THREE THINGS TO KNOW ABOUT SELF-DRIVING CARS.

One: They're here. Last fall, Tesla Motors pushed a software update to its vehicles around the world. The new code coordinated sensors, cameras, GPS and controls already onboard the cars to allow for so-called autonomous driving—albeit with humans in the driver's seat ready to take over if needed. Within weeks, a crew of rally drivers climbed into a Model S in Los Angeles and sped to New York City in just over two days, the car steering itself 96% of the way. Other stoked nondrivers have posted videos of themselves reading books, brushing their teeth and otherwise ignoring the road as their cars zoomed along. Tesla founder Elon Musk predicts that his electric cars will be entirely self-driving (even docking themselves at robotic charging stations) within three years.

Mainline carmakers from General Motors to Mercedes-Benz have also pledged to sell autonomous vehicles in the next few years. Born-again evangelists of self-driving cars include some of the most venerable names in the business, such as William Clay Ford Jr., executive chairman of the company founded by his Model T–building great-grandfather Henry, and Toyota Motor Corp. president Akio Toyoda, whose great-grandfather was known as the "king of Japanese inventors." (Toyoda, a racing buff, was adamantly opposed to self-drivers before reversing himself late last year.) Four U.S. states have legalized self-driving cars, and at least 13 more are mulling similar laws.

Two: They're superior drivers. These words may grate in the sunburned left ears of car-loving Americans. But the computer is simply a better driver than a human. Better at keeping its eyes on other drivers; better at maintaining a steady cruising speed and thereby maximizing fuel efficiency; better at parsing GPS data, weather data, traffic data—any and all kinds of data, really—and better at making rapid-fire adjustments. The computer doesn't get distracted by a spouse, kids or the jerk who just made an illegal lane change. It doesn't sneak a glimpse at Snapchat, or fumble with a leaky burrito, or steer with its knees while playing air guitar. The computer couldn't blink even if it wanted to. It never says yes to a fourth chardonnay, never convinces itself that weed *improves* its driving. Asking directions is a computer's favorite activity, and unless ordered to, the computer never falls asleep.

Three: They're going to change everything. The economic and safety effects will be staggering; the moral and legal challenges will be stubborn. There is no "right to drive" enshrined in the U.S. Constitution, but forced to choose, a lot of people would rather take the wheel than the Fifth—no matter how many statistics are marshaled to prove that driving puts others' lives at risk. Self-driving cars will likely join digital surveillance and unmanned drones among the advances and controversies that mark our times. Freedom vs. security, that quintessential quandary of the 21st century, will frame the transition from human drivers to more-skillful computers.

And because the gulf between human and machine is so vast—and growing—the next step after making driverless cars legal will be making them mandatory. Today you pay higher insurance premiums to drive a zippy roadster than a dowdy minivan. Tomorrow you could well be paying a steep price for any steering wheel at all. Who will be liable for mistakes? How should computers make life-and-death decisions? Such questions are likely to contort ethicists and lawyers for years to come. But all revolutions involve upheaval, and this one is poised to create far more than it destroys.

IN THE THRONE ROOM of the American psyche, a driver's seat occupies center stage. Think Bonnie and Clyde and their fugitive Ford V-8, Jack Kerouac on the road in a '49 Hudson, James Dean's fatal Porsche Spyder, Steve McQueen's Mustang fastback, Greased Lightning, the Love Bug, Thelma and Louise, Nicolas Cage vanishing in 60 seconds. What would the 1920s be without the Tin Lizzie, or the 1950s without the 'Vette, or the 1980s without the DeLorean? Nabokov could have been talking about a '55 T-bird or a '73 Eldorado—or whatever car you were driving the first time you mashed the gas and felt free—when he wrote, "It was love at first sight, at last sight, at ever and ever sight."

That connection between cars and drivers is nothing like the feeling we had for typewriters or landlines or any of a thousand technologies overthrown by computers and smartphones. That was utility; this is love. And yet America's long-standing romance with its cars has been deeply troubled, sapping time and treasure while leaving innumerable victims dead and maimed. A world without human drivers will be safer, more livable, more prosperous.

I admit to some bias here, since a human-driven vehicle nearly killed me.

Early on the morning of Oct. 16, 2014, I was run

FATAL TRUTHS
Cars have gotten safer but are not safe enough

28%
Increase in auto-related fatalities caused by distracted driving from 2005 to 2008

15–24
Age group for which auto-related accidents are the leading cause of death

32,675
Number of Americans who died in an auto accident in 2014

down by a minivan driven by someone in a hurry to get somewhere. The driver ran a red light and knocked me over while I was jogging to work. In his defense, it was rainy and the intersection in question is a pain to cross. I woke up long enough in the ambulance to inquire about the status of certain precious organs below my belly button but lost consciousness again before I heard the EMT's reply. A few hours later, I walked out of the hospital more or less unscathed. Many people are not so lucky.

There are about 6 million car accidents—incidents serious enough to be reported to law enforcement—each year in the U.S. About 33,000 Americans die annually as a result, with an additional 2 million or so injured. (Worldwide, there are about 1.3 million traffic fatalities every year, according to the World Health Organization.) Some 94% of road accidents are the fault of drivers, according to the National Highway Traffic Safety Administration (NHTSA), whose collection of statistics reads like a numerical translation of Stephen King's *Christine*, a chilling account of motorized lethality. The price tag for this mayhem, by one estimate, runs $836 billion.

Other statistics tell of lesser forms of wastage. The average American spends 42 hours per year stuck in traffic—the equivalent of an additional week of vacation. In the country's most congested areas—Washington, D.C.; Los Angeles; and New York City—that figure climbs as high as 82 hours. Multiplied by the span of a working lifetime, this waste of a precious resource, time, is incalculable.

Even if you have been spared a serious accident and manage to live in a place where there is little traffic, your life is shaped for the worse by other drivers' flaws. Your car, for one, bears the stamp of human fallibility. Why does it look the way it does? Why is it so heavy? Why does it have more air bags than a Vegas strip club? Why are the bumpers shaped the way they are? The answer: engineering to keep occupants safe as well as legislation intended to keep people (like me) from being killed when struck.

To make a real leap forward in safety, the obvious move is to take drivers out of the equation. That is becoming today's reality with shocking speed. Just 12 years ago, when the U.S. government funded the first international competition for self-piloting vehicles, not one of the challengers finished the 150-mile (240 km) desert course set out for them. The most successful robocar covered a little more than 7 miles (11 km) before stupidly getting itself stuck. (Its wheels also caught fire.) The following year, only five of the 23 vehicles in the competition made it to the finish line, with the fastest one averaging a poky 19 m.p.h. (30 km/h). One of the finishers weighed 30,000 lb. (13,600 kg)—roughly 10 Toyota Priuses— and the rest were so larded with sensors, cameras, computer equipment and antennas that they made Mad Max's Interceptor look chill by comparison.

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Today Google's autonomous test cars have logged more than 1.4 million miles (2.25 million km) on their odometers on public roads—equivalent to about 100 years of driving for the average individual. Total accidents: 17, all caused by human pilots. Ford's test fleet of self-driving cars—now charged with conquering wintry driving, one of the field's most vexing problems—will soon be the country's largest. And U.S. Transportation Secretary Anthony Foxx seized the occasion of January's North American International Auto Show in Detroit to announce a 10-year, $4 billion fund to promote self-driving research, along with a plan to dismantle regulatory barriers that might slow the development of autonomous vehicles. In February, NHTSA said computers controlling a vehicle should be legally defined as drivers rather than human occupants, validating those companies developing self-driving cars that have no steering wheel.

Even at this early stage in their development, self-driving cars promise huge gains in safety and efficiency. Driverless cars don't have to be perfect to change the world, argues Nidhi Kalra, an information scientist at the Rand Corp. They just have to be safer. "Relying on human drivers any longer than we must is too risky," she says.

According to a 2013 study by the nonprofit Eno Center for Transportation, converting just 10% of the U.S. vehicle fleet to self-driving cars would reduce the number of accidents each year by 211,000 and save 1,100 lives. In this modest scenario, the costs of human clumsiness would be cut by $25.5 billion. If, somewhere down the road, the share of self-driving vehicles rises to 90%, the number of accidents avoided could reach 4.2 million per year, with 21,700 lives saved. Self-driving technology is part of the reason that Volvo has pledged to have zero deaths or serious injuries in its new cars by 2020. In all, the adoption of driverless cars in the U.S. could save $1.3 trillion a year, according to a Morgan Stanley analysis—including $158 billion in fuel costs, productivity increases of $507 billion and $488 billion in accident-related savings. Total worldwide savings: $5.6 trillion.

IF YOU EVER TRIED to bump Dad to the backseat at a rest stop in Montana—no matter how many hours he'd been at the wheel—you have an inkling of the uphill fight that lies ahead for the driverless revolution. They can have our gearshifts when they pry them from our cold dead hands, many will cry. The coming years will no doubt be a seesaw of competing calculations, in which irrefutable data vies with ingrained passion.

Perhaps it helps to understand that autonomous cars don't just make human driving better. Ideally, they will remake driving in a wholly new way. Take intersection etiquette, for instance. To maintain the

peace and equality of the social contract, we place stop signs and traffic lights where roads meet. Traffic signs and signals force drivers to take turns. They suppress our inner 5-year-olds, even when the frustrations of driving push us toward a tantrum.

Fully autonomous vehicles have far less need for this wasteful stop-and-start regime. They will be capable of communicating with one another and regulating their speeds to stagger their arrivals at crossroads. They will arrange seamless mergers on and off freeways. Traffic management will become a sort of precision ballet in a fully autonomous world.

Parking, too, will be transformed. Estimates vary, but for every car in the U.S. there are between two and three parking spaces—one at home, one at work and fractions at the mall, airport and stadium. Together, these amount to about 500 million spaces in all, or a total area of more than 3,000 sq. mi. (7,770 sq km), some 2 million acres (810,000 hectares). Wildly inefficient. A University of California, Los Angeles, study found that 30% of drivers in certain metropolitan business districts are basically driving in circles at any given moment, searching for an open spot. Meanwhile, there may be hundreds, even thousands, of unoccupied spaces in lots on the edge of town.

Automated cars are like tireless parking valets (except that you don't have to tip them). They can drop passengers off at their destination, pick up a signal from an empty parking space and then zip away for the return trip. When riders are ready to be picked up, a tap on a smartphone will hail their cars. Already, Tesla software includes a function called Summon, which fetches the vehicle from nearby parking. Within two years, the firm claims, Summon will be able to retrieve cars from almost any distance.

This feature and others will gradually remake the landscape. Restaurants, big-box stores and offices will no longer be surrounded by asphalt tundra. And "if you have cars that do not crash, you can eventually begin to redesign roads," says Erik Coelingh, who leads Volvo's self-driving-car initiative. "Lanes are 3.5 meters wide. Why? Because people can't drive straight. They need some lateral margin. Bridges, overpasses, underpasses—all could be built much more cheaply" when vehicle movement can be dictated by efficient algorithms.

Subtract human drivers and efficiencies multiply. Steven Shladover, a University of California, Berkeley, engineer, has calculated that even on a freeway at peak capacity, only about 5% of the roadway surface is occupied by cars at any given moment. With computers in control and communicating from car to car, density could safely double, even triple, while the same average speed is maintained. Squeezing more vehicles onto existing roads would relieve pressure to widen highways, let alone build new ones.

The cycle could feed on itself until driver's licenses are a rare credential, like Latin professorships or tugboat captaincies

There are less tangible effects as well. Autonomous vehicles offer improved mobility for the young, the elderly and the handicapped. According to the U.S. Census Bureau, 88 million Americans will be over 65 by 2050—and nearly 18 million of them over 85. Anguished family conversations over whether to confiscate a parent's car keys would become a forgotten bit of history.

But every Eden has its serpent, the driverless autopia included. At conferences to discuss this future, contrarians often raise a version of the classic "trolley problem." What will happen, they muse, when an algorithmic car must choose between a swerve that would doom a dozen bystanders and a crash that would kill the vehicle's lone occupant? Or an easier dilemma: At what age will passengers be allowed to ride alone in an autonomous car: 18? 12? 6? Startup chauffeur services already offer rides for children as young as 7. UberFamily allows parents to order up vehicles equipped with car seats and tablets (though it discourages kids younger than 18 from riding unaccompanied). These and plenty of other objections will provide ammunition as America's libertarian id struggles to hold on to the keys.

Not to mention this: the revolution will destroy a lot. The $198 billion auto-insurance industry, the $100 billion parking industry and the $300 billion auto-aftermarket business (including everything from engine parts to mirror dice) are just a few of the industries in line for deep disruption. A survey last summer by the consulting giant KPMG estimated that the auto-insurance industry could shrink to less than 40% its current size over the next 25 years, just because of smarter cars. People will lose jobs. There are about 3 million truck drivers in the U.S., 200,000 cabbies, 170,000 auto-body and glass-repair technicians.

Many in the car business worry that self-driving vehicles are just one tragedy away from the scrap heap—like, say, a robotic car killing a child or running its occupants off a cliff. (Faulty and dangerous technology has doomed certain car models and delayed entire companies, sometimes for decades.) And hacking is a real concern that has yet to be fully grappled with.

HOW FAR OFF is this great reckoning? Estimates vary—but not by much. Tesla founder Musk has pegged the driverless-car transition to begin around 2023, a date closer to us than 9/11. "You can't have a person driving a 2-ton death machine," Musk said at a conference last year. "It's too dangerous." Ray Kurzweil, another big Silicon Valley brain, who helps run Google's engineering efforts, agrees with Musk: Prevalence in the next decade. Industry analysts roughly think 2035 to 2050.

What's certain is that like all technological revolutions, this one will have a self-compounding effect:

more and more driverless cars on the road will result in more and more machine-centric street designs. These will in turn make it harder for humans to share the road, which will force more drivers to trade in their wheels. Because computer-controlled cars don't get tickets, cash-starved municipalities may encourage their highway patrols to let a lot fewer human drivers off with a friendly warning. One way or another, you will be taxed for driving the old-fashioned way. The cycle could feed on itself until driver's licenses are a rare credential, like Latin professorships or tugboat captaincies.

For the time being, autonomous cars will include a backup role for human drivers. Indeed, during the cross-country test of the self-driving Tesla, the car—assured of its own handling skills—had a disquieting tendency to race into curves at breakneck speed. The steering wheel will probably stay—for a while, says Google co-founder Sergey Brin. In general, however, Brin and other executives in the self-driving arena continually stress that humans are the most dangerous link in the transportation chain. "I think for a large percentage of our day-to-day driving we're going to much prefer for the car to drive itself," Brin told the *Wall Street Journal* in September. "It'll be safer for both the occupant and the people around you." Manufacturers like Volvo and Mercedes-Benz have ratified that position by promising to assume the liability for any mistakes their smart vehicles make.

I find it strange, in a way, to be so eager for this future. I started my career covering the auto business, and as a kid I delighted in identifying makes and models from small details like the shape of a headlamp or a rear quarter panel. I have gotten misty in the stands of the Indy 500 and on the catwalks above Ford's F-150 truck plant in Dearborn, Mich. I hold road memories dear—especially the long hours in the passenger seat of my dad's convertible on cross-country trips devised to help me "understand America."

That understanding is impossible without an appreciation for our car culture. In the 20th century—the American century and the car century, no coincidence—the U.S. grew "strong, ample, fair, enduring, capable, rich," as Whitman rightly projected, with the auto industry in the driver's seat. The near death of Big Auto, first in the 1970s and later in the wake of the 2008 financial crisis, hit us in a way that the demise of, say, passenger trains never did. We went to the moon, and what did we do when we got there? Took a joyride in a rover that resembled a deuce coupe without a shell.

But the romance is cooling, and not just for me. Rates of motor-vehicle licensure are plummeting among millennials. Younger Americans are flocking to cities, where life is cheaper and easier without a car. The obligations and costs of transportation—

1930s
Norman Bel Geddes' vision
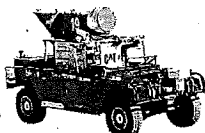
2005
DARPA self-driving car

THE LONG ROAD

Self-driving cars—extolled at the 1939 World's Fair—have come a long way since the government's first sponsored tests 12 years ago. Tesla's models were recently updated to add a raft of autonomous features. Concepts from Google and Mercedes-Benz paint a picture of the near future.

2015
Tesla Model S

2015
Google prototype

2015
Mercedes-Benz F 015 concept

accounting for about 17% of household budgets—are pushing many out of car ownership altogether. Scanning the horizon, Ford's namesake chairman refers to the firm's future as a "mobility" company, not just a carmaker. "Cars have become more appliance-like," says Jay Leno, the country's most famous car collector and host of *Jay Leno's Garage* on CNBC. "Kids don't really bond with cars anymore. Every kid I knew was at their DMV as soon as they turned 16. Now I meet kids, and it doesn't quite hold the same interest. I think the love affair is not over, but I think it's safe to say it's waning."

Mom and Dad are headed in the same direction. Nearly 60% of U.S. adults surveyed by the University of Michigan said they felt positively about autonomous vehicles; a little more than 15% said they were ready to give up driving altogether.

Drivers have already lost more control of their cars than you might imagine. Stability control, automatic braking, all-wheel drive, steering by wire, traction control, lane control, automated cruise control—these and other features add up to the skeleton and nerves of an autonomous car. The last truly analog car, whose built-in technology didn't far surpass any normal driver's natural ability, was likely manufactured three decades ago.

Freeing carmakers and designers of their chief constriction—unreliable drivers—will allow them to dream up novel creations. Consider the prototype car that Google recently unveiled. While the little two-door has all the sex appeal of a jelly bean—it looks like an old iMac on wheels—it is different enough from your average sedan to suggest the power of the new. Google's prototype has no steering wheel and no pedals. (With talks reportedly under way between Google and Ford, some version of the car could be in production by 2020.) Mercedes-Benz's recent F 015 concept car has seats that rotate 180 degrees to face each other; inside, it looks vaguely like a high-end spa. And if Apple gets into the car business, as many now expect, the iCar will surely think, and look, different.

Cars, like architecture or literature, change to reflect the times. In the jet age, they sported chrome and tail fins. SUVs mushroomed in the go-go 1990s. Hybrid crossovers reflect today's desire to have our cake and eat it too. The self-driving car will be a mirror for tomorrow. You can already glimpse the outline in Silicon Valley, where children watch for Google's test vehicles and throw both hands in the air when one passes. "Look, no driver!" the gesture says.

So I come not to bury car culture, but to praise it—not just its past, but its future. Safer, smarter, faster, more comfortable. Why not? Where the craftsmanship of our industry meets the creativity of our algorithms, there we'll find a new version of Kerouac's "purity of the road." That's what calls America forward now.