Changing the pattern of mobility: another digital battle

by

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Overview

Will the autonomous car of the future look anything like the way in which it is portrayed in science fiction films, namely a very comfortable sitting room or a mobile office, speeding along roads in complete safety? Some people thought this would be the case, but others, such as Google and Uber, are now imagining that it will be different. Abandoning the dream of a universal, driverless vehicle, they are working on less spectacular versions, but ones whose numerous advantages could hasten their implementation. The emergence of private or collective driverless robot taxis (also known as Personal Rapid Transit or podcars), limited to strictly defined environments, would be an ideal solution in cities which are saturated with passenger cars. These robot taxis would reduce problems (such as pollution and noise), lower the number of accidents, ease traffic flow, and encourage intermodal networks. Consequently, alongside already well-advanced technical solutions, the ability of politicians to reconsider urban space and mobility in a different way will play a key role in this radical transformation.

Report by Pascal Lefebvre • Translation by Rachel Marlin

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The city is the ultimate mobility ecosystem into which all innovations must blend. My experience in the car industry has allowed me to follow what Uber has accomplished over the past seven years, and observe Google which has been working on the driverless car since 2009.

In this context, three crucial factors must be considered in order to understand the way in which mobility is changing. The first is based on growing demands of clients or users who want more practicality and ease of use, an instantaneous 24/7 service using mobile telephones, instant identification on the app due to previous transactions, and an adapted and cheap service. This is undoubtedly the most important factor which prompted the emergence of Uber. The second factor is related to environmental concerns on a local (particles, nitrogen dioxide) and planetary (carbon dioxide) level. The third and final factor is the realisation that saturation points or even crises can exist in urban vehicle circulation. These three crucial factors have finally been taken into consideration because of the convergence of a group of technologies which have been assembled together, thereby initiating profound change. And this is just the beginning...

The change has started

A great deal of the available data comes from the United States, and New York in particular, where the city authorities have to be notified of all taxi, Uber or similar rides. This is currently the best collection of data on this subject and is therefore the source which I have used for my analysis.

From January 2015 to January 2018, the number of taxi rides in New York almost doubled. However, whereas Uber and Lyft (Uber's main rival) grew very quickly, taxis lost ground to the point of accounting for less than 40% of all rides. Uber and Lyft operate within destinations which are very badly served by New York's traditional yellow taxi cabs (ie. the other New York boroughs apart from Manhattan), and this fact accounts for an increase of 300% in rides during the period studied in the borough of Brooklyn, for example. The result is that there is an abundance of vehicles in New York – between 100,000 and 150,000 – if one also includes 'black cars' (taxi cabs which cannot be hailed on the street, but which are dispatched).

Uber realised that the taxi service no longer corresponded to customers' new demands, and that the technology associated with a new business model would enable things to function differently. The client of an Uber 'on demand' ride now receives a reply in a matter of seconds. The ride price is shown; the client can see the geographical position of the driver on his mobile telephone screen as his car approaches the client's location; the service is transparent and practical (payment is by credit card and includes the tip; an invoice is sent by email; there are monthly statements); and one can leave a comment about the service in two clicks. The cost may even be less if one shares the car with someone else (using the 'uberPOOL' and 'Express POOL' app services). Uber now has 2.5 million drivers throughout the world and operates 3 billion rides every year. Its Chinese rival Didi Chuxing has 7.4 billion rides.

Two studies were carried out at the end of 2016 by UC Davis (University of California at Davis) and the National Household Travel Survey (NHTS). UC Davis' study, which uses data from seven cities and 70 million inhabitants, shows that in the main metropolitan areas of the United States, 5% of people use Uber or Lyft at least once a week. The NHTS study, based on 70 million inhabitants of cities with populations of more than 1 million inhabitants which have full public transportation systems (trains, buses, underground, ferries), shows that taxis and chauffeured vehicles together accounted for nearly 2% of motorised journeys compared to 9.4% for public transport. This is not very much, but the underlying phenomenon is no longer marginal and is growing fast.

Driverless cars

A few years ago, Daimler was the pioneer of the driverless car before it abandoned this project and decided just to monitor technological development instead. The true trailblazer was Google. Google began its research in 2009, and by 2012 its prototypes were already driving on the roads around Palo Alto alongside pedestrians, lorries and cyclists, and were as successful or more so than its rivals today. In 2015, Google went one step further by launching its driverless Google Car in Silicon Valley, Austin (Texas) and Phoenix (Arizona). Rare problems occurred when passenger cars went into the back of them as the Google Car drove sometimes too carefully.

In 2016, Google created a specialised subsidiary, Waymo, and launched the 'Early Riders' programme in Phoenix, based on 'real' users, in other words, vehicles driving on public roads without drivers. Waymo has just signed a deal with Jaguar which will supply them with 20,000 electric 'I-Pace' cars, and more recently with Fiat-Chrysler for 62,000 minivans, all intended for the commercial market by the end of 2018.

The fact that Waymo chose Jaguar shows that price was clearly not the deciding factor, but that Waymo were looking for an innovative (electric) car with advanced electronics (developed with Altran). In 2017, Uber chose the manufacturer Volvo, and ordered 24,000 XC90 cars, and stated explicitly that their choice of Volvo had been dictated by the car's superior electronics. In 2012, Tesla was the first car manufacturer to create a radically different electronic architecture which enables continual 'over-the-air' software updates which do not require the vehicle to go back to the garage (these are similar to continual updates which are available on mobile telephones). To date, very few other manufacturers have achieved this, and it is a remarkably rare fact that such a fundamental innovation is taking so much time to be implemented throughout the car sector.

While its rivals were still hesitating, Waymo continued its road tests, simulating 3.8 billion kilometres from data obtained during 8 million kilometres driven on public roads. Therefore, they were able to recreate a variety of driving situations which they used to 'educate' their system with 'machine learning' techniques (where computer systems can 'learn', i.e. improve performance on a task with data without being programmed), a sector in which they are one of the world leaders, if not 'the' world leader.

On the manufacturing side, progress started only in 2013, when Mercedes and Nissan announced, almost simultaneously that they were making driverless cars. Nissan intends to market driverless cars in 2020. As for Mercedes, there is no fixed date, however the company demonstrated its know-how by reproducing with its driverless car the famous 108-kilometre run made in 1888 by Bertha Benz, an exploit which at the time contributed to the reputation of the brand. Volvo announced a pilot manufacturing project of about one hundred driverless vehicles in Gothenburg. General Motors has announced that it will be ready in 2019, and now everyone else is following suit.

In January 2015, at the Las Vegas Consumer Electronic Show (CES), Dieter Zetsche, Daimler's CEO, announced, with respect to Mercedes, that 'the car is growing beyond its role as a mere means of transport and will ultimately become a mobile living space.' He followed the line of thought that changes in the automobile industry begin as usual in the luxury sector before moving on to other sectors.

Most of the time, manufacturers refer to a six-level driving automation classification system ranging from 0 (no automation) to 5 (full automation without a driver in all circumstances). Today, driving equipment exists to reach level 1 ('hands on' driver assistance, where the driver and the automated system share control of the vehicle) or level 2 ('hands off' partial assistance where the automated system takes full control, but the driver must be prepared to intervene). Some manufacturers now offer level 3 ('eyes off' conditional assistance where the driver should be ready to intervene if necessary). All manufacturers' efforts are being focussed on levels 3 and 4 ('mind off' high automation where the vehicle is completely autonomous in predefined circumstances, for example on a motorway or during valet parking when the car can park itself).

While Dieter Zetsche was talking in Las Vegas, Uber was recruiting half of the researchers from the best American robotic laboratory, Carnegie Mellon in Pittsburgh, making it very clear that Uber was in the race for production of the driverless car. This was a surprising decision. Until then, Uber was not considered to be a potential competitor, but it did open the way for an approach which was very different to Mercedes' approach by targeting directly vehicle automation level 5 ('full automation', the driverless car) which was confined to well-defined urban environments. Uber showed everyone that its 'on demand' mobility solution could become much less expensive and could revolutionise urban mobility. Uber's fatal crash involving its self-driving vehicle in March 2018 showed that they are a long way from reaching Google's technical expertise.

The reaction from manufacturers quickly followed, and led to a radical change of direction in the industry. First to react was BMW which, in July 2016 and in collaboration with Intel and Mobileye, announced the large-scale production of completely driverless vehicles from 2021, not only as private cars for motorway travel, but also as vehicles intended to operate 'ride shares' (shared rides in urban environments). The entire automobile sector reacted to this announcement, demonstrating that the industry had understood what was at stake and that the first driverless vehicles which we will see are most likely to be robot taxis.

Due to a reduction in costs linked to drivers' wages, and despite the extra costs because of technology, it is likely there will be a massive increase in the number of these robot taxis. New York may increase the number from 100,000 or 150,000 to 300,000 or even 500,000 robot taxis in the near future.

The vision of a revolution

To make the rest of my talk more understandable, I should explain certain words and expressions, most of which are in English.

The first concept is 'ride-hailing' which is what Uber is known for today. 'Car-sharing' covers the activities of Autolib' or Car2go in France. 'Peer to peer (P2P) car-sharing' is when car owners convert their personal cars temporarily into shared cars – with other users. 'Ride-sharing' is the equivalent service of the French app 'uberPOOL' and, in this case, the ride's price is shared between two or more passengers who have booked their ride using the same platform. Finally, 'P2P ride-sharing' is similar to the French BlaBlaCar or Drivy in an urban setting. All of these services are grouped together under the umbrella term 'Mobility as a Service (MaaS)'. In French, this is referred to as 'transport on demand', 'car-sharing' or 'car-sharing rides'. This is not to be confused with a 'car-pool' which is when work colleagues share a car to drive to work (P2P), and uberPOOL when a company optimises rides between passengers who do not know each other and takes the responsibility to group them into the same vehicle with a chauffeur, using a digital platform.

Robot taxis are vehicles with eight seats or less (a vehicle with more seats is called a robot bus). These driverless electric vehicles, in conjunction with ride-hailing and ride-sharing on a large scale, could make urban and suburban mobility easier, more comfortable, less expensive and could considerably transform urban areas.

Simulations have shown what would happen in a city if there were a huge influx of robot taxis, replacing not only conventional taxis, but also buses, private vehicles, and so on. The first simulation was made by the International Transport Forum, independent of the OECD (even though it is based in its Parisian premises and China and Russia contribute to the studies). The first simulation was made in Lisbon in April 2015, and then on the entire urban area using the following hypotheses:

- the underground system and trains can increase their capacity, but the buses are eliminated;
- 2 to 5-seater robot taxis can offer door-to-door service;
- 8 to 16-seater robot buses can take passengers on street corners;
- various service constraints are imposed (such as wait-times of less than 5 minutes, circuits extended by less than 20%, and so on).

Four scenarios were devised:

- 100% ride-sharing robot taxis which are mostly full;
- 100% non-shared robot taxis;
- 50% of rides carried out by private vehicles and 50% by ride-sharing robot taxis;
- 50% of rides carried out by private vehicles and 50% by non-shared robot taxis.

Compared to the current situation as a reference, the first scenario with a fleet of shared robot taxis only representing 10% of all vehicles in circulation today would, for the same mobility, lead to much better quality of transport for those who used public transport before, as wait-times would be six times less for a virtually unchanged journey time. For the same distance, the number of necessary vehicles would be dramatically less at rush-hour, decreasing to 35% and 57% in the first two scenarios, and the number of private parked cars divided by 15 and 10 respectively.

On the other hand, in the other two cases, if one keeps 50% of journeys carried out by private cars, improvements are not visible, thereby eliminating the possibility of a progressive transition and suggesting that only with a radical change can one achieve the expected benefits.

Another important conclusion as a result of these simulations is that the demand for means of full public transport (i.e. buses, trains, underground trains and ferries), contrary to certain concerns, increases very clearly by 50% in the suburbs in the Lisbon simulation. This is essentially due to ride-sharing, robot taxis and robot buses which transport passengers from the periphery to their train stations, accentuating the benefits of intermodality.

There are multiple benefits which cities may hope to gain from this simulation. They include less pollution (because the vehicles are electric), fewer accidents (because the vehicles are driverless), more available space on roads (as there are fewer parked vehicles), cheaper mobility, fewer traffic jams, reduced (or identical) transport times, extended geographical commercial and employment areas, and the disappearance of subsidies for buses which are easily the most subsidized form of transport.

However, in return, manufacturers would be severely affected. The German management consultancy Roland Berger and IHS Markit (a well-known car industry forecaster) predict a decrease of 25 to 35% in car manufacture from now until 2040 which, in the long-term, would represent about one hundred fewer car factories throughout the world. This sort of forecast has greatly helped to make the most important manufacturers aware of the urgency for them to transform themselves into mobility operators.

The problems

Between the current situation and the outlined simulations there are various problems. The first problem is the reliability of technology and its progressive adaptation to the different types of traffic lanes (i.e. bus lanes or cars lanes), different uses, and so on. Uber was recently involved in the accidental death of a pedestrian linked to a bad choice of artificial intelligence aboard its vehicle, whereas Google, with its 5 million accumulated kilometres, has only ever had minor incidents. The state of California, which imposes the publication of the number of times a driver takes control of a driverless vehicle, has reported that this only happened once every 8,000 kilometres in 2017 for Google (in other words six times less than its closest rival, General Motors), and about 20 times less than all the other companies which test their cars in California. Uber does not have such a good track record. Google is a software company which has learned its lessons from the generally poor quality of car software compared to software used in the aeronautical or railway industries, and Google favours a much more careful approach than its rival, Uber.

The constraints of the law, such as the Vienna Convention, also heavily influence the development of driverless vehicles, and it should be relaxed in Europe as it is in a number of American states which have already decided to moderate the rules.

At the present time, a driverless car is not adapted for ride-sharing. Surveys show that sharing a journey without a driver and with a stranger, particularly at night, is a problem or even a difficulty, especially for women. Every passenger should therefore be physically separated from the other passengers in the vehicle, but this feeling of security may well disappear if the passenger is dropped off at an isolated place. Incidentally, passengers should not be able to be dropped off anywhere other than the destination specified when the passenger reserves his ride, and no other passenger in the same vehicle should be able to get out of the car at that time. It should not be too complicated to design vehicles which can satisfy these constraints.

Furthermore, there is still not a single company which to this day has all the necessary and required skills. Google can neither manufacture a car nor even manage a fleet. Uber excels in the management of ride-hailing and ride-sharing platforms, but managing a fleet is easier when the drivers themselves ensure the physical maintenance of their vehicles. Without drivers, one has to devise an entire system of logistics.

Last, but not least, for a mayor who is in charge of a city who favours fewer private cars and buses and wants to replace them with robot taxis, what would be the politically acceptable path for such a transition? Clearly, the choices are not simple and firstly need massive personal and social acceptance of driverless vehicles and robot taxis as well as an agreement to abandon the use of private cars at least partially.

Necessary public intervention

Putting the simulations to one side, one can look again at real situations, as in New York. The use of Uber and Lyft has increased rapidly, and as a result, there is much more traffic in Manhattan and the average traffic speed has been reduced by 19% at rush-hour (from 3pm to 7pm).

This increase in traffic and resulting decrease in speed are intolerable, and would be even less if the price of this form of mobility was reduced even more with driverless cars, leading to still more traffic.

This is why the major of New York announced that he intended to make drivers pay for driving in a large part of Manhattan in order to reduce the circulation of private cars, and to tax taxi rides, Uber rides (and their equivalents), therefore encouraging ride-sharing.

The UC Davis study, which is totally compatible with the New York situation, had also shown that ride-hailing with a driver (in other words, Uber's standard service) has helped to increase mobility. At the same time, it has also 'cannibalised' other means of mobility such as car-sharing, the use of private cars (without their ownership being affected for the time being), and even public transport, especially where public transport is not up to standard. Taxis and traditional car hire companies, especially regarding their 'business' activities, have been extremely badly affected.

Faced with a situation which is already difficult, public authorities will have to throw their weight behind this transformation, even when the necessary decisions will not be easy for elected representatives to take. In the long-term, there will need to be more ride-sharing, less private cars, specific facilities to make it easier to order a ride and deciding on the destination, and so on. It will also be necessary to set up a generalised plan with calls for tender for the robot taxi and robot bus fleet operators, service contracts, and so on. Uber and Google have understood that to set this in motion they will have to sign agreements with cities such as Boston and Columbus (Ohio).

The potential benefits from ride-sharing have already started to be felt, and there have been further developments. In order to reduce investments in infrastructure, such as a train station car park, a city in New Jersey has started to subsidize the Uber ride, and Uber in return has agreed to transport the users from their homes to the station and back using a ride-sharing service for $2 a ride. The car park cost is $4, so the operation is financially 'neutral' for users and saves them the stress of trying to find a parking space. This is a good example of the substitution of a mobility solution for an investment in infrastructure.

About twelve other American cities have followed this example by replacing unprofitable bus lines with a better service provided by Uber or Lyft. The same is true for the second largest US insurance company, Blue Cross Blue Shield, which awarded Lyft a contract to transport its clients or patients to hospital, replacing traditional ambulances which were more expensive.

At the end of 2015, the US Department of Transportation under the Obama administration started a competition called the 'Smart City Challenge' based on the theme of future mobility in cities, with a prize of $40 million for the winner. Seventy-eight cities entered, and Columbus, Ohio, a city with a population of 2 million, was the winner. Another competition, organised by the World Economic Forum in 2016, was won by Boston whose mayor announced the imminent arrival of robot taxis in the city.

Cities are faced with a dilemma. The benefits of this mobility revolution may be extremely important, but the transition is difficult to put in place and results in taking measures which are extremely unpopular. This poses several questions, including one in particular linked to France, that of legitimate and strong leadership in urban areas. The ability of a French town to oppose and effectively block a policy is often greater than the decision-making capacities of the person in charge of the large urban area. Therefore, one will have to predict, plan and manage the transition, and choose the best people in order to reach the tangible benefits quickly. The choices of infrastructure, dedicated transport lanes, drop-off and meeting points, car parks, all public transport (bus, train, underground, ferry), and so on, will also have important consequences.

Necessary skills to operate robot taxis

Needless to say, the technology of driverless vehicles has to be perfectly mastered, and the vehicles must be adapted to ride-sharing. The same is true for the technology of remote management platforms and those which are essential to operate the fleets in ride-sharing services. In these sectors, Uber is the leader, but there are other skills which Uber does not possess entirely which are turning out to be necessary, in particular those related to simulation tools combined with artificial intelligence and machine learning. In the most recent important publications, it turns out that after Google, Uber and Didi Chuxing have now become well versed in these areas.

In addition, there will have to be factories to clean and recharge the robot taxis every night. These constraints, far from being secondary, will have to be considered because there are 100,000 vehicles, for each of the two or three operators, which would circulate every day in a city like Paris, a likely figure if private cars disappear. Industrial-style installations will have to be put in place, and each one will need significant financial investment. Neither Google nor Uber have the necessary skills to take on this additional hardware sector.

It will also be necessary to have specific skills which will enable efficient collaboration between the transport organising authorities and the urban areas. In order to make decisions and successfully achieve this radical transition towards driverless vehicles, elected representatives will have to be convinced of the merit of this project not only by the teams in charge of showing the impact of these new solutions and jointly building the routes necessary to get there, but also by the simulation tools which are sufficiently reliable and precise. The technological skill to build these tools already exists. They are what is referred to as 'agent-base modelling', and involve the treatment of data from mobile telephones in order to identify the intended rides and to establish in a very clear, methodical way how many people are transported, at what time and where, traffic simulations and so on. This collection of data has not yet been made, or has not yet been made public. Using this Big Data, these tools could make it possible, by changing the parameters, to simulate alternative situations by giving each 'agent' (or passenger) a comfort rating, a budget, a time rating, if the agent wants to walk, and so on. In September 2016, one of the two companies able to carry out some of these skills, Urban Engines, was bought by Google. The other, which is less efficient, was bought by Porsche (in order words, Volkswagen). Without these simulations, a transition plan would be hazardous, not to say suicidal.

Finally, one must have concrete references, and the Americans like the Chinese and Japanese are in the process of making them. Unfortunately, there appears to be no French initiative on a sufficiently large scale so that those involved can buy and then demonstrate an established know-how.

The parties concerned

Firstly, those involved in this transformation are clearly the 'pure players', in other words digital companies such as Google-Waymo, Uber, Didi Chuxing, Baidu (the Chinese equivalent of Google), Tesla, and so on. I would add SoftBank which, backed by a Saudi fund worth $200 billion, invests in all these mentioned above.

Then, there are those currently involved in the car ecosystem, ranging from manufacturers (including Daimler, General Motors, Volkswagen, and Renault-Nissan-Mitsubishi) to rental companies trying to merge rental and car-sharing (Avis, Europcar, Sixt), and leasing or insurance companies. Daimler, whose CEO announced in September 2016 at the Paris Motor Show that the mobility of the future would be 'connected, driverless, shared and electric', recently bought companies involved in the ride-hailing and ride-sharing sectors for more than one billion Euros. General Motors is attempting to do the same.

There are also those involved currently in urban and suburban mobility, such as mayors of cities or people prominent in urban areas, transport organising authorities, and private urban transportation companies including the French companies Transdev and Keolis which are among the top five leading companies in the world in this sector.

Other important participants are start-ups (for example, door2door and Vulog) and energy companies, especially ENGIE.

What is clear from all of this is that in order to play a major role, private companies must have a great deal of financial resources, the know-how to rally people around them, adapt themselves to varied local conditions, and to master at least one of the key skills. Google obviously, and Uber, Didi Chuxing and Baidu, and some car manufacturers could play major roles. Google has probably more than 2,000 people working on this; General Motors targets the same number. Daimler has clearly also heavily invested. Renault-Nissan-Mitsubishi, Volkswagen and Toyota are remaining quiet about this subject. Other companies such as Keolis or Transdev will, in all likelihood, only be able to enter the system via their alliances with the key companies, but they are the only ones to have a long history of dealing with transport organising authorities and elected representatives in large urban areas.

China, the leading country in artificial intelligence ahead of the United States, has been making astonishing progress in this area. The Chinese now have multiple functioning platforms for electric vehicles, and expect important gains in terms of road safety as well as improvements in traffic and infrastructure from these new forms of mobility. In Shenzhen, a team of between 200 and 300 people is now working exclusively on the development of mobility simulations, and the Chinese government has appointed it as the service provider for all the cities which want to try this out. Unlike countries in the West, the Chinese are less hindered by personal privacy constraints, and so they have every reason to move forward quickly.

Discussion

Is safety compromised?

A speaker: *Artificial intelligence makes decisions which are just probabilities. How is this compatible with French law which requires a causal link between an action and its consequences? When there is a problem, who is responsible: the driver or the manufacturer who configured the vehicle?*

Patrick Pélata: The machines decide in a likely, but not an explicit way, based on millions of situations which they have integrated. Machine learning specialists say that one can nevertheless limit this with algorithms. Everyone is currently working on this subject. When Volvo sells cars to Uber which prepares them by integrating some of its components which are specific to the vehicle, it is clear from that moment onward that it will be the one which has validated the upper software layers – in this case, Uber – who is responsible, and not Volvo. In France, public authorities only authorise manufacturers to carry out tests on driverless cars if they are solely responsible.

Speaker: *When a vehicle which is moving without a driver has to be controlled in an urgent situation by a driver who is necessarily 'unconnected', is the reaction time not too long?*

P. P.: Level 3 is intended to be 'eyes off' and not 'brain off', but fatal accidents caused by Tesla drivers have been due to this loss of vigilance. This is why level 3 is dangerous unless it is limited to driving on motorways at low speeds (in other words, in traffic jams). I do not believe in the possibility of moving forward, step by step (from level 2 to 3, and then to 4 and 5). There is a time when one should be able to move directly to levels 4 or 5. Google and Uber have chosen the safest route which is designed to achieve complete vehicle autonomy which is also limited to zones which are completely mapped out in advance and well-defined.

The value of streets

Speaker: *In the Paris region, the situation is so confused that no-one knows who is going to pay. The problems include the inability of elected representatives to understand these questions, the complexity of the management of the Parisian regional transport union, and the enormity of investments in infrastructure (especially railways which are largely loss-making).*

P. P.: I am very pessimistic about the Parisian case. The ability of towns to block collective initiatives is a huge obstacle. The fact that there is no real decision-maker is another problem. Therefore, I do not think that it is possible that this project can be initiated in Paris. If we want to move towards robot taxis (which I think is inevitable), we should focus not only on the technology but also be interested in cities where we can implement it. In France, these cities exist but there are not many of them because few have one sole decision-maker, but this is the case in Rennes, Bordeaux, Lyon, Strasbourg, Rouen and perhaps Grenoble. Nevertheless, the fact that Singapore will manage to implement a service of robot taxis in the next three years with convincing results, and that Oslo or Helsinki will follow too, as well as Auckland, Pittsburgh, Austin or even Phoenix, will quickly set a precedent in our global communication world. It will certainly not take a long time to convince other cities, especially if one lets Uber or its counterparts increase their activity, and introduce these robot taxis in limited zones by lowering their costs.

Decisions to be made about public transport infrastructure are certainly difficult and costly, but these are the only ones. Other decisions, such as the layout of stations or drop-off points in streets are neither very expensive nor complex, and are part of the usual authorisation of a mayor who keeps a close eye on his city's budget.

Speaker: *Traffic jams which, taken to the extreme, may be the result of many cars occupied by a single driver, are a failure of rational thinking which will surprise our descendants. Is there not any solution other than these driverless vehicles stuffed full of electronics?*

P. P.: Today, everyone uses streets and they do so to such an extent that there is no space for public transport. We need to reconsider the value of streets. Not allowing cars in cities is undoubtedly ideal and would be impossible for an elected representative to suggest this unless he has a credible alternative for replacing cars. Increasing the price of car parks is a very small start towards making us recognise this common value.

Europe and smart cities

Speaker: *Is there a uniform European strategy on these subjects?*

P. P.: Driverless vehicles necessarily need to be accompanied by the relevant technology. Élisabeth Borne, the French transport minister, Anne-Marie Idrac (who is in charge of the national development strategy for driverless vehicles) and Luc Chatel (president of the French automotive industry platform) recently presented a joint strategy for driverless vehicles. Will this be sufficient compared to Google which has put a considerable amount of money into its work on this subject over the years? The technology is almost complete and driverless vehicles are already in circulation in real-life environments. The process has already begun.

Furthermore, and perhaps more importantly than the question of technology, is the subject of smart cities. The German and French governments have declared that smart cities are good subjects of co-operation between the two countries, and Europe will soon put forward a proposal on this. However, today in France there is a noticeable lack of enthusiasm about this subject which is highly regrettable because we should concentrate our efforts on a few important points in order to develop references which those in the industry can learn, like Obama's Smart City Challenge in 2015. Unfortunately, we are very far from being able to do this.

Speaker: *I think that the question of vehicle recharging is important. Does this mean that electronuclear stations will still exist?*

P. P.: The difference between consumption during the day and during the night is about 40%, or 15 gigawatts. Recharging 300,000 cars, the number of rechargeable cars conceivable for a city the size of Paris, for five hours (each car taking one hour to be recharged) at 50 kilowatts per charge (the power currently possible for batteries) would represent a total of 3 gigawatts. As long as we do not reach a few million rechargeable cars, the current infrastructure is sufficient, assuming that the network and recharging is managed intelligently (using smart grids). Nevertheless, at the same time, one must look into the industrial and managerial implications if one were to deploy large fleets of robot taxis.

Speaker: *Europe spends a great deal of money on research into transport. What do you think the priorities should be?*

P. P.: I think that the rapid development of simulation tools and agent-base modelling is crucial. It is important to be able to collect precise data about mobility and to exploit it, due to mobile telephones. Urban Engine, which was bought by Google, does precisely this and works with millions of agents. The development of upper software layers of artificial intelligence for autonomous driving is also absolutely essential.

A global vision of mobility

Christophe Deshayes: *The hypothesis of this session was that new mobilities would be the important issues for the digital world in the future. This talk proves this. It is very clear that we are faced with difficulties in communication. Since its creation in 2015, Uber has had three official business models. Is their failure to have been unable to present a single model which was legible a fundamental reason for politicians to be unable to understand us? Do we lack effective lobbying? Uber's CEO never goes anywhere without his two public affairs directors whereas Valeo's CEO, who has taken part in this seminar series[1], only has a part-time public affairs director. Is it not another case of the British and Americans being better than us at this game?*

P. P.: The recommendation that I made to a manager in the global automobile industry is to create 'business to territory' teams. This is not a specific sales force, but a group of people who are capable of thinking about mobility in a global sense. The skills can either be acquired within companies or through external alliances. On the one hand, it is about people who have experience or who have worked in the transport organising authorities, and on the other hand, engineers who are capable of making models of what is happening in real life, simulating transformations and predicting the results of a concept. If we cannot put these two dimensions together, it will not be possible to convince politicians of the merits of such a change. And then there are the lobbyists. I am most probably more of an engineer than I am a politician! The large foreign cities which I have mentioned earlier are already very active with this project because they realised the importance, the benefits and the difficulties very early on.

In France, highly placed civil servants who work on urban issues are more likely to be graduates of the *Institut des études politiques* (Sciences Po) than engineering graduates. Over the last two centuries, those in charge of

1. Jacques Aschenbroich, 'How Valeo is creating major change as a result of digital technology', Digital transformations seminar, École de Paris du management, February 5th, 2018.

developing transport infrastructure were largely engineers. The Scandinavians and the Germans, and especially the Chinese realised the need to keep engineers involved in these planning projects.

C. D.: *G7, the taxi company, was badly managed by Renault, and even more so by Simca which took over from Renault. It only became profitable when the Rousselet Group took it over and created a new organisational model. This does not give us a great deal of optimism that traditional automobile manufacturers will do a good job of managing these new mobilities.*

P. P.: Lou Gerstner, the CEO who changed IBM, wrote '*Who says elephants can't dance?*'. I do not know whether one day Daimler, Volkswagen, Renault-Nissan-Mitsubishi, Toyota or General Motors will be able to dance this dance, but I do know that when companies have their backs against the wall they can sometimes find the agility and the necessary resources to 'dance'. On the other hand, I think that Google, Uber, Didi Chuxing, Baidu and the others are a priori better placed to succeed, but they will have to learn still more about hardware. They already know how to make alliances – for example, Waymo with Avis, Lyft with an insurance company, and Uber with the city of Boston – in the context perhaps of lobbying, but certainly in the context of concurrent engineering. In Europe, we do not have any big players like them, and this is why we must fight so that those who have the financial means can join forces and 'play the game'.

Presentation of the speaker

Patrick Pélata: graduate of the *École polytechnique* and *École nationale des ponts et chaussées*. He has a PhD in socioeconomics from the Parisian *École des hautes études en sciences sociales*. He began his career with Renault in 1984 as shop foreman at the Flins factory, then as a robotic processes engineer. He took part in the Twingo project and managed the vehicle engineering department in 1998. In 1999, he joined Nissan's executive committee in Tokyo as executive vice president in charge of Corporate and Product Planning, Design and Programmes. In July 2005, he returned to Renault and occupied a similar position, and in October 2008, became Chief Operating Officer of the Renault Group. He joined Salesforce in San Francisco in 2012, and created Meta Consulting, based in California, in 2015.

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