Steering the Autonomous Car in the right direction

Why autonomous vehicles could be a disaster for our cities – and what we should be doing to avoid a gridlock scenario

A report by the University of Amsterdam & shareNL

EXECUTIVE SUMMARY

Access to clean, safe and affordable automotive transportation is essential to the effective functioning of our societies and our economies. However, despite improvements to vehicle powertrains over recent decades, road transport accounts for approximately 17% of energy-related carbon dioxide emissions globally and is the main cause of air pollution in our cities. Based on current projections, emissions from the automotive sector will rise dramatically over the coming years as urbanization increases and global demand for transportation rises. At the same time, congestion is on the rise, hampering the proper functioning of local communities, disrupting national and international trade networks, and degrading local air quality.

Fortunately, the automotive industry is on the verge of a revolution that has the *potential* to transform not only what and how we drive, but also to radically reduce both automotive emissions and congestion. The coming revolution is defined by three key trends. First, the availability of high-performance electric vehicles, which are an increasingly attractive and financially viable alternative to traditional powertrains. Second, the development of autonomous vehicles, which is predicted to offer a fully autonomous and 'digitally' connected' driving experience by 2030. Third, it is predicted that mobility will be shared. To date, most commentators assume that these trends will lead to the decline of private car ownership and to the widespread adoption of electric, shared autonomous vehicle services somewhere in the next decade. Furthermore, it is assumed that the coming transportation revolution will be a win-win-win solution for all stakeholders: emissions will fall, air quality and public space in our cities will improve and we will all spend less time in traffic jams.

Following an extensive review of the most recent literature, it is our view that an affordable, sustainable mobility paradigm is far from inevitable – even with the arrival of autonomous vehicles. Whilst the electrification of cars will go a long way towards lowering automotive emissions and improving urban air quality, the reality is that unless we also change *how* we consume our cars, congestion will surge – not fall – with the arrival of autonomous vehicles. Indeed, with the arrival of full or 'Level 5' autonomy, we expect personal mileage to soar due to reductions in automotive travel costs, the enhanced ability to use our cars for work or leisure purposes, and the creation of new mobility markets among the young, the elderly and people with health conditions or impairments. In addition, driverless cars

will compete directly with public transportation systems and possibly even with retail real-estate, drawing yet more people onto our roads. While autonomous vehicles will offer some efficiency gains from technologies such as platooning and smaller vehicles on the long run, these gains will be insufficient to cancel out increases in demand for automotive mobility services and could put our cities at risk of gridlock as personal miles travelled by car will soar.

To address the linked challenges of automotive-related carbon dioxide emissions, poor air quality and urban congestion, we must make a shift not only in the types of vehicles we use, but also – more importantly – *how* we use our vehicles. This means for one that we need get used to swapping car travel for more sustainable modes, such as public transport, walking, cycling and other 'active modes' or even choosing not to travel sometimes. Secondly, today, the largest source of congestion on our streets is the low occupancy rates of our vehicles. Studies have shown that widespread adoption of pooled rides could reduce the number of cars on the road by a factor of two-third or even more and significantly cut emissions, even without the availability of autonomous vehicles or cleaner powertrain technologies. However, increasing adoption rates of pooled rides will not be easy. Research shows that consumers simply do not like the idea of sharing their rides, even if this has little impact on their travel time and includes a door-to-door pickup service. In fact, technologies that allow for efficient ride-sharing already exist (e.g. BlaBlaCar, UberPool and Lyft Lines), yet uptake of these services is limited, with few signs of significant growth on the horizon. In this context, it is our view that, unless we tackle our collective reluctance to share our cars (e.g., via implementing positive regulatory incentives, and ensuring the effective and regular servicing of shared vehicles), autonomous vehicles will fail to bring about a sustainable mobility revolution.

THE CASE FOR A SUSTAINABLE, GLOBAL MOBILITY REVOLUTION

In December 2015, the global community adopted the Paris Agreement on climate change, with the aim of limiting world temperature rises to between 1.5 and 2 degrees Celsius. Achieving this ambitious goal will require a cross-sector effort, including from the automotive industry.

Despite improvements in vehicle efficiencies over past decades, the automotive industry is responsible for almost a quarter of the EU's total emissions of carbon dioxide (CO_2). Transport is also the only major sector within the EU in which greenhouse gas (GhG) emissions are still rising[1]. Furthermore, road transport is a major cause of particulate matter, nitrogen dioxide (NO_2) and ground-level ozone: the three pollutants that significantly harm our health. Indeed, 90% of European city dwellers are already exposed to concentrations of these pollutants that exceed the safety guidelines set by the Wold Health Organization. Moreover, the on-going process of urbanization, especially in our capital cities, will cause the air quality of our cities to degrade further as demand for road transportation increases. According to recent Eurostat[2] projections, the trend towards urbanization will continue until 2050, by which time an additional 24.1 million people will have migrated to urban areas within the EU. Urban population growth will also lead to increasing congestion[3]. Congestion within the EU is predominantly located in urban areas and already costs nearly €100 billion or 1% of GDP[4]. Based on current trends, the EU predicts that, by 2050, congestion costs will continue to rise by an additional 50%[5].

In this context, it is clear that, in order to create a sustainable mobility paradigm, we need to tackle not only car automotive greenhouse gas emissions, but also seek smart solutions to combat rising congestion trends, which are not only negatively impacting our economies, but are also our harming our health and our quality of life. Current measures to combat congestion – such as building more roads and trying to steer people towards public transportation – are simply not working[6].

TOWARDS A 'THIRD TRANSPORTATION REVOLUTION'?

The good news is that we are on the brink of what has been called a 'Third Transportation Revolution'[7]
The coming revolution is defined by three key trends. First, automation and electrification, which will likely go hand in hand. Autonomous vehicles have the ability to recharge themselves and long driving ranges eliminate the main barriers to electric uptake. Low maintenance, insurance and operation costs will make high-performance electric vehicles an increasingly attractive and financially viable alternative to traditional powertrains[8].

Secondly, these electric and autonomous vehicles will be 'digitally connected'. Once vehicles become smarter and start communicating and coordinating with one another, congestion is

More or less distance between? The Google car example

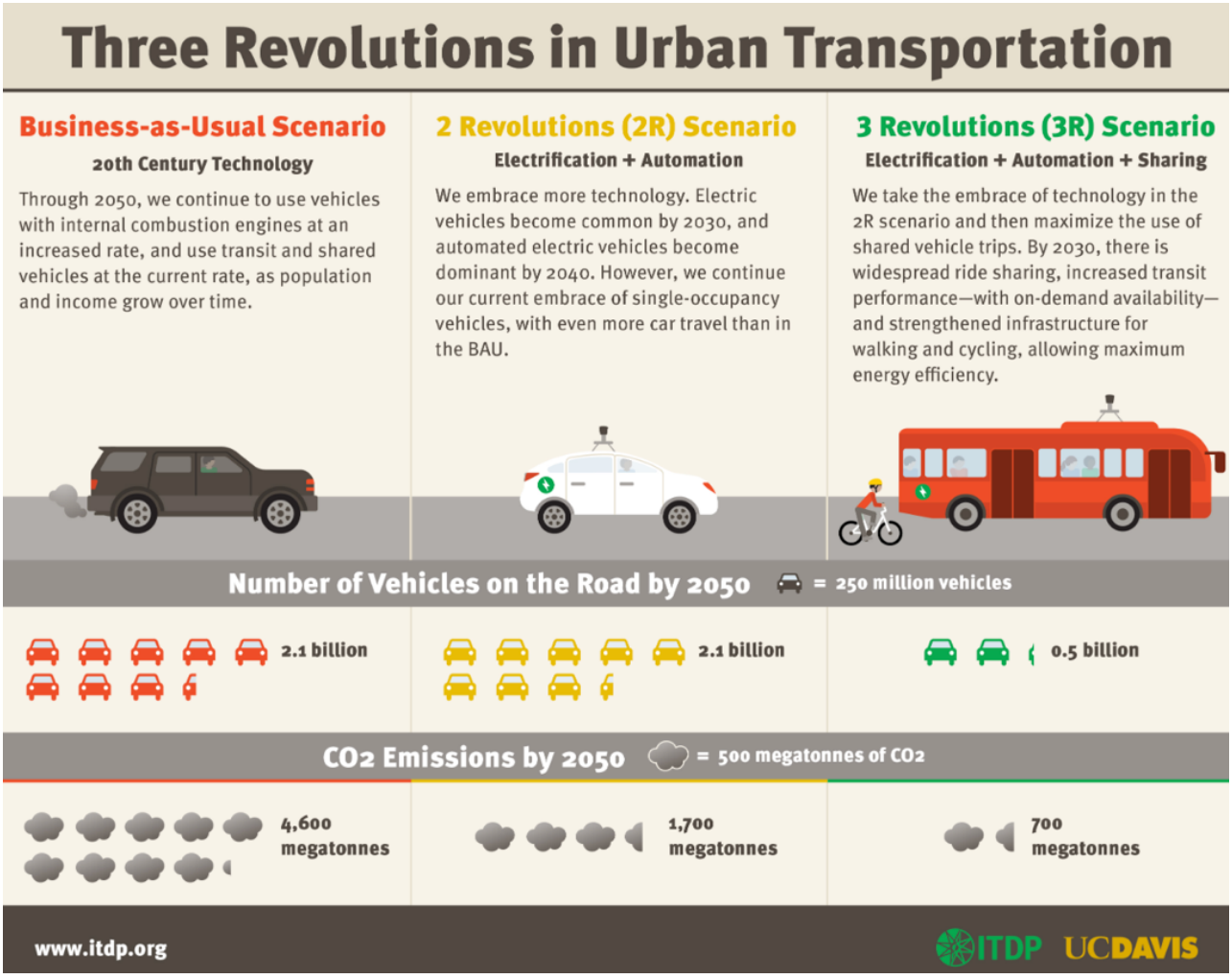
We should be careful to assume that automation and vehicle-to-vehicle communication go hand in hand and that travel efficiency benefits will automatically amass from driverless vehicles. Google's driverless cars show the error in this thinking. These cars operate independently from other vehicles, but to ensure the driver's safety, they take more (rather than less) distance between other cars than a human driver would, and require 2 to 3 seconds headway (versus 1 second of a human driver) thus adding to congestion, rather than solving it (TNO, 2015).

1 European Parliament, 2017
2 Eurostat 2017
3 EPRS, 2014
4 European Commission, Mobility and Transport, 2017
5 EU whitepaper, 2011
6 ITDP and UC Davis, 2017
7 John Zimmer, Lyft on Medium 2016
8 RethinkX, 2017

expected to decrease as traffic flow efficiencies improve the space required between vehicles decreases[9]. This could eliminate the 'accordion effect', a phenomenon in which slow driver reaction times lead to a ripple effect, causing traffic further down the line to reach a complete standstill[10]. Moreover, vehicle-to-vehicle communication will even make 'platooning' possible, a practice in which multiple cars follow each other closely, reducing the aerodynamic drag of all vehicles in a given platoon. This is not only good news from a societal perspective; it allows our road capacity to improve up to 80% once we have transitioned to a smart fleet[11], it will also bring environmental savings.

Perhaps the most welcome feat of connected cars will be the increased road safety. 90% of accidents are caused by human error. Smart technologies in turn, will also result in a reduction in accidents and collisions. Although a recent fatality with a self-driving vehicle in Phoenix, is fuelling fierce discussions about the ethics of these cars and about which price we are willing to pay to increase safety. Lastly, 'eco-driving' algorithms, programmed into autonomous vehicles, will enable us to drive more efficiently (i.e., by accelerating more gradually and shifting gears more efficiently). Indeed, according to the latest estimates, each measure will result in 5 to 20% fuel energy savings.

The third key trend is that automation will lead to the decline of private car ownership and the widespread adoption of shared autonomous vehicle services somewhere in the next decade[12]. If



9 European Commission, 2016; TNO, 2015
10 Lizbetin and Burtuska, 2017
11 ENO, 2013
12 rethink, 2017 and others

the revolution goes hand in hand with pooled rides the environmental and societal benefits will be greatest and congestion and environmental problems will be resolved in tandem[13].

In short, the coming transportation revolution can be a win-win-win solution for all stakeholders: emissions will fall, air quality in our cities will improve and we will all spend less time in traffic jams. But only once all three trends are established.

WHY SUSTAINABLE MOBILITY IS WITHIN REACH

Following a review of the latest research, it is increasingly clear that the creation of a sustainable global mobility system envisaged as part of a 'Third Transportation Revolution' and triggered by the arrival of electric, self-driving cars is far from inevitable. Indeed, many of the environmental and societal benefits that driverless vehicles promise could fail to materialize due to 'rebound effects in demand', which could cause personal miles travelled to soar even if we do away with personal car ownership[14].

For example, we already know that car mileage in New York City has skyrocketed since the introduction of ride-hailing apps such as Uber and Lyft, thanks to the convenience and ease of ride-hailing services, the number of rides tripled in New York City between 2015 and 2016[15]. In that same year, usage of the New York subway hit an all-time low, indicating that people who formerly took the subway are now opting for ride-hailing options instead. Already, the increased use of ride hailing has resulted an extra 600 million driven miles in New York City and an overall 7% increase congestion[16]. Similar results were concluded in a recent Boston study[17] and in other US cities.

Some caution with conclusions is needed. First, it is important to realise that the dynamics of a city vary and therefore effects of ride hailing will vary too. Several studies show that ride hailing can be complimentary to public transport and that it works well at night when public transport options are not available, or driving is not an option as alcohol is in play. Furthermore, ride hailing is a crucial part of the mix in cities where public transport is missing or bad.

Furthermore, once we take drivers out of the equation (a development which will likely occur somewhere in the next decade), the cost per ride will drop significantly[18]. These cost savings will eventually be passed along to passengers, reducing ride-hailing prices by a factor of three and making driverless vehicles more competitive than taking the bus[19]. Current predictions by BCG (2017) estimate that, as a result of falling costs, in Chicago, 20% of miles could shift from public transport miles to autonomous vehicle mobility services offering a convenient 'door-to-door' service. Similar predictions have been made in the city of Amsterdam. A survey held amongst 489 citizens of Amsterdam found that approximately 50% of train travellers would we be willing to switch to a self-driving vehicle. The survey also found that, among respondents that travelled to work by bicycle, 30% would be willing to switch to self-driving vehicles[20]. On a similar note, a recent study by Ford found that 39% of bus, train and taxi users choose this mode of transportation because driving is getting in the way for these travellers; they want to multi-task. Since driverless vehicles will allow travellers to do exactly that, only in more comfort, current

13 ITDP and UC Davis, 2017
14 KPMG, 2016 "the clockwise dilemma"
15 MIT, 2017
16 Schellar, 2017
17 Metropolitan Area Planning Council, 2018 https://www.mapc.org/farechoices/
18 RethinkX, 2017
19 Wilson, 2017
20 BCG, 2016

estimates regarding the impact of driverless vehicles on public transportation are, in all likelihood, too conservative[21].

Autonomous driving cars will also create new markets for segments of our society that currently have poor access to automotive transportation: the young, the elderly and people with health conditions or impairment. Young people, for example, will likely take the opportunity to have autonomous vehicles drive them to meet their friends, go to football practice, music lessons and countless other activities for which they now rely on their parents[22]. Parents also approve: focus groups held by KPMG shows that 82% of interviewees would want such mobility options for their children, assuming safety concerns were addressed. Older people, as well as those with health conditions that make it difficult or impossible to drive today, will also likely be early adopters of autonomous vehicles. Taken together, current estimates suggest that these new market segments could be responsible for an additional 1 trillion more miles on the road in the USA alone by 2050, an approximate 20-25% increase on current miles travelled.

Mobility demands are also likely to rise for existing drivers. Quantitative research by BCG (2016) among 5,500 people across 27 cities in 10 countries found that global consumer acceptance of partially self-driving cars is already very high, at 69%. Once privately-owned driverless cars become more comfortable (i.e., become mobile offices or include home theatre systems) and people no longer mind sitting in their cars for longer periods of time, the time we spend in our cars is likely to increase, as will the associated mileage. Dutch research from July 2018 confirms an expected lower Value of Time (monetary value per hour of travel time) and increased VMT for all scenarios of autonomous vehicles[23]. Indeed, consumers are quick to identify advantages of self-driving vehicles, including the ability to work or relax while in the car and to send cars on errands[24]. Indeed, if we begin to send their cars on errands empty, and the occupancy rate per vehicle on average drops below one person, the potential impact on miles travelled would be dramatic. A study by KPMG (2016) suggests than an increase in miles driven by 3 to 4 trillion by 2050 in the United States alone, is not 'outside the scope of possibility'. US citizens are already driving more than ever before with 3.22 trillion miles travelled in 2016[25]. According to KPMG predictions the arrival of autonomous vehicles could potentially more than double the miles that are being driven in the US today.

In the above scenario's, one is not yet included. It's the vision that our streets could be flooded with RATS[26]; Retail Autonomous Trips, as Zipcar founder Robin Chase calls them. This scenario builds on the enormous flight deliveries have taken, which would be spurred even more with the arrival of autonomous cars. Furthermore, one could also imagine that operating a retail business entirely from a moving vehicle, rather than from expensive real estate would encourage many entrepreneurs to offer their products or services 'on the road'.

Ride-hailing or ride-sharing?

'Ride-hailing' and 'ride-sharing' services are not synonymous and should not be confused with one-another.

Ride-hailing refers to any app-based system which we use to book a ride from a Taxi such as Uber, Lyft and Didi. Only if these rides are shared car we speak of ride sharing (or pooled rides, trip sharing or shared mobility).

Ride sharing refers to rides in which we share a trip with more than one individual that all pay separately, such as BlaBlaCar or ride together for free, like carpooling between colleagues.

If ride-hailing services such as Uber, Lyft and Didi dominate our mode of transportation, without the majority of people actually sharing this ride, this will not reduce the number of vehicles on the road at any given time compared to a scenario in which the majority of cars are still privately owned.

21 Wilson, 2017
22 KPMG, 2016 "the clockwise dilemma"
23 TNO, Arcadis, Impactstudy autonomous vehicles, 2018
24 BCG, 2016
25 NPR, 2017
26 Observer, 2016 https://observer.com/2016/11/self-driving-cars-robin-chase-veniam-zipcar-the-next-web/

Given these demand drivers, it seems safe to conclude that, once autonomous vehicles hit the market, rebound effects associated with an increased demand for automotive mobility services will be much greater than most commentators are predicting today. Following this logic, the introduction of autonomous vehicles to the market without any further measures will cause congestion in our cities to surge.

WE DON'T LIKE TO SHARE

Many commentators assume that congestion issues will, however, be addressed by a dramatic decrease in car ownership and an increase in ride-sharing once the arrival of the autonomous vehicle is a fact, which would allow the number of miles travelled to increase without significantly impacting the overall number of cars currently on the road.

According to some estimates, by 2027 a stunning 95% of all miles travelled will be provided by 'mobility-as-a-service' (MaaS) platform providers[27]. The common argument is as follows: the economic logic of accessing mobility through ride-sharing will be so compelling – up to 10 times cheaper than operating and owning your own car[28] – that that we will, *en masse*, ditch our private cars in favour of cheap, shared rides provided by MaaS providers, cutting congestion and improving traffic flows. According to RethinkX, a think tank, "behavioural issues such as love of driving, fear of strangers or habit" will not pose significant barriers to consumer uptake.

However, the fact is that, to date – unlike ride hailing -, ride sharing is not a practice that has high approval ratings among consumers. A recent study by BCG and the World Economic Forum (2016) found that consumer feelings regarding ride sharing are far less positive than about autonomous vehicles. Only 37% of people indicated a willingness to share a ride in a self-driving vehicle with a stranger. This percentage dropped to 33% for women. Resistance to ride sharing was especially high in Europe (France, Germany and the UK), with a willingness to share rides only rising above 50% when cost discounts rise to 75%. The message is clear: we don't – yet – like driving in cars with people we don't know: we find it uncomfortable and intimidating and often don't feel safe[29]. This is borne out by current experience in locations where ride sharing is already widely available. For example, according to a recent study by MIT[30] in New York City, if the local population embraced ride sharing, the number of cars on the road could be reduced by a factor of two third, without significantly impacting travel time. According to other studies, reductions achieved through ride sharing could even get as high as 97% of cars[31]. And this stunning result would be already achieved by increasing the average occupancy rate from 1.2 to anything between 2.0 - 2.6. When Uber first announced the introduction of UberPool in New York city they had one goal in mind: by pooling rides we will take 1 million cars off the road[32]. In most instances, New Yorkers opt for the comfort of Uber rather than the discomfort of a "cheaper" UberPool ride. As a result, ride-hailing companies have not help eliminate the city's congestion problem but rather added to congestion on the already crawling roads[33]. And if autonomous rides will indeed become 10 times cheaper than a ride today, as mentioned before, price reduction will be even less of an incentive to choose a shared ride over a private ride.

Viewed in this context, it is increasingly clear that the barriers to getting people to share rides are not financial or technological: they are behavioural and they will not be magically removed by the arrival of autonomous vehicles. Furthermore, if we have access to cheap, autonomous ride-

27 RethinkX 2017
28 RethinkX, 2017
29 Carma research, 2015
30 MIT, 2017
31 Universität Stuttgart, 2016 MEGAFON, ITF-OECD, 2016
32 Schellar, 2017
33 Schellar, 2017

sharing services in which we are likely to still opt to ride solo, usage of public transport will decline and the number of cars on the road during peak times will go up not down[34].

RECOMMENDATIONS

Clearly, if autonomous vehicles are to have a positive impact on urban living, we must make a shift in *how* we use our vehicles and rethink the role of the automobile in a broader sense. Ride sharing and integrated mobility solutions must be part of the equation[35]. The real question is what policymakers and other automotive industry stakeholders should be doing to ensure that the arrival of the autonomous vehicle is steered in the right direction:

1. **A draft regulatory code of practice aimed at stimulating ride sharing**
Whether at a city, national or European level, regulators have a key role to play in stimulating shared mobility and making it the preferred option for automotive travel, particularly in densely populated urban areas. There are clear opportunities for ride sharing complementing public transport in both in offering a 24/7 solution as well as covering underserved areas. For example, collaboration between Carma, a real time carpooling app, and the Central Texas Regional Mobility Authority, offered residents of Austin toll discounts of 50% if two passengers were present in a given vehicle. A 100% rebate was awarded for vehicles carrying three passengers or more[36]. Similarly, cars containing multiple occupants could be allowed access to bus or tram lanes, or even dedicated shared mobility lanes. To bring together the best practices that are beginning to be developed in a number of cities to increase vehicle occupancy rates and cut congestion, a draft regulatory code of practice aimed at stimulating shared mobility should be developed and shared with all relevant stakeholders.

2. **Pricing models aimed at stimulating ride sharing**
Road pricing practises have shown to be effective in increasing occupancy rates in various cities. Attractive pricing of pooled rides will make more passengers inclined to choose a shared over a private ride. Another option would be to use smart road pricing or taxing as opposed to flat taxing, with a focus on making high occupancy more attractive.

3. **Make shared mobility part of the (urban) transportation master plan**
Shared mobility is not a development on its own. The smartest way to travel is to be able to vary and combine modes depending on the destination, day, hour, weather conditions, personal preferences and more. Mobility-as-a-Service aims at offer just that, making the 'package of alternatives' compete with car ownership. To maximize the public benefits of the third public transportation revolution we need to prevent autonomous vehicles will compete with public transportation. Where it may be a valid and flexible alternative to largely empty bus lines, high capacity public transport remains 'the only solution able to fulfil the lion's share of trips by using a minimum amount of space in dense urban environments' according to the International Association of Public Transport[37]. At a more local city level, policy makers are experimenting with how they can ensure that public transport can seamlessly integrate with driverless technologies rather than becoming out-dated and redundant with their arrival. Cities are already rolling out apps to make intermodular transportation (i.e. commutes that involve two or more modes of transportation) a lot easier. Vienna launched a mobility app called "WienMobil" that provides consumers not only with real time data regarding bus, tram and metro services but also to taxis, city bikes, car sharing, car rental and parking. Furthermore, tickets, taxi fares and cars can also be booked and paid for through the

34 ITDP and Davis, 2017, p. 13; BCG and WEF, 2016
35 BCG, WEF, 2016
36 Viechnicki et al., 2015
37 UITP, 2017

app. According to the Economist (2016) 'combining old and new ways of getting around' will be transformative for transport and cities. Additionally, Mobility-as-a-Service platforms could play a key role in incentivising sustainable choices.

4. **Partner and pilot**

Reinventing urban mobility for the age of autonomy and achieving the goals and hopes of the Third Transportation Revolution is not something any one company, individual or government can achieve alone. Public-private partnerships and multi-stakeholder platforms, in which automakers, tech companies, fleet management companies and public agencies come together to co-design and test solutions, will be the best way forward. Some positive initiatives are already underway all around the world. However, as needs, expectations and norms regarding automotive travel will necessarily differ from country to country (and even between different cities in the same country), additional pilots involving the full range of stakeholders will be required.

5. **A service infrastructure for autonomous vehicles to enhance the end of private car ownership**

To date, much of the attention regarding autonomous vehicles has – unsurprisingly – focused on the cars themselves. However, the availability, robustness and reliability of the autonomous Mobility-as-a-Service (MaaS) network will be determined not just by the cars themselves but by the quality of the fleets, streets and broader ecosystems in which they will operate. In this context, having an effective service infrastructure in place will be a necessary pre-condition for people to make the shift from having their own private car to using ride-sharing services: no one wants to travel in a car that's dirty, been vandalized or is potentially unsafe. Proper and regular servicing could mitigate the potential downsides of sharing a ride and increase the potential upsides (e.g., the availability of refreshments or the latest entertainment services, for example). Planning an effective service infrastructure for autonomous vehicles should therefore go hand-in-hand with the technological development of self-driving vehicles.

CONCLUSION

To address the linked challenges of automotive-related carbon dioxide emissions, poor air quality and urban congestion, we must make a shift not only in the types of vehicles we use, but also – more importantly – *how* we use our vehicles. Today, the largest source of congestion on our streets is the low occupancy rates of our vehicles. Studies have shown that widespread adoption of ridesharing could reduce the number of cars on the road by a factor of three and significantly cut emissions, even without the widespread availability of autonomous vehicles or cleaner powertrain technologies. However, research shows that consumers simply do not like the idea of sharing their rides, even if this has little impact on their travel time and includes a door-to-door pickup service. In fact, technologies that allow for efficient ride-sharing already exist, yet uptake of these services is limited, with few signs of significant growth on the horizon. In this context, it is our view that, unless we tackle our collective reluctance to share our cars (e.g., via, implementing positive regulatory incentives, and ensuring the effective and regular servicing of shared vehicles), autonomous vehicles will fail to bring about a sustainable mobility revolution.

SOURCES

- Andrew Anthony (2015) "UberPool: 'Why at peak time in London does no one want to share a cab – or at least with me?'"
- BCG (2016) "self-driving vehicles, robo-taxis, and the urban mobility revolution"
- BCG (2016) "impactanalyse zelfrijdende voertuigen"
- BCG (2017) "By 2030, 25% of Miles Driven in US Could Be in Shared Self-Driving Electric Cars"
- David Schaper (2017) "Record number of miles driven in US last year"
- EPRS (2014) "urban mobility: shifting towards sustainable transport systems"
- EU (2016) "the automotive industry on the brink of a new paradigm?" (information report)
- EU (2017) "road transport: reducing CO2 emissions from vehicles"
- European Commission, mobility and transport (2017?) "urban mobility"
- European Commission (2016) "a European strategy on cooperative intelligent transport systems, a milestone towards cooperative, connected and automated mobility"
- European Commission (2016) "reducing co2 emissions from passenger cars"
- European Environment Agency (Jan, 2017) "Air Pollution"
- European Parliament (march, 2017) "towards low-emission EU mobility"
- Eurostate (May, 2017) "urban Europe: statistics on cities, towns and suburbs – patterns of urban and city development"
- Evening Standard (2016) "revealed: how average speed of london traffic has plummeted to just 7.8mph"
- Fernandes & Nunes (2012) "platooning with ivc-enabled autonomous vehicles: strategies to mitigate communication delays, improve safety and traffic flow. ieee transactions on intelligent transportation systems"
- Javier Alonso-Mora, Samitha Samaranayake, Alex Wallar, Emilio Frazzoli, and Daniela Rus (2017) "On-demand high-capacity ride-sharing via dynamic trip-vehicle assignment"
- Jason Koebler (2016) "Why everyone hates UberPool"
- KPMG (2016) "automakers confront the clockspeed dilemma"
- Lambert (2017) "BMW announces production expansion for its umpcoming electric vehivles"
- Lizbetin & Bartuska (2017) "the influence of human factor on congestion formation on urban roads"
- Münzel, Boon, Blomme & van der Linden (2017) "Explaining carsharing diffusiona across Western European Cities"
- OECD (2015) "urban mobility systems upgrade: how shared self-driving cars could change city traffic"
- OECD (2016) "shared mobility: innovation for liveable cities"
- Psychology Today (2015) "how to stress less in a traffic jam"
- Rawn Shah (2016) "Driving ridesharing success at BlaBlaCar with online community"
- Reuters Staff(2017) "Volvo cars to stop developing new diesel engines"
- Stofberg et al (2017a) "Academy of management proceedings conference"
- Stofberg et al (2017b) "Strategic management Society Conference"
- TNO (2016) "truck platooning driving the future of transportation"
- UC Davis (2017) "Three revolutions in urban transportation"
- University of Bern (2015) "Particulate matter from modern gasoline engines damages our lungs"
- Vichniki, p. abhijit khuperkar, tiffany dovey fishman, william d. eggers (2015) "smart mobility: reducing congestion and fostering faster, greener, and cheaper transportation options"
- Wilson (2017) "WWDC2017: the ultimate tes of voice interfaces"
- Zia Wadud, Don Mackenzie and Paul Leiby (2016) "help or hindrance? the travel, energy and carbon impacts of highly automated vehicles"

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