Where shall autonomous vehicle drive us?
Three lifestyle scenarios based on a literature review

Synthesis of the main findings

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The emergence and spread of technological innovations have continually reshaped and permanently structured the organisation of our societies and our ways of life, in particular the activities we practice, the places we inhabit and the ways we occupy them. Combining advances in the spheres of artificial intelligence, sensor technology and telecommunications, the autonomous vehicle is touted as one of the major innovations of the coming decades, likely to have an impact well beyond the spheres of transport and mobility alone.

Indeed, this technology seems to promise disruptions to the sociotechnical system, the "automobility system", which up to now has performed a powerful structuring role in societies in the industrialised countries and now also for many emerging countries. This system is notably based on: ownership by a majority of households of one or more private car(s); dominance of the car over other forms of transport both in modal share and hence in household activities, and in the priority assigned to it in the arrangement of space, the regulation of its use and the organisation of the different urban functions within it; an industry that is one of the pillars of the world economy; significant problems relating to safety, the environment and health (air pollution, noise), energy consumption or congestion on road infrastructures. According to the claims, the autonomous vehicle promises to challenge private vehicle ownership, disrupt the modal structure of travel with possible consequences for the organisation of space, to transform the global value chain and deal some powerful new actors into the game (the digital giants), to change the way individuals and households spend their time, or indeed to significantly reduce the problems associated with intensive use of the private car.

Studies exploring the social and societal implications of autonomous vehicles have proliferated in recent years. While a very large majority of the publications on the subject in the last half-century have focused on the technical aspects (e.g. engineering, computer sciences), there has been a sharp increase in those that consider the non-technical aspects (e.g. social sciences, law, urban studies, philosophy) since 2005. Many recent studies have begun to tackle the complex question of the potential effects on different components of the lifestyles of individuals and households: on mobility practices and vehicle ownership of course, but also on the nature of the activities that people practise and their spatiotemporal organisation, on residential strategies or indeed on tourist activities. Other approaches try to look more globally at the future of mobility. Finally, several publications provide compilations of approaches, looking at the political and societal implications, at modelling and in particular the modelling of the interactions between transport and land use, at feedback from surveys

on preferences or else at the "minimum fleet problem", i.e. determining the optimum number of (shared) vehicles needed to meet the mobility needs of a given population.

Drawing on a review of the international literature, the aim of this research was to bring together the suggested advances and place them within the conceptual framework of lifestyles, which to our knowledge has not been done before. More specifically, we proposed to discuss the nature and scale of the lifestyle transformations that may be triggered by the autonomous vehicle.

Our decision to focus on the notion of lifestyle is justified by at least three properties associated with its use. First, because of its multidimensional character, this notion is used in many disciplines as a framework for analysing a population, its practices and its representations. Second, it offers a useful entry into the discussion of the sustainability of our future lifestyles, since these constitute the matrix of our uses of energy and our greenhouse gas emissions. More specifically, the notion of lifestyle allows us to focus on the levels of activity that need to be catered for (e.g. surface areas of homes, travel distances, number of cars to build, constructible land) rather than how to satisfy them (energy intensity, carbon intensity). Third, by tackling different aspects of our lives, the lifestyle-based approach seems to us to be a more down-to-earth way than cost-benefit analyses to discuss the desirability of the futures to which the large-scale rollout of this new technology may lead. It is important to note that this summary of the literature concentrates on studies that assume that highly autonomous vehicles will become widespread on all road networks, the only situation that seems likely to contribute to a significant change in lifestyles.

Since this literature describes futures that differ greatly according to the form that the deployment of autonomous vehicles takes – and more specifically whether they will be privately owned or shared – we propose to divide our findings into three families of scenarios.

The first family of scenarios is an extension of the current automobile system dominated by individual ownership of autonomous vehicles. It envisages a continuation of current lifestyles, with a renewal of the system of automobility through the large-scale replacement of conventional private vehicles by autonomous private vehicles. Vehicle ownership is therefore not challenged: every household has its own car(s). Modal shares do not fundamentally change. This situation could nevertheless lead to several lifestyle changes, the four main ones being, according to current studies: more varied lifestyles for the population categories currently excluded from car use ([i.e. nondrivers], a spatial and temporal reconfiguration of day-to-day activities, changes in suburban lifestyles and a transformation in tourist practices. This scenario could in particular contribute to the movement of households away from city centres and therefore prompt a series of changes: increase in motorisation levels, in house sizes, in the proportion of detached houses, in the level of suburban activities, in distances covered.

The second family of scenarios envisages a system dominated by individual ownership of autonomous vehicle. It is characterised by a move away from individual vehicle ownership because of substantial development in on-demand door-to-door mobility services, which will also drive a number of changes partly similar to those in the previous scenario, but differing notably in respect of residential location choices and their consequences. They are difficult to anticipate but will notably depend on the differences in the cost of trips in a shared autonomous vehicle compared with the private car. However, there is currently no consensus on this point.

The third family of scenarios proposes a system organised around alternatives to the car (public transit and active modes), which will be supported by autonomous vehicles. It constitutes a break with the first two, this time with a move away from the automobile system as a whole, encouraged both by the existence of extensive public transport services and by spatial reconfiguration (in cities, and possibly in the suburbs and rural areas), leading to a series of changes in location by a certain fraction of households, as well as changes in activities and transport modes, in particular an increase in the proportion of active modes.

Literature shows that another major change, less specific to the type of scenarios considered, is the possibility for (current) nondrivers (elderly people, teenagers, etc.) to access new forms of mobilities, and therefore new activities (including workplaces, education, leisure), and new locations, and therefore – in principle – to enjoy more varied lifestyles.

Finally, we were able to observe through this literature review that certain changes have received less, little or no scholarly attention, whereas others seem to be considered within the framework of highly speculative approaches, with a large element of uncertainty: these include changes in tourist practices and, more broadly, in long-distance travel. In fact, it is questions linked with changes in day-to-day mobility that are dominant in current research. Moreover, the literature has primarily explored the lifestyles of households, and much less so changes that could affect businesses – notably in terms of location strategies – and that could in their turn influence residential choices and household mobilities.

We also discussed the pathways associated with these three family of scenarios, in particular the connections between them, and argued that each comes with different probabilities. The first trajectory seems to be the one most likely to spread widely, because it requires no real political or societal shifts and is compatible with intermediate levels of vehicle autonomy. Next, while the second trajectory has been fairly well covered in the literature, this is less true of the third set of possibilities which is more rarely investigated and exclusively within the framework of qualitative and often speculative studies.

However, in terms of their "sustainability", the first family of scenarios is the one that carries the most risk of increasing energy needs above current levels, whereas the third is the one that seems associated with "avoid" and "shift" type opportunities. The three trajectories also lead to different living conditions, which can vary in their desirability according to cultural contexts or individual aspirations. These two criteria of desirability and sustainability are relevant when considering the conditions in which autonomous vehicle technology is desirable. In particular, do the societal benefits associated with driverless vehicles justify large-scale investment in appropriate infrastructures (smart roads, 5G network)? Do they justify dedicating a proportion of public space exclusively to these vehicles if technological progress is not sufficient for them to operate in open environments? Are they sufficient to justify potential increases in the cost of mobility in the eyes of users? Will they benefit everyone or just a fraction of the population (e.g. high income groups)? These are all questions that today's political decision-makers need to consider, and which we believe require further in-depth exploration.