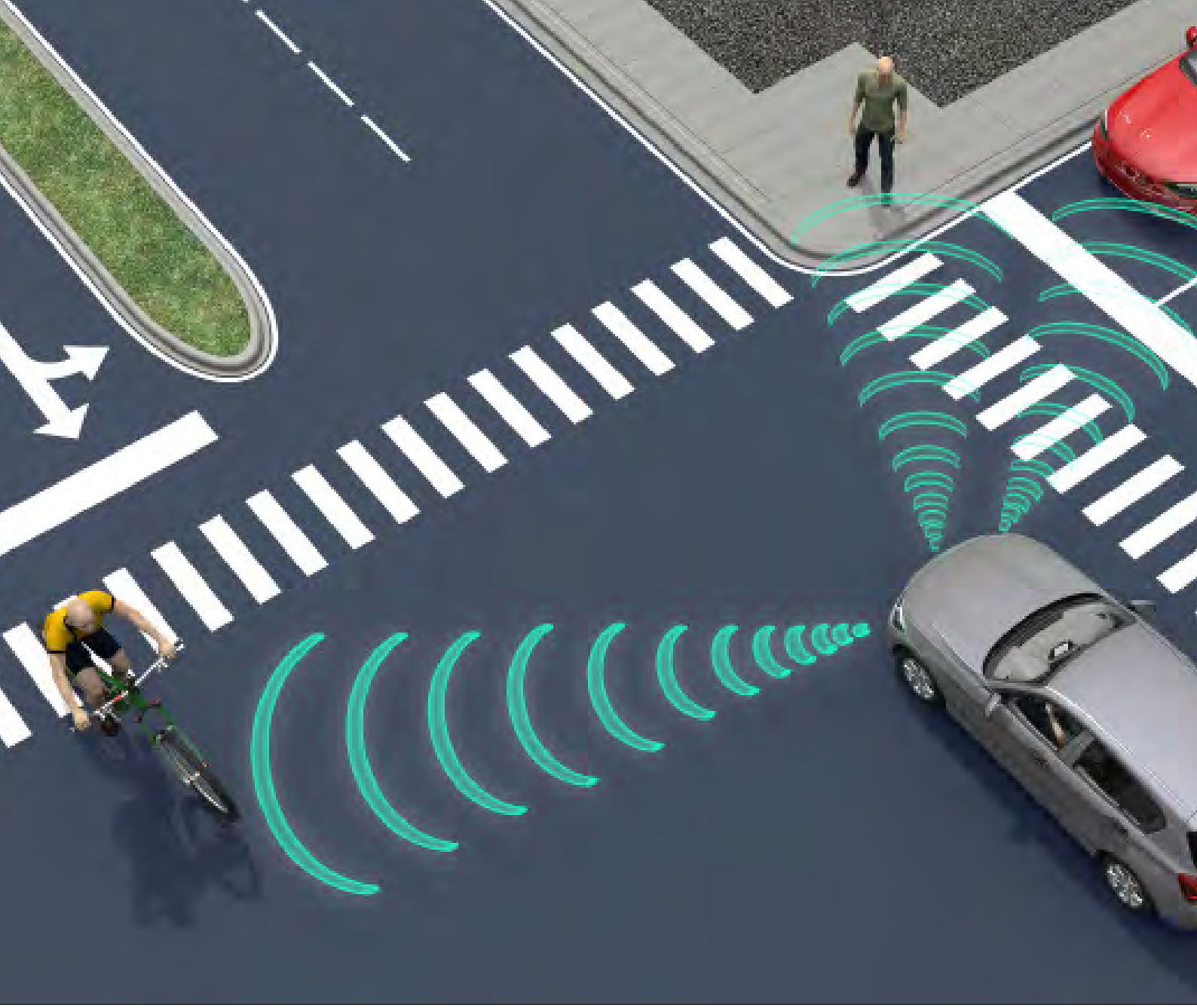
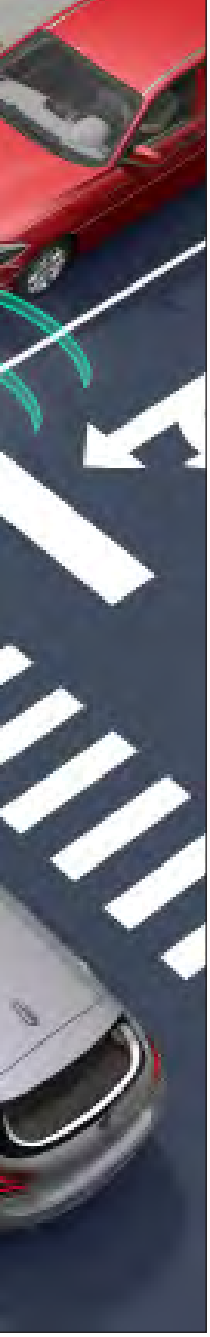


The long road ahead for self-driving cars

Little has been reported recently on autonomous car developments. Away from the headlines, however, some interesting moves are taking place. So how should we measure progress and when might we really get there? *Neil Barrett* has been looking for the answers



"Are we nearly there yet?" says the child, bored in the back. "No," hisses the parent from the driving seat. "But we're going in the right direction." That is the approximate answer as we consider the journey towards the reality of self-driving cars.

DEFINITION

Firstly, we should probably be clear on what we mean here. Cars that can drive themselves on a motorway, keeping in lane while maintaining distance and speed, are well established already. I first drove a hired Volvo XC60 on holiday a number of years back and was blown away by what it could do.

We have already moved on. For example, newer hardware in most Tesla models allows them to overtake, undertake and negotiate an exit slip road by themselves. They could do more, but regulations currently don't permit. Most would consider those to be examples of self-driving.

But at the moment, the driver may need to take charge at any moment. Also, with many of the features being confined to motorways, we're nowhere near the automation of a full A to B trip just yet. There are plenty of definitions out there, so how do we make sure we're not comparing apples with oranges? Simple – we go by the official levels of vehicle automation (see table).

THE CURRENT POSITION

Our progress on this journey is worth celebrating. As well as the examples above, we have automatic parking, the ability to summon our cars from a distance, reaction to other vehicles, speed limit recognition and pre-collision warnings: all fantastic technological steps that help put us at level 2, arguably reaching level 3 at times.

Hardware in the latest vehicles is extensive. As well as the powerful central processing unit, there are varying combinations of cameras, radar, LIDAR, GPS and other sensors in different cars. Combining this with maps, weather information and other data, the building blocks are there for some pretty impressive decision making. The software makes that happen. With some models able to receive over-the-air updates, this can only get better, especially as some production cars are already sharing real-world driving data with development teams. This is an important point. There are many cars on the road right now, actively contributing to the achievement of the next level of autonomy. That's quite the milestone.

REGULATION AND INSURANCE

The legal, ethical and political aspects of autonomous vehicles have moved out of pure theory and into the realms of practical application. I mentioned European overtaking earlier. European regulations split the overtaking manoeuvre into five distinct steps: indicating, lateral movement of the vehicle, the actual lane change, switching lane keeping back on and switching off the indications. In Europe, the main lane change must happen within five seconds of signalling. This is for safety. It can have a different effect, though: some cars which apply the regulations fully will abandon a move mid-change if necessary, with a confusing swerve back into the original lane.

The regulations also cover how far away you can be from a vehicle you're asking to come to you (just 6 metres) and how fast the car can be going for assisted turns.

Politics plays a part in progress. The UK government has been quite clear that it wants to be at the forefront of this revolution, with development and trials actively supported. There has also been legislation. The Automated and Electric Vehicle Act 2018 is on the statute book but hasn't yet been activated.

Once it does kick in, there will be a detailed set of laws in place covering insurance and many other matters. However, there is a lot more work to do in the creation of a clear-cut regulatory framework. It has been widely reported that Audi postponed - possibly shelved - plans to add its level 3 Traffic Jam Pilot system to the A8 in Europe, with talk of possible legal issues >>

AUTOMATION LEVELS

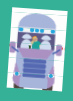
Level 0: No automation
The driver performs all the driving tasks.

Level 1: Driver Assistance
Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.

Level 2: Partial Automation
Vehicle has combined automated functions, such as acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.

Level 3: Conditional Automation
Driver is a necessity but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times without notice.

Level 4: High Automation
The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.



Level 5: Full Automation
The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

>> for the manufacturer in the event of a crash.

And what of the ethics? Once computers are making all the decisions, real life-and-death choices are in their hands. What should happen when a collision is inevitable but the next half a second could make a difference to the outcome for the vehicle occupants and those outside? What happens when only one group's outcome could be positively affected? Who gets priority - three passengers or seven pedestrians? These conversations are increasing in pace and frequency.

One large-scale global experiment is the Moral Machine by the Massachusetts Institute of Technology Media Lab. Via a website, the team at MIT have invited the public to decide on the lesser of two evils in a number of moral dilemmas for a driverless car. The moral judgements between participants have varied, it's fair to say.

If we are going to reach our level 5 destination, these conversations need to convert into a coherent, consistent electronic code of conduct for self-driving vehicles.

BUSINESS MOVES

One sign of a maturing industry is a race to consolidate; to dominate. This has been true of the autonomous vehicle industry, with some high-profile takeovers having taken place along the way. Whilst the list is full of vehicle manufacturers acquiring some of the technology they need by investing in the companies that invented it, the biggest attention goes to household name tech firms using deep pockets to buy their way into the industry.

> *Via a website, the MIT team have asked the public to decide on the lesser of two evils in a number of dilemmas...*

One of the most recent acquisitions was Amazon buying self-driving startup Zoox for a sum believed to exceed one billion dollars. This could further revolutionise the delivery process, as well as represent Amazon's move into autonomous ride-hailing services, such as Waymo, owned by Alphabet, the parent company of Google.

Whilst many things haven't had their usual prominence in the news in recent months – for obvious reasons - these moves have still been going on. The Zoox purchase was announced in late June this year. Trials have started or been continuing in recent months. More data is being collected. As long as it's big business, the industry will keep making good progress.

WHERE NOW?

There's a prospect of plentiful innovation and excitement on this journey – and, sadly, some tragedies along a challenging road of development – but the overall outlook is positive. My view is that we can get there by the end of this decade, with some significant milestones along the way. However, the opportunity for that hands-off commuter journey or a quiet trip home from the pub in the back seat still lurks beyond the horizon. ■