drivetech

Whitepaper:

Autonomous Vehicles

Will they be safer and where does this leave the “driver”?

Introduction

Nearly 1.3 million people die every year in road crashes across the world and between 20 and 50 million people are injured or seriously injured (ASIRT 2017). World governments desire to put an end to this carnage and the awful impact on families, but how can they succeed when we are talking about fallible human beings that constantly make errors or commit violations when driving?

Welcome to the world of automated vehicles and artificial intelligence...

Imagine a future where there are no traffic lights or controlled junctions because all vehicles are connected and know exactly where they are in relation to other road users, where cars automatically re-route themselves around traffic jams (if there are any). A silent world that is perhaps more reminiscent of the period at the turn of the twentieth century for quietness in the towns and cities due to electric powered vehicles. In this brave new world,

vehicles are designed differently because they should no longer crash in to each other; airbags, seatbelts and safety cages are not required, and they don't even need indicators or mirrors. In fact, they won't have a steering wheel either because the greatest risk has been removed; the driver!

Is this thought an utopian view? Many commentators believe we will start to see elements of this new artificial intelligence technology in our vehicles over the next five years. Indeed, we can now see a number of semiautonomous features on modern vehicles, such as Autonomous Emergency Braking (AEB). It sounds fantastic but whatever you think about this, many governments are serious about reducing the casualties and removing harmful emissions from our atmosphere. Hydrogen powered vehicles are being developed, but the primary solution in current thinking appears to be automated electric or hybrid vehicles. The key issue for us is the long transition to this utopian world. It presents significant risk and may even increase the number of incidents in the short term before we really see the desired results.

The real issue continues to be driver behaviour and the lack of training that drivers receive. We currently live in a world where technology is used to aid the driver, however, many are not comfortable using their cruise control let alone allowing the vehicle to take over altogether. Practical driver training solutions and complimentary online learning or workshops is key to helping drivers understand the technology on their vehicle and to use it confidently and effectively.

Autonomous technology is not new. The road to autonomous cars began decades ago, when manufacturers started introducing driver aid technologies into personal cars, with Chrysler first introducing power steering in 1951. Widespread vehicle automation has never seemed so close as today. However, as this whitepaper demonstrates, that although many believe widespread vehicle automation is in the very near future, the reality is that there are still many key issues and challenges toovercome before then.

DriveTech is at the forefront of driver risk management, with a focus on the human training and behavioural aspects of safe, risk-reducing and effective road use for the business operator. This whitepaper looks at the challenges ahead and asks if fully autonomous vehicles are something we should currently and realistically expect to be a reality in the next decade. Furthermore, what likely impact will this have on the human in the equation – will the current "driver" still be in the driving seat? And could this wrongly diminish the perceived need for practical and prudent driver training?

ACFO's John Pryor believes the reality of fully autonomous vehicles is some distance into the future but in the meantime, more and more systems are becoming autonomous, and that is something fleets should be aware of and can benefit from. This is echoed by The AA's Stuart Thomas: "In the short term, both drivers and fleet operators can benefit from enhanced driver aid systems such as Automatic Electronic Braking (AEB), lane assist and blind spot assist. Although these are functionally beneficial for the driver, fleet operators can also see benefits through reduced repair and maintenance costs as the systems can help avoid collisions."

Key Issues and Challenges

As with any breakthrough technologically-driven change in modern society – and the vision of the fully autonomous vehicle must surely be viewed as a real paradigm shift in the development of modern individual transportation systems - it is complex. What sets out to be a relatively simple idea, can become interdependent on very many dimensions, and quite complex to execute in reality.

Along with the economic imperative to drive increasing efficiencies into everything we do, there are less and less human machine interfaces that are not affected in modern life. Driving is an area increasingly under investigation and exploration with the interface between man and machine at a pivotal moment in time.

Driver assistance becomes driver obsolescence?

We are all benefiting increasingly from what would clearly be positioned as "assistance technologies" in vehicles – from AEB (autonomous emergency braking)* to park assist, lane assist to blind spot and proximity sensors. These are helping to support the driver – a human still in final, and therefore ultimate, control over the direction and speed, and safe use of the vehicle.

Thatcham Research's Head of Research, Matthew Avery said: "We are starting to see real-life examples of the hazardous situations that occur when motorists expect the car to drive and function on its own. Specifically, where the technology is taking ownership of more and more of the driving task, but the motorist may not be sufficiently aware that they are still required to take back control in problematic circumstances."

Things are changing. This more passive assistance is increasingly moving towards fully autonomous control – with the vehicle – effectively a sophisticated self-propelled mobile combination of hardware and software – developing 'senses' and decision-making processes all of its own and acting independently of the "driver". Fully connected to other cars and systems external to, and remote from, the vehicle via telematics, the so-called 'connected car'. The compelling promise is that this new technology holds great improvements on the road – safer performance, more efficient traffic management and the opening of new market and usage opportunities. The key question on everyone's minds is safety. Who remains in control, and who is responsible as and when things go wrong? Drivetech looks at some of the key headline areas of consideration and seeks to understand what the future holds for the driver in this complex and developing equation.

https://www.euroncap.com/en/vehicle-safety/the-rewards-explained/autonomous-emergency-braking/

Technology meets safety – but who is safer?

So, just how safe is this potentially autonomous vehicle technology on-road in real world conditions?

The 'Safe System' approach is widely recognised as the core underpinning of a safe road transport policy representing a fundamental shift as its ultimate goal is to prevent any road user being subject to impacts sufficient to cause fatal or serious injury when inevitable errors of judgement result in crashes.

The Safe System* approach recognises that humans as road users are fallible and will make mistakes. There are also limits to the kinetic energy exchange which humans can tolerate (e.g. during the rapid deceleration associated with a crash) before serious injury or death occurs. A key part of the Safe System approach requires that the road system be designed to take account of these errors and vulnerabilities so that road users are able to avoid serious injury or death on the road.This desire alone means that any holistic approach to an autonomous vehicle network (local, regional, national or wider) must be consistent and be committed to this core human safety premise.

A serious concern has already been raised indicating that human interaction and behaviour when sharing driving tasks – such as when machine to human handovers take place – can be a point of vulnerability. In reality,

the "handsfree driver" (behaving more as passenger for sustained periods) is suddenly called into action after being in a relatively disengaged/passive state.

A clear and current message is that the technology capabilities of modern vehicles are not necessarily being successfully and comprehensively communicated to vehicle owners/drivers and there are incorrect and dangerous assumptions or beliefs about what the technology will and will not do. There is a need for simple but understandable messaging about what automated cars are capable of, to avoid the risk of driver complacency and a feeling of total protection and security in-vehicle – hands-free and naively care-free!

There are a number of broad areas that need to be considered – not just the technology application and driver understanding in-vehicle.

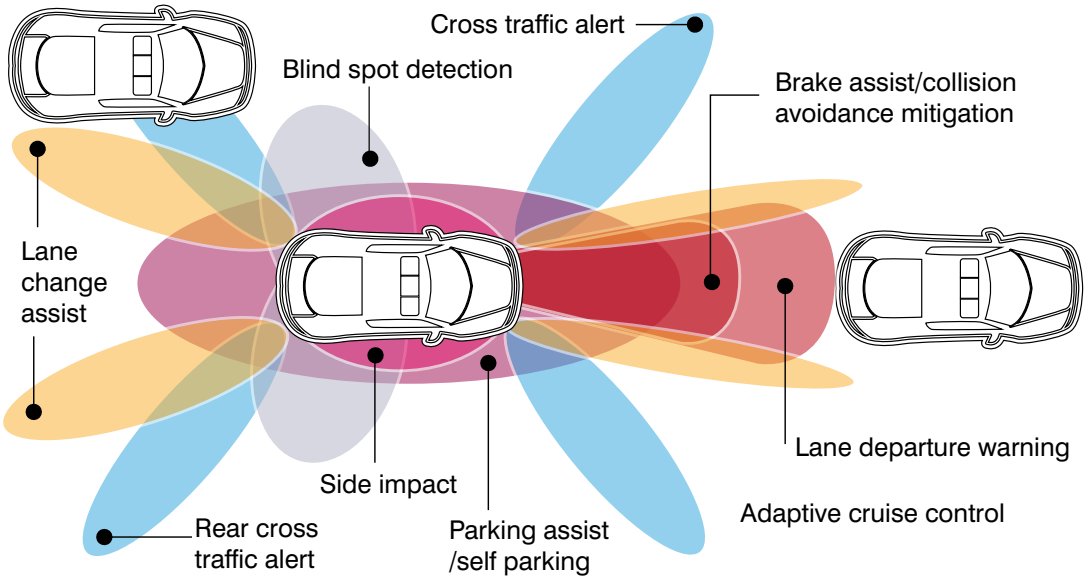
Safe System Approach explained:

https://www.towardszerofoundation.org/thesafesystem/

Thatcham Research (the UK motor insurers automotive research centre) and the ABI (Association of British Insurers) have produced a report entitled 'Assisted and Automated Driving Definition and Assessment' in which are identified "dangerous grey areas associated with some driver support technologies". The report references the use of terms such as Autopilot and ProPilot, which are used by Tesla and Nissan respectively for their driver assist technology, as potentially misleading drivers into believing their car can take full control in all circumstances.

Automotive Safety Technology Beyond passive safety devices such as air bags and seat belts, car designers are pushing technology to help drivers and prevent road accidents.

Driver Assistance Features How sensors, radar, LIDAR, cameras and other technologies in a car can cover potential risks and assist drivers.



NOTE: Areas covered representational only and are not to scale

Sources: Reuters Insurance Institute for Highway Safety

Roads Infrastructure

Roads infrastructure is an integral part of the matrix and any autonomous network would have to consider the different nature of road networks, from the relatively “straightforward” nature of the typical motorway networks to more distinctive and individual A and B road networks not to mention the idiosyncrasies of individual countries such as roundabouts.

Acknowledging different cultures, highway laws and systems is a must (or there is a need to drive greater consistency across countries and continents), and any autonomous vehicle infrastructure must be flexible to take into account changing scenarios and environments.

Regulatory, Insurance and Police Enforcement Considerations

At the core of the autonomous vehicle debate is the ownership of, and responsibility for, the vehicle especially when things go wrong. The insurance industry might well have to re-consider their underwriting policies substantially to ensure that liabilities and responsibilities are clear and covered in this new age. And how would the police assess things differently at the scene of a collision, trying to not only judge the behaviours and intents of the different drivers involved, but also automatic/autonomous decisions that may have been taken by the vehicle.

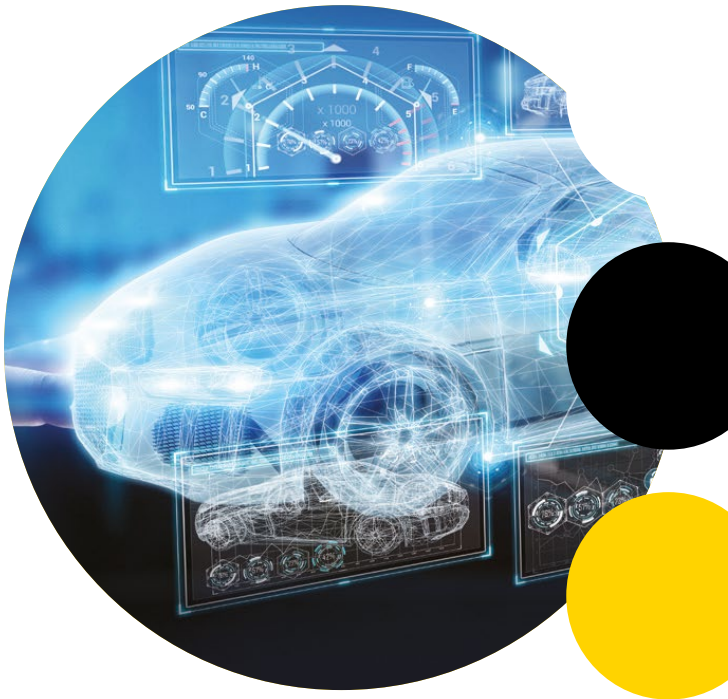
Depending on the robustness and reliability of the technology employed, some actions may even be inexplicable but blamed on a technology glitch, not human error. And in such instances, who in reality is to blame?An observation from Bristow’s (commercial law firm particularly known for its technology and IP work) in their 2018 article “Who’s going to drive you home? Liability for Autonomous Vehicles”* is that new legislation (and much of it) will be needed, and note the enactment of the Automated and Electric Vehicles Act (July 2018) is a first step to understand such considerations as amendments to the existing compulsory third party insurance framework by extending it to cover use of automated vehicles (in addition to dealing with electric and hydrogen powered vehicle charging).

As the infrastructure develops there will be a complex set of interdependencies with different technology platforms working together and requirements for highly sophisticated algorithms for every conceivable predictable (and unpredictable?) eventuality. This is a significant stretch from the current clear accountability of a single driver in clear and definitive control of the vehicle they are driving.

Hacking and the Risk of Cyber-crime

As the speed of technology applications improves, so too does the desire to interfere with normal system operation for the purposes of financial gain, or deliberate disruption. The technology will have to be safe and secure to avoid the modern autonomous vehicle equivalent of the “faked car accident” triggered by technology interference rather than a deliberate human act. The approach will need to embrace:

- robust and secure operating systems
- safety critical sub-systems
- steering control, acceleration, deceleration isolated
- risks of using open-source code in any part of the system development chain
- tamperproof systems in-vehicle and within in-system architecture



Connected vehicles and the use of telematics

Big data is a term often used these days for the collection and use of vast amounts of information to help learn, inform and improve on a significantly large scale. The potential for connected vehicles to provide more of this big data is enormous.

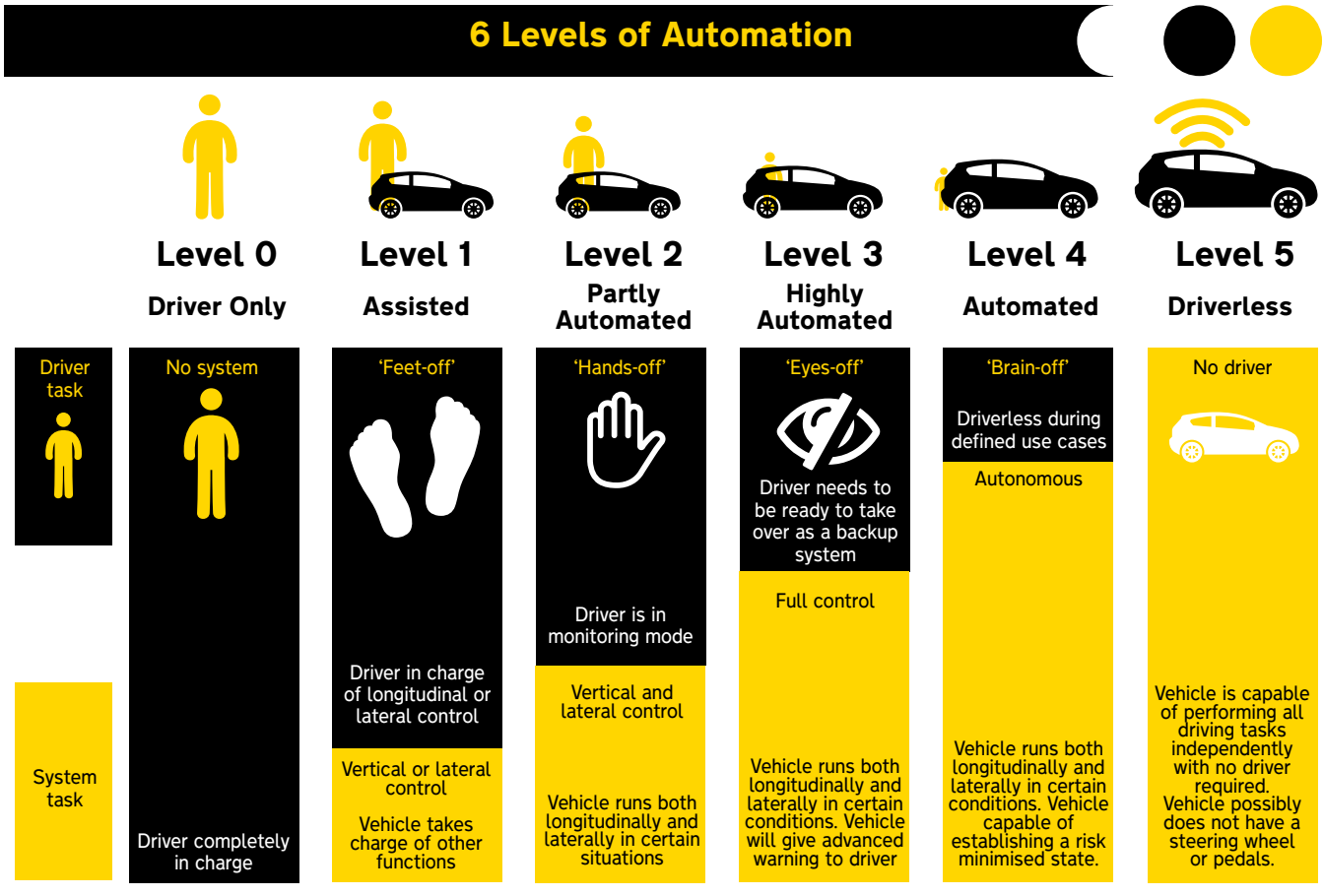
We can already see this in vehicle diagnoses that can be performed remotely (vehicle self-diagnosis which might identify a potential fault and communication of this to decision makers and interested parties such as servicing centres and vehicle manufacturers before a breakdown even occurs).

But there does remain a number of issues around this vehicle generated data that needs to be clearly and more definitively resolved – notably who owns the data? Is it the driver, the vehicle manufacturer, the insurer, or other interested parties?

Levels of automation

A number of reports and insights into the development of true vehicle automation indicate a sequence of logical developmental stages in the evolution of a pure driverless car and one such predicted evolution is featured here. There are generally 6 accepted stages of vehicle automation (for 0-5 see below) from purely reliant on driver in control to totally driverless vehicles. Whilst this might be logical and understandably staged, the likely timescales for each phase and the final predictions of a fully real-time driverless vehicle scenario are a little less precise, and are likely to run into decades, not years.

At the current stage of testing and development, much of the research and development is being driven by vehicle manufacturers on one hand, and global technology giants such as Apple, Google, Microsoft on the other (with a whole host of mainly entrepreneurial and commercial collaborations and partnerships in between). For true harmonised and consistent, safe and secure driverless car operation, this is going to require high level government-led national and international agreement and coordination – with robust standards in place. The pioneers are great at blazing the trail and achieving breakthough applications and proof of concepts in test environments, but this development has road safety at its core and needs overarching control and coordination.



Roads Infrastructure

Driver education and understanding is key to the successful development and mainstream adoption of autonomous vehicles, and understanding is still not widespread or fully complicit.

Researchers at the University of Southampton have been testing people in simulators and on test track for years. They've been trying to find out how good people are at taking back control when the computer systems go wrong. "In simulated emergencies, up to a third of drivers of automated vehicles did not recover the situation, whereas almost all drivers of manual-control vehicles in the same situation were able to do so."

In addition, research showed that drivers of automated vehicles took, on average, six times longer to respond to emergency braking of other vehicles compared to manual control drivers.

Uber

Self-driving Uber kills Arizona woman in first fatal crash involving pedestrian

Tempe police said car was in autonomous mode at the time of the crash and that the vehicle hit a woman who later died at a hospital

Sam Levin *and* Julia Carrie Wong *in San Francisco*

Mon 19 Mar 2018 22.48 GMT

20,391

This article is over 9 months old

A car passes the location where a woman pedestrian was struck and killed by an Uber self-driving sport utility vehicle in Tempe, Arizona, on Monday. Photograph: Rick Scuteri/Reuters

An autonomous Uber car killed a woman in the street in Arizona, police said, in what appears to be the first reported fatal crash involving a self-driving vehicle and a pedestrian in the US.

Tempe police said the self-driving car was in autonomous mode at the time of the crash and that the vehicle hit a woman, who was walking outside of the crosswalk and later died at a hospital. There was a vehicle operator inside the car at the time of the crash.

Conclusion

The development of "autonomous" vehicles will undoubtedly continue at pace, but the focus needs to be on the overall environment and infrastructure, not just on including more and more technology in-car in isolation. This holistic and harmonised approach needs to include vehicle technology, telematics, road and legal infrastructure, IT security and protection against error or deliberate interference but most importantly education, understanding and confidence for the driver (and their vehicle operators/owners in the business driving context) who must remain "at the wheel" and hands-on for a significant time to come.

There is a danger that the popular terminology around "autonomous" implies freedom and non-involvement for the driver and a totally passive experience. Whilst this ultimate ambition for a fully autonomous on-road system is admirable and visionary it remains somewhat futuristic. The driver must remain and be fully aware, that they remain in ultimate control of their safety, and the safety of others, on-road.

Training and education of real-world drivers as to the emerging technologies and safe use of such new"assistance" systems is critical and has not yet been recognised or prioritised as much as the technological developments themselves.

We leave the driver, including driver education and training, behind at our peril.

References and Further Reading

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About Drivetech.

Drivetech is the world leader in fleet risk and safety management, and driver training. It is also the UK's largest provider of driver offender retraining courses. With a track record built over the last 25 years, Drivetech now delivers fleet consultancy, driver assessment and training services in over 95 countries, in 35 languages through over 40 partners. Our fleet solutions improve driver safety, reduce fleet running costs and ensure compliance with legal and duty of care responsibilities. Our customers range from companies with small fleets through to large corporate customers where driver training is a core activity, an understanding of their sector required and a clear return on investment is demanded.

Drivetech is part of the **Automobile Association.**

Contact Us.

Drivetech UK & Drivetech International
Fanum House, Basing View, Basingstoke
Hampshire, RG21 4EA, UK

T 01256 610907
E tellmemore@drivetech.co.uk

drivetech