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What role for cars in tomorrow's world?



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*There is no desire more natural
the desire of knowledge*

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What role for tomorrow's cars?

What lies ahead for cars? The need to improve air quality and the quest for more fluid means of mobility, and sometimes dogmatic viewpoints have led some to want to exclude cars from towns.

Despite the undeniable progress that has been made to mitigate its impact, cars remain a source of undesirable externalities. In France, transport represented 26.9% of greenhouse gas emissions in 2013¹ and 28% of particulate emissions in the Île-de-France region.² Congestion in city centres leads to increase in both of these emissions and a considerable loss of time (estimated at 38 minutes per day in Paris³) and money for those who drive.

The recent, repeated scandals involving automobile manufacturers' efforts to falsify emission testing results have contributed to tarnishing the image of this industry. This lack of transparency increases negative feelings towards a mode of transportation that is already the target of numerous criticisms. Cities' prohibition of certain types of vehicles and pedestrianisation of urban areas illustrate large cities'

¹ Road transport of passengers and goods represents 95% of traffic. Source: European Environment Agency, October 2015. However, it should be noted that greenhouse gas emissions from road transport in the region have decreased 7.3% between 2004 and 2015 (source: The 2015 transport accounts, French Ministry of the Environment, August 2016).

² "Inventaire régional des émissions en Île-de-France" (*Regional Emissions Inventory in Île-de-France*), Airparif, 2012. At the national level, concentrations of particles, in close proximity to road traffic and in urban settings, have been decreasing: PM10 levels have been going down since 2007, and PM2.5 since 2009 (source: "Les particules atmosphériques : la connaissance progresse", Datalab, February 2017, Ministry of the Environment).

³ Source: TomTom Telematics, 2016 Traffic Index.

“anti-car” dynamic. Today, this orientation appears to be the public authorities’ preferred solution for overcoming the challenges faced by the future of mobility.

But are cars really doomed to become a relic of the past, to disappear from our streets and our thoughts? To answer this question, the Montaigne Institute commissioned an in-depth survey⁴ carried out not only in France, but also in Germany and in California, thereby providing the Institute with two additional sets of data to which data collected in France can be compared to. This survey concluded that cars remain a crucial social object for a very large part of the French population. It still enjoys a positive image for more than three quarters of the French: it is, above all, a source of independence and freedom (56%) and of pleasure (20%). Only 22% of those surveyed hold an unfavourable view of cars, regarding them as a source of expenditure (17%), a constraint (3%), or harmful to the environment (2%). It is certainly no coincidence that 99.2% of respondents do not consider giving up their car in the medium term, even in the most dense urban areas. Such attachment is identical in the two other geographical areas surveyed: Germany (98.7%) and California (99.5%).

Moreover, cars are essential to a large proportion of the French population. More than 60% of them drive their car to work, 43.7% of whom have no alternative means of transportation. This proportion is greater than in Germany (35%) and in California (41%). Cars are more than just a gadget: they are a daily life necessity. This finding must be taken into consideration when reflecting on the automobiles’ future.

⁴ Survey conducted by Kantar for Institut Montaigne in December 2016 in France, in Germany, and in California, with approximately 1,000 people surveyed per country.

Beyond cars' social, and even emotional, importance, is its fundamental economic role: in 2015, the French automotive industry employed 440,000 people⁵ (full-time equivalents), almost half of whom work in the core business sector (car manufacturers, equipment manufacturers, designers). It indirectly led to 2.1 million additional jobs according to the *Comité des Constructeurs Français d'Automobiles* (CFFA, Committee of French Automobile Manufacturers)⁶, including *via* the trades related to using a car (sales, after-sales service, rental, etc.) and trades involved in mobility (road transport of goods, transport of passengers, etc.). The automotive sector generates 16% of the turnover of the French manufacturing industry as a whole, and is one of the leading patent-producing fields in France.

Today, policies prioritise the fight against pollution over mobility issues, which are vital nonetheless. How can these two approaches be reconciled while maintaining ambitious economic and ecological objectives?

Numerous innovations – both recently released and those still under development – show the real efforts being made by the automotive ecosystem both to respond to criticism and to meet citizens' needs. Whether by means of cars' new uses (carpooling, car hire between private individuals, private hire, etc.), the considerable progress made in engine design, or, of course, autonomous vehicles, in the future cars could optimise mobility and make a significant contribution to reducing pollution.

⁵ French Ministry of the Economy and Finance, 2016.

⁶ CCFA, "Analyses et statistiques 2016".

However, cars have not yet reached this point: they generate both fascination and hostility, they are still indispensable but threatened, and run the risk of being driven out before being able to keep all its promises. And time is not on its side, since updating the fleet of cars on the road is slow work: it takes an estimated 20 years for an innovation to spread to half of the vehicles in circulation.

The future of cars relies on overcoming three challenges:

- A **societal** challenge: the revolution of connected and autonomous cars will make it possible to significantly develop multimodal transport policies and thus respond to communities' various challenges involving mobility (safety, congestion, environment);
- An **environmental** challenge: while the goals are known – improving air quality and fighting climate change – the strategy to achieve them can no longer be limited to imposing ever stricter standards on only new vehicles, it must be comprehensive (European harmonization, actions applicable to the entire fleet of cars, etc.);
- An **economic** challenge: the automotive industry is innovating at a hectic pace, bolstered in part by newcomers (Tesla, Apple, Google), who are a direct threat to the sector's traditional players. For France to produce the car of the future, cooperation between businesses and public authorities is crucial.

In all these areas, close partnerships must be formed between public authorities, industry, and society. The future of the car depends on their collective capacity to respond to this threefold challenge and to ensure a fluid transition towards a new model of mobility.

As such, to respond to these three challenges, the work group formulated ten proposals. They are based on the following guiding principles:

- **Incentive measures**, based on market mechanisms, are preferable to a coercive approach;
- **Experimentation** must be encouraged, starting with tests at the local level before considering a rapid, large-scale deployment;
- Regulations must be guided by a **results-based approach** rather than a means-based approach, and allow actors enough latitude when making technological choices; they must **consider the problems in a comprehensive manner**, to limit possibilities for circumvention;
- **Standards harmonized at the European level** allow the market to reach critical mass, without impeding local variations that take territories' specific characteristics into account;
- All actors – public and private, established and new, large and small – can contribute to innovation, and progress by working **collaboratively**.

PROPOSALS

Responding to the societal challenge by making cars a safer means of transport and improving links with other mobility solutions

Proposal no. 1: Encourage public and private mobility players to develop intelligent and intermodal transport solutions to adapt supply to demand in real time («group private hire», notably in low density areas).

A large proportion of the country has little access to public transport because of profitability reasons. The development of connected vehicles offers a possible way out of this deadlock. Based on the private hire model, passenger transport services can be developed based on low capacity vehicles (minibus, etc.), whose routes would be adapted to real-time user requirements. This would represent a true revolution in the economics of public transport in low density areas.

In addition to buses with fixed timetables and routes, an on-request shuttle system or “micro-transits” could be created, which would only run if enough users were interested. This solution, largely facilitated by current technologies, has already been launched in Canada, via Uber Hop, and could be implemented in France to good effect.

The development of these solutions should associate the various parties involved: local governments, public transport companies, private mobility companies, etc. The role of the public authorities

could be both financial – invitation to tender, innovation competition, etc. – and regulatory – introducing some flexibility into the standards governing passenger transport. These services must be financially affordable for users to offer better mobility to as many people as possible.

Proposal no. 2: Adopt common normative principles for the regulation of traffic at a European level, so as to reduce both congestion and pollution.

While it is important to develop new means of transport in less well serviced areas, it is natural to seek to regulate traffic in areas suffering from congestion, usually located in city centres. However, to facilitate the implementation of such schemes without obstructing mobility, it is essential to homogenize norms governing mobility from one city to another and from one country to another.

Traffic regulation will be increasingly reliant on “intelligent” systems: dynamic micro-tolls requiring the installation of a specific device inside cars, connected information signs, etc. Harmonizing regulations would ensure the interoperability and compatibility of these schemes throughout the European Union (e.g.: an automatic toll device recognised in all cities and on all roads applying a toll).

This would also be beneficial to citizens, whose travels around the cities of Europe would be facilitated, as well as to industrial firms, opening up a vast market to which adapted technological solutions could be proposed at reasonable costs. Similarly, a harmonised environmental categorisation of vehicles could be set up as a basis for traffic restriction measures decided locally (e.g. an interoperable European sticker).

The legal and regulatory framework, once harmonised, would serve as a toolbox, enabling local and national authorities to adapt regulations to the particularities of their territories. Simple recommendations (presentation of a range of incentive measures, notably in relation to urban tolls) could be combined with elements that would ultimately become mandatory (e.g. the harmonised environmental certificate, which could be part of a directive).

Proposal no. 3: Develop the collection and collective use of data from on-board computers to maximise joint benefits: at a European level, this will involve defining the concept of mobility data of common interest and the rules of accessing, sharing and exploiting such data to stimulate innovation while guaranteeing security and confidentiality.

The harmonisation of norms must also include the numeric aspects of mobility. The use of driving data represents a hoard of new services and is therefore a leverage of competitiveness for the French industry. However, it also represents a potential risk requiring reassuring and protecting the population.

The definition of data access rules must be combined with the development of dynamic traffic regulation mechanisms (micro-tolls, reserved lanes), whose operation depend upon the collection of data related to cars and their usage (number of occupants, vehicle type, etc.).

The notion of “data of general interest” could also be taken into account: information collected by a vehicle – an accident detected by on-board cameras, for example - could be useful to other vehicles, for example to warn drivers approaching an accident zone.

Proposal no. 4: Accelerate the generalisation of the most effective new safety systems (emergency braking and drowsiness detection systems in particular), as soon as their efficiency has been demonstrated by independent studies, to enable exploitation of the full potential improvement in road safety offered by such systems.

Personal safety could be considerably improved by adopting major innovations that are currently under-exploited. Technologies such as emergency braking or attention systems are successfully used on certain premium vehicles, but are slow to be installed on bottom-range cars: many lives could be saved if the distribution of such technologies was accelerated.

Once their efficiency has been proved by independent studies, a possible approach could be to make these systems mandatory on new vehicles, or even on all vehicles if it is possible to adapt them to existing models. This could be the case of drowsiness detection systems, notably.

It would also be possible to adopt an incentive scheme for users, based on financial benefits for example, such as modulating the price of urban tolls for cars equipped with certain safety features.

Responding to the environmental challenge by setting objectives that are more ambitious and better controlled than at present, while granting more freedom in terms of how to achieve them

Proposal no. 5: Implement incentive schemes (rather than traffic restrictions) to enable effective and fair regulation of traffic and pollution in the densest urban areas.

Traffic regulation in our densest areas represents an essential objective. The solutions proposed must be both adapted to the specific context of their implementation and compatible with the harmonised European normative framework. Rather than a simple blanket ban on all motorised vehicles, it would be possible to limit their use by dissuasive measures, while encouraging more virtuous behaviour.

The first step would consist in setting up self-assessment mechanisms in major urban centres. Using technological progress, data on real time emissions can be collected to inform drivers of their environmental impact and compare it with fellow road users, to encourage them to drive more fluidly and generate less pollution.

This self-assessment phase could then be supported by financial incentive schemes, such as dynamic micro-tolls, or other incentives, such as traffic lanes reserved to car-poolers. The mass of data collected by the self-assessment systems would enable to optimise the design of these incentive schemes, thereby rendering them more acceptable and improving their efficiency. The following principles could be retained:

- micro-tolls and other schemes would first be tested and their impacts assessed independently. They would then be maintained or with-

- drawn, depending on the results of these assessments, and after public consultation if necessary;
- the price of the dynamic micro-toll would be modulated on the basis of a number of criteria: the “*smart congestion charging*” model, for example using vehicle category (level and type of pollution emitted), use (occupancy rate), traffic conditions and air quality (higher price during rush hours or periods of high pollution), frequency and intensity of use in the target zones, etc. Pricing would take into account the social situation of drivers to avoid weighing excessively on the least wealthy;
 - income from the micro-toll would be re-invested in public transport and road infrastructures;
 - the micro-toll would apply to private cars and goods transport vehicles, subject to different price conditions, if applicable.
 - In the longer term, these intelligent regulation systems could be applied to other areas: adaptive speed limitation on motorways according to weather or traffic conditions, in areas affected by episodes of high pollution, etc.

Proposal no. 6: Revise European regulations regarding manufacturers’ calculation method CO₂ emission objectives so as to encourage vehicle weight reduction, an emission limitation measure that is still under-exploited.

European CO₂ regulations aim to make manufacturers internalise the environmental costs of cars by setting a CO₂ emission norm (95g/km by 2021) applicable on average to all new cars sold within the European Union. This general norm is determined for each manufacturer according to a system known as the “emission rights slope”. The actual slope (and the ponderation criterion used) is decisive in that it assigns a value to the different ways of “saving” grammes of CO₂.

By favouring vehicle mass over its footprint as the ponderation criterion, European regulations penalise the strategy of reducing vehicle weight as a means of limiting the environmental impact of cars, in spite of the recent progress made in new, lightweight and more resistant materials, which further enhances the potential effects of such strategies.

To resolve this situation, the most consensual option consists in altering the slope of weight reduction neutralisation (for example from 60% to 40%) to encourage further lightening of manufactured cars.

A second, more ambitious option, but less acceptable for manufacturers of heavier, *premium* vehicles, would be to replace the weight ponderation criterion by a vehicle footprint-based system (which is already in use in the USA), making weight reduction all the more advantageous.

In all cases, checks must be stepped up to guarantee the efficiency of regulations and to restore public confidence.

Proposal no. 7: Regulate emissions according to incentive schemes founded on an overall results-based approach, without imposing technological choices.

Emission regulations, whether mandatory or incentive, must be based on a results requirement, without favouring one technological choice over another. In the short term, it would be advisable to accelerate the convergence of emission norms for diesel and petrol powered engines (in the next EURO norms) in collaboration with the industrial stakeholders, notably with respect to the gaps observed between emissions in actual use and in test conditions.

Furthermore, while preserving the current individual vehicle emission limits, more limiting targets could be set for average fine particle and nitrogen oxide (NOx) emissions for cars released each year by individual manufacturers, as is the case for CO₂. This would enable each manufacturer to find the best technological mix to reduce the emissions of its fleet overall, thereby improving air quality in the cities faster.

More particularly in terms of fine particle pollution, emission norms should include all sources of particle emission, and not just from the exhaust pipe, which only represents 5% of the direct and indirect emissions of recent car models (compared with two thirds of emissions due to fine particles being re-suspended⁷).

In the longer term, it would be beneficial to encourage the most promising technologies (petrol-diesel hybrid, hydrogen, electric, etc.) in a balanced manner, by adopting a full cost (including costs related to electricity distribution infrastructures), overall “well-to-wheel” and full product life cycle (notably including the issues of battery recycling) approach.

⁷ *Non-exhaust PM emissions from electric vehicles*, Victor R.J.H. Timmers & Peter A.J. Achten, Atmospheric Environment, 2016.

Responding to economic challenges by structuring a highly innovative, forward-looking industrial sector in France

Proposal no. 8: Catch up on experimentations of autonomous vehicles in actual driving conditions. In order to do so, France needs to develop more sites and programmes allowing experimentations in real conditions as well as to facilitate innovation, by encouraging the various mobility stakeholders (manufacturers, startups, transport operators, public authorities, etc.) to work together in an open innovation approach.

Experimentation is an essential part of innovation and testing technologies in conditions close to reality helps to accelerate the learning curve. Experimentation sites have either already been created or are being set up in Europe, including in France. Some countries are already a step ahead, which is the case for Germany (motorway sections equipped with specific infrastructures, in particular road signs, to allow the use of connected vehicles) and the USA (tests conducted by Uber in Pittsburgh), which have test devices in real conditions, built into the existing infrastructures. It is essential for France to do the same in order for the country to bridge the technological gap from which it suffers.

The participation of both local and national authorities in such experiments is important, since it would help to better anticipate future innovations and their consequences, both in terms of regulations and urban planning policies. Such zones must of course be operated under maximal safety conditions (specifically mapped zones, vehicle use restricted to periods of optimal conditions - weather, light etc.).

The development of a truly innovative ecosystem would also stimulate investment, in particular risk capital, i.e. in companies (startups) that have not yet attained their equilibrium. Initiatives that bring the various stakeholders together (incubators, innovation centres, etc.) can play the role of catalysts on this topic.

Proposal no. 9: Anticipate the consequences of the car of the future on the labour market with an ambitious training and redeployment policy.

The stimulation of innovation requires technical investments as well as investments in human resources. The evolution of technology and its uses will have a major impact on employment in certain sectors, such as passenger transit and transport of goods, car dealerships, etc. These transformations are inevitable and carry their own advantages (better mobility, productivity improvements, etc.).

They must be accompanied by a prospective and strategic management of the transformations that will soon occur in the labour market. The automotive industry, with the support of public authorities, must start to analyse the impact of the car of the future on employment as soon as possible, both quantitatively (number of jobs threatened in each sector of activity) and qualitatively (possible redeployment according to skills). This shared diagnosis would enable the adoption of a forward-looking job and skills management strategy, and thus ultimately avoid potential abrupt restructurations.

Proposal no. 10: Gather mobility stakeholders of the future to encourage dialogue, by including the new mobility stakeholders(e.g. by strengthening the role of the PFA, France's car and mobility industry organisation), **in order to optimise our anticipation of the upcoming evolution of industrial needs.**

The contributions of all French stakeholders to design and produce the car of the future should be better coordinated. Instances for dialogue and consultation already exist (e.g. the strategic committee of the automotive industry), but these must be expanded.

It is important to encourage exchanges between traditional big groups and the market's newcomers to promote network innovation. A multitude of experiments could then be carried out rapidly, and the most convincing innovations could be shared on a large scale.

The incentives to such cooperation projects could be amplified *via* private-public partnerships: support for collaborative projects, innovation competitions, etc.

Conclusion: the promises of the autonomous car

Cars face societal, environmental and economic challenges, at the heart of which lies the development of autonomous cars, which is a promising prospect. Indeed, such cars would improve road safety, life quality, access to mobility, and even environmental performance, both in urban centres and in peripheral areas.

It also entails an international competition that extends beyond just companies in the sector. If it tries hard enough, **France can be a leader in the development of accessible autonomous cars.**

From the automotive sector to digital and “smart city” technologies, French companies have tremendous assets. A powerful dynamic is already engaged. It must now be strengthened and supported by public authorities.

Public authorities’ role regarding this issue is crucial. A concerted approach must be taken and a favourable regulatory framework must be developed at the European level. Meanwhile in France, this innovative industrial policy must be supported, in particular through the future investment programme and/or by the development of infrastructures that can accommodate autonomous vehicles. Finally locally, experiments under real conditions must be launched to investigate how to manage the integration of autonomous cars in tomorrow’s mobility mix.

Our country’s ability to take the lead in this technological revolution depends on this voluntary, long-term action.

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