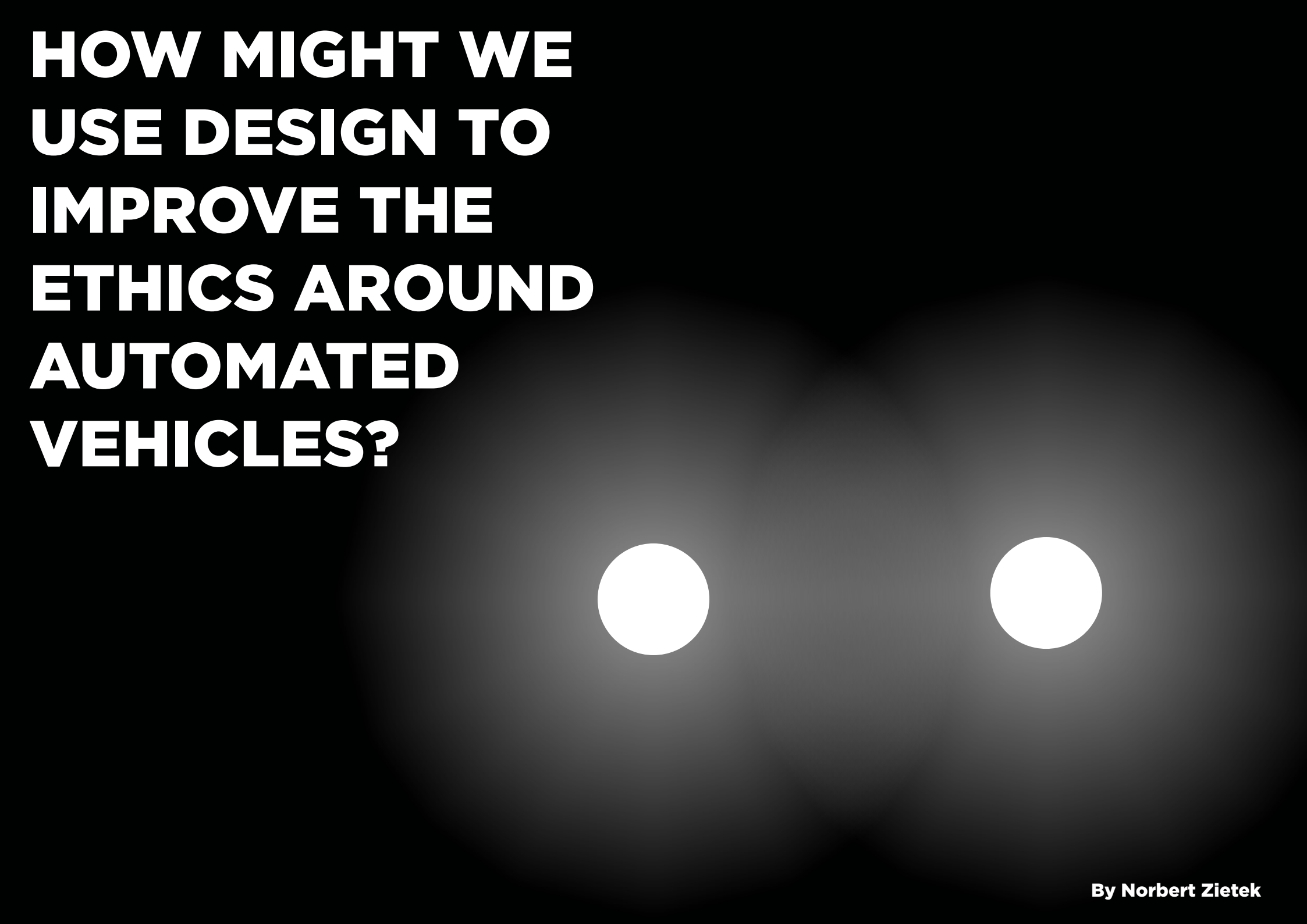
HOW MIGHT WE USE DESIGN TO IMPROVE THE ETHICS AROUND AUTOMATED VEHICLES?



By Norbert Zietek

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Framing the Question

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When the computer code takes the wheel, driverless cars can provide a safer, cleaner, and additionally convenient mode of transportation. Although the technology is ready, automotive and policy manufacturers might not be. The manufacturers build a compelling case for why the government, industry, and customers need to work together to create the next “Apollo moment.”

Fig.1

Within the past couple of years, the autonomous driving dream has gone from being likely, to possible, to inevitable. Car versatility gives us a set of points of interest, such as the impressive flexibility of transportation for those who can possess the car. However, numerous distinctive impacts take place, making the current vehicles unsustainable on the off chance that we consider their security, energy-related environmental impacts, congestion activity, time went into the operation, and land use.

Fig.1: https://www.omegawatches.com/media/catalog/category/header_image_1600x400_ndg_v2.jpg

Aims and Objectives

02

The overall goals and objectives of this report are to identify how autonomous vehicles and technology that surrounds it could help and improve the world.

The main questions in this report are:

Aims 1:

How far have we as humans progressed with the autonomous vehicles?

Objectives 1:

•Data will be extracted from knows historical reports on automated vehicles.
•Data will be extracted from each table detailing the statistics in a more simplified way.

Aims 2:

What are the main benefits and disadvantages of autonomous vehicles?

Objectives 2:

•Data will be selected carefully from various sources and categorised in this report to synthesise the correlation between the different points that already exist.

Aims 3:

What opportunities do automated cars have in city spaces?

Objectives 3:

•Analyse the documents representing the future infrastructure in the next 10 years and how different aspects of today's infrastructure will change due to evolution of today's technology.

The primary method of researching in this report is going to be using quantitative approaches. This way of researching will help accumulate as much accurate data as possible in the small timeframe we were assigned to, thus, creating the research thorough and elaborate on various views surrounding the subject.

Methodology

03

This report uses qualitative and quantitative research methods. Firstly, the technological factors of autonomous cars were explored through surveying relevant academic journal articles. The report briefly describes the history and development of autonomous vehicles, characterises automation levels of cars and highlights the main features that distinguish AVs from standard cars.

The advantages and disadvantages of these vehicles have been discussed quite extensively, with a particular focus on safety in general, the impact on everyday life and the environment. The publication also focuses on predicting the development of autonomy in a number of respects, along with forecasts of the changes that will take place in industry and the economy in relation to the use of AVs.

This research will be specific to world views of consumers, and therefore, the only way is to look at already completed surveys that ask a large variety of countries. The survey will seek to increase the general understanding of the contributor's lifestyle in terms of how ready they are to create changes within technologies, or for more instance, how prepared the consumers might be to create trade-offs.

Source: https://iphonewalls.net/wp-content/uploads/2017/01/Tesla%20Model%205%20Dark%20Brake%20Light%20iPhone%206+%20HD%20Wallpaper.jpg

The data was accumulated mainly utilising visual methods, such as reading of publications on the subject, observing videos published by automotive companies as well as studying legal and government documents such as the Ipsos Mori. Consequently, this report is considered a methodical analysis, which is an appraisal and combination of primary research papers utilising a rigorous and documented methodology in both the research, strategy and the selected of studies.

The report discusses selected planning and organisational issues for these scenarios and analyses their impact on key elements of transport sustainability. Based on the study, it has been demonstrated that automation of traffic can significantly improve urban mobility while meeting the many objectives of the sustainable development strategy. However, it also found that it also entails certain risks, which could be addressed through wide coordination of organisational activities, multidimensional preparation of transport systems for new technology.

Discussion

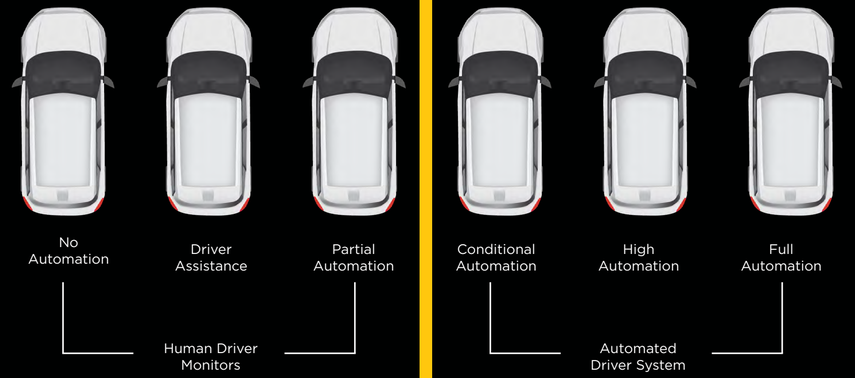
04

The development of the automotive industry has been observed since 1769, i.e. since the construction of the first vehicle-powered steam artillery tractor which was built by Nicolas Cougnot. Over the years there were new solutions in this area. The past century witnessed the most significant progress in the development of vehicles (Louis,2016).

The last two decades is primarily the search for new technologies by manufacturers, which will make it more comfortable for the rider. This technology is directly linked with the implementation of autonomy. But what are the concerns with the vehicle? In a general sense, this is a car that is highly advanced technologically and which can move from point A to point B without human action. Today there are many systems to control the vehicle, but none of them reached full autonomy. It still requires a human to intervene; they must be prepared to take over control of the vehicle at any time. Vehicle manufacturers try to use more advanced technological solutions, such as Radar, GPS, image recognition, or Odometry (Robo-Rats,2001).

Advanced systems enable the collection of the necessary information from the environment around themselves, which is then analysed to determine the route and behaviour of the vehicle. For example, the adaptation of speed, acceleration and the avoidance of obstacles has to be accounted to proceed in a safe manner.

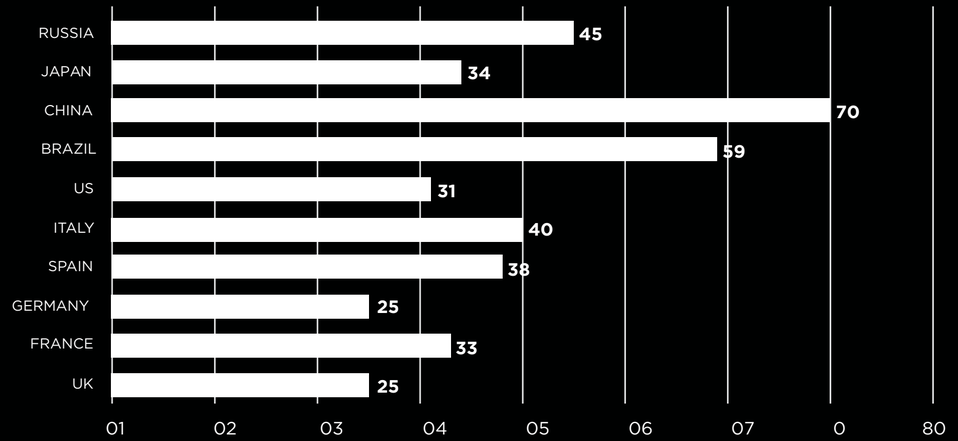
As the self-steering vehicles developed over time, this created several ways to classify them, but the most common is just one of them, developed in the United States. In 2014 classification of autonomous vehicles was published by the SAE (Society of Automotive Engineers), which



bears the name of the SAE J3016 Autonomy Levels. The classification is more focused on the number of driver intervention and the need for attention while driving than the technical ability of the vehicle.

The classification presented in Table 1 considers the six levels of autonomy. In the case of the first three, the human is responsible for monitoring the situation on the road and for making decisions based on their observations. Level 0 refers to older vehicles, which didn't get any technology installed, nor facilitate the process of driving. The next levels – one and two include the vehicles that have some technology, but they are not sufficient to let the human give full control to the system. The last three levels - the system is responsible for activities related to steering. Therefore, a key step in the development of autonomy is the transition from the second to the third level. In the case of the third level, the system can take control of the driving. Nevertheless, the driver must always be prepared to take control. Level four vehicles are capable of independent driving but are not fully autonomous. The desired outcome is to achieve the highest level, which provides the highest level of security and safety.

Level of interest in owning an autonomous car for personal use (%)



Base: 106,740 participants across 10 participating countries. (Source: Ipsos Automotive Navigator Survey)

The operation of a car without customary human interaction opens entryways to tackle the utilisation of vehicles for new concepts to emerge. Customers anticipate an autonomous vehicle (AV) to be used for commercial purposes, with just 43% of them envisioning owning an AV for individual use (Peter Otto, 2019). This incline is more predominant in developed markets. As of now, the private and commercial industry will require to prove to the buyer the benefits of owning an autonomous vehicle.

The Law

05

One of the most significant problems facing autonomous vehicles in compliance with the law. The Vienna Convention of 1968 is an international treaty defining the rules of the road in force in the countries that are signatories (currently 73 countries). One of the fundamental principles of Article 8 is saying that “Every moving vehicle or combination of vehicles in motion should be in charge,” and that “everyone should have the control necessary physical and mental and be physically and mentally fit to drive.

Every driver of a vehicle motor should have a news resource and skills essential to drive the vehicle; However, this provision does not prevent the teaching of driving following national legislation. Each control should always prevail over your vehicle or running animals (Council Directive,1997). This is an explicit negation of the idea of autonomous vehicles; therefore, before they will appear on the roads will be necessary to regulate all legal aspects of the implementation of the concept of autonomous vehicles. Therefore, tests can be carried out legally in this country in the field of autonomous vehicles, following the applicable state law.

In order for self-driving vehicles to become highly popular, a broad and in-depth discussion should be held on the legislation that affects many areas of everyday life. The key issue will be to find answers, including the following questions:

• Who is responsible for the accident involving the AV - the person in the vehicle (not necessarily able to control the vehicle) or the owner?

• Who will respond when the vehicle was empty?

• Should full insurance become compulsory?

• What if the pedestrian is injured? Who will be held by the police?

• Will it be a crime to take part in an accident where a person sitting in the driver’s seat has taken control of a car clearly striving for a collision?

• Who will be responsible if the autonomous vehicle is used to commit a crime (e.g. attack or kidnapping)?

• How to treat a person staying in the car AV, which can potentially take control of it, but it is under the influence of alcohol or drugs?

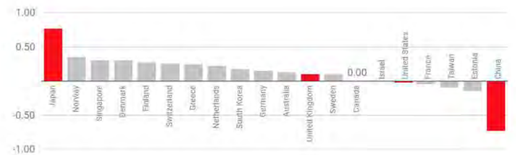
• Is the amount of compensation paid will depend on whether the vehicle was empty autonomous, whether it was in person with the right license?

From these questions, there are many loopholes in legislation and chances for abuse. When considering the situation where there is a person who is potentially able to react to a dangerous situation and take control of the vehicle, you can try (but not always) to ‘fit’ up to date regulations, taking into account only the real driver, as a person fully responsible for what is going on with the car. The problem is definitely growing when an autonomous car ‘drives itself’. The question of “who is responsible” then remains unambiguous, which makes it much more difficult to identify the perpetrator of the accident or collision. As you can see, the legal and motor insurance challenges are significant, and good solutions are far ahead of us.

Global Observations

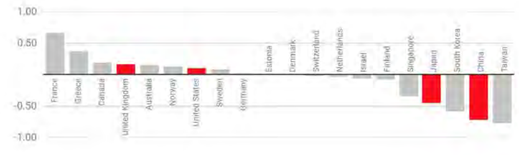
06

How countries compare in sparing pedestrians over passengers



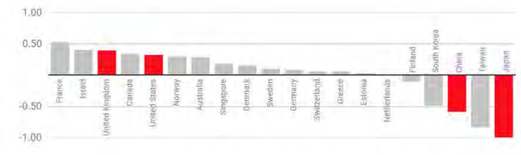
Asian countries are much more cautious of the lives of the elderly. However, the West is quicker to protect the lives of the youthful. (Karen Hero, 2018)

Countries with more individualistic cultures are more likely to spare the young



The western part of the world is performing a variety of utilitarian calculus whereby three lives are worth three times as much as one. This does not imply that Japanese drivers will recklessly swerve into crowds; this means that they respect more lives compared to one. (Karen Hero, 2018)

Countries with more individualistic cultures are more likely to spare more lives



Chinese language drivers see random pedestrians as a way more expendable than their friends, family or colleagues who're presumably their passengers. Japan, via evaluation, sacrifices passengers to pedestrians to a marked volume. (Karen Hero, 2018)

From this research of graphs, we get an accurate understanding on how the world would portray driverless cars in the future and what kind of laws and regulations would have to be in place to make this happen.

The Advantages

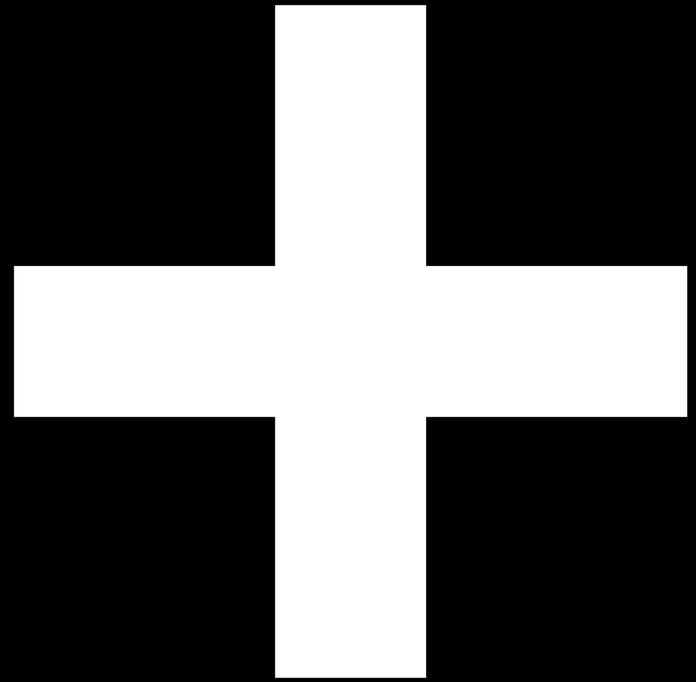
07

One of the most frequently mentioned benefits of the implementation of autonomous vehicles is the increase in safety and ultimately the reduction of the number of collisions and accidents on the road, thereby reducing the number of injuries and deaths. Over the years there are tests to try and reduce the amount of crashes on the road. Various technologies are used, such as airbags, ABS, a collision warning system, etc. However, the process of introducing such solutions to the majority of the vehicles on the roads takes about three decades, starting from luxury vehicles, and ending with the budget models. It is estimated that if vehicles were equipped with assistive technologies (warning of an imminent collision and the assistant “dead spots”), we could be preventing every third collision or accident (Insurance Institute for Highway Safety, 2010). It is predicted that autonomous vehicles will have a lot more technology, increasing the level of safety.

In the case of vehicles with a third level of autonomy, the driver can give the car full system control of the vehicle in critical situations in order to increase the chance of security. This would significantly reduce accidents. The statistics of accidents involving motorcycles, pedestrians and cyclists would also be improved, as the system is not dispersed, not weakened and not reckless, and could also be avoided if they meet a human who is vulnerable to the above factors. Accidents involving drunken drivers would also be a much rarer phenomenon. However, the highest level of safety will be provided by vehicles with the fifth-highest degree of autonomy.

One of the indisputable advantages of developing autonomous vehicles is increasing the mobility of people with disabilities. Vehicles that reach the fourth level of autonomy will be capable of transporting such people; this is an opportunity for a significant improvement in the mobility of people with disabilities. Which currently cannot run conventional vehicles; however, this does not only apply to people with disabilities, but it also applies to older people or children who are unable to drive the vehicles themselves. Estimated benefit for these groups is to increase their independence, overcoming social isolation and to allow access to the necessary services. It is worth noting that this would probably be much cheaper than adapting the means of urban communication transport for disabled people. It is estimated that public transport companies spend around 14-18% of their budgets on disabled individuals. (Government Accountability Office, 2013)

Another advantage of the expected implementation of autonomous vehicles is to reduce congestion on the roads and reduce associated costs. The introduction of this type of vehicle can affect the congestion on at least three different ways: by reducing the number of journeys made, allowing the increase of capacity on the roads and reducing delays directly related accidents.



The Dis-Advantages

08

At present, vehicles have extensive communication possibilities. Often, they are connected in a network. Different networks have different degrees of sophistication of security systems with the risk of cyber-attacks and data protection. Autonomous vehicles have external software and hardware. These solutions to problems are developed, implemented and managed by the vehicle manufacturers. The connection between the system in vehicles and the central server must be safe, in such a way that the data flow can be secured against unauthorised access.

Uncontrolled access to data by third parties, directly and indirectly, threatens the safety of both vehicle and road users. The problem of security against cyberattacks in recent years is growing. Autonomous vehicles can generate data such as mileage, travel, travel time etc. Such data is sensitive and are particularly vulnerable to abuse them by others with malicious intent for these people. The increased risk of attacks will also be geared in particular trucks, carrying valuable loads, which can be stolen. Autonomous vehicles can be equipped with a range of technologically advanced precautions for the safe operation of the car in case of an attack which could be exposed to deliberately causing an accident. In the event of an attack, they are exposed to a deliberate accident by an attacker. In such a situation, it shall apply appropriate legal conditions to protect the data of users of such vehicles and the continued development of methods of protection against ever-increasing risks. (S. Pillath,2016)

It is also a significant risk as humans will start to rely primarily on technology, which may, at any time, begin not to act correctly or stop working. The process of conducting this type of vehicle depends mainly on sensors and other technologies. Certain road conditions such as heavy snow, fog or dust greatly hinder the proper operation of specific solutions (radar, LIDAR). To ensure complete safety, all devices must be aware of the surrounding conditions. The problem is also unexpected traffic situations, such as road works, traffic cop, the emergence of the emergency vehicle, etc.

Autonomous cars must be able to choose appropriate solutions to such situations. It is a question of the development of artificial intelligence. Also problematic is the issue of data selection according to their usefulness. Installed sensors collect vast amounts of data. In many situations, it is necessary to interpret the relevant data and choose which ones are important at the moment. There shouldn't be situations in which the vehicle mistakenly interprets a situation with too much information because the information gathered from the environment. (S. Pillath,2016)

What Opportunities Do Automated Cars Have In City Spaces?

09

The rise of level four and level five autonomous vehicles will be reflected in the way we as humans use space. Currently, most cities rely on a similar prototype form. It says that the city centre has a denser building than its suburbs. Many companies and individuals have to make local decisions based on a trade-off between land and transport costs, e.g. the associated time spent on travelling into the workplace. People would be more willing to buy land or live in areas more remote from cities in this case; as people do daily commuting to jobs, schools, etc.

The driver could engage in several activities other than driving during prolonged driving. As with the development of automotive in the early 20th century, suburbs and settlements emerged into an even more fragmented urban structure (RAND Corporation, 2014). When the vehicle can arrive at designated locations itself, it will not be necessary to park near the place of residence or work. Vehicles could be parked elsewhere which it would drive up

to the user if needed. This means private homes could transform parking spaces into housing, and architects and planners could seek to make more efficient use of the urban area. Businesses or shopping centres could get rid of burdensome and extensive parking spaces. The problem of parking in cities is significant, given that studies have shown that passenger cars spend 95% of their life cycle in the parking lot. In such situations, it is appropriate to seek more efficient arrangements for the use of parking space to increase usable space (E. Guerra,2015).

The appearance of the road infrastructure will also change. If conventional vehicles are entirely replaced by autonomous vehicles, the need for light-signalling, signs and other components will disappear. They will be replaced with digital versions in the cloud. Vehicles, based on the information gathered by themselves will adapt their speed to road conditions (JM Anderson,2014)Within the past couple of years, the autonomous driving dream has gone from being likely, to possible, to inevitable. Car versatility gives us a set of points of interest, such as the impressive flexibility of transportation for those who can possess the car. However, numerous distinctive impacts take place, making the current vehicles unsustainable on the off chance that we consider their security, energy-related environmental impacts, congestion activity, time went into the operation, and land use.

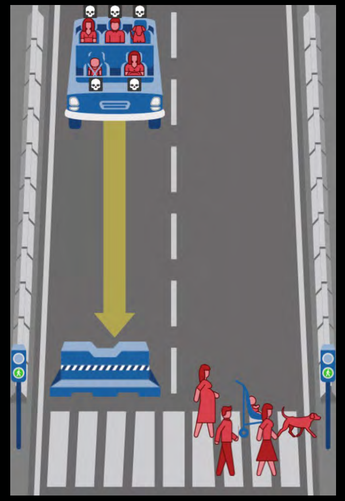
Threats and Ethics

10

One of the most severe problems with the introduction of autonomous vehicles is an ethical issue. There is a need to consider in which the driverless cars should be programmed to respond in situations where accidents are highly likely or unavoidable. As long as autonomous vehicles travel with not as advanced vehicles (Level 1), such cases will occur because of the difficulty of predicting human decisions. This situation, therefore, raises important ethical questions. For example, should autonomous vehicles always minimise deaths? Should the lives of the passengers be prioritised? What ethical considerations should be the basis of these algorithms? This problem is often compared to the theoretical 'trolley problem', simple way to put it is; The train driver burst out of control and rushes down the tracks. There are five people attached to the tracks by a crazy philosopher. But you can move the switch and then turn the wagon to the other track; however, there is one person attached. What should you do? How this problem is resolved will undoubtedly affect the public's approach to the idea of introducing autonomous vehicles in daily life.

How the issue is resolved can have a significant impact on the public acceptance of the concept of introducing autonomous vehicles.

A machine algorithm was created to track these kinds of questions; it is called the Moral Machine which collected responses from respondents regarding nine cases: whether an autonomous car should save people or animals, passengers or pedestrians, more or less lives, women or men, older or younger, poorer or richer, lawful or violating the law, and above all whether the car should take action or stay on the original course.



An Example Question Posed to Moral Machine Participants.
Moral Machine

For example, one question concerned a situation in which a car could either continue driving while killing three older pedestrians or save pedestrians by hitting the barrier, which would result in the death of three young passengers, which is seen in the image above.

Even if autonomous vehicles are universally accepted and implemented, the safest solution would be to implement them as soon as possible to eliminate conventional cars from use. However, this will not be easy, and this process may prolong significantly. Most vehicles on the road will continue to involve the driver for couple of years till these kind of vehicles become available. Some drivers are emotionally attached to their vehicles and will not be inclined to change, even if new models are much safer. Also if the governments of different countries were to try to impose an obligation to use autonomous vehicles, it is difficult to think that they will be supported and ban the use of conventional vehicles, even if this would result in a reduction in travel costs and a lot of other benefits. In any case, it will be necessary to consider making the process more globally than locally, which would allow the adverse effects of a prolonged process to be offset.

One of the toughest challenges for autonomous vehicles will be expectation to respond and operate the vehicles, led by a man, as compared to the response to the actions of other autonomous vehicles, due to the greater predictability and the ability to communicate with each other (T. Neumann,2017) The presence of the drivers on the road will also be the source of another problem, due to the likelihood of quickly learn to use behaviour of autonomous vehicles. These vehicles are designed to prioritise the safety of road users. People can take advantage of it and not give way and disregard the law, knowing that the vehicle will stop each time to avoid an accident.

This situation also affects the other side of the problem - drivers who will have difficulties predicting the behaviour of autonomous vehicles, which can, e.g., stop unexpectedly. Humans, when driving a vehicle, rely on a series of instructions that can be seen by observing the behaviour of other people on the road or sidewalk. The lack of signals from autonomous vehicles is a problem in a comprehensive assessment of the situation for people (drivers, cyclists and pedestrians). Autonomous vehicles would be much safer if they did not have to interact with human drivers. These difficulties are likely to significantly delay the date on which the advantages of autonomous vehicles can be fully exploited (T. Litman,2018). The development of autonomous vehicles can have detrimental effects on the automotive industry.

For many people, especially men, the pleasure of having a vehicle is closely linked to the experience of driving (T. Litman,2018). When this disappears, the expected decline in interest in vehicles will occur. People will pay less attention to vehicles, with the result that demand for private vehicles will fall. Vehicle economics will change dramatically; at present, 95% of private cars are not produced (J. and D. Bates Liebling, 2012).

In the future, these vehicles could be rented when the owner does not need them. Building private vehicles into becoming a part of the taxi system in society. This effect will be enhanced by the companies providing services in this regard with their fleet of autonomous vehicles. Anyone will be able to order, utilising an application, a stand-alone vehicle will arrive by themselves. Vehicles may also pick up and drop off other people travelling on similar routes during a single journey just like a carpool in Uber. These solutions will be much cheaper than owning a vehicle. This situation will have a negative impact on the automotive industry, significantly reducing the demand for products. It is also worth noting the aspect of the employment structure that would change as a result of the elimination of driving jobs. In the case of the fourth and fifth level autonomous vehicles, any activity of the driver (including his presence during the journey) is unnecessary, and therefore professions such as truck drivers, courier, taxi drivers, etc. they would have no place anymore. People trained in this direction would lose their jobs and be forced to transform and educate themselves for something completely new.

Summary

11

Roughly 43% of people will not want to part with driving, despite the distinct rational advantages of safety. Nevertheless, the transition will be relatively smooth because now, more modern vehicles contain reliable driver assistance.

Autonomous vehicle technology expands at rapid rates. Many vehicles and software manufacturers run advanced testing and research to create both an efficient and secure solution. However, many challenges remain as it is before the self-driving vehicles are in an excellent condition to be on the roads. If they are suitable and completed, the idea will enter a phase of implementation, transport and other areas of the economy will be subject to considerable changes. Introducing this type of technological innovation will help solve critical problems, such as road congestion and excessive emissions. However, the most important factor that this change may affect is the improvement of road safety and, as a result, the

reduction of deaths and injuries caused by accidents.
Although the implementation process has been successful, and it is necessary to develop detailed and considered implementation strategies. Autonomous vehicles should become the common good, supporting mobility and accessibility for all citizens, not just innovation aimed at increasing sales of private cars. Otherwise, automation can entail many adverse effects. In conclusion, autonomous vehicles can bring positive results impacts on UK transport. However, only when they meet all the requirements.

It is difficult, based on current knowledge, to answer the question of whether an autonomous car is completely safe. Technical solutions suggest “yes”, but on the other hand, the quantity and weight problems associated with the use of this type of vehicle leaves a shadow of a doubt. If we can solve all issues, whether the car will remain a stand-alone only technologically advanced product without the use of mass - the future will tell.

The design question has changed to **“How might we utilise design and the ethics around automation to change the perceptions of people to encourage them to own an automated vehicle?”.**

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Fig.1 https://www.omegawatches.com/media/catalog/category/header_image_1600x400_ndg_v2.jpg (Accessed on 21/02/2020)