4 Self-driving turnaround or automotive continuity? Reflections on technology, innovation and social change

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1. INTRODUCTION

The automobile is one of the salient features of modern industrialized societies and symbolizes social progress and individual prosperity. In the countries of the Western world, the number of private cars per capita of the population and the distances travelled daily by car continue to increase. In 2018, there were 568 passenger cars per 1,000 inhabitants in Germany (Umweltbundesamt 2019b); prior to the Corona pandemic[1] each person covered an average of 29 out of 39 kilometres daily by car as a driver or passenger (Nobis/Kuhnimhof 2018: 46). There is clearly a close connection between economic growth and the growth of freight and passenger transport (Altvater 2007: 787; Verron et al. 2005: 7).

Motorized individual transport, especially traffic based on the so-called "driver car" (Dant 2004), is now also seen as a symbol of the ecological unsustainability of the modern lifestyle and is increasingly reaching its limits in cities. The negative implications of private motorized transport, and in particular its fossil fuel drive, have now moved into the political arena – not only since German courts started to give precedence to health protection over the interests of diesel car drivers (e.g. Stuttgart Administrative Court, 2017) or the Paris climate protection goals were resolved (cf. Umweltbundesamt 2019a). Indeed, in the European Union motorized road transport is the only sector (apart from aviation) in which CO_2 emissions have increased in relation to the reference year 1990 (European Commission 2017: 126, 134). For cities, the large number of private cars presents a further pressing problem in view of their high space requirements on roads and in parking areas. Especially in prospering metropolises, these requirements are increasingly competing with space demands on the part of slow and active traffic and for the purpose of recreation and leisure and for residential usage. In light of this, the need for a turnaround in mobility and transport is now generally acknowledged. Already today, various trends in development are discernible that can be understood as signs of such change. On the other hand, it remains to be seen where the change in this sector is heading, how far-reaching this transformation must or may be, and how it can be initiated.

With the aim of gaining a more differentiated view of current developments in the field of self-driving transport technology and mobility, the relationship between technological innovation and social change will first be examined in the following from a sociological perspective. Using the example of various autonomous vehicle prototypes, it will be shown that technologies are closely interwoven with specific notions of social structures. However, society is not simply being transformed by technological developments: not least the history of the automobile shows that technological innovations are dependent on politically generated framework conditions and on integration into social practices. An ideal-typical distinction is then made between three forms of change in transport: (1) a drive and automation turnaround, which above all comprises technological further development of the current dispositive of automobility (Manderscheid 2012), (2) a transport turnaround, in which other means of transport besides the private car play an increasingly significant role, and (3) a mobility turnaround, which focuses on the driving factors, dynamics and constraints involved in overcoming spatial distance and acceleration effects. In the following, the possible roles of self-driving vehicles are discussed for each type of turnaround. This makes it clear that the technology of self-driving vehicles does not in itself dictate the transport and social mobility of the future, but is merely one element of a complex process of negotiation in politics, economics and society at large.

1 The changes in transport behaviour during and immediately following the lockdown are examined in a study by Infas (infas/Motiontag 2020). It is doubtful whether transport behaviour will return to the former distribution patterns in the near future.

2. TECHNOLOGICAL INNOVATION AND SOCIAL TRANSFORMATION

Political and public discussion of the future of transport is focusing on technical solutions. New developments in the field of vehicle technology are likely to address the negative effects of the status quo or provide impulses for a more or less fundamental change within society. Technology and innovation are seen here as quasi extra-societal forces that more or less directly impact society from the outside and change the behaviour of individuals. An obstacle on the path to technological solutions is repeatedly seen in public acceptance of new technologies (Fraedrich/Lenz 2015). At times, attempts are made to generate acceptance by means of information and advertising strategies or socio-scientific accompanying measures.

Autonomous or self-driving cars are seen as a technological innovation that should make a significant contribution to solving today's traffic problems (e.g. Vaid 2018). Replacing the driver with automated control systems is expected to make the use of vehicles safer for passengers and other road users, ensure efficient driving and thus low fuel consumption, reduce space requirements and congestion by means of more precise driving and parking, and reduce the overall number of vehicles on the roads. The automation of vehicles and of traffic itself is widely accepted as a fact for the future. Socio-political and socio-scientific discussion concentrates above all on ethical issues, problems of public acceptance and political challenges (Dangschat 2017, Goodall 2019, Lenz/Fraedrich 2015a, Schreurs/Steuwer 2015, Thomopoulos/Givoni 2015).

A different view of the relationship between innovation and social change can be found in techno-sociology, which regards technology in its development, form and potential, its social significance and its fundamentally contingent use as a societal phenomenon (e.g. Blättel-Mink 2006, Rammert 2010). The development, dissemination and use of technological innovations are understood here as a multidimensional process within society that is by no means easy to plan or predict (e.g. Elias 1995). Regarding the question as to what autonomous vehicles mean for traffic and thus for society, it follows from these techno-sociological considerations that it is first necessary to broaden our field of vision and to illuminate the diverse interrelationships of social and technical development.

Certain views of problems, along with values and assumptions regarding target groups, are already incorporated into the development stage of technologies. From the point of view of sociological technology research, technological artefacts – and thus also vehicles – are seen not merely as material-technical objects, but also as an expression of specific social assumptions, values and perceptions of problems. The social scientist Madeleine Akrich describes this social dimension of technology with the concept of "script":

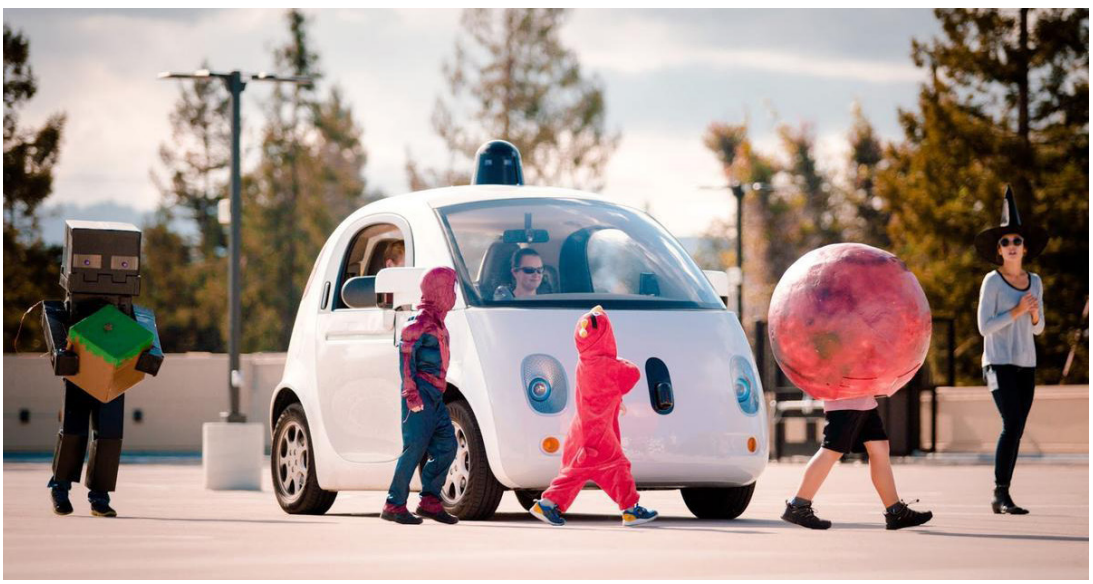
> *"[W]hen technologists define the characteristics of their objects, they necessarily make hypotheses about the entities that make up the world into which the object is to be inserted. Designers thus define actors with specific tastes, competences, motives, aspirations, political prejudices, and the rest, and they assume that morality, technology, science, and economy will evolve in particular ways. A large part of the work of innovators is that of 'inscribing' this vision of (or prediction about) the world in the technical content of the new object. I will call the end product of this work a 'script' or a 'scenario'" (Akrich 1992: 207f.).*

The diversified car market in particular reflects this diversity of differentiated target groups and assumed patterns of use: business limousines and sports cars contrast with family cars, panel

vans and small and micro cars (Wajcman 1994). The more or less clearly defined target group described in this socio-technical script is accompanied by assumptions about their spatial environment and the broader social context. In addition to the development engineers, this script is also influenced by public discourse and media representations, and the perceptions that these condition among society.

Various differently accentuated narratives can be found in the scripts of autonomously driving cars, as is shown in a comparison of the marketing visualizations of a number of these vehicles (cf. Manderscheid 2018): the first widely known prototype of a self-driving car was the Google car Firefly (Google Self-Driving Car Project 2014); however, its development has now been discontinued. With this prototype, Google formulates the claim to make urban traffic more *socially inclusive and safer* – by reducing the scope of human agency. Social inclusion refers here to the mobilization of groups of people who did not previously use cars due to physical limitations, such as the blind or the elderly. In this narrative, social inclusion is technically mediated via individual auto-mobility, which makes the individual socially and temporally independent of their context. In this script, autonomous driving technology takes the place of other persons, who drive, or of timetables.

Figure 1: Google's Firefly



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A second narrative regarding self-driving cars is the time saved for individuals by being relieved of the task of driving and thus having the opportunity to concentrate on the "essentials". The Mercedes F 015 concept car (Mercedes-Benz 2017), for example, visualizes this in the form of business meetings, while the Google subsidiary Waymo (2019) focuses on family, leisure and socializing while being driven. In addition, self-driving cars are to be able to autonomously take over everyday driving tasks, e.g. for shopping and errands, or taking children to and from their destinations (VW 2017, 2018).

In both of these cases, actively steering the vehicle, which to date has been an essential and identity-forming element of driving, is interpreted as a waste of time and a burden. Here, the new technology assumes the role of a chauffeur, available to reasonably affluent households. The promise is that this will create new time windows in the normally hectic everyday routine.

Figure 2: The Mercedes F 015 concept car (top) and the VW Sedric (bottom)

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The technology of networked autonomous driving is not limited to use in passenger cars, but is also undergoing development for public transport. Self-driving buses are being tested or are already in use in urban contexts (e.g. in Helsinki, Hamburg, Berlin and Vienna), on company and airport premises (e.g. at Frankfurt Airport) and on university campuses. For rural areas, too, replacing the driver with technology is expected to open up new opportunities for transport connections. The technology of autonomous driving is thus by no means restricted to passenger cars; its use in larger vehicles such as buses, lorries or similar is also conceivable. In these applications, the focus is above all on economic efficiency due to the cost savings achieved by replacing the driver and on flexible, demand-driven use.

Figure 3: A Navya shuttle of the transport operator Wiener Linien

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It is not possible to simply derive future traffic scenarios from these scripts of autonomous vehicles, which can be understood as current notions of future transport (cf. Grunwald 2009). The actual integration of new technologies into the social framework takes place in the course of multilayered interrelationships. In the tradition of cultural studies (cf. During 2000), various studies have shown that users repeatedly integrate technologies into everyday life in unpredictable ways and develop new practices. Examples are studies on the dissemination and development of idiosyncratic uses of the Walkman (Du Gay et al. 1997) or of the mobile phone (Rettie 2008, Thulin/Vilhelmson 2007, Wajcman 2008). These adaptations do not occur spontaneously, but are flanked by generated framework conditions. The macrostructural processes of integrating technical innovations into the social context are systematically elaborated in the approach of socio-technical transition (Geels/Schot 2007, Kanger et al. 2019). The history of the private car likewise impressively shows that the process of establishing new vehicle technologies is complex and has been significantly supported by political framework conditions and social attributions of meaning.

This sociopolitical basis, which founded the success of the car, is elaborated by various authors (Dennis/Urry 2009, Kuhm 1997, Norton 2008, Paterson 2007); this deconstructs the myth of a "natural spread" of the car that caters to pre-existing needs among the population. Rather, the social acceptance of the car was preceded by massive lobbying and political decisions on the direction to be taken, and by the largely publicly supported development of the corresponding infrastructure such as car-friendly roads and urban structures, along with the creation and adaptation of the corresponding legal framework and institutions. This development has been flanked by the decline of public rail vehicles, which were the means of mass transport in early industrial societies (Knie 2007: 51; cf. Norton 2008). Furthermore, the corresponding social

practices had to emerge: motor sport, car travel, shopping and leisure, and social distinction through the car (Gerhard 2000, Miller 2001, Peters 2006); modes of social subjectivation (Bonham 2006, Laurier et al. 2008, Manderscheid 2013) and the concomitant structures of need and desire also had to become established. In other words, the specific form of automobility that appears "natural" and self-evident to us today came about in a complex interplay of political, economic, material-spatial and social power relations and cannot be derived from the potentiality of automotive technology alone. The way cars are integrated into contemporary societies and the everyday lives of individuals hardly corresponds any longer to the socio-technical script pursued by the developers of the first vehicles.

From a techno-sociological perspective, therefore, future integration into social practices and everyday organizations can be deduced neither from the potentiality of the technology nor from the intentions and ideas of the developers. Rather, the dissemination of new technologies is promoted, steered or impeded by a number of overriding conditions and is also subject to a societal obduracy in the attribution of significance to and the emergence of new socio-technical practices that cannot be anticipated in advance.

3. A TURNAROUND IN DRIVE AND AUTOMATION, TRAFFIC OR MOBILITY?

With regard to the depth and breadth of the turnaround in transport, an analytical distinction can be made between three concepts of varying depth: (1) a drive and automation turnaround, (2) a traffic turnaround and (3) a mobility turnaround. In the following, these three forms of transformation in road traffic will be examined in terms of the possible roles of self-driving vehicles and of the corresponding conditions for opening up opportunities for politics and society. In view of the above considerations, however, this typology should by no means be seen as a "blueprint" for generating corresponding futures, but rather as a demonstration of the socio-political preconditions that go beyond technological innovations.

In the field of individual mobility, politicians and companies focus above all on new drive systems such as electric and hybrid technologies. In this context, German Federal Minister of Transport Andreas Scheuer explicitly speaks of a "drive turnaround", i.e. the gradual replacement of combustion engines with units powered by hydrogen, fuel cells or batteries (Gathmann/Traufetter 2018). In addition, autonomous vehicles and the gradual introduction of various automated driving assistance systems are expected to lead to more efficient driving and thus to fuel and emission savings and, above all, to greater road safety; this can be described as an *automation turnaround*. Automated safety technology such as turning assistants for lorries along with braking, emergency lane keeping, cruise control or reversing assistants will become the new standard in vehicle manufacture as a result of EU Regulation 2019/2144. These innovations can build on a long tradition of technical improvements for greater road safety – from uniform vehicle lighting, speed limits, seat belts for vehicle occupants, improved braking systems and airbags to automatic accident alerts. The introduction of new drive and assistance systems is currently being promoted by legal regulations, the public expansion of appropriate infrastructure and financial incentives for the purchase of corresponding vehicles. However, these political measures are not intended to bring about a fundamental transformation, but rather to further promote and develop hegemonic privatized automobility. It is quite conceivable that the partial automation already existing today will be gradually extended and that in a few years'

time entirely self-driving passenger vehicles will also be seen on the roads. Such fully autonomous private vehicles would presumably first enable the economic elite to expand their radius of action in geographical space by spending their travel time with activities other than driving. This would increase the spatial and temporal independence of this social group, but in the long run would further accelerate social life overall while maintaining privatized automobility (Manderscheid 2012, Rosa 2005). The current pandemic situation could well also be a significant driver of this development.

A distinction can be made between a drive and automation turnaround and a *transport turnaround*, which sets out to supplement or reduce traffic in private cars both as an aggregate and in individual practice with other, more ecologically compatible modes, while retaining the overall level of mobility. Especially in large cities and metropolitan regions, the use of alternative modes of transport is increasingly being promoted – from the extension of public transport to the encouragement of so-called active transport (walking and cycling), the licensing of new micro-vehicles such as electric kick-scooters, and an offer of various mobility services (MaaS – Mobility as a Service). MaaS includes, for example, car-sharing offers – station-based and "one-way" (Lanzendorf/Hebsaker 2017: 137f.) – and app-based ride-hailing services, i.e. driving services that chauffeur individuals or groups with similar routes on demand, along individual or fixed routes. While public and private ride-hailing services are currently performed by a driver, experiments are already being carried out with self-driving vehicles in both of these areas (e.g. Lenz/Fraedrich 2015b). This politically intended extension of the urban mobility offer anticipates that users will flexibly and spontaneously assemble their own transport solutions from the various offers, depending on location, time of day, weather, occasion and destination (Lanzendorf/Hebsaker 2017: 145). The proponents of this initiative therefore believe that maintenance of current transport volumes in urban space could also be ensured beyond the sphere of private automobility. The focus of the transformation here is primarily on urban transport and its efficient organization. The driver of such a change is the increasing dysfunctionality of privatized car transport in cities, while alternative modes of transport are at the same time becoming socially and politically more attractive. In this connection, self-driving vehicles represent a technological option that – to the extent to which they are becoming embedded in information and communication technologies – facilitates a change from a vehicle approach to a system approach in road transport. The proposals of the National Platform Future of Mobility (NPM) in Germany, for example, which are formulated above all in the context of digitalization and autonomous vehicles, are directed towards systemically networked mobility concepts (NPM 2019: 46). Within such a paradigm shift in transport models, the electrically powered self-driving car would be understood as an element of multimodal transport concepts that is part and parcel of the energy transition and would no longer be seen as deficient in comparison with the hitherto predominant petrol-engined car (Lenz/ Fraedrich 2015b; Sauter-Servaes 2011: 37).

Thirdly, a distinction can also be made between these two transformation perspectives and the *mobility turnaround*, whereby such a clear differentiation between transport and mobility turnaround is often not made in social discourse. In the present context, the use of the term mobility rather than transport is intended to emphasize that the whole matter is to be thought of more holistically and that – in addition to the empirically observable physical movement of people and goods in the streetscape – virtual, symbolic and imagined movements are also intended, along with the associated implications and social horizons of meaning (cf. Cresswell 2006, Urry 2007). This extended understanding of movement originates from sociological mobility research and the so-called "new mobilities paradigm" (Sheller/Urry 2006). From this perspective, various authors argue that since the second half of the 20th century, automobility – as a system (Urry 2004), a regime (Böhm et al. 2006) or a dispositive (Manderscheid 2012) – has not been a purely technical-functional means of overcoming distance that plays a merely objective role in society, but on the contrary is a constitutive element of social and economic dynamics and of spatial organization (Kuhm 1997, Paterson 2007). To put it pointedly, the spatial, temporal,

economic, social and symbolic order of contemporary societies can only be understood with and through the privately driven car as a hegemonic medium of mobility. Conversely, this also means that for a sociological understanding of automobility it is not sufficient to attribute car traffic and its growth to a single causal dimension such as needs of the individual, a superiority of technology or globalization. Accordingly, sociological research into mobility considers not only the routes and distances travelled and the means of transport used, but also the socio-economic, cultural and spatial dynamics and constraints that underlie social normalities and individual needs. The dynamics that lead to a sustained increase in these observable routes and distances, as well as the leeway and restraints that individuals face in dealing with the mobility expectations of society, can then be incorporated into this integral perspective (Cass/Manderscheid 2019).

A mobility turnaround towards social and ecological sustainability would then aim at reducing the compulsion to be mobile – in other words, it would supplement the right to mobility with a right to immobility (cf. ibid., Rajan 2007). According to the basic tenet of the mobility paradigm, mobilities arise from social contexts such as employment, family, circles of friends, and the spatial organization of everyday life (Cass et al. 2005, Hammer/Scheiner 2006, Larsen et al. 2006, Shove 2002). Individuals and social groups differ significantly here in the extent to which they can autonomously shape their mobilities and immobilities. In particular, the demands of labour markets and social policy, and of the conditions of the housing market and the infrastructure of residential areas in terms of transport and supply, make mobility necessary in order to participate in society. The technology of automated vehicles can definitely be included in the development of ideas for a socially and ecologically sustainable future of mobility in order to ensure flexible transport connections above all in peripheral or rural regions. Self-driving cars would then chiefly be an element of integrated transport services in the sense of MaaS that can be flexibly ordered and used. However, it can be assumed that such an offer can only be provided by the private sector to a limited extent; this would require structures to be developed by public and civic bodies. The key drivers of such a mobility turnaround are therefore to be found outside the sphere of transport technology and presuppose fundamental changes in the social and economic framework conditions of everyday life.

4. ENVISIONING AND SHAPING THE FUTURE

The notions of possible futures are by no means inconsequential academic flights of fancy. Rather, they are potentially performative and have an influence on the production of future in society, in that they influence actions in the present. In terms of discourse theory, visions of the future are elements of discursive practices that “systematically form the objects of which they speak” (Foucault 1981: 71). As (visualized) elements of communication, social and technological visions of the future already exist in the present and become part of future knowledge by framing and limiting the discursive space of social production of the future, by defining and excluding what constitutes a problem that needs to be addressed. Although driverless cars and buses still only exist as prototypes, their incorporation into motorized traffic as part of current transport policy, planning and legislation is already being prepared materially and in terms of infrastructure. At the same time, this knowledge of the future legitimizes political and economic decisions such as pressing ahead with the expansion of the 5G network. Scientific research and discussion on driverless cars, their possible acceptance by society and their effects on the organization of traffic, along with ethical challenges, likewise contribute to the establishment of the driverless car as a knowledge-based traffic object.

These theoretical reflections draw attention to heterogeneous attempts to shape the future. In view of climate and health crises, the "peak car" hypothesis and outlines of a sharing economy, prior to the Corona pandemic the future of private automobility was perhaps more open than it had been for a long time. Nevertheless, numerous protagonists play a role here, among which the car industry is a powerful player with a strong interest in continued automobility for the future. The interests of IT companies and the automotive industry appear to coincide, at least in part, in the field of networked automated transport technology, without an underlying controlling centre being assumed. In this context, concepts of networked autonomous vehicles accentuate the need for the extension and use of ever-new networked and mutually communicating technologies and the extension of the necessary infrastructures such as the 5G network. Here, these interests can tie in with the predominant digitalization narrative, whereby there is also a relevant economic interest in the data produced during driving operation. The visions of driverless cars should therefore be seen as elements of the discursive approach to future mobility. Sociologically and socially significant here is not only what is said, but also what is excluded. Consequently, neither the interests associated with the technological innovations nor the less vociferously propounded ideas of societal mobility futures should be disregarded in the course of critical sociological research on self-driving cars.

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