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Review

## Drivers' Perspectives of Car Dependence

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### Abstract

The concept of car dependence includes both travel to destinations for which other modes than the car are not practical and preference for car travel even when other modes are available. While the concept has been a focus for transport analysts for some time, car ownership and use have continued to grow. This reflects the utility of the car for travel on roads where drivers do not experience excessive congestion and where there is parking at both ends of the journey. Local public transport and active travel only become generally attractive alternatives to the car in dense city centres where road space for car use is limited. Reduced car dependence is facilitated by city planning that encourages increased density, opportunities for which are constrained by the stability of the built environment. As well as utility for travel to achieve access to desired destinations, car ownership is also attractive on account of positive feelings, including pride, reflecting both self-esteem and social status. The positive feelings of the population at large towards car ownership are not consistent with the critical view of many analysts, a divergence in point of view that contrasts with the general acceptance of the need to respond to climate change, for which the purchase of electric vehicles is seen as an appropriate action. Rather than advocating measures explicitly aimed at reducing car dependence, a more effective policy approach would be to increase the availability of alternative modes while mitigating the detriments of car use.

### Keywords

car dependence; car ownership; car pride; car utility

### Issue

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### 1. Introduction

The concept of car dependence was first articulated in an editorial by Goodwin (1995), which arose from a substantial study (Goodwin et al., 1995). This was prompted by the observation that many people have built their way of life around their cars and depend on them for many regular and occasional journeys, despite the wide range of societal problems arising from growing car use. Goodwin noted the distinction between car-dependent people and car-dependent trips, suggesting that focus on the latter would be more likely to lead to changes in behaviour. Goodwin also recognised that car dependence is a process, not a state, such that those acquiring cars tend to rely on them more over time and pay less attention to alternatives.

The concept of car dependence has stimulated much academic research, notably the following contributions.

Stradling (2007) extended Goodwin's typology, distinguishing between car dependent places, car dependent trips and car dependent persons. Mattioli et al. (2016) proposed an alternative three-fold distinction of car dependence as a function of scale—as an attribute of individuals, of societies, and of trips—employing time use data to identify trips involving carrying shopping, heavy goods and children as a contributing factor to car dependence. Lucas and Jones (2009), in a comprehensive study of the car in British society, reviewed the uses in the literature of terms associated with the concept of car dependence, identifying a spectrum of behaviours from reliance to pathological dependency or addiction. These authors recognised that purchase of a car made possible faster travel with greater access to, and more choice of, destinations, allowing more complex lifestyles. von Behren et al. (2018) developed a survey methodology encompassing both subjective and

objective measures of car dependence that allowed the identification of differences between cities, as well as within the populations of individual cities.

Newman and Kenworthy (2015) analysed mobility in a large number of cities in both developed and developing economies, concluding that automobile dependence varied in a clear and systematic way with land use patterns, dependence increasing as population density decreased. Cullinane and Cullinane (2003) surveyed car owners in Hong Kong, a very high-density city where public transport is dominant and car ownership is very low, finding that once people acquire a car, they perceive it to be a necessary part of their lifestyle. Buehler et al. (2017) examined five major European cities where the car share of trips has fallen in recent years, and concluded that car dependence had been reduced by coordinated packages of mutually reinforcing transport and land-use policies that made car use slower, less convenient, and more costly. Mattioli et al. (2020) discussed the political-economic factors associated with car dependence, including cultures of car consumption.

The concept of car dependence has been taken up by those concerned with policy for transport, land use, and urban development. Cao and Hickman (2018) investigated the relationship between car dependence and housing affordability in outer London suburbs, where potential problems arise from a high proportion of travel to work by car, longer average journey distances to work, limited access to public transport, and high levels of housing unaffordability. Handy (2020) argued that while it is not realistic in the foreseeable future for most Californians to live without their cars, it is possible, and would be beneficial, to decrease car dependence. The intergovernmental International Transport Forum has reviewed the range of policies that can reverse car dependency by encouraging citizens to use alternatives to private cars (International Transport Forum, 2021a). In the context of its Transport Decarbonisation Plan, the UK Government wants walking, cycling or public transport to be the natural first choice for short journeys, and recognises that the planning system has an important role to play in encouraging development that promotes a shift towards sustainable transport networks (Department for Transport, 2021).

The current critique of car ownership and use, as embraced by the concept of car dependence, has a two-fold thrust: challenge to the existence of locations where the car is the only feasible means of access, particularly where other modes of travel might be provided; and challenge to car use in locations where other modes are available in the form of public transport and active travel. In this latter context, the term 'car dependence' has some resonance with other kinds of undesirable dependence, such as on alcohol or drugs.

Nevertheless, the impact of the critique of car dependence on observed travel behaviour has been at best quite limited. In Britain, for which relatively comprehensive travel statistics are available, the number of private

cars licensed for use increased steadily from 2 million in 1950 to 30.5 million in 2019 (Department for Transport, 2019a, Table VEH0103). Car traffic increased with minimal interruption from 16 million vehicle-miles travelled in 1950 to 278 million VMT in 2019 (Department for Transport, 2019a, Table TRA0101). The estimated number of holders of driving licences also increased steadily to reach 36 million by 2020, with more than 80% of males and females between ages 30 and 70 being qualified to drive (Department for Transport, 2019b, Table 0201). On the other hand, while the proportion of households owning one or more cars increased from 14% in 1951 to reach 75% by around 2000, thereafter it remained unchanged through to 2019 (Department for Transport, 2019b, Table 0205). And the average distance travelled by car, driver and passenger, fell significantly, from 5,800 miles a year in 2002 to 5,000 miles in 2019 (Department for Transport, 2019b, Table 0303). More generally, evidence from a number of developed economies indicates that car use per capita grew until the beginning of the present century, after which growth ceased; whereas car mode share in some large cities has peaked and then declined (Metz, 2021a).

So, the question to be asked is why car dependence has generally persisted, despite analytical and policy orientations that favour its decline. In broad terms, the answer two-fold. First, the widespread deployment of the car over the past century has proceeded in parallel with the development of the built environment, within which are found the origins and destinations of nearly all trips. Expeditious door-to-door travel by car has made possible access to a wide range of people, services and destinations to which we have become habituated. As with path-dependent processes generally, reversal is difficult without loss of benefit. Second, car ownership is attractive to a large proportion of the population, and a large industry has come into being to satisfy this desire.

Car dependence is an impediment to decarbonisation of the surface transport sector, where many analysts and policy advisors take the view that technological change, largely by replacing the internal combustion engine by electric propulsion, would in itself be insufficient to achieve a trajectory to Net Zero by 2050 consistent with international agreements. Thus, the International Transport Forum argues that reducing reliance on cars in cities is pivotal to decarbonise urban mobility (International Transport Forum, 2021b). Yet the attractions of the car mitigate against such reduction. Hence to consider the scope for reducing car dependence, it is useful to address the perspective of drivers, who generally find the car of utility as a practical means of conveyance, as well as desirable for the wider benefits of ownership.

Accordingly, the purpose of this review is to summarise the main evidence relating to positive perceptions of car ownership and use, with the aim of helping policy makers, planners, analysts and practitioners make realistic judgements of the likely impact of interventions

to reduce reliance on the car in the context of transport decarbonisation. In the course of the discussion, opportunities to advance understanding through research are identified. It is also the intention of the article to offer a counterbalance to a negative view of the behaviours denoted by the concept of car dependence, common within the disciplines of academic transport and urban studies and of transport planning practice. Arguably, there is too much wishful thinking about the scope for reducing car use through policy interventions, implicitly validated by reference to “car dependence,” yet a reduction that seems likely in practice to be quite difficult to deliver.

To prepare this article, the TRID transport database was searched using the terms “car dependence” and “car dependency.” Relevant sources were selected that illuminate the policy challenge implied by the concept of car dependence. A comprehensive literature review was not attempted since an extended itemisation of all citable papers would detract from the policy-relevance of the article that follows.

The article first addresses the utility of the car as a mean of travel, then other aspects of the attractiveness of car ownership, before discussing the implication for policy and practice.

## 2. Utility of the Car

The modern era of travel began in 1830 with the opening of the first passenger railway, between Liverpool and Manchester. Thereafter, the energy of coal fuelled the worldwide growth of railways in the nineteenth century, followed by oil that powered the internal combustion engines of road vehicles in the twentieth century. The benefits of travel at faster than walking pace took the form of increased access to people, places and services that enlarged opportunities and choices. The car, which permits door-to-door travel, has been central to the growth of access, even in cities such as Copenhagen, famous for its cycling, with excellent infrastructure and a strong cycling culture. Nevertheless, there is substantial car use in the city, only slightly less than in London, as shown in Table 1.

Aside from cycling, the other large difference is that public transport use in Copenhagen is half that London. This is consistent with the proposition that people can be attracted away from buses onto bicycles by good

cycling facilities, since cycling is cheaper, healthier, environmentally benign, and no slower than the bus in congested traffic.

There is some evidence concerning the extent to which new cycling facilities attract users away from car travel. A study of the impact of new cycle schemes in eight UK cities found that only 5% of cyclists said they would have travelled by car if the scheme had not been built, although most users had cycled before implementation of the new schemes (Sloman et al., 2021, section 10.3). The UK Department for Transport’s guidance for the appraisal of cycle investments, based on a review of evidence, stipulates a car-cycle diversion factor of 0.24, meaning that if there were to be 100 new cyclists, there would be 24 fewer people travelling by car (Department for Transport, 2022a, para. 3.7.3). The corollary is that 76% would switch from other modes, likely mostly from buses.

The car remains attractive even in Copenhagen, a small, flat city with excellent cycling facilities, where almost all drivers have experience of safe cycling. Some information on trip mode shares is available for other European cities. Kodukula et al. (2018) compiled data for thirteen cities. A wide range of travel patterns was found, reflecting historic city boundaries, population density, and public transport provision. There were also differences in the sources of data, whether from household surveys or from counts of traffic and passengers. The mode shares for Copenhagen and London were close to those shown in Table 1. Amsterdam was similar to Copenhagen with 32% cycling and 17% public transport. In contrast, Vienna, Zurich, and Madrid were similar to London with 38–40% public transport, although rather more cycling (6–8%). However, no city was found to have high levels of both cycling and public transport.

Kodukula et al. (2018) noted that car mode share varied widely, from 20% for Amsterdam to 65% for Rome (car mode share for Paris is stated to be 15.8%, but there is some uncertainty whether this predominantly reflects the high-density central area of the city). Buehler et al. (2017) found that the largest cities in Austria, Switzerland, and Germany had succeeded in reducing the car share of trips over the past 25 years: from 40% to 27% in Vienna, from 40% to 33% in Munich, from 35% to 30% in Berlin, from 39% to 30% in Zurich, and from 48% to 42% in Hamburg. Nevertheless, car use remains substantial, notwithstanding policies to reduce car dependence.

**Table 1.** Trip mode share 2018 (%), Copenhagen and London.

	Copenhagen	London
Cycling	28	2.5
Car	32	35
Public transport	19	36
Walking	21	25

Sources: City of Copenhagen (2018; data for trips to, from, and in the city of Copenhagen) and Transport for London (2019; data for all trips by residents and non-residents with origin and destination or both in the area of the Greater London Authority; motorcycle and taxi omitted).

So, why are cars widely used even in cities that encourage other modes of travel? The answer surely is that cars are useful for carrying people and goods, including child seats and other equipment that is regularly used, as well as for making trips longer than would be comfortable by bicycle. The car is well-suited for meeting needs for access to people and places, including for trips with a chain of destinations, for door-to-door travel where there is road space to drive without unacceptable congestion delays and the ability to park at both ends of the journey. Car travel generally requires less planning than trips by public transport, with digital navigation based on satnav devices a means of selecting the quickest route (Metz, 2022).

The car offers flexibility, comfort, privacy, and security, compared to public transport, particularly for people with mobility difficulties. The English National Travel Survey for 2019 (before the Covid-19 pandemic) found that the most common mode of travel for adult respondents with a mobility difficulty was by car, with on average 238 trips per person per year as drivers and 178 as passengers, compared to 123 walking trips, 39 bus trips and 7 rail trips (Department for Transport, 2019b, Table 0709).

Following lifting of restrictions on daily activities and travel during the Covid-19 pandemic, when public transport was less attractive on account of the perceived risk of infection, car use revived rapidly to close to pre-pandemic levels. In London, for instance, car use reached more than 90% of pre-pandemic levels by the summer of 2020, whereas public transport use was only at the 50% level. By the autumn of 2022, public transport use was back to 85% and car use to around 95% of pre-pandemic (Transport for London, 2022, section 2.2). National data show a similar picture (Department for Transport, 2022b).

Car travel may feel less costly than public transport, particularly with a full load of passengers. Car ownership requires a commitment to pay the costs of purchase, servicing and insurance, so trading off large one-off payments for low marginal costs at the time of use. Such sunk costs are largely disregarded when making a choice between car use, active travel and public transport for an intended trip. Thaler (1999), in his seminal paper on “mental accounting,” observes that many urban car owners would be financially better off selling their car and using a combination of taxis and car rentals; yet paying \$10 to take a taxi to the supermarket or a movie is both salient and linked to the consumption act, so seeming to raise the price of groceries and movies in a way that monthly car payments or a fully owned car do not. Moreover, even when public transport was made available free of charge for a group of state employees in Hesse, Germany, car use and availability did not decline (Busch-Geertsema et al., 2021), consistent with the proposition that low costs at the time of use are not a decisive consideration when commitment has been made to the costs of car ownership.

Importantly, the amount of travel that can be undertaken is limited by the time available, given the 24 hours of the day and all the activities that must be fitted in. For settled populations, average travel time amounts to about one hour a day (Metz, 2021b). Accordingly, faster travel allows greater access within the travel time available. Car travel is generally faster, door-to-door, than other modes over short to moderate distances, which increases people’s access to desired destinations. Access increases approximately with the square of the speed of travel, so that urban car travel at, say, 30 km per hour allows four times the access than does cycling at 15 kph, and 25 times more than walking.

Consistent with this perspective, Smart and Klein (2020) found that in the US access to an automobile is strongly associated with employment, job retention, and earning more money over time. A meta-analysis of research studies demonstrated that car ownership significantly increases employment probabilities (Bastiaanssen et al., 2020).

The value of access to people, places and services, of the choices and opportunities that ensue, is the main reason for the popularity of the car for short-to-medium journeys where there is adequate road space, and for longer trips where the alternative modes, rail or air travel, may be less attractive. Yet the attractions of car ownership go beyond the utilitarian, as discussed next.

### 3. Attractions of Car Ownership

There is a growing literature on why the car is seen by many as attractive, quite apart from its utility for making journeys. Sheller (2004) argued that “car consumption” is never simply about rational economic choices, but is as much about aesthetic, emotional and sensory responses to driving, as well as patterns of kinship, sociability, habitation, and work. Steg (2005) noted motives for car ownership that included feelings of sensation, power, superiority, self-esteem, and social status. She carried out interviews with samples of drivers to demonstrate that symbolic and affective motives play an important role in explaining the level of car use, in particular for commuting, concluding that these motives may be a reason why attempts to influence car use have not been very successful. Gatersleben (2021) has summarised the extensive yet diverse literature on the symbolic and affective aspects of car ownership and use. Cars can be symbols of both social identity and status as well as of personal identity. Affective aspects refer to emotions that include pleasure and pride, freedom and being in control.

Studies commissioned by Transport for London identified a number of emotional benefits associated with car use, including status, self-expression, power, and independence; car ownership could also support relationships with family, neighbours, and work colleagues (Roads Task Force, 2013). Ikezoe et al. (2021) surveyed car owners in Tokyo, finding that symbolic and affective factors were twice as important than convenience

for motivating car ownership. Ho et al. (2020) investigated the scope for introducing mobility-as-a-service in a region of the UK, concluding that for a large proportion of the population, nearly 50%, “the car will still be king,” since car-lovers value the convenience of their own cars, so that mobility-as-a-service is better marketed as a substitute for a second household car.

Moody and Zhao (2019) developed a survey methodology, applied in two US cities, to measure “car pride”—related to the social status and self-esteem associated with driving a car. This was found to be positively predictive of car ownership, but not the reverse. The survey was extended to Shanghai (Zhao & Zhao, 2020) and to 51 countries via telephone interviews, finding a wide range of scores: developed countries ranked lower than developing countries, the USA having the highest score for a developed country and Japan the lowest. India and Kenya were the highest ranking of the developing economies (Massachusetts Institute of Technology, 2019, Section 3.4). The observation of an Indian journalist is to the point: “Cars remain deeply aspirational in India, and it’s common for new buyers to offer prayers when a family adds a new vehicle. The upgrade from a two-wheeler to a four-wheeler is also a hugely important status symbol” (Kotoky, 2022). More generally, acquisition of a car in a low-income country represents a step towards modernity.

Moody et al. (2021) estimated the value of car ownership in four US metropolitan areas by means of discrete choice experiments. They found that the total value was at least as much as estimates of the average cost of private ownership, and that more than half the value was non-use value, beyond the use value of getting from A to B.

The fact that cars are generally parked for 95% of the time is an argument for the economic benefits of car sharing, which would make fuller use of a costly capital investment. Conversely, this also indicates the value of the car to individual owners, both for ready use when required, including at short notice, but also for the non-use benefits of ownership.

One indication of the non-use attractions of the car is the growth of sales of sports utility vehicles (SUVs), larger, heavier and more costly than the vehicles they replaced. In 2021, SUVs were expected to account for more than 45% of global car sales (Cozzi & Petropulos, 2021). While there may be some practical advantages, it seems likely that this growth reflects positive feelings about ownership of these vehicles.

The literature on the attractions of car ownership beyond utility in use is diverse and generally persuasive, but does not offer clear indications to action to reduce car dependence.

#### 4. Discussion

The evidence outlined above indicates that car use is motivated by both utility and positive feelings. For travel between locations where there is no convenient alternative mode, utility is sufficient to account for travel

behaviour. Where other modes are available, utility may still be the main motivation, on account of door-to-door speed and other convenience factors, although positive feelings may reinforce use of a car. Even when the car is the slower option, those with positive feelings about car ownership may prefer to drive.

From this perspective, there are a number of possible approaches to reducing car dependence that broadly fall into three categories: providing acceptable alternative modes of travel, making car use less attractive than the alternatives, and lessening the good feelings about car ownership and use.

##### 4.1. Alternatives to Car Travel

Alternatives to car travel are receiving considerable attention in the context of transport decarbonisation. Investment in public transport is relevant, particularly rail that is fast and not impeded by road traffic congestion, but which generally requires public subsidy. Providing better cycling facilities is less costly, yet which attract people from public transport rather than out of their cars, as discussed earlier. Electric micro-mobility is likely to act in the same way. Provision of opportunities for car sharing, whether for short-term rental of vehicles from street locations or sharing journeys with others for longer trips, should help reduce personal car ownership and result in less car use overall.

Opportunities to offer such alternatives to car travel are greatest in high-density urban areas where traffic congestion impedes movement and parking opportunities are limited. Moreover, the economics of public transport provision are most favourable and catchment areas, whether of schools or supermarkets, are compact, facilitating access by active travel modes. Yet beyond dense urban areas—in suburbs, towns, villages, and rural locations—car use remains attractive.

There is particular concern when new housing on greenfield sites is planned without alternatives to use of the car. A question that arises is whether those who purchase these homes feel deprived on that account, or whether they choose to live in such locations because they are positive about driving and are pleased to have plenty of parking space for their cars. While there has been investigation into how attitudes, behaviours and residential choices influence choice of sustainable travel options in urban areas (Kant et al., 2015), empirical investigation is needed to understand to what extent a new greenfield housing development results in involuntary car dependence, with deprivation for those residents who do not have access to a car. Given that these developments are built to sell, it is possible that most purchasers are content with a car-based lifestyle.

The converse of car-dependent greenfield development is transit-oriented development where housing is constructed on sites within walking distance of new rail-based transit schemes. There is an extensive literature on the topic of transport-related residential



self-selection—whether people choose to live in neighbourhoods that align with their travel preferences. A recent review highlights the complexity, heterogeneity and uncertainty of research findings (Guan et al., 2020).

While the planning of new settlements can and should include consideration of provision of alternative modes of travel to the car, the greater problem concerns the existing built environment that has developed over the period since the middle of the last century as car ownership has become widespread. The result has been low-density development where the car has facilitated access to people and places, allowing dispersion of opportunities for access to employment, housing, services, as well as to family and friends. In these circumstances, the scope for the planning system to reduce car dependence is very limited, particular since the vast share of property, both residential and commercial, is owned privately. Besides, home-owners value attractive neighbourhoods and could not afford the cost of rebuilding. Hence the ability to reduce car use through creation of “15-minute cities” or “20-minute neighbourhoods” is for the most part more of an aspiration than a reality in existing built environments. Conversely, car dependence in economically vibrant rural areas may be seen as a positive feature since, without the car, depopulation would be likely as people move to cities for employment opportunities.

#### 4.2. Making the Car Less Attractive

To complement the availability of appealing alternatives to the car, there is scope for making car use less attractive—together amounting to a “carrot and stick” approach. Interventions may reduce distances travelled by car, but the larger effect is likely to be to change the mode of travel.

Urban car use is made less attractive by constraints on parking, including limiting parking at the kerbside to permit unloading of goods vehicles and setting down from taxis; likewise, reducing carriageway available for general traffic by conversion to bus and cycle lanes and pedestrian space. Low traffic neighbourhoods constitute area-wide efforts to reduce car use. Raising charges for parking also discourages car use, both on-street and off-street facilities controlled by local authorities. A Workplace Parking Levy, as implemented in Nottingham, UK, can discourage car-commuting while generating revenue to fund public transport (Dale et al., 2019).

Road user charging, also known as road pricing and congestion charging, deters car use, as implemented in London, Stockholm, and Singapore (Metz, 2018). Singapore, as a city-state without a rural hinterland, has always levied a high charge for entitlement to car ownership, to limit the number of vehicles to the capacity of the road network, so that car ownership is about 100 per thousand population, compared with more than four times that number in other developed countries. Some Chinese cities have also limited car ownership, whether by auction of entitlements, as in Singapore, or by lottery.

Road fuel taxation adds to the cost of motoring, with quite wide variations between countries. However, high taxation tends to encourage use of smaller vehicles, which while good for the environment, has limited impact on car dependence.

#### 4.3. Lessening Good Feelings About Car Use

As noted above, feeling of pride in car ownership vary widely across countries for reasons that are not apparent, beyond the status associated with ownership in developing economies. Attitudes also vary within countries, with younger adults in developed economies making less use of cars, particularly when living, working, and studying in or near attractive city centres. More generally, concerns about the environmental detriments arising from car use prompt some to give up their cars, although it is difficult to predict how far such a movement might spread, particularly as the switch to electric vehicles reduces environmental anxieties.

Nevertheless, the marketing efforts of the highly competitive car industry will continue to identify motivations for the purchase and use of cars, while the engineering side will continue to innovate to develop more attractive products. The aim of these efforts is to instil positive feelings about car purchase and use, which tend to trump the countervailing efforts to reduce car dependence. The innovations associated with the current switch to electric propulsion yield vehicles attractive to drive, as well as receiving the endorsement of governments through financial incentives to purchase, including lower rates of taxation, and support for provision of electric charging facilities. More generally, the governments of countries in which car manufacturers and their supply chains are located are supportive of these businesses and their outputs, for reasons of both employment and industrial policy.

Attitudes to the car are part of a wider debate about the role of consumption in society, including whether current levels of consumption of goods are sustainable, the role of repair and recycling, and concepts such as the ‘circular economy.’ In this context, a better understanding is needed of how favourable behaviour change may be achieved, for instance within the COM-B framework, which posits that to change, an individual must have the capability, the opportunity and the motivation (Michie et al., 2011), and which has been widely used in the public health context (Public Health England, 2020). Behaviour change techniques have been applied with success to improving road safety (RAC Foundation, 2017). In contrast, a systematic review found no evidence of efficacy of behavioural interventions aimed at reducing car trips (Arnott et al., 2014). Nevertheless, the Scottish Government has stated that it has considered interventions to reduce car use in the context of the COM-B model of behaviour change, although no detail is provided (Transport Scotland, 2022, p. 21).

## 5. Conclusions

The car is one of the great inventions and is justly popular for the access it makes possible to people and places, family and friends, jobs and homes, opportunities and choices. In developed economies, more households own cars than have children. Car ownership is widely associated with positive feelings, of pride of achievement and of self-esteem. However, this popularity gives rise to the well understood detrimental aspects of car use—carbon emissions, air pollutants, traffic noise, deaths and injuries from crashes, road traffic congestion, severance of communities, and impeding use of streets as places for social and economic engagement. Moreover, widespread car use has permitted the evolution of a relatively low-density built environment that can leave those without access to a car at a disadvantage.

These concerns have stimulated interest in the concept of car dependence, in the expectation that reducing such dependence would be a direct way of reducing the detriments. Notably, reduction in car use is seen by many authorities as necessary to achieve net zero climate changes objectives. For instance, the Scottish Government aspires to achieve a 20% reduction in car kilometres by 2030 (Transport Scotland, 2022).

Yet, as argued above, a policy-led direct assault on car dependence is unlikely to succeed. Instead, it seems more productive to tackle the detrimental aspects of mass car use individually through evidence-based policies. Thus, the switch to electric propulsion that eliminates tailpipe emissions can be pursued independently of a pushback of urban car traffic in favour of active travel and place-based street activities. The need is to develop a range of policies covering both technological innovation and behavioural change, and to test these for public acceptability and impact. At present, new technologies seem to be more acceptable than behavioural changes that would reduce the access to which we have become accustomed and from which we benefit.

Nevertheless, human behaviour is mutable and it is possible that car dependence may be lessened through appropriate interventions, were there to be better understanding with supporting evidence. Accordingly, there is scope for further research that would illuminate opportunities to reduce car dependence, including investigation of the following:

- The factors that contribute to car use in locations like Copenhagen where cycling and public transport alternatives are good and where there is a strong cycling culture;
- A systematic comparison of the factors affecting car use in European cities, where its mode share varies very widely;
- The socio-economic determinants of car pride, both those attributed to self-esteem and to social status, and why these vary widely across countries;
- Why people choose the particular models of cars they purchase, especially SUVs, an aspect doubtless well understood by the car manufacturers but not by those outside the industry;
- Tracking car use by young adults as they grow older, start families and move to less dense suburbs;
- The effectiveness of interventions to effect behaviour change that would reduce urban car use, most of which seem to have had limited impact so far.

All in all, the concept of car dependence has proved to be less helpful for policy development than had originally been hoped, in part because it implies a judgement by planners and researchers that has not commanded popular support. This contrasts with climate change, where the attitudes of experts, the car industry and the public are broadly aligned in respect of the need to switch from oil fuels to electric propulsion. The evolution of policy and practice is most effective when it moves in line with prevalent public perceptions.

### Conflict of Interests

The author declares no conflict of interests.

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