Self-Driving Cars Will Improve Our Cities. If They Don't Ruin Them.


If we take action, we can build a dream transportation system around self-driving cars. If we don't, we'll create a nightmare.

Ten years ago I found myself standing outside the Automotive Hall of Fame in Dearborn, Michigan. I looked out over acres of glinting windshields in a packed parking lot. I'd reached this spot by driving from Ann Arbor on the I-94, where the highway sometimes reaches 12 lanes across, in a little over an hour. Public transit would have taken me three and a half hours. What would Henry Ford think, one hundred years after the birth of the car? Pride or horror? It took 50 years to transition from the horse to the car. Surely few could have imagined the impact the car would have as it tore through cities, countries, and economies worldwide. Today, average Americans spend almost two of their eight hours at work paying off their car, which they need to get to that job. Last year in the US, more than 38,000 people died and 4.4 million were seriously injured due to motorized transport. Farther afield, in Singapore, 12 percent of the island nation's scarce land is devoted to car infrastructure. In Delhi, 2.2 million children have irreversible lung damage because of poor air quality.

Incredibly, we might actually get a chance at a do-over — of our cities, our fossil fuel dependence, and the social contract with labor — thanks to the impending advent of autonomous cars. Yes, their arrival is inevitable, but how they will impact us is yet to be determined.

Most of what has been written about self-driving or automated vehicles (often abbreviated as AVs) focuses on subjects like their technical aspects, the regulatory battles to license them, or the fascinating but remote dilemma of a self-driving car being forced to choose between holding its course and hitting grandma, or swerving into a troop of boy scouts. There's relatively little discussion of the speed and scope of change, the impacts
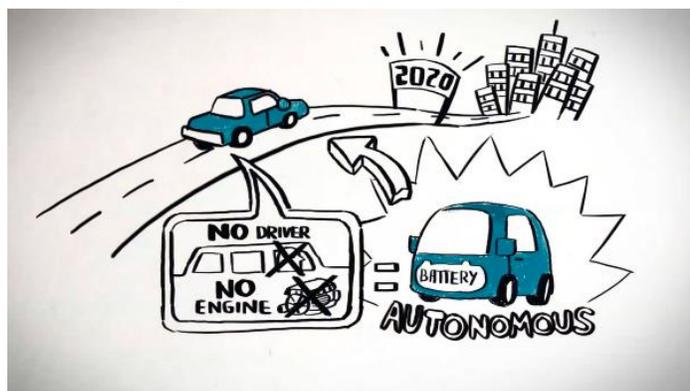
that go well beyond the auto industry, or the roadmap to unlocking the enormous upside potential if we actively guide the trajectory of their adoption.

We're at a fork on that roadmap. One direction leads to a productive new century where cities are more sustainable, livable, equitable, and just.

But if we take the wrong turn, we're at a dead end. Cities are already complex and chaotic places in which to live and work. If we allow the introduction of automated vehicles to be guided by existing regulations we'll end up with more congestion, millions of unemployed drivers, and a huge deficit in how we fund our transportation infrastructure. We will also miss an opportunity to fix transportation's hereto intractable reliance on liquid fossil fuels (and their associated pollution).

Right now, we're not even alert to how crucial the choices are. In fact, we're falling asleep at the wheel. Most people in charge of shaping cities — mayors, transportation planners, developers, and lawmakers — haven't realized what is about to hit them and the speed at which it is coming. They continue to build as if the future is like the present.

Instead, cities and countries must actively shape the introduction of AVs. We are getting access to this technical marvel at the precise moment when cities are full and bursting from the urbanizing of our planet, when we absolutely need to transition rapidly from fossil fuels, and when it is imperative to improve people's access to opportunity: jobs, education, health services. We have the ability to eliminate congestion, transform the livability of cities, make it possible to travel quickly and safely from A to B for the price of a bus ticket, improve the quality of our air, and make a significant dent in reducing CO_2 emissions. We might also find ourselves with the political support to transform social benefits, and rebalance corporate and labor taxation, but these will be second order effects. Every one of these possibilities requires policymakers and communities to take an active role.

The advent of autonomous vehicles couldn't have happened at a better time. Or a worse one. Here's how to steer towards the better outcome.

 Step 1: Wake Up, This Is Happening I used to think that self-driving cars belonged in some distant sci-fi future. Indeed, car manufacturers used to preach that AVs were at least 20 years off. But in 2010 Google announced that it had a car that was safely self-driving around San Francisco. Wha-at? With no special roadside infrastructure or city retrofitting? This was just 6 short years after not a single autonomous car had been able to complete a course in the middle of the desert set by DARPA (the U.S. military agency that financed the Internet). How is it possible the technology advanced so quickly? While I might drive 600,000 miles in my lifetime, a fleet of cars can accumulate that amount of experience in weeks, sharing the learning with each other. They are doing so now, for multiple companies: dozens of cars are now driving all-day shifts in Mountain View, Austin, Ann Arbor, Wuhu, China, and Singapore. In the last few years, a hundred Google cars have completed 2 million miles of on-road travel without injuries or fatalities, and are simulating and learning from 3 million virtual miles of driving every day. Tesla has 50,000 vehicles, sold to that public, that are driving autonomously on highways right now, collecting millions of more miles of real world driving experience (albeit with one fatality).

This gives companies like Google, Tesla, GM, Ford, Toyota, BMW, and Nissan the confidence to promise commercial sales of fully autonomous cars by 2020, less than four years away.

Once those vehicles go on sale, the pace of adoption and transition will exceed any proposed speed limit, driven by compelling economics on both the demand side (us) and supply side (taxi, transit, shuttle services). Companies that are currently paying drivers can shed one of their most significant costs — Uber, for instance, can't wait for self-driving cars and has invested in its own technology to make it happen. It's only one of many players who will switch to autonomous as soon as they can. There will also be big savings for the trucking industry, so it's no surprise that startups like Otto (founded by ex-Googlers) are already testing mammoth road carriers that drive themselves.

Consumers also can't wait — just look at how quickly Tesla owners have taken the company's "autopilot" features beyond prescribed limits. And there are millions who will appreciate new services that, without the cost of drivers, will give them speedy, reliable, on-demand travel.

Once it starts, there will hardly be time to shape how AVs are used. But we must.

Step 2: Recognize the High Cost of Doing Nothing

Simply eliminating the drivers from cars, and keeping everything else about our system the same, will be a disaster. Picture zombie cars — those with no one in them — clogging our cities and our roads, because it will be cheaper to keep them moving than to pay for expensive urban parking, and cheaper to bring retail to a customer than to pay rent on a retail store. While the number of vehicle miles driven skyrockets, our transportation infrastructure revenues, dependent on the gas tax, parking, fees, and fines will disappear. Unemployment will spike as professional drivers will be be laid off in droves. It will be a nightmare of pollution, congestion, and social unrest. Let's break it down. Congestion. The traffic alone will make people curse the technologists who brought AVs to our streets. Right now, our "congested" roads and cities are mostly filled by individuals driving alone in their cars (75 percent of all trips). Just imagine our streets and your frustration when 50 percent of the cars have no people in them at all.

When we don't have to drive them, we'll use our cars more. My 2004 Prius costs me about $1.50 for an hour of run time. It will be cheaper to have my car double-park or circle blocks rather than pay for a parking meter or, heaven forbid, pay for parking in a downtown garage. It'll also be cheaper to have my car pick up pizza or drop off dry cleaning than to tip a delivery person. Endless double-parking and block circling already happens in places where the cost of a human driver is either very cheap (think Delhi) or expense is irrelevant (think about luxury black cars in New York City).

Unemployment. There are 3.5 million freight and delivery truck drivers in the United States. There are 665,000 bus drivers. In New York City alone, there are 90,000 registered taxi and livery drivers — not counting Uber and Lyft drivers. If US car manufacturers miss out on this transition, or if we use vehicles more efficiently, there are 5.5 million people manufacturing and designing cars, and 1.65 million people working at dealerships. All of these jobs are at high risk.

Lost Tax Revenue. The Center for Automotive Research found that taxes associated with motor vehicle manufacturing and use amounted to $206 billion a year. Major sources of revenue for

city, state, and country transportation infrastructure — fuel taxes, parking revenue, parking and speeding fines, driver registrations — will disappear if we go with electric AVs. These vehicles won't pay for parking when it's cheaper to drive themselves back home and park for free. They won't violate posted traffic speeds or get parking tickets. Machine learning will make sure that every AV can recognize a speed trap. We'll also lose the income taxes from employees made redundant, and of course all the income they would have spent in the economy.

Step 3: Seize the Opportunity

But there is so much opportunity to love! If we steer toward it, and plan for it, we will get benefits that once seemed as distant and unlikely as those science fiction scenarios I mentioned earlier. Shared cars. For starters, getting away from our wasteful model of car ownership totally eliminates the congestion problem. If we share rides in shared cars, we will only need 10 percent of the cars we have today. That also makes a huge dent in our pollution problem. Just as Zipcar, Uber, and Lyft have demonstrated, wireless technology and smartphones have taken almost all the hassle out of sharing. AV technology removes all of it.

I feel pretty confident about this estimate. It's from an excellent study by the International Transport Forum at the OECD that used actual origins, destinations, and timing for trips in the city of Lisbon. This is in line with numbers I've heard from a modeler at Google, a transport planner for the Bay Area, and taxi studies in Singapore and New York City. I can even see how this happens. A bold mayor will be the first mover, welcoming a discrete pilot within city limits. A hundred cars will shepherd tourists, students, late shift workers, and the curious. No one will die. It'll be cheap and convenient.

After all, these first vehicles won't be cheap, so unlike personal cars, which are idle 95 percent of the time, these will be intensively used — rather like Zipcars (the company I co-founded) or taxis. Today, 50 percent of all Uber and Lyft rides in San Francisco are shared — meaning that passenger-strangers going in the same general direction are sharing the trip and enjoying a reduced fare. If I use Zipcar's economics (like self-driving cars, Zipcar doesn't pay for drivers), the company is profitable earning about $70 per car per day. The cost of "fueling" and maintaining electric cars is one tenth that of regular combustion engine cars, and the parking would be cheaper since most vehicles could be stored in distant locations the little time they are not in use. When we take trips in shared cars, the cost of inner city travel will be the same as bus fare and the trip time will rival personal car travel (especially once you remember you never have to find parking).

There will be operational problems in this pilot city and they'll be fixed. Another 400 cars will be added. These cars market themselves. Everyone sees one. Everyone knows someone who has taken one. Second cars are sold as people realize it is cheaper, faster, better to use the shared electric AVs. And then many people, if not most, will sell their primary car, as well.

Yes, I can already hear the car lovers out there bleating their horns at the very concept of sharing their beloved vehicles with people outside the family 'People love driving!" they'll insist. "Cars are important status symbols!"

No one is forcing you to make the switch. You will be able to drive your own car for years to come. And some minority of people will miss what was once a fun part of their lives. (People

loved smoking, too.) But the vast majority of us will reap massive benefits. We will be able to admire the scenery instead of worrying about threading our way through traffic. We will get to punch away at our smartphones and get things done while in motion — safely. We will rent or own housing that is 25 percent cheaper because it won't include parking. We will never squander time refueling, washing, or maintaining a car, will never care about whether and how expensive parking is at our destination, will walk or bike for most short trips because we'll want to, and we will certainly appreciate pocketing the thousands of dollars we would have spent on our cars. That money will go toward purchases that will surely be more beneficial to the local economy.

The very landscape of our cities will change. On-street and almost all off-street parking, including parking garages, will be unnecessary and we'll get rid of them. Communities and local governments can come up with criteria and priorities for how to repurpose that newly available public space: wider sidewalks, more street trees and plantings, bike lanes, street furniture. Progressive cities will make use of old parking lots, garages, and gas stations to fix what was lacking: affordable housing, green space, grocery stores, schools. Proactive cities will know their priorities neighborhood by neighborhood, as well as their criteria for action, before the transition begins.

We'll have a better taxation system. The old way of collecting taxes to pay for transportation infrastructure will be gutted. With only 10 percent of the vehicles, and electric ones at that, we can kiss goodbye to gas taxes, parking revenues, driver's licenses, and traffic fines. We'll also lose 60 to 80 percent of the toll revenue (shared trips, fewer cars), car registrations, and inspections. This reality makes me feel joy — because whatever replaces our current means of transportation taxation is bound to be better. Our current system for raising money to pay for our transportation infrastructure in the US has been broken for years. The federal gas tax has been stalled at 18.4 cents a gallon since 1993. The US has the second lowest gas tax rate in the world. Our fuel prices are half those experienced by Europeans. Our roads, bridges, train stations, and airports are decrepit, as noted by visitors from Europe and Asia. With the impending rapid adoption of AVs, our hand is forced. It would be unfair to let these new vehicles use publicly financed infrastructure for free.

The new system will build on what we've learned from our 100-year history of driving, creating needed disincentives and incentives. A tax on gasoline was first introduced in 1919. It was a delightfully simple solution but it didn't disincentivize things that we now know to be very costly: air pollution, congestion, and vehicle size (seventy-five percent of cars today have only one person in them, congesting roads and requiring larger areas for parking). Vehicle registration can assign cars to the right tax category based on fuel type and footprint, then we can apply the appropriate rates based on such factors as distance traveled and peak usage times. We'd also need to make it really expensive to be a zombie car (those empty cars running errands for their owners).

Our energy grid will expand, while the climate benefits. As we move BTUs from fossil fuel gasoline to electricity, the incremental energy will come from renewables. Of course this will only happen if we demand that it be so, with state-based regulations. But we should, since installing new wind and solar capacity will mean jobs, to design, manufacture, install, and then maintain this new additional capacity. And, we have to because every nation has pledged to have zero emissions by 2050. There's also a second order benefit: savings in military spending and wars avoided by weaning ourselves from fossil fuel dependency for passenger vehicles.

We'll rethink labor security and how we tax income. The unemployment of professional drivers outlined in our hellish scenario will come about no matter what happens. And it won't only be drivers who lose jobs. As personal car owners switch from owning a vehicle they use just 5 percent of the time and costs them 18 percent of their income to being driven for a fraction of that price, we'll see lay-offs in repairs and maintenance, and car insurance, as well as car design and manufacturing (5.5 million jobs nationwide), sales (1.65 million work in dealerships), and distribution/logistics.

But once again, innovative planning will turn the problem into an opportunity for positive transformation. The cost and inaccessibility to transport has been found to be the largest barrier keeping people in poverty. Shared AVs have the potential to transform access to opportunity — jobs, education, healthcare, leisure. We'll also have way fewer traffic deaths and injuries (up to 90 percent, so over 30,000 lives saved in the U.S. every year); greener and more livable cities; clean air; reduced CO_2 emissions; more disposable income and more money spent locally. This goes a long way towards compensating for those lost jobs.

(Courtesy of the International Transport Forum)I'm not suggesting we abandon those workers stranded by the transformation. In the short run, we will cushion and support these workers who did nothing to merit the loss of their income and profession. I'm no expert on labor theory, but I do know that in a future where all sorts of automation will replace jobs, we need to make it easy and safe to have a diversified stream of income, a key to individual resilience. Easy: to hire and work part-time. Safe: all benefits — social security, paid vacation, catastrophic insurance, health care — follow a worker regardless of the number of hours he or she works. And we must eliminate loopholes that allow employers to pretend that such benefits are applicable only to full-time labor, no matter how configured.

A Capitalism Do-Over. Productivity gains once were the harbinger of improved standards of living, and improved quality of life, but automation brings jobless productivity gains. Self driving cars will be the ultimate example of this: AVs will probably be productively employed and generating revenue about 65 percent of the time, compared to our personal car's 5 percent. No one can deny that enormous productivity gains are being enjoyed. But with so few associated workers, enjoyed by whom?

As an entrepreneur, I appreciate the hours and years of effort that has gone into building these AVs: the new IP, the many years and huge costs without any revenue to show for it. But I also understand that this is a massive market (trillions of dollars worldwide seems plausible), and the marginal cost of running the software for each of those trips will be close to zero. We need to make sure we distribute this new wealth, by closing corporate tax loopholes and taxing wealth and platforms more effectively.

As we lose more jobs, the necessity for change opens up the possibility of a fairer system, one that minimizes income inequality. A Bureau of Labor Statistics study projected an 83 percent probability of job loss by automation for workers earning less than $20 an hour, and a 34 percent probability for jobs between $20–40 an hour. In the new automated world, does it really make sense to be taxing labor at all? It makes much more sense to be taxing the new technical platforms that are generating the profits, and taxing the wealth of the small number of talented and lucky people who founded and financed these new jobless wonders.

In a world where machines do most of the work, it is time for a [universal basic income](). This will distribute the gains from productivity, and give more people the opportunity to focus on purposeful, passion-driven work, allowing for the next generation of ideas and technologies to emerge faster.

How we deal with the job loss caused by AVs will be a signature model for how we respond to automation throughout the economy. Even more, it may be the flood that sweeps clean a system that no longer serves the people.

Remember, *this is going to happen*. While one city, or one state, or one country might try to slow it down, there are many others that will step forward to lead the way. No matter how protracted the fight and the transition, we are going end up choosing self-driving cars so that we can avoid the 38,000 traffic deaths in the US, the 1.25 million deaths worldwide, and the tens of millions of serious injuries, with all their associated suffering and medical costs. That in itself is a worthy reason for adoption. But with the right planning, we will expand that upside to include better cities, a livable planet, and a future that serves us all. In the future, when some entrepreneur looks out over Dearborn, Michigan, or New York City, I want them to reflect with gladness on how one hundred years earlier, people had seized on the opportunities offered by the autonomous car to rein in the tyranny of single occupancy vehicles and domination of cars in cities, to distribute the fruits of automation, and to address climate change.

All by keeping our hands off the wheel.