, of powerlessness so cunningly disguised as power that one labors under a persistent sense of unreality—it is plainly driving people crazy." *See* NICHOLS FOX, AGAINST THE MACHINE: THE HIDDEN LUDDITE TRADITION IN LITERATURE, ART, AND INDIVIDUAL LIVES ix–x (2002).

160. Gleb Tsipursky, *(Dis)trust in Science: Can We Cure the Scourge of Misinformation?* SCI. AM. (July 5, 2018), https://blogs.scientificamerican.com/observations/dis-trust-in-science [https://perma.cc/QS3M-QRUZ]; Bastiaan T. Rutjens, *What Makes People Distrust Science? Surprisingly, Not Politics*, AEON (May 28, 2018), https://aeon.co/ideas/what-makes-people-distrust-science-surprisingly-not-politics [https://perma.cc/7SHD-D2PZ]; James Delingpole, *It's Not Science I Don't Trust – It's the Scientists*, SPECTATOR (Aug. 22, 2018), https://spectator.co.uk/2018/08/its-not-science-i-dont-trust-its-the-scientists [https://perma.cc/5X8T-L2PK].

161. A comprehensive 2019 study by the OECD on the future of work offers a bitter-sweet outlook: they estimate that automation will likely impact almost half of existing jobs within the next 15 to 20 years, eliminating about fourteen percent and radically changing a further thirty-two percent. This is a legitimate concern many, especially low skilled adults who are less likely to partake in training, share. *See* OECD, OECD EMPLOYMENT OUTLOOK 2019: THE FUTURE OF WORK 3, 24–25 (2019), https://www.oecd-ilibrary.org/employment/oecd-employment-outlook-2019_9ee00155-en [https://perma.cc/JP7N-K5PH]. The report notes that during the years 1995-2015 employment in the manufacturing sector in OECD countries has declined by twenty percent, while jobs in the service sector risen by twenty-seven percent. *Id*. at 25, 64.

162. *Id*. at 24–28, 57–59.

163. An estimated three percent of all working Americans are drivers, and most of them (two percent) are truck drivers. But the jobs are not evenly distributed across the country, with some areas expected to take a greater hit from automation than others. *See* Mark Fahey, *Driverless Cars Will Kill the Most Jobs in Select US States*, CNBC (Sep. 2, 2016), https://cnbc.com/2016/09/02/driverless-cars-will-kill-the-most-jobs-in-select-us-states.html [https://perma.cc/D5M5-UYD2].

164. And if you are troubled by our powerlessness in the face of the technological revolution, it is probably acceptable to call you a Luddite. *See Brian* Merchant, *You've Got Luddites All Wrong*, VICE (Sep. 2, 2014), https://vice.com/en_us/article/ae379k/luddites-definition-wrong-labor-technophobe [https://perma.cc/5JTR-FVT8]. Stop using the word "Luddite"—unless you're talking about a powerful, anti-automation labor movement that struck fear into the heart of industry.

the ride" and the advantages.[165]

Third, technology changes the way we think, making certain skills obsolete. Think about human evolution. Technology might do the same to orientation and navigation skills. We rely heavily on *Waze* and *Google Maps* for driving. What happens if the technology vanishes suddenly? What happens if we lose internet or our electricity?

Finally, the discomfort we see here for humans is not from relinquishing yet one more daily chore to a machine that does it better (because it is physically stronger and, thinks, communicates, and acts faster). We are getting used to the idea that machines are "smarter" than humans.[166] What is unusual in the case of AVs is that we now are expected to relinquish control—all direct human oversight (of oneself or a human proxy) to a machine—and blindly trust it with our lives. This is an enormous step, which we have thus far been unwilling to take. Even where automation is thoroughly integrated in standard operations, like in commercial civil aviation—the fact remains that while the "autopilot" conducts most of the flight operations, human pilots retain the ultimate control.[167] The same holds for AVs, in the sense that people are concerned about giving full control to the machines—making humans entrust the machine with their lives, in a fully automated AV, is going to take some time and effort.[168]

b. The AVs Revolution Is Not Here, Yet

With technology and auto giants already producing some forms of AVs and vigorously testing newer generations, the AV revolution seems just around the corner. And all of this makes sense: given the huge potential benefits of AVs—from saving money, to saving lives, to saving the planet—it would seem that the case for AVs is very strong and their entry almost a done deal. Or is it? We can think of several difficulties.

First, there is the issue of politics. The question is whether AV regulation will go beyond making way for such cars to share the road with human drivers to granting preference for AVs perhaps allotting them special lanes or even complete monopoly of the road (clearly the most efficient solution). If that is the case,

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165. *Cf.* Marc Andreessen, *This is Probably a Good Time to Say That I Don't Believe Robots Will Eat All the Jobs . . .*, PMARCA (June 13, 2014), http://blog.pmarca.com/2014/06/13/this-is-probably-a-good-time-to-say-that-i-dont-believe-robots-will-eat-all-the-jobs [https://perma.cc/F3R2-YQR8].

166. When IBM's Deep Blue computer beat chess world champion Kasparov in the late 1990s, it was big news; now such news would seem quite trivial. *See Deep Blue (chess computer)*, WIKIPEDIA, https://en.wikipedia.org/wiki/Deep_Blue_(chess_computer) [https://perma.cc/EVH3-9RLS] (last updated Aug. 9, 2019).

167. "We have the technology to fly planes piloted entirely by computers, experts say. The problem is that passengers aren't ready for robotic planes — and neither are human pilots." *See* Dan Vergano, *We Could Easily Have Planes Without Pilots — If Only Passengers Would Fly In Them*, BUZZFEED NEWS (Mar. 26, 2015), https://buzzfeednews.com/article/danvergano/planes-dont-need-pilots [https://perma.cc/BG7F-58ZL].

168. *See* Matthew Hutson, *People Don't Trust Driverless Cars. Researchers Are Trying to Change That*, SCIENCEMAG (Dec. 14, 2017), https://sciencemag.org/news/2017/12/people-don-t-trust-driverless-cars-researchers-are-trying-change [https://perma.cc/LD2D-V869].

it will come across two of the most significant fault lines in politics. One is the urban-rural divide, familiar in North America and Western Europe.[169] Differences are very relevant, not just because rural areas tend to be more socially conservative, but because most of the rationales supporting AVs in dense metropolitan areas simply do not apply in the less densely populated rural areas. If we are correct, economic consideration alone means that AVs are likely to come to major urban areas first, and rural areas later. Perhaps much later.[170]

Another is the old-young divide:[171] it is possible that driving will become another topic of friction in this area where the interests, concerns, and priorities of different generations (especially those just starting their careers and those nearing retirement) hardly align.[172] As the U.S. Presidential elections and the Brexit vote suggest, it is dangerous to ignore the rural vote. It is estimated that "[v]oters over retirement age will continue to dominate U.S. politics until at least 2060."[173]

The reason we are stressing two major political tensions—the rural-urban and intergenerational divides—is that we do wonder what impact these issues will have over the decision to adopt AVs. This is a relevant question along three separated fronts: the adoption of AVs will likely require serious groundwork—physical and legal—laying the foundation for such issues as the manufacture, sale, import, export, and especially the actual use of the road of such cars. If we are correct that AVs are more attractive to younger, urban voters—how will those who stand to gain less react? One issue is financial, who will pay for the changes needed for the advent of AVs? Market forces may well leave much of the nation without AV access; a related, second issue is social—will AVs be available nationwide? If so—it makes more sense to ask for public money to be used—and AV infrastructure to be installed and subsidized in less densely populated areas; a third related issue is regulatory: what regime is going to be adopted for the use of AVs? For example, urban areas may have dedicated AV lanes and limit human driving to improve the efficiency of coordinated automated cars. Other schemes may be

169. Where "[r]ural residents feel left behind by the globalized economy and alienated from big cities' multiculturalism." *See* Rahsaan Maxwell, *Why Are Urban and Rural Areas So Politically Divided?*, WASH. POST (Mar. 5, 2019), https://www.washingtonpost.com/politics/2019/03/05/why-are-urban-rural-areas-so-politically-divided [https://perma.cc/G9HL-XTD7].

170. Case in point—rural areas also tend to fall behind on other major infrastructure improvements—now considered vital—such as internet access. See, *e.g.*, *Internet Access: Too Many Rural Areas Have Little or No Service*, PITTSBURGH POST-GAZETTE (last visited Jul. 13 2020) https://www.post-gazette.com/opinion/editorials/2020/03/16/Internet-access-Too-many-rural-areas-have-limited-or-no-service/stories/202003040050 [https://perma.cc/UQ72-HCP7].

171. *See*, *e.g.*, Pippa Norris, *Young and Old Are Voting Very Differently in the U.K. and U.S. That's a Big Deal*, WASH. POST (June 14, 2017), https://washingtonpost.com/news/monkey-cage/wp/2017/06/14/young-and-old-are-voting-very-differently-in-the-u-k-and-u-s-thats-a-big-deal [https://perma.cc/JQ8Q-VKUH].

172. *See*, *e.g.*, Brad Allenby, *The Self-Driving Car Generation Gap: Older People See Driving as Representing Freedom*, SLATE (June 22, 2016), https://slate.com/technology/2016/06/the-self-driving-car-generation-gap.html [https://perma.cc/7VE9-VAEU].

173. *See, e.g.*, Michael Hobbes, *America's Defining Divide Isn't Left vs. Right. It's Old vs. Young*, HUFF POST (Mar. 11, 2019), https://www.huffpost.com/entry/america-baby-boomer-old-generation_n_5c82db8de4b0ed0a00136b0c [https://perma.cc/PH4M-SWQS].

relevant for less densely populated areas, and it is only fair to respect the needs, choices, and cultural heritage of people and communities and let them evolve at their own pace. These are very significant considerations given that the use of AVs is not likely to remain an issue for private industry and are most likely going to be resolved (and possibly paid for) in the public sphere.

There is another legal aspect, much more approachable than the terms of future regulation of AVs. It is a matter of rights, human, civil, perhaps even constitutional. Public lawyers are always happy to explore the potential to establish new civil and human rights or expand existing ones to accommodate the changing needs of humanity. AVs offer at least two very cool—if currently hypothetical—arguments for a 'rights talk.'[174] One concerns the question of whether access to AVs will become a civil, perhaps human right; a second concerns the question of whether banning human self-driving would infringe on a protected life-liberty or property interest (to use the phraseology of the 5th and 14th Amendment of the U.S. Constitution). The case for both sides is far-fetched, but not outlandish. One can today argue that access to electricity is as fundamental as access to water.[175] Or that given what current research has shown, there is a right to sleep, derived from established human rights such as the rights to health, life, rest, and leisure,[176] or that there is a right to internet access.[177] In the near future, denying access to AVs may seem just as unjustifiable.

Arguing the flip side, the right to drive *in person* may be more difficult: the closest legal issue we are aware of in the AV context is whether there is a right to a driver's license. A non-trivial matter is the many areas where an inability to obtain a driving license is a serious limitation on a person's ability to work, study, or travel. That limit may infringe on many human rights, starting with the freedom of movement. But even this argument has failed with state-issued driving licenses considered a privilege, not a right.[178] The jump to a 'right to drive in person' seems difficult—especially if AVs will offer effective and efficient options

174. On this term, see, famously, MARY ANN GLENDON, RIGHTS TALK: THE IMPOVERISHMENT OF POLITICAL DISCOURSE (1991).

175. *Cf.* A Subramani, *Electricity Supply Is a Legal Right, Madras High Court Says*, TIMES OF INDIA (Oct. 10, 2013), https://timesofindia.indiatimes.com/india/Electricity-supply-is-a-legal-right-Madras-high-court-says/articleshow/23841025.cms [https://perma.cc/ZZL2-8ZTB].

176. For such a landmark ruling *see* Jen Mills, *Sleep Is a Fundamental Human Right, India's Supreme Court Rules*, METRO.CO.UK (Feb. 28, 2016), https://metro.co.uk/2016/02/28/sleep-is-a-fundamental-human-right-indias-supreme-court-rules-5722453/ [https://perma.cc/7TBH-AK4K]. For the holding *see* Ramlila Maidan Incident v. Home Secretary, (2012) 5 SCC 1 (India).

177. *See Right to Internet access*, WIKIPEDIA, https://en.wikipedia.org/wiki/Right_to_Internet_access [https://perma.cc/4KJC-L85N] (last updated July 9, 2019).

178. *See*, *e.g.*, *Driving is a Privilege, Not a Right*, DRIVERSED.COM, https://driversed.com/driving-information/the-driving-privilege/driving-is-a-privilege-not-a-right.aspx [https://perma.cc/N6NW-M3AF] (last visited Aug. 12, 2019); *Driving is a Privilege, Not a Right*, CANADIAN IMMIGRANT (May 10, 2011), http://canadianimmigrant.ca/settling-in-canada/driving-is-a-privilege-not-a-right [https://perma.cc/2T5F-LMFY] [hereinafter Canadian Immigrant]; *Supreme Court Has The Opportunity To Declare That Driving A Right Not Merely A Privilege*, NAVE LAW FIRM, https://nysdwi.com/supreme-court-opportunity-declare-driving-right-not-merely-privilege [https://perma.cc/BA36-QCV2] (last visited Aug. 12, 2019).

for transportation. Proving people have a legitimate interest in driving in person will be much easier if AVs offer spotty coverage and where traffic is so light, that human driving will not unduly burden the efficiency of AVs. In other words, completely banning self-driving is very unlikely to occur, even if driving cars will become a leisure activity, like horseback riding is today.

In other words, we respectfully do not think driving a car is a strong enough interest to justify constitutional protection. In fairness, it is true that such a right was not recognized because driving was not under threat until now, and one could think of a constitutional amendment to secure such a right. Indeed, the Human Driving Association is likely pursuing this goal at this very moment.[179] We think it is unlikely that such an amendment shall pass, just as an amendment to ban same sex marriages or to revoke the Second Amendment's right to bear arms is unlikely.

While the interests supporting the freedom to drive cars likely do not amount to a constitutionally protected right, they are significant enough that any regulation concerning AVs should consider the extent we should allow AVs to monopolize the roads. The most familiar argument in favor of a right to drive concerns human autonomy and choice: precluding people from acting in pursuit of their happiness (and for many, driving the open road represents freedom, mobility, youth, and power) should not be undertaken lightly. Yet reducing car injuries and significantly improving traffic efficiency are significant rationales. This brings us back to the rural-urban divide: not only is the case for a ban on human driving clearly stronger in densely populated areas, so is the likelihood that people will accept the need to give up use of their cars, and maybe even do so voluntarily given good alternatives[180] or financial incentives.[181]

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179. *See The War On Driving Is Here: Pick Your Side*, HUMAN DRIVING ASS'N, http://humandriving.org [https://perma.cc/B75F-ME3S] (last visited Aug. 12, 2019); M. R. O'Connor, *The Fight for the Right to Drive*, NEW YORKER (Apr. 30, 2019), https://newyorker.com/culture/annals-of-inquiry/the-fight-for-the-right-to-drive [https://perma.cc/X8AS-FUR4].

180. In Manhattan, a densely populated and relatively small area, where public transportation of varied types is available and the cost of keeping a private car is high—only twenty-three percent of households keep one. *See The Most Unaffordable Housing Markets In North America, Charted*, DIGG.COM (Oct. 26, 2017), http://digg.com/2017/most-unaffordable-housing-markets [https://perma.cc/VHV8-WWXV]; *New Yorkers and Cars*, NYCEDC.COM (Apr. 5, 2012), https://nycedc.com/blog-entry/new-yorkers-and-cars [https://perma.cc/D2UB-U8DR]. In 2012, only 9.22% of US households were car-free, a tiny figure but an increase from 8.87% in 2005. *See List of U.S. Cities With Most Households Without a Car*, IPFS, https://ipfs.io/ipfs/QmXoypizjW3WknFiJnKLwHCnL72vedxjQkDDP1mXWo6uco/wiki/List_of_U.S._cities_with_most_households_without_a_car.html [https://perma.cc/SA3Y-PPNV] (last visited Aug. 12, 2019); *Vehicle Ownership in U.S. Cities Data and Map*, GOVERNING, https://governing.com/gov-data/car-ownership-numbers-of-vehicles-by-city-map.html [https://perma.cc/FW89-VHZ7] (last visited Aug. 12, 2019).

181. *See*, *e.g.*, Conor Dougherty, *Self-Driving Cars Can't Cure Traffic, but Economics Can*, N.Y. TIMES (Mar. 8, 2017), https://nytimes.com/2017/03/08/upshot/self-driving-cars-cant-cure-traffic-but-economics-can.html [https://perma.cc/DCS6-WPFH].

II. GUESSWORK OR FUTUROLOGY

What is the AV regulatory model likely to be? AVs have great potential to improve current conditions in many ways. But it is clear that AVs must be regulated much more heavily than humans, which is great news because machines are much better at working according to a script than humans, who need discretion in their operation.

To us, the most intriguing question is whether AVs and human operated cars can safely and efficiently coexist, i.e., share the same road. Such coexistence may be possible, but it will most likely slow down AVs to accommodate human driving abilities.[182] Thus, it is likely that if the driverless car is to achieve its promise—and provide a faster, more convenient, and cheaper commute—it will need to have a monopoly over lanes. This is going to be very difficult to achieve in the highly congested cities of today (where this technology can have its greatest impact) without limiting human driving by either segregating lanes and roads or shutting human-driven cars out of roads entirely in an effort to clear the way for AVs.[183]

Would city-imposed limits on human-driven cars withstand legal scrutiny? As we expressed earlier, the answer is likely yes. Even today, many cities limit the entry of private cars, dedicate lanes to carpools and public transportation, and turn streets into pedestrian zones.[184] While some people may decry any limitations on their personal freedoms, including the right to self-drive in endless traffic, most commuters do not enjoy the driving aspect of protracted, bumper-to-bumper driving capped with a search for a parking spot.

Let us stress three points:

First, as we stated earlier, we doubt whether there is a civil or human right to drive a car. The issue that has come for debate is whether driving is a right or a

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182. *See also Humans Don't Know How to Drive Self-driving Cars*, POPULAR SCIENCE (Nov. 14, 2016), https://popsci.com/humans-cant-drive-self-driving-cars-autopilot-tesla?src=SOC&dom=tw [https://perma.cc/LC98-F5KE]. Julia Carrie Wong, *San Francisco Sours on Rampant Delivery Robots: 'Not Every Innovation Is Great'*, GUARDIAN (Dec. 10, 2017), https://theguardian.com/us-news/2017/dec/10/san-francisco-delivery-robots-laws [https://perma.cc/WR68-DXWL]; *cf.* Terrence Cullen, *Self-driving Bus Gets Into Accident on its First Day in Las Vegas, Human Driver Blamed for Collision*, NY DAILY NEWS (Nov. 9, 2017), http://nydailynews.com/news/national/self-driving-bus-accident-day-las-vegas-article-1.3621441 [https://perma.cc/XMS5-JAD6].

183. I expect this issue too will become an area where legal regulation of a human practice will significantly diverge between rural and metropolitan areas, with greater regulation in the cities and greater personal freedoms in the rural areas—i.e., more options for humans to drive a car—in rural communities.

184. "Cities around the world are coming to the same conclusion: they'd be better off with far fewer cars." *See* Stephen Moss, *End of the Car Age: How Cities Are Outgrowing the Automobile*, GUARDIAN (Apr. 28, 2015), https://theguardian.com/cities/2015/apr/28/end-of-the-car-age-how-cities-outgrew-the-automobile [https://perma.cc/M9CN-RPTR]. *Cf.* Adele Peters, *Paris Is Redesigning Its Major Intersections For Pedestrians, Not Cars: The New Designs Make Sure Pedestrians Get at Least 50% of the Public Space, Lanes of Traffic Be Damned*, FAST COMPANY (Aug. 4, 2016), https://fastcompany.com/3058685/paris-is-redesigning-its-major-intersections-for-pedestrians-not-cars [https://perma.cc/6H4A-2JY8].

privilege.[185] We are of course familiar with the prominence of the car in American life, both as a practical and a cultural matter. The realistic scenario is somewhere in between the extremes and is therefore much simpler. It seems much easier to defend barring the use of private cars from operating on public roads in many contexts. Such a limit is a balance between the legitimate wants of individuals (to use their private car) against the needs of the many. If balanced well, the interest in streamlining congested traffic, easing pollution,[186] turning historic touristic areas into pedestrian-only zones, and limiting cars to the number of available parking spaces,[187] all seem like rational, legitimate middle grounds.

Second, our expectation is that people—especially in urban areas—will give up on their cars voluntarily, given a more effective alternative. Indeed, some have done so already, before the advent of the self-driven cars. Notably, in Manhattan, one of the most in-demand residential areas in America, the cost of maintaining a car, the relatively small size of the area, and the availability of public transportation, taxis, and ridesharing result in only twenty-three percent of households owning a car.[188] Again, we do not foresee a near future where humans will be completely banned from or voluntarily completely give up driving[189]—just a future where people are disincentivized from owning and driving cars and incentivized to use self-driven pods.[190] People are likely to keep driving cars, especially in less densely populated areas where self-driven cars may be slow to arrive.[191]

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185. *Cf.* Canadian Immigrant, *supra* note 178.

186. Or at least trying to. *See* Matt McGrath, *Car Ban Fails to Curb Air Pollution in Mexico City*, BBC (Feb. 2, 2017), http://bbc.co.uk/news/science-environment-38840076 [https://perma.cc/2Z4U-LZPW]. But *cf.* Jonathan M. Gitlin, *How Much Carbon Emissions Would Robot Taxis Save?: Efficiency Gains Per Mile Traveled Could Be Immense, According to a New Study*, ARS TECHNICA (June 7, 2015), https://arstechnica.com/cars/2015/07/how-much-carbon-emissions-would-robot-taxis-save [https://perma.cc/DH6G-ASBN].

187. The potential for savings here is enormous. The average automobile spends ninety-five percent of its time sitting in place; and that is a substantial place. 2011 data suggests that there are one billion parking spots to accommodate the 253 million passenger cars and light trucks in the country, taking up ca. 6,500 square miles, bigger than Connecticut. *See* Clive Thompson, *No Parking Here: You've Heard About How Robocars Are Going to Upend the Economy. But Have You Thought About What They Will Do to Urban Space?*, MOTHER JONES (Jan. 2016), http://motherjones.com/environment/2016/01/future-parking-self-driving-cars [https://perma.cc/XD9C-K4VC].

188. *See supra* note 180. In 2012 9.22% of US households were car-free, clearly a minute number, yet an increase from 8.87% in 2005. *See Transportation in the United States*, WIKIPEDIA, https://en.wikipedia.org/wiki/List_of_U.S._cities_with_most_households_without_a_car [https://perma.cc/4WGJ-BQ2H] (last updated Aug. 19, 2019).

189. But *cf.* Tamara Warran, *The Future of America is Driverless*, THE VERGE (Nov. 1, 2016), https://theverge.com/a/verge-2021/secretary-anthony-foxx [https://perma.cc/58UQ-GGVP]; and more dramatically Kevin Roose, *Driving Should be Illegal*, SPLINTER (May, 10, 2015); https://splinternews.com/driving-should-be-illegal-1793851503 [https://perma.cc/83BR-GH6M].

190. *Cf.* Dougherty, *supra* note 181.

191. Take the evolution of electricity. Although electricity was installed in the White House in 1891, it took decades to be fully installed in urban areas and even longer in rural areas. In 1930, only ten percent of rural areas had access to electricity, while ninety percent of urban areas were on the grid. Over the next decade this figure was raised to over eighty percent for the farmer and rural villages. 1 ALEXANDRA KINDELL & ELIZABETH S. DEMERS, TOP OF FORM BOTTOM OF FORM ENCYCLOPEDIA OF POPULISM IN AMERICA: A HISTORICAL ENCYCLOPEDIA 201–04; Betty C. Monkman, *The White House*

Third, we believe we can point to both past and current data to support our suppositions. Much has changed in human living condition since the 1900s. Take the matter of home baking. Available data suggests that in 1900, seventy-five percent of American families still baked their own bread. But while baking was a point of pride, this was an onerous job: bread took a full twenty-four hours to produce, and most used communal ovens.[192] Industrialization offered an easier, often cheaper solution, and when preservatives came along most households stopped baking almost completely. Many people still bake for health, religious, cultural, and social reasons. But this is a personal choice of the few, with the dominant alternative being the modern, professionally baked bread.[193]

Or take the rise of the mass produced, privately owned car. As one observer notes, "In just a few short decades, owning a car could be a lot like owning a horse—mostly for hobbyists and really unnecessary for transportation purposes."[194] This is probably true, both in terms of identifying the process and the time frame. In 1899, thirty American manufacturers produced 2,500 motor vehicles. In 1906 Ford changed the marketplace forever when it introduced the $600 Ford Model N (1906–1907) followed by the $825 Model T (1908). By 1912, the Model T runabout sold for $575, less than the average annual wage in the United States. In 1913, the United States produced some 485,000 of the global total of 606,124 motor vehicles.[195]

This is impressive, but it took a long time for the car to replace its predecessor, the horse. In 1900, there were 76 million people in the U.S. and 21,531,635 horses. The equine number rose up to 1915, when it hit 26,493,000 (human population was then 100.5 million). Equine numbers were surprisingly slow to drop—equine population was over 22 million in 1925 (115,829,000), and almost 14 million in 1940 (132,122,446) reaching a low of 3 million in 1960 (180,671,158). In 1900, U.S. cities with population over 25,000 averaged 4,396 horses per 100,000 inhabitants.[196]

Lastly, and closely linked, we think that our assessment is backed by both past lessons and current data. History proves that people overwhelmingly embrace

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Gets Electric Lighting, 1891, THE WHITE HOUSE HISTORICAL ASSOCIATION, https://whitehousehistory.org/the-white-house-gets-electric-lighting [https://perma.cc/ZQP5-X68V] (last visited Aug. 12, 2019).

192. *See* JULIE HUSBAND & JIM O'LOUGHLIN, DAILY LIFE IN THE INDUSTRIAL UNITED STATE, 1870–1900 112–113 (2004).

193. Donald R. Stabile, *Bakery Products, 20.5*, *in* MANUFACTURING: A HISTORIOGRAPHICAL AND BIBLIOGRAPHICAL GUIDE 46–48 (1990); BAKING INDUSTRY, *in* THE ENCYCLOPEDIA OF NEW YORK STATE 143 (1st ed. 2005).

194. *See* Cadie Thompson, *Why No One Will Own a Car In 25 Years*, BUSINESS INSIDER (June 29, 2015), http://businessinsider.com/why-no-one-will-own-a-car-in-25-years-2015-6 [https://perma.cc/R6Q8-VULB].

195. *See Automobile History*, HISTORY.COM (Aug. 21, 2018), http://history.com/topics/automobiles [https://perma.cc/P435-A9M6].

196. *Motor Vehicle Registrations*, ALLCOUNTRIES.ORG, http://www.allcountries.org/uscensus/1027_motor_vehicle_registrations.html [https://perma.cc/2WPU-KYQU] (last visited Aug. 12, 2019); *U.S. Population From 1900*, DEMOGRAPHIA.COM, http://www.demographia.com/db-uspop1900.htm [https://perma.cc/5V9Y-NWZV] (last visited Aug. 12 2019).

new technologies, especially when they are an unequivocal improvement over those previously available.

III. LESS (HUMAN) DRIVING WILL LEAD TO BETTER LIFE QUALITY

Our suggestion here is simple, intuitive, and hardly controversial. AVs hold the promise to improve many people's quality of life by replacing driving in places where traffic is congested and parking is short. We will make this argument in three points, where we will try to supplement the discussion with some of our current research, specifically on the topics of shaming and agency law, to support the argument that it would be beneficial to retire human driving, at least in congested, high-volume traffic areas.

A. The "Easy" Utilitarian Argument for Less Human Driving

We advocate for fewer human-driven cars in favor of "better quality of life." But what does this term mean? One can think of at least two pertinent meanings. The first and more formal meaning refers to the potential increase in life expectancy[197] and improvement of the quality of life.[198] AVs have the potential to improve life in both senses: they have the potential to reduce accidents, prevent driver's stress and road rage, and make commutes shorter and more productive. They also have the potential to improve the efficiency of car use, reduce the cost of travel, help curb pollution, and possibly reduce infrastructure that now supports driving: roads, traffic signs and lights, parking spaces, the free roads, and parking spaces. There will be some losses—some jobs (such as police and DMVs) and perhaps more generally notable, a decline in the significance of the car in American life.

All in all, this seems to be a worthwhile trade, at least in high volume traffic areas, and a change that most will embrace—just like most embraced the move away from horses and landlines as the main means of household transportation or communication.[199] This is something that cities and their dwellers are likely to

197. That seems to be on track for continued elongation in Western nations; setbacks are viewed as deeply troubling and part of the deeper trouble in mostly rural areas. *Cf.* Lenny Bernstein, U.S. life expectancy declines for the first time since 1993, WASH. POST (Dec. 8, 2016), https://washingtonpost.com/national/health-science/us-life-expectancy-declines-for-the-first-time-since-1993/2016/12/07/7dcdc7b4-bc93-11e6-91ee-1adddfe36cbe_story.html?utm_term=.99e2c97dceb3 [https://perma.cc/TR8Y-XAKR]; Katie Rogers, *Life Expectancy in U.S. Declines Slightly, and Researchers Are Puzzled*, N.Y. TIMES (Dec. 8, 2016), https://nytimes.com/2016/12/08/health/life-expectancy-us-declines.html [https://perma.cc/KJ5Y-CGCR]*; see also* Olga Khazan, *Where Life Expectancy Is Dipping Across America*, CITYLAB (May 8, 2017), https://citylab.com/equity/2017/05/kentucky-is-home-to-the-greatest-declines-in-life-expectancy/525801 [https://perma.cc/2LLW-NYHZ]. Kentucky alone has eight of the thirteen US counties where life expectancy decreased.

198. In the economic evaluation of medical options, one important measure is QALY (quality-adjusted life year). QALY combines the expected length *and* quality of life for patients. *See Quality-adjusted life year*, WIKIPEDIA, https://en.wikipedia.org/wiki/Quality-adjusted_life_year [https://perma.cc/PNX3-AQJU] (last updated July 8, 2019).

199. On the huge, swift, and continuing decline in landline use see, e.g. Felix Richter, *Landline Phones Are a Dying Breed*, STATISTA.COM (May 17, 2019), https://statista.com/chart/2072/landline-

find very attractive. Several organizations publish closely watched "best city to live in" studies.[200] Quality of living indexes typically consider the economic and political environment, infrastructure, public transport, health, recreation, and housing. The results typically award top spots to major cities that are small, rich, and politically neutral such as Stockholm,[201] Melbourne,[202] Vienna, or Vancouver, thus rewarding "the safe, clean, and bland."[203] These polls are looking for "best cities to live in," not "best city to visit,"[204] and so clean, orderly cities with good public transportation are chosen and are rightly the envy of many.

The failings of cars are significant: the internal combustion engine offers low fuel efficiency and much pollution leading to the estimated premature death of about 53,000 Americans per year.[205] As we mentioned earlier, the cars sit idle most of the time.[206] "And that's not even counting cars' most dramatic cost: They waste lives. They are one of America's leading causes of avoidable injury and

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phones-in-the-united-states [https://perma.cc/9R83-TWLK]; Niall McCarthy, *The Great Decline Of The Landline [Infographic]*, FORBES (Feb. 27, 2015), https://forbes.com/sites/niallmccarthy/2015/02/27/the-great-decline-of-the-landline-infographic/#110eede512f3 [https://perma.cc/A3JG-47AN]; Roland Banks, *Who Needs a Landline Telephone? 95% of UK Households Don't*, MOBILE INDUSTRY REV. (Dec. 1, 2014), http://mobileindustryreview.com/2014/12/who-needs-a-landline-telephone.html [https://perma.cc/6UWT-TGFU].

200. Such studies are essential, as they provide quantifiable, verifiable, approximation of what makes cities welcoming for long term inhabitants, and they are especially important because they are conducted annually, and they note the annual changes. *Global Liveability Has Improved for the First Time in a Decade*, ECONOMIST (Aug. 16, 2017), https://economist.com/blogs/graphicdetail/2017/08/daily-chart-10 [https://perma.cc/YD8B-HJ2L]. A tumultuous decade (2007-2017) of civil wars, terrorist attacks and a financial meltdown has brought a decline in the "liveability" score in ninety-eight of the 140 cities surveyed. The survey focuses on expats and business travelers, but I assume that local residents were similarly impacted.

201. *See These Are the 20 Greatest Cities to Live In*, TELEGRAPH (Apr. 4, 2019), http://telegraph.co.uk/travel/galleries/The-worlds-most-liveable-cities [https://perma.cc/J3EC-MMG6]; Lianna Brinded, *The 27 Cities with the Best Quality of Life in the World*, BUSINESS INSIDER (May 18, 2016), http://uk.businessinsider.com/mercer-2016-quality-of-living-worldwide-city-rankings-2016-5 [https://perma.cc/3ES6-TFZ6].

202. *See* Oliver Smith, *Revealed: The World's Best (and Worst) Cities to Live in*, THE TELEGRAPH (Aug. 16, 2017), http://telegraph.co.uk/travel/news/liveable-cities-2017-economist-intelligence [https://perma.cc/6SN9-9DPL]; Talia Avakian, *The 10 Best Cities to Live in Around the World*, TRAVEL & LEISURE (Jan. 26, 2018), http://travelandleisure.com/trip-ideas/most-livable-cities-on-earth [https://perma.cc/GZ2P-LEET].

203. *See* Gavin Haynes, *Why the 'Best Cities to Live In' List Rewards the Safe and the Clean*, GUARDIAN (Aug. 16, 2017), https://theguardian.com/lifeandstyle/shortcuts/2017/aug/16/why-the-best-cities-to-live-in-list-rewards-the-safe-clean-and-bland [https://perma.cc/FJ6T-SAYS].

204. Top travel destinations in 2016 – Bangkok, London and Paris ranked 102, 53 and 29th respectively. Alison Millington, *The 30 Most Visited Cities Around the World in 2017*, BUSINESS INSIDER (Sep. 26, 2017), http://uk.businessinsider.com/the-most-visited-cities-around-the-world-in-2017-2017-9/#2-london-uk-20-million-international-visitors-29 [https://perma.cc/ZJL4-YZ2K]; ECONOMIST, *Full Ranking with Rating and Category Breakdown*, HERALD SUN (2015), https://media.heraldsun.com.au/files/liveability.pdf [https://perma.cc/8ABY-RQRB].

205. *See* John Berkeley, *The Death of the Internal Combustion Engine*, ECONOMIST, https://www.economist.com/leaders/2017/08/12/the-death-of-the-internal-combustion-engine [https://perma.cc/RJS2-EZ6B] (last accessed Mar. 5, 2020).

206. *See* the discussion about the high tag price for car owners, *supra* note 115.

death, especially among the young . . . The traffic death toll in 2015 exceeded 3,000 a month."[207]

This is why the imminent technological revolution of AVs is so promising. Even if it will take some time to arrive across the globe, it promises a significant improvement in the quality of life for all residents of major metropolitan areas. It does so in two completely different ways. The first already noted: private cars are a major burden on both individuals and society. Their use is both economically inefficient and dangerous, and autonomous cars promise to change all that, with the potential sacrifice of the dubious right to drive one's personal vehicle on all public roads at all times. But there is a more subtle benefit, where the argument becomes both more personal and more pertinent to public law.

B. Traffic Congestion, Autonomy, Discretion

In preparing this research, we have spent much time thinking about what driving is—beyond the danger and costs—that makes it such an unpleasant experience. We have no discomfort with being in a car; if anything, today's cars are surely much more comfortable (better-engineered, air-conditioned, and equipped with audio and visual equipment) and safer than they have ever been.[208] Our intuition was that it had to do with the other drivers on the congested road. But what exactly is it about our co-drivers that make us so uncomfortable? Is it the stress of close proximity of cars in high volume traffic? The noise? The pollution? We think not, and we came up with two possible explanations. To our surprise, we found both explanations linked to our current research agenda and to broader public law and policy implications. These are discussed in the present and the following subsection.

One point has to do with agency law, an area of private law that is closely linked to public law. In a recently published book, Gary Lawson and Guy Seidman raise the idea that the founding generation—familiar with private law instruments that could be used to produce their public law advances—most likely viewed the U.S. Constitution as a fiduciary or agency document, a "great power of attorney."[209] This puts into perspective what it means to be a person of legal capacity [sane, adult, citizen] in a liberal democracy. It means we are at liberty to

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207. When it comes to the number of people who die in car wrecks, America experiences the equivalent of four airliner crashes every week … Car crashes are the leading cause of death for Americans between the ages of one and thirty-nine. The direct economic costs alone—the medical bills and emergency-response costs reflected in taxes and insurance payments—represent a tax of $784 on every man, woman, and child living in the U.S. REP. OF WHO ON ROAD SAFETY 2015 (2015), http://www.who.int/violence_injury_prevention/road_safety_status/2015/en [https://perma.cc/T9C6-QQZW].

208. Although I can imagine people feeling discomfort, even fear, of driving or being in a car for various reasons. *Cf. supra* note 103; Ezra Dyer, *Why Cars Are Safer Than They've Ever Been*, POPULAR MECHANIC (Sep. 11, 2014), https://popularmechanics.com/cars/a11201/why-cars-are-safer-than-theyve-ever-been-17194116 [https://perma.cc/F3MJ-PWGW].

209. *See generally* GARY LAWSON & GUY SEIDMAN A GREAT POWER OF ATTORNEY: UNDERSTANDING THE FIDUCIARY CONSTITUTION (2017); *see also* Gary Lawson, Robert G. Natelson & Guy Seidman, *The Fiduciary Foundations of Federal Equal Protection*, 94 B. U. L. REV. 415, 428 (2014).

do anything that does not infringe on the rights and liberties of another. It means we are free and autonomous to make all the decisions relating to ourselves, unless we choose otherwise. We often choose to empower others: we do so in private law, corporate law, and public law. But, for the most part, we wish to maintain the idea, even if it is more an ideal than a practicality, that we can make all the decisions by ourselves, and we *choose* to use others as our agents.

Much of this is more an ideal than reality. Do we really have free will? More specifically—do we really have much choice in life?[210] And even if we have all the options open to us, do we really have the time and the talent to replace all the experts and specialists we appoint to help us—and sometimes replace us—in decision making and daily chores? With more free time, could we really replace teachers and homeschool our children? Achieve better growth for our money than corporations and investment advisors? Do we really want to replace our medical doctors with the best of internet websites?

Taken to the next level—from private to public law—can we really survive without a government to regulate and coordinate citizens' activities? We doubt even ardent libertarians would seriously argue that. Indeed, even the foundational assumptions of human rationality that classical economics relied on have proven inaccurate, as behavioral law and economics exposed human biases and irrationality.[211]

Some of these biases are directly pertinent to car drivers, most notably, the optimism bias: this bias, "which is commonly defined as the mistaken belief that the chance of experiencing a negative event are lower than they actually are"[212] has troubling effects on drivers' risk-taking. Indeed "[r]esearch suggests that people are excessively and unrealistically optimistic when judging their driving competency and accident risk."[213] This makes driving even more dangerous than one might initially guess because drivers overestimate their driving ability and may

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210. We are not determinists, but clearly, the opportunities open to us depends on where, when are to what parents we are born, to name to most obvious issues. For a delightful example of the strong impact of parents on the career choice of their children *see* Quoctrung Bui & Claire Cain Miller, *The Jobs You're Most Likely to Inherit From Your Mother and Father*, N.Y. TIMES (Nov. 22, 2017), https://www.nytimes.com/interactive/2017/11/22/upshot/the-jobs-youre-most-likely-to-inherit-from-your-mother-and-father.html [https://perma.cc/2TB7-WKNB]; *Determinism*, WIKIPEDIA , https://en.wikipedia.org/wiki/Determinism [https://perma.cc/XPK9-PM5B] (last updated Feb. 2, 2020); *see generally Free Will*, WIKIPEDIA, https://en.wikipedia.org/wiki/Free_will [https://perma.cc/4DQ6-D222] (last updated Feb 25, 2020).

211. For useful overviews on the topic, see generally Christine Jolls, et al., *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471 (1998); Russell B. Korobkin & Thomas S. Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 CAL. L. REV. 1051 (2000); Joshua D. Wright & Douglas H. Ginsburg, *Behavioral Law and Economics: Its Origins, Fatal Flaws, and Implications for Liberty*, 106 NW. U. L. REV. 1033 (2012).

212. *See* Asaf Eckstein, *Great Expectations: The Peril of an Expectations Gap in Proxy Advisory Firm Regulation*, 40 DEL. J. CORP. L. 77, 107 (2015); *see also* 250 Words, *Is Time-Saving Technology Making Us Lazy and Incompetent*?, INC (Oct. 14, 2014), https://www.inc.com/250-words/is-time-saving-technology-making-us-lazy-and-incompetent.html [https://perma.cc/TMK4-XK2Z].

213. *See* David M.DeJoy, *The Optimism Bias and Traffic Accident Risk Perception*, 21(4) ACCIDENT ANALYSIS & PREVENTIONS 333, 333 (1989).

be willing to take risks, say, speeding or overtaking, that may be overly optimistic. Luckily, some counter-factors contain these dangerous consequences, especially cars' tolerance; car safety has greatly improved in recent decades, both in terms of cars' physical attributes and in tools that provide drivers with advanced warnings.[214]

The bottom line is this: our human judgment may be flawed and the machines we use may be dangerous, but for the most part, this danger is kept at socially acceptable levels. This is the current status quo: every atomist, individual car driver, operates her own discretion on the road. But we are not alone on the road. And every single driver's judgement call impacts nearby drivers.

What about traffic laws, you may ask? They are designed to ensure the safe streamlining of traffic, and for the most part, they achieve this goal.[215] But it is our impression as drivers, passengers and travelers, that traffic laws—the extensive criminal code of conduct on the road—are often violated, and underenforced.[216] It is possible that enforcement agencies focus their efforts and resources on what they consider more important traffic offenses, such as carjacking, road rage, extreme speeding and DUIs.[217] That leaves many forms of road conduct, some considered violations of traffic law, others merely a violation of driving etiquette, unchecked.

This means the "reasonable driver" has to drive while noting the discretionary reasoned decisions of two types of drivers and make the necessary correction to his own driving. One type is aggressive drivers. Their actions—speeding, cutting into lanes, and not waiting for their turn are probably traffic violations, but are unlikely to be enforced. Thus, their driving habits need to be factored into driving. The second type is the under-aggressive drivers. People who are slower—perhaps more careful—than the average driver. They are not optimizers, they are

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214. *See* Ezra Dyer, *Why Cars Are Safer Than They've Ever Been*, POPULAR MECHANIC (Sep. 11, 2014), https:/popularmechanics.com/cars/a11201/why-cars-are-safer-than-theyve-ever-been-17194116 [https://perma.cc/2W46-8TES].

215. This is the result of better, safer, design, and myriad applications that help improve human driving abilities, alerting the driver to dangers faster and more accurately than human sensory perception.

216. *Cf*. Mary Dejevsky, *The Rules of the Road Exist to Keep Us Safe. Why Aren't We Enforcing Them?*, GUARDIAN (Jan. 30, 2017), https://www.theguardian.com/world/commentisfree/2017/jan/30/road-safety-enforcement-may-dejevsky [https://perma.cc/2TQL-TESQ]. That said, it is mostly "low- and middle-income countries" where "a combination of insufficient or nonexistent safety laws, poor infrastructure and a lack of enforcement" results in high rates of traffic fatalities. *See* Olga Khazan, *A Surprising Map of Countries That Have the Most Traffic Deaths*, WASH. POST (Jan. 18, 2013), https://washingtonpost.com/news/worldviews/wp/2013/01/18/a-surprising-map-of-countries-that-have-the-most-traffic-deaths/?utm_term=.3cd3cba8121d [https://perma.cc/W9H2-8FY2]; *see also* Heidi Worley, *Road Traffic Accidents Increase Dramatically Worldwide*, PRB (Mar. 1, 2006), http://prb.org/Publications/Articles/2006/RoadTrafficAccidentsIncreaseDramaticallyWorldwide.aspx [https://perma.cc/2WK5-TM3T].

217. The European Transport Safety Council stresses the enforcement efforts of "the following 3 'main killers'" –speeding, non-use of seat belts and drink driving. *See* EUROPEAN TRANSPORT SAFETY COUNCIL, TRAFFIC LAW ENFORCEMENT ACROSS THE EU: TACKLING THE THREE MAIN KILLERS ON EUROPE'S ROADS (2011), https://etsc.eu/wp-content/uploads/Traffic_Law_Enforcement_in_the_EU.pdf [https://perma.cc/37GD-MPAE].

deliberate. The under-aggressive driver is slower than average in accelerating, and he is deliberate in the space he keeps between his own car and the car ahead.

Consequently, traffic laws alone cannot regulate safe, orderly behavior on the road. Social norms help.[218] For example, most drivers observe driving etiquette, either because of the dangers of riding, or because they share the misery of car-pooling, or because (and as long as) most drivers abide by these social norms.

The fact is that while driving education, signs, and etiquette attempt to influence human behavior and streamline it to allow pursuance of the collective task of driving from point A to B—humans remain just that—*human*. Perhaps, this is why we are now thinking about replacing human drivers with automatons. As stated earlier, each one of us brings to the driver's seat his or her personality, preferences, and discretion on how to act and react at all time.[219] In a way, driving in slow traffic is much like standing in a physical human queue: everyone in line has the same goal in mind—which is to move the queue along. Some people may actually enjoy the queue—or the slow drive—but we think it is a fair presumption that most people simply want to get to their destination. Just like physical queueing, driving is a collaborative effort. The problem however, is a practical one—each driver must employ his or her judgment and must do so often. And while most of us are aware of out-of-line behavior that is simply rude, like cutting other cars, it is often the slower drivers that irritate us the most.

C. The "Easy" Utilitarian Argument for "Better Life Quality"

As drivers (if not as lawyers), we all know that the law is well aware of the dangers of placing very potent machines at the disposal of the majority of the population, and a special branch of criminal law regulates traffic. Its primary aim is to safely coordinate human driving, telling us, inter-alia, where we may drive fast, and where we must drive slowly; telling us to take note of particular dangers near the road. Driving requires education and testing—and failed drivers often have to requalify through additional education and testing.

The law is supplanted with social norms: rules of civility in human-driver interaction that make driving so much more pleasant in the American Midwest than in mid-Manhattan.[220] Herein lies much of the problem: human comity, individual drivers' self-restraint and tolerance towards fellow travelers, and generally some cooperation among drivers' is needed to make traffic an acceptable experience. In reality, traffic laws are difficult to enforce at all times—with millions of fast-moving vehicles on the road at all time—and civility is hard to come by. Indeed, it seems that people behave very differently on the road, in car-to-car interaction than they would in face-to-face interactions.

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218. *Cf. id.*

219. Van Lennep, *supra* note 14, at 217, 222.

220. *See, e.g.*, Susanna Daniel, *Living in the Midwest: Does It Make You Complacent and Likely to Wear Clogs?*, SLATE.COM (Apr. 14, 2011), http://slate.com/articles/life/family/2011/04/living_in_the_midwest.html [https://perma.cc/P6AF-FMW7].

The starting point concerns two core elements that lie in the nature of the car. One, as we already discussed, is the sheer power that a car places in the hands of an individual. The second point is the near anonymity that human drivers enjoy when they step into a vehicle and the change in human behavior that entering a car encourages. Some drivers transform when united with their car, liberated from the social constraints of regular human interaction. The effects of anonymity on human behavior becomes especially clear when studying shaming (and other behavior) on social media. It seems that car drivers exhibit behavior reminiscent of that of people interacting online and are much less affected by law and social norms than physical interactions between individuals.

Having just explained why AVs are likely to be an improvement in reducing human inter-personal friction, let us backtrack a little. We want to argue in favor of the shared human experience of driving. It is not that sitting a long time in sluggish traffic somehow makes us grow fonder of mankind. But there is something to be said of how we, as individual drivers, each cooped in a car, share this social experience communally.[221] We take part in a well-behaved, fair and equitable collective exercise of cultural norms of the sort that makes some people more fond of well-ordered queues.[222] We will not argue that giving up driving, like giving up other mundane chores for automation, is anything but liberating, freeing resources for discretionary activities.[223]

Driving is one of the last of the everyday actions that almost all humans do, even when they have the alternative. Consider the vast popularity of cookbooks and food-related reality shows. These epitomize our deep interest in keeping in touch with cooking skills. Then remember that only a minority of us actually home-cook daily.[224] As noted earlier, the vast majority of us still drive cars *daily*.

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221. *See*, *e.g.*, Tracy E. Robey, *You Might Think You Hate Crowded Stores, but Science Says Otherwise: Researchers Since the 1970s Have Been Exposing Our Evolution-Determined Love of Shopping in Herds*, RACKED (Nov. 22, 2017), https://racked.com/2017/11/22/16649384/crowded-stores-black-friday-science [https://perma.cc/G5UP-QP5V].

222. Although some people seem fonder of queuing than others. One example is the British. *See* Denise Winterman, *Queuing: Is It really the British Way*, BBC (July 4, 2013), http://bbc.com/news/magazine-23087024 [https://perma.cc/R6D5-VVSR]; *see also* Katie Morley, *The Rule of Six That Governs Why and How We Brits Queue*, THE TELEGRAPH (Feb. 16, 2017), http://telegraph.co.uk/news/2017/02/16/rule-six-governs-long-queue-shop [https://perma.cc/3WH7-5K5P]. Another are the Swedish, where, according to ethnologist Karl Olov Arnstberg, the abundance of lines and queueing originates from Swedish people's liking of rationality and order. *Is It a Myth That Swedes Love to Form a Queue?*, RADIO SWEDEN (July 22, 2014), https://sverigesradio.se/sida/artikel.aspx?programid=2054&artikel=5920025 [https://perma.cc/P6P7-F4C8]; *see also* Brendan Cole, *Why We Hate Some Queues More Than Others?*, BBC (Oct. 15, 2015), http://bbc.com/future/story/20151008-why-we-hate-some-queues-more-than-others) [https://perma.cc/X86V-GYAR].

223. Among the opposite arguments is the suggestion that time saving technology somehow reduces human skills, and that people do not use free time usefully. *See*, *e.g.*, 250 Words, *supra* note 212.

224. While "[t]hat's because cooking at home is still the preferred way to prepare a meal for ninety-eight percent of Americans, according to a new survey by *ReportLinker*" only about "a third of Americans say they cook at home daily, and fifty percent say they cook between three and six days a week." *See Julia Child Would Be Thrilled: Most Americans Prefer to Cook at Home*, REPORT LINKER (Nov. 23, 2016), https://reportlinker.com/insight/americans-cooking-habits.html [https://perma.cc/EE32-PZYB]. *See also* Lindsey P Smith et al., *Trends in US Home Food Preparation and Consumption:*

And even given the option to be driven by others, many people prefer driving themselves, in the comfort, privacy and familiarity of the vehicle they own. This may explain why even celebrities are, time and again, caught by traffic police, not just for speeding but for much more embarrassing offenses related to sex and alcohol.[225] So this argument may read as suggesting that driving is part of what "makes us human." But we mean it as a common, shared human experience. And it is on this term—shared—that we want to make two socio-legal observations.

The first is that liberal democracies actually make very few requirements of their citizens for *physical* participation. The draft is mostly gone,[226] and both taxes and the vote can be processed by mail (as can a fine, where it is mandatory).[227] As far as the State is concerned, anyone can sequester himself or herself at home and never leave. The possibility of working from home and ordering home deliveries make this a real possibility.[228]

The second observation, which we will define in intellectual property terms, is that humans enjoy the right to have a monopoly on our social interactions: to be seen when and where we want, meeting only those we wish. As long as one stays at home this is relatively easy to do, and it requires extraordinary efforts to maintain such social isolation in public—walking in the street masked, talking to no one, is awkward. And keeping it up is complicated and expensive. The only people who take such measures are mega-rich mega-celebrities.[229] Consider the following report: "Kim Kardashian and Beyoncé Come Face-to-Face at Serena

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Analysis of National Nutrition Surveys and Time Use Studies From 1965–1966 to 2007–2008, 12 NUTR J. 1 (2013).

225. *See* Hollie McKay, *Driving While Famous: Why Are More Stars Getting Busted for DUI?*, FOX NEWS (July 13, 2010), https://www.foxnews.com/entertainment/driving-while-famous-why-are-more-stars-getting-busted-for-dui [https://perma.cc/WVH3-2JST]; Katherine Clegg Smith et al., *Media Coverage of Celebrity DUIs: Teachable Moments or Problematic Social Modeling?*, 44(3) ALCOHOL & ALCOHOLISM 256 (2009); Jason Rodrigues, *Hugh Grant Arrested With Sex Worker 20 Years Ago*, GUARDIAN (June 26, 2015), https://theguardian.com/film/from-the-archive-blog/2015/jun/26/hugh-grant-arrest-prostitute-divine-brown-20-1995 [https://perma.cc/B8SH-5SZ6]. Sometimes there is good (celebrity driving related) press. *See e.g.* Jackie Willis, *Harrison Ford Helps Woman After She Crashes Car Off the Highway*, ET (Nov. 2017), https://etonline.com/harrison-ford-helps-woman-after-she-crashes-car-highway-91409 [https://perma.cc/K358-F7K3]; Kendall Fisher, *Kim Kardashian and Beyoncé Come Face-to-Face at Serena Williams' Wedding for the First Time After Kanye and Jay-Z's Fallout*, E NEWS (Nov. 17, 2017), http://eonline.com/news/894654/kim-kardashian-and-beyonce-come-face-to-face-at-serena-williams-wedding-for-the-first-time-after-kanye-and-jay-z-s-fallout [https://perma.cc/96ZB-QWAF].

226. *See Conscription*, *supra* note 26.

227. *See Compulsory voting*, *supra* note 27.

228. There have been recluses and hermits in every society in history; in contemporary Japan this is a phenomenon known as *Hikikomori*, with an estimated half a million Japanese youth having become social recluses. *See Hikikomori*, *supra* note 28.

229. *See e.g.*, Lily Harrison, *The Price of Kim Kardashian's Safety: Why It Costs $100,000 a Day to Protect Kanye West's Wife?*, E. NEWS (Oct. 4, 2016), http://eonline.com/news/799768/the-price-of-kim-kardashian-s-safety-why-it-costs-100-000-a-day-to-protect-kanye-west-s-wife [https://perma.cc/Y3UA-YQ9V]; Kenzie Bryant, *The Staggering Price Tag on Safety in the Modern Celebrity World: From Kim Kardashian West to Brad Pitt, What Stars Are Willing to Pay for Peace of Mind is Almost Unthinkable*, VANITY FAIR (Nov. 4, 2016), https://vanityfair.com/style/2016/11/bodyguard-security-cost-kim-kardashian-brad-pitt [https://perma.cc/WDH7-NUEM].

Williams' Wedding for the First Time After Kanye and Jay-Z's Fallout."[230] If you follow *Keeping Up With The Kardashians* (as we do, for purely academic reasons) you will note that security is a major issue; that the series is mostly shot inside the Kardashians' well-guarded mansions and that when the cast is seen shopping or dining they are the only patrons in the establishment. So, it requires a huge effort to choreograph the moves of two mega-celebrities such as Kim and Beyoncé so that they do not meet (although they move in similar circles) unless and when they want to. This brings us to the matter of cars: for a myriad of reasons, historical, social, rightly or wrongly economic—roads are considered a public good, and the vast majority of them are public, and open to everyone.

Celebrities, ordinary people, millionaires, and paupers all share the highway. City traffic is often slower than horse drawn cart,[231] and no one—save, the motorcade of a Head of State[232]—escapes it. There is a humbling, democratic, egalitarian, sharing of fortunes effect in this, and we do wonder, whether AV can and will maintain this setting.

IV. REFLECTIONS

In the previous parts we discussed AV's effect on human driving. We argued against human driving, while explaining the challenges—legal, social and others—that banning human driving might induce. We realize that any policy change requires further deliberations. In this part, we outline how AV regulation could look while challenging some of the more prominent assumptions.

First, given the huge hurdles facing the introduction of AVs, on the one hand, and the huge technological developments taking place, we cautiously limit our vision to the coming five to ten years. Longer-term predictions we leave to better (sci-fi) writers.

Second, our recommendations are aligned with our normative expectations and reasoning (that human driving is in a decline, and our belief that human driving is

230. Did they have an icy exchange? Is their rift healed? Read all about it at: Kendall Fisher, *Kim Kardashian and Beyoncé Come Face-to-Face at Serena Williams' Wedding for the First Time After Kanye and Jay-Z's Fallout*, E. NEWS (Nov. 17, 2017), http://eonline.com/news/894654/kim-kardashian-and-beyonce-come-face-to-face-at-serena-williams-wedding-for-the-first-time-after-kanye-and-jay-z-s-fallout [https://perma.cc/87C3-JV9W]; *Kim K & Beyonce: No Bad Hubby Blood Spilled At Serena's Wedding*, TMZ (Nov. 18, 2017), https://www.tmz.com/2017/11/18/kim-kardashian-beyonce-cordial-serena-williams-wedding/ [https://perma.cc/R8MR-ZDUQ]; *Beyonce, Kim Kardashian "Icy Exchange" At Serena Williams Wedding Is Fake News*, GOSSIP COP (Nov. 17, 2017), https://www.gossipcop.com/beyonce-kim-kardashian-serena-williams-wedding/ [https://perma.cc/MJ4V-GHQ8].

231. *See*, *e.g.*, Peter Henn, *Cars Slower Than a Horse and Cart in Gridlocked UK*, EXPRESS (Oct. 17, 2016), https://express.co.uk/news/uk/721789/Cars-horse-cart-slow-gridlocked-traffic-UK [https://perma.cc/EGK2-263D]; Jamie Micklethwaite, *London Traffic Means Buses Are 'Slower Than a Horse and Cart'*, EVENING STANDARD (Oct. 16, 2016), https://standard.co.uk/news/london/london-traffic-means-buses-are-slower-than-a-horse-and-cart-a3370316.html [https://perma.cc/487M-2ML4].

232. Besides heads of state, private individuals like Elon Musk may be uniquely capable and fond of escaping mass transit. *See* Anzilotti, *supra* note 24. It turns out that "Musk revealed he's no great fan of mass transit. The whole sharing space with other humans thing? It's kind of icky." *See* Marshall, *supra* note 25.

not the most efficient way to commute). In other words, we view AVs potential as a *positive* one. Other scholars might be driven by different normative assumptions, and thus, may arrive at different policy recommendations. For that reason, we assume that AV policy is expected to encounter the same variations and differences between jurisdictions as current regulations are viewed across the world. We hope a singular, streamlined, global AV regime will emerge, but as realism and history prove time and again—we are more likely to end with differences across regions and jurisdictions.

Third, we also assume that AV regulation will be more coherent and share many similarities across jurisdictions in comparison to other fields. In coming to that assumption, we rely, again, on current regulations. Rules governing roads and traffic signs share more in common across jurisdictions than any other area of law. A human driver from Toronto, Canada, can recognize traffic signs in Arizona, US and Sydney Australia without much effort. On the other hand, driving in Canada and in the US is very different from driving in the UK.

Fourth, we believe guidelines and soft laws should be introduced first. For some commentators, the challenges of AV demand swift legal action to address every possible concern. We do not believe that this is necessarily the best approach. Although law has a reputation for being laggard, especially in relation to emerging technologies, we know it will take some time before AV reaches its potential.

It is wise to admit the obvious—we simply have incomplete information about the technology and its implications. Thus, it is reasonable to make sure that governments craft flexible policies that help to build the infrastructure needed in order to foster the positive impact of AVs while minimizing its risks. As Gaon and Ian Stedman stated: "Policies can signal to the public and to industry how the government wants to proceed without the government having to move too quickly. Although policies may eventually map onto laws, they afford greater flexibility in the interim and allow more time for dialogue to take place and consensus to emerge about the best way forward."[233]

In framing AV policy, we should pay closer attention to the method in which we apply the policy. In addressing this issue, we acknowledge two approaches: the first is described as the gradualist approach in which AV regulation changes gradually adapting "as we go" (or as we drive). It is an evolutionary approach from using safety electronic mechanisms in vehicles and proximity and automated parking systems.[234] The alternative is applying an AV policy in a broader scale for detailed specifications. We are more inclined to the former approach, with some reservations. At the current stage, the gradualist approach is more like putting a bandage on a wound. We apply regulation when needed and not in accordance with a coherent policy. This approach might allow the practice of big companies such as Google, Tesla and car manufacturers to create their own

233. Gaon & Stedman, *supra* note 42, at 1164.
234. Pearl, *supra* note 9, at 10.

polices—making a stand in the market that in the future might be difficult to change.[235]

As we already mentioned, a few initiatives and laws are already in place governing AV. True, there is not yet an AV federal policy—only state laws. However, the US Department of Transportation (DOT) reports from 2017 (A Vision for Safety) and 2018 (Preparing for the Future of Transportation),[236] share the ideas raised in this paper and express the regulatory progress in relation to AV in the last three years, at least in the United States.

In "Preparing for the Future of Transportation," DOT outlined AV principles. These principles are important in addressing AV policy and thus should be taken into account by both state legislators, major companies, AV manufacturers and other jurisdictions. As we implied earlier, human driving is an important part of American culture, and although it may be difficult to argue for a constitutional right to human driving, driving took root in US tradition in a way any policy would find very difficult to uproot.[237]

This brings us to our next (and final) argument: the public road. For many reasons, historical, social, and, economic, rightly or wrongly—roads are considered a public good,[238] and most roads are public—they are owned by the public, maintained at public expense, and freely open for the public to use. There are some wrinkles to this model, such as privatization and private-public partnerships of roads,[239] and toll roads.[240] We agree that in the coming five to ten years—in which our policy recommendations are limited to—AV will share the roads with human drivers. We could expect more pressure on regulators to create special lanes for full AV. We would advise against this policy, at least for non-commercial vehicles. We think that there are good reasons (like public health, public policy, and democratic spirit) that support the idea that a shared car ride on public roads is a humbling, egalitarian experience, and thus view human driving favorably. We would therefore advise regulators against

235. *Id*. at 12–13.

236. US DEPARTMENT OF TRANSPORTATION, *supra* note 8.

237. US DEPARTMENT OF TRANSPORTATION, *supra* note 8, at V: "U.S. DOT embraces the freedom of the open road, which includes the freedom for Americans to drive their own vehicles. We envision an environment in which automated vehicles operate alongside conventional, manually-driven vehicles and other road users. We will protect the ability of consumers to make the mobility choices that best suit their needs. We will support automation technologies that enhance individual freedom by expanding access to safe and independent mobility to people with disabilities and older Americans."

238. *See* Randall Bartlett, *Is Infrastructure a Public Good? No, Sort Of, and What Role for the Public and Private Sectors*, IFSD (May 15, 2017), https://ifsd.ca/en/blog/last-page-blog/infrastructure-public-goodhttps://ifsd.ca/en/blog/last-page-blog/infrastructure-public-good [https://perma.cc/B6K9-PRQA].

239. *See* Eric Jaffe, *The Uncertain Future of Public Roads*, CITYLAB *(*May 6, 2013), https://www.citylab.com/solutions/2013/05/future-public-roads-private-hands/5490 [https://perma.cc/A9XB-476G].

240. *See* Robert Dunphy, *Toll Roads: A Problem or a Solution?*, URBAN LAND MAGAZINE (May 28, 2015), https://urbanland.uli.org/industry-sectors/infrastructure-transit/toll-roads-problem-solution [https://perma.cc/39KH-GTAJ].

an outright ban of human drivers unless leaving human-driven car lanes is a physical, technological, or economic impossibility.

Indeed, governments should encourage AV driving. However, taking into account the social impact that human driving has on society, there are good reasons to avoid banning human driving and to instead allow AVs to share the roads with other human drivers, at least until the impact of a future without human drivers becomes clear.

To clarify: we still believe human driving is bad; however, we argue that human driving has a greater social impact than most scholars acknowledge, and this impact should be considered in any AV policy, at least for the coming five to ten years. Furthermore, we do not believe that banning human driving is a feasible policy—AV supremacy can be achieved naturally building on the current trend of declining human driving and the technological developments in the field.

Sharing the public road is only one aspect of AV policy. There are other considerations such as safety and privacy. These issues are already addressed in several policy discussions including the DOT reports. The main concern we wish to highlight is the question of who will make the rules—the current leaders in technology (such as Google and the like), the national governments or the international community and organizations? We are already in a position where governmental influence on technological progress is in a stiff decline. Add to this vacuum the major companies and manufacturers that are entering and forcing the rules from the bottom up. This view might be practical given the complexities AV regulation is facing. But from a normative perspective, it is not wise in the long run because companies are more inclined to build policies that are tailored to their vision and not broad enough to take into account other considerations.

Take privacy for example. Data is worth money, a lot of money. Building a Facebook model for Google or Tesla AVs where the ride is free, but the data gathered by the AV is owned by the AVs' operating companies, should be addressed by governments and international organizations, especially given the privacy concerns we are aware of today. There are other considerations to this data policy such as tax consequences—should the government tax the data gathered by AV companies? Should we encourage data collection for any reason at all?

Other policy concerns relate to the model in which AV driving system will be designed. The final decision will, of course, be up to the designers of such systems. However, if we draw on past experience, it seems more likely to expect a system where there will be several classes of service—as we see on trains, airplanes and even UBER—rather than a "one size fits all" of public buses and subways. Do these models serve the public interest or should we revisit the current model of travel "classes" creating initiatives that would incentivize shared models for AV commute? Given the social impact of AV, driving sharing commute might alleviate the social impact of AV on human interaction and thus we should consider initiatives that will incentivize sharing the commute, because—sharing is caring!