Are Cars Really 'Killing Machines'?

Worldwide, nearly 1.25 million people die in road crashes each year–on average 3,287 a day and approximately an additional 50 million are injured or disabled. [1] A car is an inanimate object i.e. it cannot move of its own conscious will, however with the advent of autonomous vehicles which could be considered as animate, they may well be able to move under their own will. This article looks at the various ways people can be killed whilst in control of cars. The first accident involving Mary Driscoll and the first recorded accident on Harrow-on-the-Hill is looked at. It queries whether cars are really 'killing machines' as some people argue. The VW scandal and the Ford Pinto case are expounded on. Mechanical failure and cars as vehicles of terror are explored. This article also looks at the development of automated and connected vehicles that comes with a promise that driver-error related crashes will be reduced. Finally, conclusion is given.

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Are Cars Really 'Killing Machines'?

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What is the heaviest computer you own? The chances are - you're driving it and with all the hacking news flying around, day after day, our imaginations have not even begun to grasp its significance. In modern times, society is entrusted with the responsibility of using one of the most accessible pieces of machinery. With the rates of injuries and fatalities caused by vehicles continuously increasing, it has become the role of designers and engineers to evaluate and improve measures taken to prevent accidents caused by vehicles. Cars are part of our daily lives, so they seem normal and safe. But if you give them a second look, you can start to see how dangerous they really are. Worldwide, nearly 1.25 million people die in road crashes each year–on average 3,287 a day. And approximately an additional 50 million per year are injured or disabled. [1] Driving is filled with perils. Drivers need to be 100pc on-guard all the time to remain safe. Car crashes are unfortunately very common in Ireland and Great Britain and the majority of these road crashes are caused by human error. While some accidents are relatively minor, thousands of lives are lost each year by these horrible crashes. Because your life can be at risk if you drive in an unsafe manner, it is very important that you follow all traffic rules and regulations. A car is an inanimate object i.e. it cannot move of its own conscious will, however with the advent of autonomous vehicles which could be considered as animate, they may well have a "mind" of their own and be able to move under their own will in the foreseeable future. Cars appear as machines, lacking any anthropomorphic (human-like) features. Moving at high speed in a complex and imperfect machine while surrounded by multi-ton vehicles on busy roads isn't exactly a stroll in the park. To make matters worse countless of crashes could have been prevented if an involved driver had been paying close attention, had chosen not to drink and drive, or had otherwise held the safety of others in high regard. Traffic accidents are the leading cause of death among young people aged 17 to 29 years in industrialized countries. For example, in Great Britain in 2011, 22pc of road accidents involved at least one young driver aged 17 to 24. In fact, accidents including young drivers typically represented about a quarter of all road fatalities.[2] As already mentioned, globally, approximately, 1.25 million people are killed each in vehicles that many claim are killing machines and up to 50 million are seriously injured.

First Vehicle Accident

There were little more than a handful of petrol cars in Britain when labourer's wife Bridget Driscoll took a trip to Crystal Palace in south-east London. Following a crash, she became the first UK traffic fatality. She died a few weeks later after a new Parliamentary Act – designed for the new and lighter petrol, electricity and steam-driven cars – raised the speed limit to 14 mph, while the flagman role was scrapped altogether. However, the first recorded automobile crash occurred on the 25th March 1889 on Harrow-on-the-Hill. Middlesex. The accident involved a wagonette motor vehicle – similar to the 1899 Daimler.

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[1] Theodere F. Claypoole. 9 August 2019. *The National Law Review. Heavy metal murder machines and the people who love them.*

[2] *Frontiers in Psychiatry*. (1 June 2017). *Description of various factors to traffic accidents in youth and measures proposed to alleviate recurrence.* frontiersin.org

The vehicle driven by Edwin Root Sewell was going down Grove Hill at the breakneck speed of 14 mph when one of the front wheels collapsed and the occupants were thrown out. Mr Sewell died instantly and a passenger called a Major Richter died later from a fractured skull and a further four passengers received minor injuries. Some say the driver was 'showing off' his driving skills. This may well be the first double fatality in a car crash, but little did we foresee the millions of drivers that would subsequently be killed by the 'infernal' combustion killing machine.

Killing Machines?

Most people have no idea that they are risking their lives each day by doing the simplest of tasks however; one of them does not include driving a car. Not too many people know, but, travelling by car is actually more jeopardous than flying in a plane. If a person is killed inside or outside a car, many would refer to it as a dangerous "killing machine" - similar to motorcycles. Most of us have heard about a car crash or even some may have experienced one. A car coming into our lives and unleashing horrendous injuries on our loved ones, friends, family and even ourselves is unthinkable. So, are cars really dangerous "killing machines?" Pedestrian fatalities involving vehicles in the United States have increased 41pc since 2008, more than 6,000 pedestrian were killed in 2018 alone. Of these, 4,000 were kids. Statistics clearly don't seem to persuade anyone of the magnitude of the problem. If numbers can't change minds, can personal experiences? Asking "What if" begs further questions: who makes decisions about new technology? Whose concerns are heard? Whose common ground are we cultivating? If we heeded the warnings of those who foresaw the dangers of cars – from pedestrian safety to climate change- when cars were adopted over a century ago, we would be living in a different world today. By asking questions and developing strategies now, we will be more likely to live in a future that we design – not one that our vehicles design for us.

Research

The global human health impact of the diesel emissions scandal has been revealed by new research showing a minimum of 38,000 people a year die early due to the failure of diesel vehicles to meet official limits in real driving conditions. The emissions are responsible for premature death due to heart and lung disease and strokes. Most of the deaths are in Europe, where highly polluting cars are the main culprit and in India and China where 'dirty' trucks cause most of the damage. Nitrogen oxides are at illegally high levels in many Irish and British cities and the Government (GB) estimates this pollution is responsible for 23,500 premature deaths a year. [3] The conclusion of a study conducted in Max Planck Institute for Chemistry in Mainz, Germany and headed by Jos Lelieveld showed that air pollution –which contains vehicle exhaust emissions – has now joined the ranks of major risk factors such as high blood pressure, diabetes and obesity. Also, the study found that air pollution [4] causes 800,000 "extra" deaths in Europe each year which is double the previous estimates.

[3] The Guardian. May 2017. *38,000 people a year die early because of emission testing failure*.

[4] Air pollution is anything in the air that causes harm, but the pollution of biggest current concern in the UK is particulate matter (PM) and the gas nitrogen dioxide. Particulate matter is all solid and liquid parts suspended in the air. These are both man-made such as diesel and soot and natural such as sea spray, dust and pollen.

In Great Britain, 7.9 million Londoners – nearly 95pc of the capital's population – live in areas that exceed the World Health Organization (WHO) pollution guidelines by 50pc or more. Also, in London, 50pc of pollution comes from traffic [5] which is a considerably high proportion.

VW Scandal

The confession of cheating and prevarication that's embroiled Volkswagen is one of the biggest scandals in the car industry that came on the sidelines of an academic conference focused on global transportation. After more than a year of subterfuge and stonewalling investigators, VW stunned two senior officials with the Environmental Protection Agency and California's watchdog by admitting the automaker hacked its own cars to deceive US regulators about how much their diesel engines pollute. As a result, VW the world's largest car maker by sales, faces EPA fines that could reach €18 billion, class actions and other lawsuits that could add billions of dollars more in liability and a US criminal investigation.[6] Volkswagen, who lacked moral turpitude – and certainly would not be conferred with *summa cum laude* in the car manufacturing industry - is a classic example of a company that has got away by doing practices that have not only broken the law, but also developed killing machines.[7] VW installed software in diesel engines on nearly 600,000 VW, Porsche and Audi vehicles in the US that activated pollution controls during Government tests and switched them off in real-world driving. The software allowed the cars to spew harmful nitrogen oxide at up to 40 times above the legal limit. There is some estimation that the health of up to 200,000 people would have been negatively impacted by these actions alone, with many deaths attributed to VWs 'killing machines' and the deadly pollution they emitted. In all, some 11 million vehicles worldwide were equipped with the software.[8] US regulators confronted VW about the software after university researchers discovered differences in testing and real-world emissions. Volkswagen at first denied the use of the so-called defeat device but finally admitted it in September of 2015. Volkswagen reached a US $15 billion civil settlement with environmental authorities and car owners in the US under which it agreed to repair or buy back up to a half-million of the affected vehicles. Such negative publicity, massive criminal charges, huge civil settlements and potential investor lawsuits and criminal probes should surely have affected its share price in the long-run? Not so. After a massive 20% fall when the diesel-emissions scandal broke in October 2015, just two-years later in November 2017, Volkswagen AG's share price was back above where it was. Since its nadir in October 2015, the company has clawed back more than 35 billion Euro (US $40 billion) in market value.[9] In fact, in April 2018, Volkswagen AG's share price rose despite a drop in earnings. [10] Whilst management accountants undertake cost-benefit analyses on a regular basis, a higher moral and ethical standard must be applied when these numbers are used as ammunition pertaining to conflicting objectives. This is especially the case when there is a conflict between the objectives of maximizing a company's shareholder value versus the social responsibility objective of keeping its customers safe.

[5] Airweshare.co.uk (Last accessed 9 February 2020).
[6] CNBC. *After a year of stonewalling, VW finally came clean.* 24 September 2015. cnbc.com
[7] ABC News 2017
[8] supra
[9] (Bloomberg, 2017)
[10] (McGee 2018).

CO Deaths

Clean vehicle and fuel technologies provide us with an affordable means of reducing transportation related air pollution and climate change emissions. These include fuel-efficient vehicles that use less oil; cleaner fuels that produce less emissions; and electric cars and trucks that can entirely remove tailpipe emissions. [11] Passenger vehicles are a major pollution contributor producing significant amounts of nitrogen oxides, carbon monoxide and other pollutants. There has been many instances of deaths by carbon monoxide (CO) either accidental or by suicide. Even a long exposure to CO in an open space can cause acute poisoning. CO is an odourless gas that is emitted by running vehicles and can quickly cause disorientation, sudden illness or even death. Often called the "silent or invisible killer", the deadly gas often goes undetected striking victims who are caught off guard or succumb in their sleep. According to the Centre for Disease, Control and Prevention, more than 400 people die in the US each year due to unintentional CO vehicle related poisoning. [12] CO poisoning from a petrol engine exhaust is most commonly accidental and is one of the lesser common methods of committing suicide. In Denmark, just 11.2pc of men and 3.7pc of women who committed suicide chose this method. Such incidents usually occur in a closed space, such as a garage or a car with windows fully shut. [13]

Ralph Nader – "Unsafe At Any Speed"

Few drivers could imagine owing a car these days that did not come with airbags, anti-lock brakes or seatbelts. In his book *"Unsafe at Any Speed"* the famous and often outspoken 31-year-old attorney, consumer advocate and political activist, Ralph Nader, completed an investigative report on US automobile safety published in 1965. *"Unsafe at Any Speed"*: *The Designed-in Dangers of the American Automobile* excoriated the American automotive industry based in Detroit for its prioritization of style and design over consumer safety. Nader's book eventually became a bestseller and helped spur the passage of the National Motor Vehicle Safety Act in 1966, the country's first significant automobile safety legislation. At the time, the rising death toll from traffic accidents was also driving leaders in the US Congress and elsewhere in Government to look at the issue of automobile safety. For years, driver error had had been the sole focus in the investigation of traffic accidents. Nader and others suggested however, that the cars themselves might be to blame in many cases. At the behest of the then Assistant Secretary of Labour – Daniel Patrick Moynihan – Nader wrote his famous book. In his book, Nader attacked the entire Detroit automobile industry. General Motors and its Corvair model came under particular fire. The Chevrolet Corvair [14] had been a focus of controversy in the courts since 1961, when a woman who lost an arm after her Corvair flipped over, sued GM for selling cars with unsafe steering designs. The case was settled out of court, but other similar cases followed. In fact, by 1967, about 150 lawsuits had been filed against GM in connection with claims regarding the Corvair. Nader went on to become the most recognizable and influential champion of the consumer advocacy movement. In 1968, he founded the centre for *Study of Responsive Law* and its staff quickly became known as *"Nader's Raiders"* as they focused their investigations on issues relating to consumer and health.

[11] *Vehicles, Air Pollution & Human Health* July 18 2014. Union of Concerned Scientists. ucsusa.org
[12] *CO poisoning. Idling cars*. kidsandcars.com
[13] Zaba, C. *et al*. Karger. Medical Principles and Practice. karger.com
[14] *Was the Corvair as bad as Ralph Nader claimed?* goldeagle com

Although the influence of these consumer advocacy groups waned somewhat in the 1980s, the impact of Nader's *"Unsafe at Any Speed"* had in establishing standards for consumer safety is undeniable. [15]

The Ford Pinto Case

The famous (infamous?) case of profit versus social responsibility conflict is the *Ford Pinto Case*. [16] The Ford Pinto was a small car designed to compete with foreign cars of the company's competitors in the 1970s. It had a target selling price of US $2,000. It was a rushed project, led by Lee Iacocca, in which the planning took just 25 months compared to the industry norm (at that time) of 43 months. Ford's testing found several defects: (a) at 25 mph and over, the gas tank would rupture in a rear-end accident; (b) at 30 mph and over the rear endings would cause the gas tank to leak and the rear of the car to be folded into the back seats and (c) at 40 mph and over the car doors would jam. Still, much to the disgust of the production engineers, Ford's top management rushed the Pinto to the market. It was a veritable killing machine and consequently, there were several serious burn injuries and deaths when these low-speed accidents inevitably happened. In 1973, under instructions from top management, Ford's engineers and management accountants developed a cost-benefit analysis entitled *Fatalities Associated with Crash Induced Fuel Leakage and Fires* for submission to the NHTSA in support of Ford's objection to proposed stronger fuel system regulation. The document became known as the "Pinto Memo". In this memo, the cost-benefit analysis appeared to compare the cost of recalling and repairing the faulty product vis-à-vis the societal costs for injuries and deaths related to expected future fires of the Ford Pinto. If Ford recalled the car, it would cost them $11 per car for the safety alterations for a total of US $137 million. However, if Ford ignored the fact that they will be killing their customers, and accepted the legal costs of settling claims, it would cost them considerably less. The actuaries estimated that, based on the faulty cars sold, there would be a maximum of 180 future burn deaths, 180 serious burns and 2,100 burnt Pintos that would need to be replaced. By using a settlement value of US $200,000 per death; US $67,000 per serious injury and US $700 per car, it would only cost Ford US $49.5 million; i.e. a saving of US $87.5 million, if they did not do a safety recall of the Pinto. The reality was that the "Pinto Memo" was a well-researched, but poorly communicated document. The cost-benefit analysis actually compared the cost of repairs to the societal costs for injuries and deaths related to fires in cases of vehicle rollovers for *all cars* sold in the US by all manufacturers (not just Ford). In the memo, Ford also estimated the cost of fuel system modifications to reduce fire risks in rollover events to be $11 per car across 12.5 million cars and light trucks (i.e. of all manufacturers), for a total of $137 million. The public misunderstanding of the cost-benefit analysis has contributed to the mythology of the Ford Pinto case. The Time magazine said the memo was one of the automotive industry's "most notorious paper trails". A common misconception is that the document considered Ford's tort liability costs rather than the generalized cost to society and applied to the annual sales of all passenger cars, not just Ford vehicles. However, the bottom-line is that Ford did not recall the Pinto, and thus when the 'Pinto Memo' surfaced, it was a public relations disaster for Ford as it implied Ford was callously trading lives for profits.

[15] Regan Brumagen 13 November 2013. *"Unsafe at any Speed".* encyclopedia britannica.com
[16] The Ford Pinto Case: *A Study in Applied Ethics, Business and Technology*, 1994.

This shows the importance clearly communicating the management accounting numbers on which critical decisions are made, especially where a company's products and services may endanger human lives. It also shows that human life cannot be equated to a monetary value in settling a legal liability. Many people felt the issues raised in the Ford Pinto case were an example of the "deep pocket" by the company disregarding consumer safety in pursuit of the almighty dollar, while others felt they were an example of runaway media coverage blowing the story out of proportion. [17] Regardless of opinion, the Ford Pinto car was a "Molotov Cocktail" that involved a tangled web of many complex legal and ethical issues. [18]

Mechanical Failure

Vehicle recalls are common. In fact, in 2017 Maserati announced a recall of 40,000 vehicles with Honda recalling another 772,000 in the US due to some air bags ejecting metal shrapnel. Both mechanical failure and manufacturing or design defects can increase the likelihood of an accident. Occasionally, manufacturers are responsible for vehicle and equipment failures. Companies endanger the lives of their customers and other motorists by knowingly selling defective vehicles and equipment. (See the Ford Pinto case above). Millions of people have been affected by dangerous motor parts for example; more than 1.6 million vehicles manufactured by General Motors (GM) were recalled due to faulty ignition switches that were used between 1997 and 2011. Previously, Toyota recalled 2.3 million cars that had 'sticky' accelerator pedals. In that case the company knowingly concealed the problem and endangered the public. Then, Firestone was responsible for one of the biggest tyre recalls in history. More than 6.5 million tyres were recalled, including 2.8 million fitted to Ford vehicles. Each of these controversial recalls resulted in billion dollar settlements. [19] The failure of some equipment inside the workings of a car can result in serious accidents and thus is known as 'Accidents Due to Equipment Failure'. Mechanical failure can happen for several different reasons. Sometimes it is out of control of the driver, and other times not. Not carrying out routine maintenance or tending to a fault on your vehicle can cause an accident. Bald tyres, ineffective brakes are some of the things which need to be addressed in a timely manner. Imagine driving around with a fault - which if not corrected- could lead to an accident then; you really cannot blame the car. It was the car owner's responsibility to maintain the vehicle. Remember, over 50 years ago, when Ralph Nader's – *'Unsafe at Any Speed'* demonstrated the need for Government regulation of the car industry so that car companies' raw greed would not override customer safety concerns. Soon after, Lee Iacocca led a Ford design team that calculated it was worth the horrific flaming deaths of 180 Ford customers each year in 2,100 explosions due to flawed gas tank design. That was eventually rectified with a tool costing less than €1.00 per car. Granted, safety is much more important issue for car manufactures now than in the 1970s, but if so, why have we not seen industry personnel meeting to devise safety standards into car electronics the same way that standards have been accepted in car mechanics. If the industry won't take this standard – setting seriously, than the Government should force them to do so. Nothing in our daily lives is more dangerous than our vehicles out of control.

[17] The Ford Pinto Case: *A Study in Applied Ethics, Business and Technology*, 1994.
[18] The Ford Pinto Case: *A Study in Applied Ethics, Business and Technology*, 1994.
[19] Stephen S. Sweat. Personal Injury Lawyers. victimslawyer.com

Also, as already mentioned above, nearly 1.25 million people die in road crashes each year–on average 3,287 a day globally and approximately an additional 50 million per year are injured or disabled. [20]

Vehicles As Weapons Of Terror

What could happen if a hostile person decided to hack our car computers - individually or in masse? [21] Vehicle terrorism has seemingly become the new *modes operandi* for many violent groups and it appears it may continue into the future. In September 2014, an ISIS spokesman called for lone-wolf attacks using improvised machinery. Terrorists have turned to a frightening weapon that often is within easy reach and is particularly hard to guard against: using cars and trucks as killing machines. Also, another terrorist group encouraged its Western recruits to use cars and trucks as weapons. A 2010 webzine article "The Ultimate Mowing Machine" called for deploying a pick-up truck as a *"Mowing Machine not to mow grass but mow down the enemies of Allah"* Once again the world saw images of what authorities are investigating as a terrorist attack conducted with a vehicle – this time a truck in Berlin that ploughed into a Christmas market, killing at least 12 people in December 2016. Counterterrorism officers used to worry about truck bombs, now they also have to worry about trucks and other vehicles being used as weapons, which can generate many casualties at public events. This was made vividly clear by the case of the terrorist who killed 86 people with a truck. The victims were celebrating the French national holiday on 14 June 2016 on a promenade in Nice in the south coast of France. Then we had the recent horrifying London Bridge attacks. From 1981 to 2019, there have been 44 vehicle ramming incidents worldwide by terrorists.

Vehicular Homicide

In the UK, there is no offence of "vehicular homicide" where a vehicle has been used as a weapon as part of a deliberate assault, and the intention was to kill or cause serious injury. If that assault resulted in the death of the victim then the driver may be charged with murder contrary to common law. Also, when the death is a result of driving that falls short of a deliberate assault, the Road Traffic Act (RTA) (1988) governs the disposal of the case. [22] The offences created by this act relating to road deaths are as follows:

- Causing death by dangerous driving
- Causing death by careless or inconsiderate driving
- Causing death by driving; unlicensed, disqualified or uninsured drivers
- Causing death by careless driving while unfit through alcohol/over the prescribed limit

Dangerous driving is defined under the RTA (1988) as:

[20] Theodere F. Claypoole. 9 August 2019. *The National Law Review. Heavy metal murder machines and the people who love them.*
[21] natlawreview.com
[22] UK Govt. The Road Traffic Act 1988 (as amended). HMSO. Retrieved 17 March 2015.

> ***"Driving in a manner that falls considerably below the minimum accepted standard expected of a competent driver and in such a way that it would be obvious to a competent driver that there is a serious risk of personal injury or damage to property. There will have been an obvious risk of danger and clear blame".***

If found guilty of dangerous driving the consequences can be severe. You face:

- A custodial sentence of up to 14 years
- A mandatory disqualification from driving any motor vehicle for a minimum of 2 years
- An unlimited fine
- A compulsory extended retest

C.M.V. Clarkson, [23] an advocate of vehicular homicide, opines that while people's perceptions are that death resulting from a motor vehicle is in a different "family" to other killings,

> ***"In terms of fault there can be little distinction between those who kill through dangerous operation of their cars and those who kill with machines, trains etc."***

However, in the US, all states except Alaska, Montana and Arizona have vehicular homicide statutes. The laws have the effect of making a vehicle a potentially deadly weapon. The relevant statute allows for easier conviction and more severe penalties. However, in states without such statutes, defendants can still be charged with manslaughter or murder in some situations. [24] [25] Vehicle manslaughter is the crime of causing death of another individual due to the illegal driving of a vehicle and the sentence for dangerous driving can take many forms. Causes of vehicular manslaughter include:

- Gross negligence driving
- Drunk driving
- Drug driving
- Reckless driving and
- Speeding

Autonomous Vehicles

Self-driving vehicle safety is about the one kid, the software might have missed, not about the 99 it didn't. The development of automated and connected vehicles comes with a promise that driver-error related crashes will be reduced. Advocates of self-driving vehicles have predicted that they will reduce 80pc of road crashes. However, this remains to be seen. [26]

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[23] CMV Clarkson (2000). *"Context and Culpability in Involuntary Manslaughter. Principle or Instinct?* In Andrew Ashworth; Barry Mitchell (eds.) *Rethinking English Homicide Law*. Oxford University Press. Pp. 148-150, 164. ISBN O-19 -829915-X

[24] *The Facts: Vehicular Homicide and the Impaired Driver*. US Department of Transportation. Archived from the Original on 28 April 2009. Retrieved 10 February 2009.

[25] en.wikipedia.org *Vehicular Homicide.*

[26] *Interpersonal Communication and Issues for AVs*. University of Michigan Transportation Research Institute Centre for Advancing Transportation Leadership and Safety. June 2007.

As a society, we all work together every day to make our world safer and more efficient, but we also need to be cautious of the dangers that technological advances bring. The car industry is no exception – car manufacturers and drivers need to tread lightly when it comes to adopting new automotive features. The oft-repeated promise of driverless technologies is that it will make the roads safer by reducing human error–the primary cause of accidents. However, car manufacturers have a long way to go before they can eliminate the driver altogether. What's left is a messy interim period when cars are being augmented incrementally with automated technologies such as obstacle detection and lane centering. In theory, these can reduce the risk of crashes, but they are not failsafe. As a Tesla spokeswoman put it: *"Autopilot is intended for use only with a fully attentive driver".* [27]

Conclusion

It's a long time ago since the first recorded fatal car accident occurred on Harrow-on-the-Hill. Since then, cars have become part of everyday life. However, with this convenience, comes the dangers of crashes of which many are fatal, crashes that are fundamentally caused by driver error. Many people will argue that cars like motorcycles are dangerous. Yes, so is a shotgun if placed in the wrong hands. However, a car is an inanimate object i.e. so far, it doesn't have a mind of its own and cannot move of its own conscious will, however with the advent of autonomous vehicles which could eventually be considered as animate, they may well be able to move under their own will in the future. Moving at high speed in a complex and imperfect machine while surrounded by multi-ton vehicles on busy roads isn't exactly a stroll in the park. To make matters worse countless of crashes could have been prevented if an involved driver had been paying close attention, had not chosen to drink and drive, or had otherwise held the safety of others in high regard. However, cars emit carbon monoxide (like the VW emission scandal) which can be harmful to health and some are even built with manufacturing flaws like the Ford Pinto which had a defective petrol tank. Also, terrorists have turned to a frightening weapon that often is within easy reach and is particularly hard to guard against: using cars and trucks as killing machines. Once again the world saw images of what authorities are investigating as a terrorist attack conducted with a vehicle – this time a truck in Berlin that ploughed into a Christmas market, killing at least 12 people in December 2016. Counterterrorism officers used to worry about truck bombs, now they also have to worry about trucks and other vehicles being used as weapons, which can generate many casualties at public events. This was made vividly clear by the case of the terrorist who killed 86 people with a truck on the promenade in Nice in the South of France in June 2016. Every death by a vehicle on our roads is deplorable, of course. But ordinary traffic fatalities have not led to calls to dramatically redesign roads, cars and trucks regardless of costs, yet, a tiny fraction of the carnage when caused by terrorists creates much alarm. Finally, little did we know how the automobile would evolve and become a potential 'killing machine' when we look back to 29 January 1886, when Carl Benz applied for a patent for his "vehicle powered by a gas engine". His patent number - 37435 - may well be regarded as the birth certificate of the automobile as we know it today.

[27] The Guardian. 24 January 29018. *Who's driving? Autonomous vehicles may be entering the most dangerous phase.* theguardian.com