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Look, Ma, no hands, no feet, no attention, no problem!

Leaving Driving to the Robots

Drivers could easily get the impression that there must be a lot of cars on the streets already equipped with automated driving systems. But all those folks zipping along intent on their phones likely aren't being assisted by anything other than pure luck.

The scary amount of **distracted driving,** however, points out a real need for such vehicles. They are not far off now at all, though some technical problems still need to be worked out. Yet the real difficulty will come from the massive social changes that driverless cars will bring. There hasn't been a development this disruptive in transportation since people gave up pony carts for horseless carriages a century ago.

The potential benefits of automated transport are immense, but so are the adjustment problems it may bring. At the very least, jobs ranging from long-haul truckers to cabbies (including Uber drivers) to parking lot attendants will go the way of livery stable operators and buggy whip manufacturers.

But those are just the easily foreseen first losses. It is **estimated** that driverless cars might ultimately cost 5 *million* jobs, almost *3%* of the total work force.

It's been a long road

Americans love driving but even back in the 1920s people were tinkering with remote-controlled vehicles. The first were "**phantom cars**" without occupants which wowed onlookers as they raced around empty, run by a radio link in a following car.

People got their first glimpse of the future of driving in 1939 at the **New York World's Fair**. The hit of the show was General Motors' **Futurama** exhibit. The source of the name of a later cartoon show, it showed visitors the automotive wonders of 1960, including controlled-access multi-lane expressways. While the prophesied speeds of 100 mph and embedded lighting tubes in curbs never happened, it also predicted aids like automatic distance control that still might.

In 1958's animated ***Magic Highway***, Disney's visionary speculations went a lot further, showing fully autonomous driving on smart roads with sensors and even equipped with air-conditioning and heating.

Cars would receive their preprogrammed routes via punch-card, and robotic parking lots would save space and walking. Consumers are still waiting for jet- or atomic-powered autos, but its predictions of how freeways would lead to suburbs, urban sprawl, gentrification, and so on were quite accurate.

Over the next several decades, real experiments began, usually trying to control vehicles with **magnetic strips** in the roadbeds. Science fiction as always led the way with stories by **Asimov** and **Heinlein**, and eventually shows like 1982's ***Knight Rider.***

In the 1980s, with a vision-equipped **Mercedes-Benz** van that navigated empty streets and the start of **DARPA's funding** of such projects, the effort began in earnest. In 2004, they began their famous "**Grand Challenge**" autonomous road races. No team won the first but improvement was so rapid that the third was moved to a more-challenging urban setting.

With the new millennium, driverless car development went into high gear with most major auto makers working on it, along with **Google** and **Apple**. **Uber got into trouble** recently by running an experimental vehicle without authorization on the streets in California, but many other hands-free cars have emerged from test tracks for open-road testing.

Tesla Motors announced its **Autopilot** assist system in 2014, and by the next year, used over-the-air software updates to allow self-parking capabilities. By October of last year, the company claimed to have built a full array of video cameras and other sensors to allow the car to fully drive itself. This despite the

first **fatal accidents** in 2016, one due to a glitch and the **other** due to the system not being turned on.

Types of auto autos

A fully-automated hands-free vehicle that can take to any road to deliver passengers safely and efficiently anywhere is a lofty goal to reach. But there are a number of lesser steps that must be achieved along the way. Therefore the **Society of Automotive Engineers** devised a 6-step scheme describing the ladder of enhancements which the government adopted.

These are based on the amount of attention the person in the drivers' seat must pay. They range from the car having no automatic controls but issues warnings to the driver (*Level 0*), through the vehicle assuming ever more self-control, until all the driver has to do is set the destination and start the car (*Level 5*).

Yet a **smooth evolution through levels** is unlikely. Most assistive technologies – such as **parking aids** – work for short periods with the driver closely watching. But the situation becomes radically different once the vehicle is driving itself for most of the journey. Unexpected emergencies can happen abruptly at any time, with no warning or any margin for error.

Research has shown that human drivers may be unable to suddenly **take control** in emergencies. It may be much more efficient and safe to go directly to a fully-autonomous car than to get there by steps. Thus, there might not be a **gradual introduction** of smarter and smarter vehicles. Instead, like Tesla, they may merge onto the roads fully equipped.

Would such a car have to be able to make moral decisions? Could it disobey laws to save lives or avoid accidents? What about the "**trolley problem**", where the robot car might be forced to decide between say, killing the driver or a bunch of pedestrians?

These are all dilemmas for which no right answer exists for humans or machines. The best that can be done for vehicles, some experts **conclude**, is to program them not to violate their basic safety protocols. Liability will doubtless be determined by the courts.

Another factor to be considered is how truly independent the car should be. **Autonomous vehicles** are completely self-governed; all the data and instructions they need are on-board. This might be just a phase for most urban transport, for most driverless cars out there are not truly autonomous.

Instead they are **automated** – relying on data from the cloud right now, and in the future, will also be **networked** together, along with smart intersections and traffic controls. This could eliminate perhaps as much as *90%* of accidents, not to mention traffic jams, rush hour congestion, and even traffic lights.

However, smart cars will *not* respond from fixed programs. They will **learn** from real situations, just like humans do, so they must be taught. Not only that, but in order to navigate, a vehicle must constantly estimate its position and velocity. All this means it might be hard to determine just *why* the car acts as it does, and the possibility of it behaving unexpectedly much like people do will probably always remain.

Getting from here to there

Of course, **connecting cars to the net** makes them just as vulnerable to hackers as the rest of the Internet of Things. Security for all these hurtling masses of steel *must* be foolproof. A **bipartisan bill** in Congress will seek to develop standards, as cars have already been **taken over** in experiments while thieves can **steal multiple makes** with laptops or special gizmos.

Security is just **one issue** that will affect adoption. Privacy in smart vehicles, anxiety over lack of control, fear of hijacking or terrorism must also be overcome.

New laws will be needed, for people may be relied upon to take advantage of the abilities of self-driving cars in novel ways. If they can't find a parking space why not have the car circle the block until they return? Or teens might reinvent "playing chicken" if they are sure the other car will get out of the way.

It's easy to imagine that there might soon come a time when driving one's own vehicle in congested or high speed settings will be outlawed. In fact, the days of privately-owned vehicles may already be numbered. Only in rural areas might drivers still run wild.

Driverless cars will at first be **limited** to well-mapped roads. Until they can **freely roam** across the entire planet at will and the price drops, most consumers might not be all that interested or able to own one. But corporations wiil **quickly replace** their fleets to save money, move goods faster and more safely.

Eventually we may dwell in a world where individual ownership of vehicles has been replaced by vast car-sharing services, summoned as needed. Once they get that all worked out, maybe then we'll finally get those **flying cars** they've predicted for so long.

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