Full speed ahead: How the driverless car could transform cities

Author : Matthew Claudel

Date : September 16, 2015

Self-driving cars are not just about a hands-free driving experience. Their emergence points to an urban transformation that will change the way people navigate, access information, and interact with one another.

Just like Ford's Model T, which debuted in 1908, today's automobiles have four tires, a steering wheel, and seats. Henry Ford would have little trouble behind the wheel, but he would be completely baffled by the **technology** under the hood. Cars today are, in many ways, high-performance computers that can race at 70-plus miles per hour. Automotive digitization has led to important transformations, but the networked era has only just begun to tap its ultimate potential: the driverless car. Thanks to the advent of ubiquitous computing, various forms of semiautonomous technology, such as adaptive cruise control, automatic parallel parking, and collision warnings, are already widespread.

Indeed, full-fledged self-driving vehicles already exist. Several manufacturers, including **BMW, Ford, GM, Toyota, and Volkswagen**, have integrated these systems into their fleets and expect to start selling premium cars with different degrees of autonomy as early as 2016. MIT has worked with local researchers in Singapore on a prototype, while **Google** is using them in California. While fully self-driving cars cannot be bought off the shelf yet, autonomy is, in a sense, the next step in a continuing evolution of silicon under the hood.

Cars and the city

But what is the point of self-driving cars? Are there substantive benefits beyond sending guiltless text messages on the way to work? The answer lies in broader trends that point toward societal and urban transformations. Over the past 20 years, **digital** tools have changed the way people meet, access knowledge, and navigate—all built upon networks, sensors, mobile **communication**, and real-time information. These technologies are only now beginning to enter the urban space. In effect, more and more intelligence is suffusing our cities. It is possible to collect real-time information, seamlessly, on every dimension of urban life. HubCab, for example, is a web-based interactive visualization that looks at how New York's 170 million annual taxi trips connect the city.

A parallel trend is happening with regard to the automobile: cars collect information about passengers and about the environment. Systems inside the car can detect drivers' sleepiness, and galvanic skin-response sensors can give a metric for stress. Outside the car, radar, cameras, and laser scanners can "read" the road and then respond. Autonomous cars are at the nexus of these two lines of development, benefiting from advances on board and on the street.

Researchers at the MIT SENSEable City Laboratory are interested in the urban consequences of autonomous technology. Self-driving vehicles will have a dramatic impact on urban life when they begin to blur the distinction between private and public modes of transportation. "Your" car could give you a lift to work in the morning and then give a lift to someone else in your family—or, for that matter, to anyone else: after delivering you to your destination, it doesn't sit idle in a parking lot for 20-plus hours every day. By combining ride sharing with car sharing—particularly in a city such as New York—MIT research has shown that it would be possible to take every passenger to his or her destination at the time they need to be there, with 80 percent fewer cars.

Clearing the roads of four out of five cars has momentous consequences for cities, by measures such as environment, traffic, efficiency, and even parking. In most cities, for example, designated parking accounts for a huge amount of land, which ends up being useless for most of the day. With fewer cars, much of this space could be freed for other uses. Such reductions in car numbers would also dramatically lower the cost (and related energy consumption) of building and maintaining the roads. One engineering study found that automation could quadruple capacity on any given highway. And, of course, fewer cars also means less noise and a smaller environmental impact.

Driving patterns of individual cars can be algorithmically optimized as well. Because autonomous vehicles don't get lost, they create less congestion and shorten travel times. More important, self-driving cars would also make for much safer roads; more than 30,000 people a year die in automobile-related deaths in the United States every year and 1.2 million worldwide. One of the key challenges for the driverless future is to address the underlying logistics and legalities. Insurance, specifically, is an open question: When an accident involves a self-driving car, who is liable? Social acceptance is another important component: Are drivers ready to take their hands off of the wheel? Digital security is a third. Computer viruses are all too familiar, but the question is what to do if somebody "hacks" a self-driving car and changes the gas pedal into the brake, or even worse, makes the intersection go haywire.

As it always has, **technology** will continue to advance, and none of these issues is insurmountable. At this point, the transition is poised to happen, but several things must fall into place over the coming years—specifically outside the car—to pave the way forward. At the moment, fewer than half a dozen US states allow driverless vehicles on the roads, but many more states and countries are beginning to address the question. The federal government is working on creating a national policy to inform future development, but it is moving slowly.

It is likely that autonomous cars will deploy gradually—first, with more semiautonomous functions becoming standard (as GPS already has), then proceeding to systems that let drivers choose to

take their hands off the wheel in certain situations (such as traffic jams or parking), and finally, to fully driverless vehicles. According to IHS, a firm that provides automotive forecasts and insights, sales of autonomous cars, including driver control, will begin by 2025 and could reach 11.8 million in 2035; sometime after 2050, says IHS, almost all vehicles will be autonomous.

From a **technological** point of view, driverless cars have arrived; the bigger task is for cities to integrate them. As autonomous driving matures, one thing is all but certain: the world's mobility challenges will increasingly be met with silicon rather than asphalt.

About the authors

Matthew Claudel is a research fellow at the Massachusetts Institute of Technology's SENSEable City Laboratory, which studies how digital technology can affect the design, development, and operation of cities. **Carlo Ratti,** who directs SENSEable City Lab, is a professor at MIT.