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BRAVE NEW ROAD

Today, engineers are developing the technology for self-driving vehicles. Tomorrow, those autonomous vehicles will reshape our society in unexpected ways.

BY BRIAN DAVID JOHNSON

Autonomous cars used to exist only in culture, not in technology. You could find self-driving cars springing from the imagination of science fiction writers and filmmakers or in the musings of Silicon Valley visionaries. But they were tropes, not technologies. A self-driving car just wasn't the kind of thing one could expect to see on the road in a lifetime.

No more. Vehicles that can drive themselves without a human hand on the wheel or foot on the brake pedal are a technological reality today and soon will be cruising through your neighborhood, if they aren't already there.

Indeed, according to one estimate, 10 million self-driving cars will be on the road by 2020.

For many, this now-inevitable triumph of technology is neither needed nor wanted. People love their cars. They enjoy the freedom a vehicle gives them to commute to work, run personal errands, and escape on family vacations. Car culture is so embedded in our society—and our emotions—that one in four people name their car and many more talk to them on a daily basis. If you have the physical, mental, and financial strength to drive a car you love, then the driverless future seems like an unnecessary, even frightening, prospect.

As a futurist, I look at technological, economic, and cultural changes to understand what it will feel like to live a decade or more in the future. That sounds like an abstract and ethereal thing to do for a living, but the future is local and is built every day by the actions of people. I'm trained to look for change where it happens first—at the margins, on the fringes, in places where the present state of technology isn't really working out for people the way it ought to. Those are the people and places that need change and see disruptive new technologies not as a burden, but as an opportunity.

By thinking about what people on the fringes could do with that opportunity, you can begin to map out some potentially surprising ways a new technology like self-driving cars could reshape our society.

The engineering community is building this future, and is focused on making autonomous vehicles safe and efficient and attractive to use. That is incredibly important. But it's also important not to

This delivery droid operated by Just Eat autonomously delivers takeout orders to hungry Londoners.

lose track of the social implications of this new technology—and every new technology—when it reaches the market and comes into wide use.

If many people think they aren't ready for autonomous vehicles, which have been foreseen for decades, wait until they grapple with the changes they didn't anticipate.

REGAINING INDEPENDENT MOBILITY

When I talk about people on the fringes, that makes it sound like leather-clad youths with spiky green hair. But I'm thinking more of people with gray hair: I believe the group that will experience the most unexpected impact from self-driving cars is the elderly.

For one thing, the Baby Boom generation that is now aging into retirement is used to having things its own way. Their entire lives, popular culture and Madison Avenue have sold Boomers on the idea that they could have it all, and that they had a birthright to the freedom of the open road. Think *American Graffiti*, Jan and Dean, or *Thelma and Louise*. Even when the so-called Me Generation starts to lose its eyesight, it will insist on

keeping that independence, no matter the cost.

AARP, for one, recognizes the size of the potential market. "About 36 million current older drivers still hold valid licenses. About 80 percent of them live in car-dependent suburbs or rural areas, not cities with public transit. And nearly 90 percent say they intend to age in place," wrote David Dudley in *AARP Magazine* in 2015. "For those whose independent living is closely tied to their ability to drive safely, self-driving tech is a future that can't come soon enough."

By 2030, the number of Americans over 65 is expected to reach 72 million.

AARP's interest is important for another reason: The elderly vote, and if they want self-driving cars, lawmakers will quickly tackle some of the thorniest policy hurdles—such as regulation, local traffic laws, and insurance.

But an elderly-led adoption of autonomous vehicles will look different from what the technology's biggest backers have been touting. For one thing, the epicenter for the self-driving future would not be Silicon Valley with its tech millionaires and billionaires, or Las Vegas with autonomous tourist minibuses, or Pittsburgh, where Uber is now testing driverless taxis. Instead, the

first place to incorporate autonomous vehicles into its mainstream may well be The Villages, a 70,000-resident retirement community in Florida.

If so, that would change the type of vehicle to be rolled out. Instead of some sleek sedan, think of a self-driving golf cart!

The Villages already has around 100 miles of golf-cart trails, and for residents it is the preferred mode of transportation in the community. From an infrastructure standpoint, kitting out a retirement community with the sensors, lane markers, and other technology needed to have a meaningful fleet of autonomous vehicles is far simpler than doing the same for a city like Boston, with narrow and windy streets that follow precolonial deer trails. What's more, since they aren't intended for the open road, golf carts can be lighter and slower than street-legal cars, and that translates into a dramatically lower barrier to entry—and reduced stakes in case of mishap.

However, the really interesting changes are what happens after people on the fringe adopt the new technology. An elderly population freed from (what is to them) the burden of driving would be given a new lease on independence. Forget about doctor's appointments made on time or the absence of stress about faltering reflexes: Think about the impact on social activity. Would new hobbies develop? Would volunteering or even paid work increase? Perhaps the over-65 set would find themselves attending night clubs—or maybe "afternoon clubs"— that would bring together a wider variety of retirees in a time in life when company and companionship matters the most.

We won't know until the technology reaches them. But I suspect the impact of autonomous vehicles on the lives of elderly people will be profound.

REIMAGINING THE SUPPLY CHAIN

Vehicles carry more than people—the other passengers are the things in the international supply chain that can stretch from a factory in Vietnam or a farm in Chile to your front door. But increasingly, semitrailer trucks do more than simply carry goods from point A to point B.

I learned that lesson while I was in the back of a minivan on the A6 autobahn racing from Stuttgart and Frankfurt. I didn't want to look at the speedometer as my driver, Anatoly, gunned and revved the minivan from lane to lane like something out of James Bond movie, so instead I focused on the seemingly endless stream of long-haul trucks that shared the road with us.

In a rare moment of calm as we slowed down for some construction, I asked Anatoly why there were so many trucks on the highway.

"People don't warehouse anymore," Anatoly replied, taking his eyes off the road to glance back at me. (Why do I ask my drivers so many questions?) "Back a decade ago, all the big companies had warehouses where they stored goods. Then they would deliver them from storage when people placed an order. But today nobody does that. Everything is just-in-time delivery. Most of what is on this road is not people—it's things, it's stuff. Stuff is going for a ride on the autobahn."

He shook his head as we hit a bump. "It's very hard on the roads and bridges."

Highways are the new warehouses, but within the limits placed by human labor. After all, a giant warehouse can be staffed by a handful of workers, but each 40-foot container on the back of a tractor-trailer has a human driver.

Or to put it in the frame of a futurist, overland cargo is a fringe use of human-driven vehicles. And self-driving delivery is a disruption that could have all sorts of advantages.

In an age of autonomous vehicles, smart cities and roads, intelligent logistics, and artificial intelligence, the human-imposed limit on the number of hours a day a shipment can stay on the road disappears. We can automate, iterate, and designate exactly where we want our stuff and how to get it there. Goods may never have to leave the road—or sea lanes or air routes—from the factory gate to the front porch.

"Autonomous transport of goods will allow us to completely reimagine the future of the global supply chain," Abe Ashkenazi, the CEO of APICS, a global supply chain trade association, told me recently. "We think it could have as much impact as the PC revolution had on business. It won't be just about moving
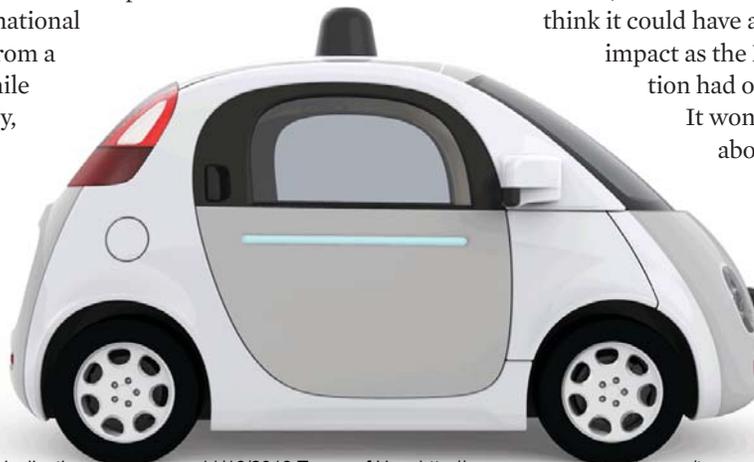
Google's self-driving car is a street-legal vehicle. But autonomous golf carts might be more practical.

This truck didn't need a driver for its 120-mile beer delivery in October 2016.

things from point A to point B. The whole system will change." In response, the vehicles will change, too.

The necessity of putting a driver in the front with a view of the road has restricted the design of passenger cars and freight-carrying trucks. But autonomous delivery vehicles won't be subject to that constraint. A self-driving vehicle constructed to deliver a week's groceries or an IKEA sofa won't have to look like the common delivery van—or each other, either.

There's evidence today for what our tomorrow might look like. Just Eat is a company in the United Kingdom that receives takeout orders via an app and sends the food to the customer using a delivery droid. It's essentially an autonomous vehicle, but it doesn't look or act anything like a car. The six-wheeled hauler is more like a large insulated picnic basket, with a hissing on-board air-conditioning unit. The machine is so unassuming that after a few days of rolling along the sidewalks of London, local residents stopped giving it a second thought.

RECLAIMING THE INFRASTRUCTURE

Like the Just Eat droid, future autonomous cargo vehicles not only will shed their human drivers, but even the form factor of being trucks. Acting as both transport and storage, they will be efficiently designed for the single-minded purpose of getting goods into the hands of consumers as directly as possible.

But the roads—suffer the roads. It will be a brave new world for our roads, quite a dystopian future of wear and tear that was never imagined by the engineers who designed them half a century ago. The effect on our infrastructure as the rolling supply chain hammers the road hasn't even begun to be addressed.

In another way, though, autonomous vehicles may also help extend the life of the built infrastructure.

Back in 2012, I was sitting on a Tempe, Ariz., bus bench with writer and futurist Bruce Sterling, who is best known for championing the cyberpunk movement of the 1980s and the ubiquitous device design trend that followed—that is, the world we are living in now. We had ducked out of the annual Emerge event at Arizona State University and were musing about autonomous cars and staring out across the desert spring landscape.

"I think the thing that I'm really excited to see is what the cars will do at night," Sterling said in his scratchy Texas accent.

"I spend a lot of time staring out of hotel room windows at night," I replied. "I travel constantly and I love watching cities at night."

Sterling's flair for science fiction narrative got excited. "You can imagine standing in your hotel room, watching all of the driverless cars moving themselves back into place for the next day. All of them empty. All of them getting ready for the next rush hour."

"It's like a front-row seat to the midnight ballet," I added, imagining the cars easing down the street, dodging each other with a dancer's ease, in no hurry, but beautifully efficient.

A midnight ballet may sound a bit strange, but if we dramatically shift the metaphor we use to think about our cars and roads, might we not begin to see new patterns and new ways to imagine these vehicles?

"It's not about cars at all," Shahar Waiser explained

to me at a recent event. Waiser is the co-founder of GetTaxi, a ride-sharing service that allows customers to order a taxi via an app or website. What has set Get-Taxi apart from its competition in the 70 cities where it operates across Israel, Russia, United Kingdom, and United States is how it works not only with travelers but businesses as well.

"We are changing how corporations think about moving people and goods," Waiser said. "We are optimizing our system to have fewer cars on the road, but with increased utilization. We are trying to not only do business but also make the cities cleaner and less congested. Autonomous vehicles will only increase that."

It won't just be cars deadheading home, as Sterling suggested. Delivery runs can be made at night. Self-driving cargo pods can take the most industrial and blighted routes, leaving the parkways and stateliest streets for cars with human passengers. And the roadsides themselves will be transformed, as preprogramed cars won't be swayed by flashing neon or large signs proclaiming deep, deep discounts.

That sort of perspective shift has happened to other landscapes. Rivers and waterfronts were the industrial highways of previous centuries, but now we see them as pastoral. Perhaps, as we drive on them less, we will be more inclined to see our roads and city streets as works of architecture or public art.

To the extent that self-driving cars will be perfect-driving cars, we may reclaim the streets for strolling on or playing hopscotch.

The cultural effects of technological change are often the most surprising. It's not good or bad, it is just what's been happening as long as we have been humans.

And so, the most interesting changes that will be brought by autonomous cars will be the cultural shifts. What will happen when we have an entire generation of children who have never known a time when cars did not drive themselves. What will their children think and their children's children?

Whole infrastructures that we take for granted today as critical will recede into the distance. Try explaining to a seven-year-old that at one point the entire world's overland transportation was powered by horses.

There will be a time when stop lights and road signs recede away like so many stables and barns.

The future of autonomous cars will certainly change our lives in both dramatic and subtle ways, but the ways that will be most interesting are the things that are forgotten, the things that the next generation deem useless and frivolous. It's exactly the shedding of this baggage that will allow the next generation and their children to be unencumbered by the past.

As I said at the beginning, it's important for the engineering community to think through the scenarios of how new technology can affect the course of society. Engineers are the ones building this future, and the technology choices they make will determine the other choices the rest of us can make when using the technology. It's not enough to perfect the technology. Engineers have to be mindful of the way their technology impacts an all too imperfect world. **ME**

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