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Mobility justice in low carbon energy transitions

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ABSTRACT

Mobility systems raise multiple questions of justice. Work on mobility justice and policy often treats different elements of the debate separately, for example focussing on environmental justice or accessibility. This is problematic as it can privilege policy solutions without a full view of the winners and losers and the values implicit in that. Using analysis of current policy, we investigate how mobility justice can reconcile its different components, and find two major consequences. First, is doubt about the justice of the existing policy approach which tries to tackle transport pollution primarily through a shift to low emission vehicles. This approach privileges those with access to private vehicles and further privileges certain sets of activities. Second is a need to reassess which basic normative ideas should be applied in mobility justice. Work on mobility justice has tended to appeal to conceptions of justice concerned with access to resources including resources enabling mobility. These conceptions say little about how resources should be used. We show that avoiding stark inequalities means collectively thinking about how resources are used, about how we value activities involving mobility, and about what sorts of goods and services we create.

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1. Introduction

Whether or not they are explicitly recognised as such, normative ideas are embodied in policies, policy tools and actions influencing transport. Tied up with their explanations of how transport does or could work, are assertions about what is valuable (for instance time, cost, safety) and assertions about how value should be achieved or sought, and sometimes about what constitutes reasonable expectations (for instance, polluter pays, fare subsidy, operator profit). Increasingly there is recognition of the justice concerns associated with mobility and transport. This includes justice questions raised by difficulties some people face in moving around, whether that is moving around neighbourhoods, or over long distances. Further, it involves justice concerns associated with impacts of Transport, and the often uneven distribution of those impacts. There is now work on multiple aspects of what we might call mobility justice, including on matters such as accessibility (e.g. Refs. [46,47,53,59,69]), affordability [54], safety (e.g. Refs. [72,101,102]), greenhouse gas emissions [51,75], health impacts of pollution [55], and land take for infrastructure (e.g. Ref. [22]).

Often, and with some reason given their complexity, work has focused on one or other of these aspects. We argue that this tendency to focus separately on different aspects of justice has limitations which can be far greater than a matter of scope, and that addressing this has two major implications for mobility justice. First, considering aspects of justice independently can lead to a failure to consider how solutions to one problem might impact other justice concerns. Second, reconciling multiple aspects of mobility justice prompts a reassessment of theories of justice or fairness implicit in many of these normative debates. In particular, there is a very strong normative tradition of placing value on individual choice. This tradition has unpinned ideas of justice within transport policy. This paper critically engages with this approach, showing how this framing of value can undermine basic ideas of mobility justice because it tends to arbitrarily privilege some choices, and preferences of some groups of people. Given this, we contend that sustaining basic ideas of mobility justice requires direct consideration of substantive questions of value.

The mobility we consider in this paper is primarily that concerning movement of people and sometimes goods, but without reference to questions such as citizenship. In this use, 'mobility' is broader than 'transport' is often taken to be. Mobility in this context includes the norms, expectations, laws, communications and competences which influence the transport system (see Ref. [8]). It also includes movement other than 'trips', such as walking to a neighbour. Nevertheless, the term mobility also covers a range of

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matters which extend beyond those we discuss in this paper, such as migration.

In the next section we outline theoretical notions underpinning mobility justice, including ideas of how people's lives matter, and why therefore mobility and other social and economic arrangements affecting people's lives should also matter. Then, we investigate different aspects of mobility justice and the potential tensions and resolutions for addressing these aspects through a case study around the transition to low emission vehicles. By drawing in a more holistic set of concerns we explore how this approach to tackling pollution issues can create social exclusion and disadvantage both for those without access to vehicles and for those who struggle financially to run a vehicle. In the face of this, we begin to explore how different approaches to reducing pollution, involving mobility systems less reliant on private powered vehicles may be more promising at reconciling different aspects of mobility justice (cf. [46]). It is in examining the potential of these approaches for settling tensions in mobility justice, that we engage with choice based theories of justice, and then examine the case for collective thinking about values and what sorts of activities should be accommodated, enabled and curtailed. Whilst such an approach is potentially politically contentious it is clear that embedded within the status quo are a range of implicit assumptions which if codified explicitly would also be contentious. This approach is new territory in discourses on mobility justice, but has roots both in transport studies (e.g. Refs. [2,67]), and in approaches in political philosophy which ask "what sort of society" we should have [12,49,78]. The paper concludes by briefly discussing approaches to decision-making for a more just mobility system, taking account of both the impacts of Transport, and of the ways in which different activities are supported or constrained by provision for mobility.

2. Mobility, transportation and conceptions of justice

It is rarely, if ever, possible to simply read off from a description of a situation to an account of what should be done. There can be little dispute that a situation is bad (for instance, deaths on the roads), but much greater disagreement about justifiability of measures to reduce deaths—consider arguments about reducing speed limits, about strict liability [32], and so on. Some investigations of mobility justice draw on specific, and different, theories of justice (e.g. Refs. [53]). Others do not apply any particular theory, but instead implicitly appeal to general notions of fairness or equality [55,36]. Given this diversity of approach it would be meaningless to describe one theory which underpins work on mobility justice. We can, however, outline some basic notions which will be compatible with many of the arguments on mobility justice, and which while under-determined, distinguish these arguments from other normative approaches such as libertarian approaches (e.g. Ref. [60]). These notions will help ground the debate in the rest of this paper, giving some basis for addressing questions such as 'equality of what?' (e.g. Refs. [9,14,80]), or what collective responsibility do we have for one another? These basic notions are:

- i Beginning from the assumption that each person matters (morally) as much as any other: so their life matters, and their ability to make something of their life also matters [35,38,39].
- ii There is a societal responsibility to make political, social and economic arrangements which reflect this assumption that each person matters. This has been described as showing equal concern [25,35,38,39]. The societal obligation also falls on each person, so that people have some responsibility to accept limitations for the benefit of others [59].

- iii Treating people 'as equals' is not necessarily the same as 'equal treatment,' as treatment as equals may require taking account of people's differing needs and contexts ([24], p. 68).

These ideas are compatible with theories falling, broadly, within major and frequently contrasted branches of political and moral philosophy, including liberal egalitarianism on one hand, and virtue ethics and communitarianism on the other. The former is based in a tradition which has been, and to a large extent remains, dominant in western philosophy over the last two centuries (see Refs. [48,25]) however the latter which has a far longer history, has been regaining prominence in recent decades (e.g. Refs. [1,48,99]). Very broadly, for liberal egalitarians, justice must have concern for the distribution of ability or power a person has to exercise choice about the way in which they live (see Refs. [25,56,77]). This requires concern for distribution of resources and conditions, so:

"government must assure all citizens a decent level of income, housing, education, and health care, on the grounds that those who are crushed by economic necessity are not truly free to exercise choice in other domains" ([77], p. 58)

Some of the motivation for this focus on choice (within and beyond egalitarian theories) stems from distrust of the idea that society should constrain individualism. This position is found within some political opposition to authoritarian government (e.g. Ref. [4]), and also within some struggles against discrimination where choice and individualism are adopted as a response to social repression, such as social expectations that women remain in their place—in the home and out of public life (see e.g. [100]). As such, there is an obvious appeal to liberal theories of justice.

In this context, the more recent advocates of communitarian and virtue ethics theories, have tended to frame their arguments as responding to apparent deficiencies in the 'choice' based liberal theories. It may be helpful to outline two strands to these arguments. First, critics of 'liberal choice' point out that the conception of choice in those liberal theories is one which assumes that people can make a decision as if in a vacuum, unencumbered by context, such as social norms, partial and value laden perceptions of the world, and even psychological influences (see e.g. Ref. [48]). This, they argue is an implausible idea of the way in which people act, and think about acting. People exist, and form their sense of self, in relation to the world (and society) in which they live (see e.g. Ref. [99]). Further, our understanding of the world is partial and distributed in the sense that no one person is omniscient, and is value laden in relying on contestable and changing theories (scientific, social and so on) to make sense of the world [6,88]. The context in which people make their choices, is one which is situated, with multiple influences, and this frames both actions and decisions about actions (or choice). Second, the 'choice' based theories of justice tend, it is argued, to present 'choices' or options to people which appear unfair. This sort of argument is commonly made in relation to those liberal theories which justify large economic inequalities, for instance, theories which assert that redistribution is unjust on the grounds that it interferes with people's choices about the way in which they use their property (e.g. [60]). However the objection can also be levelled at liberal egalitarian theories despite the concern that those theories have for making social and economic arrangements in which everyone has access to (some level of) resource. One difficulty is that their focus on individual choice, does not allow for adequate (or fair) accommodation of social values. For instance, choice based theories are criticised by feminist virtue ethicists on the basis of the way in which they treat care giving. While recognising that 'choice' based egalitarian theories would require that resources are provided for care (since some people need care to be able to exercise choice), they argue that this commodification does

not capture the nature or social value of care giving (see for instance, Ref. [81]). For virtue ethicists and communitarians, there is a case for theories of justice asking what should be valued, accommodated and supported by society.

This brief discussion indicates that there are at least some compelling reasons underpinning both of these branches of political philosophy. In this paper, while we begin from a position of accepting concern for equality we are also, at this stage, neutral between these two branches. As our argument develops we show that for mobility and Transport, the liberal 'choice based' theories face particular problems, and this makes a case for adopting an approach closer to the virtue ethics and communitarian approach.

Both of these branches of political philosophy will have concern that people have material and other conditions needed to live well. In relation to mobility this broadly involves consideration of accessibility and inclusion on one hand and life-threatening risks and aspects of sustaining life on the other (e.g. Refs. [3,36,46,53,55,57,59,95,102]). Both are conditions for surviving and living well, and making something of life. The focus on inclusion, accessibility, or availability of movement or Transport, recognises that this enables engagement in social, economic political and personal activities. The focus on sustaining life and on physical risk or harm reflects the role of transport in provision of essential goods and services, and in ending lives in multiple ways, particularly through collisions, poor air quality and potentially through carbon emissions. In this paper we do not challenge the relevance of these factors, but we do emphasise significance to justice of considering these aspects together rather than as distinct elements.

3. Pollution reduction and the reductionism of mobility justice: a case of British policy on tackling transport pollution

To explore the first of our contentions from Section 1 we use a study of the policy approach in adopted in Britain aimed at reducing carbon and other transport pollution. Whilst a broad spectrum of policies could be applied to tackle local and international pollution problems, the overwhelming response has been to pursue technological solutions to reduce tailpipe emissions and therefore tackle environmental injustice. We draw on the broader conceptualisation of mobility justice which emerges from Section 2 to exemplify the risks in considering different aspects of mobility justice in isolation.

The reliance that our existing mobility patterns have on fossil fuels creates a heavy, and well recognised, burden of pollution. In many countries transport is the major source of poor air quality including nitrogen oxides and particulates which have huge impacts on morbidity and mortality [11]; WHO, 2012. For instance, in the UK, poor air quality predominantly caused by Transport, has been estimated to have mortality impacts 'equivalent to nearly 29,000 deaths' in 2008 ([11], pp. 1–2).¹ Pollution from diesel has been identified as a cause of lung cancer [96]. Moreover, exposure to poor air quality is uneven, and there is a broad correlation between levels of nitrogen oxide pollution and the proportion of households in poverty [55]. Beyond this, emissions from transport account for nearly a quarter of total worldwide carbon emissions from fuel combustion [42]. This pollution prompts concerns not only about the nature of impacts, but also about the ways in which climate impacts on health and welfare and can be exacerbated by existing social and income inequalities ([43], p. 6). The nature, scale, and the

distribution of impacts of pollution on health and welfare, make a compelling moral case for seeking substantial emission reductions.

In many countries, including Britain, the policy approach on tackling transport pollution relies heavily on an extensive expansion of powered low emission vehicles (see for instance Refs. [20,27,79,10,21]). In Britain, hopes for development of ultra-low emission vehicles intended to replace the current fleet of vehicles, is the dominant feature of the Westminster Government's plan for meeting its commitments to reduce carbon from transport. This ambition is illustrated in Government's Carbon Plan [40] (Fig. 1).

Low emission vehicles are not the sole strand of measures to improve pollution from transport. Other measures, appearing in transport policy and planning locally, nationally and internationally, and intended to help reduce transport pollution include various approaches intended to increase walking and cycling, to support public transport and to reduce travel (e.g. Refs. [2,16,27]). However these take a secondary role at present. For instance, the Committee on Climate Change (who advise the English Government) hopes that measures to encourage travel by means other than private cars could yield reduction of 3 MtCO₂ by the early 2020s ([10], p. 142). This is small compared to the approximate 43 MtCO₂ reduction from road transport intended by the CCC in the same period.²

This policy approach has implications on two levels for our first contention on mobility justice. First, some of the specific policies in this area raise concerns about fairness and distributive justice. Second, the overarching approach of focusing on vehicle technology may exacerbate existing justice concerns around accessibility, affordability and availability of transport. These are explored in the remainder of this section.

3.1. Distributive fairness and pollution policies

We briefly describe two pollution reduction policies which exemplify the kinds of initiatives which are underway to tackle a combination of local and global environmental issues. The first is the raft of incentives which are currently in place to encourage the adoption of electric vehicles. There is a substantial cost premium between a new electric vehicle and a new petrol or diesel engine vehicle. This is, in part due to the technology maturing, but also because of continued high battery prices. Over time it is anticipated that this cost differential will reduce (see Ref. [10]). The extent of the cost differential between the vehicles which the consumer is faced with is a matter of government policy. In the UK, for example, a £5000 grant is available for electric vehicles which makes, for example, an electric VW Golf around one third more expensive to buy than a petrol equivalent. There are then in-use charges which can also be manipulated with, for example, electric vehicles paying lower energy taxes, being exempt from annual road charges and the like [10]. The running costs of the electric Golf in the UK are estimated to be around one third of those of the petrol equivalent. The country with the highest proportion of new electric vehicle sales (23% of all new vehicle sales in June 2015) is Norway. Table 1 shows the incentives on offer in Norway until 2018 and the questions which this might raise.

In this respect we could expect advantages to people who have access to an electric vehicle, and who therefore use less of their income engaging in whatever activities involve driving. That by itself might not concern justice, if those who do not benefit do not also suffer a further dis-benefit. However there could also be further reaching more indirect impacts. For instance, costs of run-

¹ The complicated language here is because poor air quality will be one among several factors implicated in deaths, making it unfeasible to attribute given deaths to poor air quality alone. The mortality figures which are given are therefore an estimate of life years lost across a population due to poor air quality (see Ref. [11]).

² 43MtCO₂ is calculated using the CCC Headline Indicators for the British third carbon budget which runs to 2022 (CC2015, Annex 4) and from other data in the CCC [10] report.

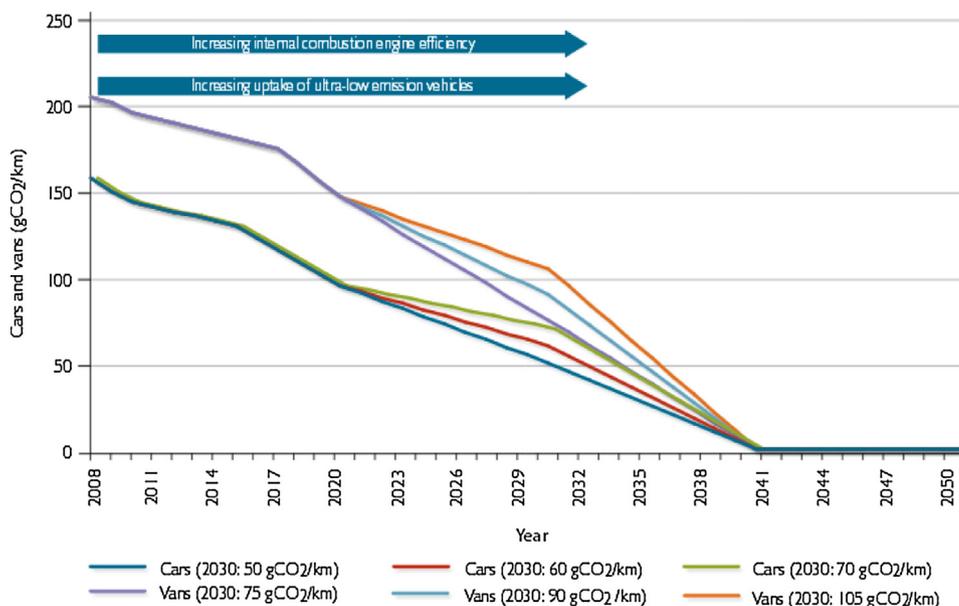


Fig. 1. Source [40], p. 53.

Table 1
 Norwegian Electric Vehicle Incentives [89].

Incentive	Issue
Exempt from purchase tax (currently around 100% of the cost of the vehicle)	There are other ways in which this tax rebate could have been spent
Exempt from VAT on purchase at 25% of transaction	Essential items such as clothes (25%) food (15%) have VAT payable as does public transport (8%)
Exempt from annual road tax (£230/annum)	
Exempt from all public parking fees	These all make use, rather than ownership of the car more advantageous relative to other modes.
Exempt from all toll payments	
Rights to use the bus lanes	
Access to a public charging network of 5000 public charging stations	These spaces are often in convenient and prestigious locations and commit road space to car use.

ning second hand cars may increase due to battery maintenance, or there may be pressure to raise fuel duty for fossil fuel vehicles, particularly as they become a minority yet one which is predominantly low income drivers. These are a potential consideration for justice, albeit a consideration complicated by the problem that the nature and scale of such impacts are difficult to judge, especially in advance of the ability to make assessments the scale of any changes in disposable income.

In London, in addition to a less aggressive role out of electric vehicles, an Ultra-Low Emissions Zone has been proposed. The zone which will operate 24/7, partly for practical reasons will cover the same area as the central area congestion charge and will be enacted in 2020. The approach has been to develop different standards which should be adopted by different user categories (e.g. car, bus, taxi, motorcycle) with the aim that most vehicles entering the zone will be compliant as a result of fleet renewal. It is estimated that 23% of heavy goods vehicles, 27% of cars and 33% of light goods vehicles using the zone will pay the charge [90]. The fee for drivers is set to be £12.50 per day. The goal is therefore to deter frequent users who are also high emitters of NOx and particulates and to provide spatially targeted improvements to air quality, which is currently above levels defined as safe to human health. This is an access and use based charge rather than an ownership charge and therefore only mirrors part of the issues raised by electric vehicle subsidy. Here the concern will be that these are regressive taxes, especially if it is those who are wealthier who can afford the less polluting vehicles [26,97]. Exemptions are perhaps an obvious response to

justice concerns associated with regressive taxes, or more broadly with high costs of travel. However it is only if we can determine that this justice problem is marginal, affecting only a small number of people and their vehicles and so requiring just a few exemptions, that exemptions would mitigate the concern without counteracting the very purpose of the tax or charge on polluting vehicles.³ Discussions surrounding exemptions and discounts to the London congestion charge were contentious, with discounts or exemptions for people with disabilities, National Health Service vehicles, and armed services, residents living in certain areas near the congestion charge zone, low emission vehicles, motorcycles, public Transport, and emergency services.⁴ What are the implicit values being placed on different activities here and would they apply also to pollution charges?

3.2. Accessibility, transport availability and policy on low emission vehicles

Inaccessibility and lack of availability or difficulty in paying for travel, in their many often quite diverse forms, can be justice problems as they can be a firm barrier to participation in social and

³ Here we have left open the question of how the justice problem might be determined, that is, what level of financial burden, affecting which people, would be a justice problem requiring action.

⁴ See TfL [91] <https://tfl.gov.uk/modes/driving/congestion-charge/discounts-and-exemptions>.

personal activities, caring, education, employment, healthcare, and so on. To see this, let us reflect on existing arrangements of transport and mobility. For many people, many everyday activities involve travel by car (or similar) either as driver or passenger: for instance in Britain, estimates are that 64% of trips were by car in 2014 [19], and across Europe in 2013 over 83% of passenger km were by car [31]. It is not just that more of this travel happens to involve cars, but rather it seems that in many cases there is little other option, and travel without a car can be difficult for a range of reasons, including:

- i. Time taken to access services can be much greater without a car (see for instance, Ref. [17], s1.5). The relevance to justice of this form of accessibility is complicated by the way in which the importance of access to given services varies for different people, and at different times. Further justice concerns may arise if an accessible service is not the most appropriate of its type for the people requiring it (this might be especially relevant where services specialise—for instance, specialist hospitals).
- ii. There are physical difficulties in travelling without a car, including:
 - Difficulties in negotiating public transport [86];
 - Severance caused by busy roads [68];
 - Relatively high risks and safety fears associated with some non-car modes [68,59]
 - Insufficient public transport and lift services (see Ref. [98]);

i. Walking in polluted and unpleasant environments (such as high traffic environments) has been found to be detrimental to welfare [7].

Finally there are concerns that unaffordability of transport has detrimental impacts on household budgets. Public transport fares have been identified as a factor exacerbating social inequalities [86]. Further where access by non-car means is particularly poor (e.g. in rural areas), significant proportions of household budgets can be spent on running a car, leaving less wealthy people facing what Mattioli and Colleoni (2015) call 'car related economic stress'.

While traffic makes participation difficult for some, it does not necessarily make it impossible. So drawing on the sort of libertarian argument that says people should manage for themselves even if that is difficult, some might question whether this difficulty in participating is really a concern of justice. Yet this form of argument is problematic for any idea of distributive justice which is broadly concerned with the welfare that people are able to achieve. Simply, making basic or important activities difficult, even if not entirely impossible, is going to inhibit that welfare. What we have is a mobility system which privileges those who can access a private vehicle and can afford to use it, and which privileges certain activities over access to welfare for others. Consequently it is not feasible to dismiss the relevance to justice of problems of travelling without a car.

Given this, what are the further justice implications of pollution policy emphasising take up of low emission vehicles? There is some difficulty in assessing what impact this policy approach might have on the difficulty of moving around without a car. This is due to the problems of speculating with confidence on whether electric vehicle uptake would be on the basis of one-to-one replacement for journeys, by conventional vehicles. It is suggested that there is some demand elasticity between car travel and fuel prices ([15], p. 958). Beyond this, wider social changes, which might or might not be influenced by availability of electric vehicles, might have impacts on the way in which vehicles are used in future [37]. Moreover it is not apparent just how much, or how fast electric vehicles might be taken up. For instance, the UK government grant intended to incentivise sales of ultra-low emission vehicles will be reviewed after '50,000 cars have been sold' ([16], p. 8). Even at this level,

50,000 private low emission vehicles appear a drop in the ocean given over 26 million private cars on Britain in 2013 [18]. There is uncertainty about how much, or where, impacts of low emission vehicles would be felt there were much higher levels of take up.

Yet these questions about future impacts of policy on electric vehicles, risk obscuring an important factor. That is, we have a policy approach predicated on the assumption that there will be a major take up of low emission vehicles, and so gives relatively little attention to reducing travel by powered vehicles. As such, it is a policy approach which seems to help sustain our existing conditions involving reliance on cars. Consequently it is an approach which fails to address the mobility injustices which as we discussed in the last section are associated with difficulties in moving around without access to a car.

4. Reconciliation for mobility justice?

The second contention we set out in Section 1 is that reconciling multiple aspects of mobility justice prompts a reassessment of theories of justice or fairness implicit in many of these normative debates. This might not be immediately apparent: much of the tension described above is associated with unequal wealth and cost burdens, and a first attempt at resolution might be to reach for familiar forms of re-distribution. In this section we first consider the potential, and the limitation for justice of a re-distributive approach. We then examine the alternative approach of reconciling the tension by a mobility system substantially more focused on walking, cycling, and public transport and with much less emphasis on private vehicles. This, we argue, could tackle limitations of re-distribution, and it is this that requires reflection on the underlying normative theories.

4.1. Cost and choice

Altering resource distribution might take multiple forms, ranging from a comprehensive public policy programme for reducing wealth inequalities to far more focused measures within specific sectors or areas. It could, initially, appear that attempting to tackle mobility justice through resource re-distribution might require only focused interventions, for instance around reducing tax, or providing subsidies for low emission vehicles and fuel. This idea has some traction in policy and public debate where arguments on fuel taxes are often framed in terms of their distributional impacts [36,44,97]. Tax and subsidy may impose greater or fewer burdens on different groups, and can be more or less just. However this is a long way from its being a tool for effectively tackling mobility justice. To begin, a necessary condition would be that the system was robust enough to provide people with low emission vehicles which they could afford to run. There are, at best, doubts over the financial viability of this sort of intervention (cf. [33]) and potentially further questions on whether production of low emission vehicles could meet the levels required. Moreover, to avoid creating greater, acute, mobility injustices, any policy approach of this sort would need to facilitate provision for people who cannot drive. Shared vehicles, lift services might provide for some of his need, although extensive provision might raise further questions about affordability and employment conditions for those staffing the services (cf. [74]).

The sorts of (re-)distribution discussed here are difficult and perhaps unfeasible for public policy. If however we put these doubts aside, a further concern appears. The proposal here is to support much greater use of vehicles, and that will limit other possibilities, including possibilities for land use taken up by roads and parking spaces, and options of moving around without vehicles. This constraint could be framed as a limiting of people's choices. Against

this, there might be an attempt to draw on preference utilitarian arguments to claim that the constraints are a legitimate consequence of people exercising their choice to use vehicles. This type of claim tends to be subject to objections that inequalities in society mean that people have greatly unequal ability to exercise choice, and that therefore they frequently face unjust conditions imposed by the consequences of other people's choices (see Ref. [25]). However if there were the sort of redistribution described here, which seeks to reduce inequalities in access to vehicles, then this claim would have some resilience to such objections. Nevertheless the resilience would not save the argument. The possibilities available to people, and the decisions people take to travel in particular ways to particular places, are all made and constrained, within the context of the built environment within which they live. People influence those conditions, but individually they cannot be said to have created or chosen them (see Refs. [51,78]). So the question that remains is, what possibilities (or sets of choices) do we collectively want to attempt to facilitate? We will return to this question later in this section.

4.2. Values in less motorised mobility

There is nothing new in the idea that mobility involving substantially more walking, cycling, public transport, taxis and lift sharing, along perhaps with travel reductions (perhaps using more virtual technology) can reduce transport pollution (see Ref. [51]). Importantly for our present discussion, these forms of mobility have often been presented as having potential to address many of the justice concerns associated with accessibility, availability and affordability of transport (e.g. Refs. [41,46,59]). This idea also follows from discussion in Section 3 which described how traffic itself can be a mobility barrier especially for those reliant on non-car modes, and a financial burden for some people who rely on car use.

Yet there are also questions about whether, or under what conditions, greater non-car mobility could reconcile the different aspects of mobility justice. First is a need to consider potential implications of a significant shift to reducing car use. In part this is required because, although there has been long-lived discussion of the benefits of reducing travel by cars, this has not translated into substantial levels of change. There are partial exceptions, such as quite dramatic increases in levels of cycling in some countries (such as Netherlands, German and Denmark—see Ref. [70]), but in those cases the change has not been great enough to avoid substantial pollution problems (compare NO_x emissions in Denmark [28]; Netherlands [29]; UK [30], and greenhouse gas emissions from transport [92–94]). So what might be the other justice implications of changes substantial enough to effectively reduce the injustices pollution creates?

We can expect that a significant shift to non-car mobility would limit possibilities for, or ease of, conducting some activities, while making other activities easier or more feasible. There is uncertainty about exactly what impacts would be associated with different configurations of mobility, coupled with uncertainty about how different configurations of mobility could be created (cf. [71,83]). Nevertheless we may be able to make some broad points about the sorts of impacts that might be at issue.

In a move to system of mobility with significantly less car use, impacts on activities could be expected to depend in part on where people live [54], and on how services and developments themselves re-configure to take account of the changing mobility system (see e.g. Ref. [73]). Impacts could also vary with differences in physical health and mobility (although any mobility system which does not mitigate these differences would be unjust for that reason alone). The impacts, and distribution of impacts, may also stem from differences in the sorts of activities people engage in, and benefit from. For instance, some longer distance, or complex leisure travel might

be less feasible where there is more non-car mobility. Some business practices might need to Change, especially where a premium is put on face to face meetings and conferences between geographically dispersed colleagues (see for instance, Ref. [87]).

We suggest in what follows, that we might not be able to rely on initial or expert judgements about the importance of activities and deliberation is required to judge their value and how society might support them. Nevertheless these initial judgements can be a good place to start, as questions involved in thinking about value begin to emerge when we consider activities for which, on the face of it, we can expect a broad level of agreement that there is significant value. If justice is concerned that people can obtain a reasonable quality of life, we might assume that there is a fairly uncontroversial value in activities including securing food and shelter, healthcare and education. Yet once we begin to think about what these activities can involve, then it becomes apparent that there is an open ended range which could reasonably fall within the scope of these basic activities. As Shove [82] argues, everyday practices concerned with apparently basic aspects of living, alter and over time can expand to involve increasing resources. Among the influences on practices are the conditions in which they occur and which make them possible. For instance, for many people, aspects of health, and sometimes life-saving healthcare, can be supported by fast access to hospitals and access to medicine, by constant availability of nutritious food, by good housing and by living in unpolluted areas. Some of these activities, such as access to specialist healthcare, are supported by a transport system which accommodates relatively long distance travel by geographically dispersed populations. This is not just a question of getting ambulances in emergencies, but takes in factors such as health service logistics, patient appointments, staff and visitor travel. It may, for example, be necessary to consider changing the spatial patterns of health service delivery in a mobility system far less reliant on cars (cf. [45]). Whilst this might seem challenging it is worth reflecting that some cities are already far less car dependent and we already have different service structures in play. However these justice questions require deliberation of substantive values: for instance, we may need to consider the value of a mobility system capable of supporting very specialist healthcare interventions against value of a less polluted environment or an environment which presents fewer barriers associated with traffic.

This is where attempts to reconcile different aspects of mobility justice lead us to diverge from some liberal theories of justice which aim to develop sets of resources and conditions to which people should have access. In short, we are arguing that we need to think about substantive values of activities which involve different resources or conditions. Moreover we are suggesting that there can be constraints on how people can justifiably engage in activities which contribute to quite fundamental needs. The reason for this is just the equal importance of others' ability to participate, and the potential for some forms of participation to amount to barriers to other activities. This might appear controversial, however as we noted in earlier sections, this is an approach which reflects a long tradition in political philosophy of virtue ethics and communitarianism which places emphasis on consideration what should be valued, and supported by society. Further, substantive values already shape much public policy, such as healthcare provided by taxpayers and free at the point of need.

In thinking about how to make these substantive value judgements about different types of activities, it is possible to take some steer from the basic ideas of equality unpinning many theories of justice. Yet these take us only so far. These ideas can be good at helping to identify some injustices, but although they do give a guide, they leave more difficult questions for thinking about what is just. As we can see with the example of specialised healthcare services many justice questions are nuanced, and there are no obvious judgements about what is just. Following others, we

can suggest that in a democratic society these types of questions should form part of public deliberation and debate (for instance, Refs. [23,58,64,84]).⁵

4.3. Partial knowledge, reflexivity, and understanding impacts of change

Questions about what activities should be supported and what conditions are just, cannot be separated from questions of how we assess the influence of different mobility configurations on activities, and how different configurations might occur. Without some ability to understand what activities are feasible, there is little purpose in attempting to discuss substantive values of those activities. Further, if we are uncertain about the influence of interventions (whether these come from policy, or citizens' or organisations' actions), then we may also run a risk that interventions will lead to circumstances more unjust than before. To aid decision-making there are, of course, models and other decision-support tools drawing on combinations of theories of behaviour (such as welfare economics, behavioural economics, social psychology) and empirical data (see e.g. Ref. [62]). It is worth recognising the limitations of these tools. So, it may be inevitable that models are theory laden⁶ and that debate on theories will be an ongoing process, involving difficult questions about how well social scientific theories explain what has happened and predict what will happen [71]). It may also be inevitable that data is partial. Data collection is limited by practicalities, and will be shaped by the theories and assumptions underpinning the models (see Ref. [52]).

Reflexive approaches in social and other sciences, and in governance, have been proposed in response to recognition that knowledge and predictions are something that is at best partial and uncertain [5,13,76]. Given this, reflexive approaches may have something to offer in thinking about implications of different mobility configurations. Very broadly, reflexive approaches accept that people's understandings will be shaped by the (parts of the) world they live in, and so in that sense will be partial.⁷ These approaches also suggest that activities do not follow constant patterns over time but instead develop and change, partly, in response to one another [83]. By recognising partial knowledge and unpredictability, reflexive approaches hold prospects of building processes of knowledge development which include involvement of people across society. These approaches can take seriously the prospects that knowledge is distributed across groups and people in society (e.g. Ref. [6]). Further, these approaches may avoid attempting to fully specify aims or ambition for change at a single point in time, instead leaving some flexibility to take account of developments and to make provisional decisions based on recognition that knowledge at a given point is only partial. This is intended to give scope for developing knowledge, and interventions, in response to the different (partial) knowledge brought by different people and in response to emerging events [76].

The difficulties and potential limitations faced by participatory approaches should not be understated however. To be meaningful, participatory approaches would involve deliberation, influencing public policy and planning, from national, regional or even international levels (concerning high level positions, such as on the sort of public services society might support and the transport system

required to make them possible) to much more local decisions such as whether children's ability to play outside should take priority over convenience for drivers. There are well documented practical limits to participation which have implications for the democratic and epistemic claims which can be made for it. These limits include tensions between depth of inclusion and the numbers of people that can engage in public debate. It is difficult to hold nuanced discussions among large groups (cf. [23,58]), and this limits the both potential for representation and for including diverse experiences and knowledge. Further concerns surround power imbalances leading to certain sorts of knowledge being ignored, and other sorts of knowledge being privileged (see e.g. Refs. [50,63]). Beyond this are the many epistemological questions and arguments on the way in which we can, through any processes, understand aspects of the world as it is now or in the future.

Despite limitations, reflexive approaches appear to have a particular relevance at least as one of the means for trying to assess impacts, and justice implications of mobility change. It is clear from the two policies which we discussed that the current approach to thinking through policy implementation is largely blind to a significant number of significant justice issues. We suggest this is likely to be endemic in the sector and connected to the technocratic expert led approach to problem solving. Whether a reflexive approach could produce the epistemic conditions to facilitate different and more just outcomes is a question for further empirical investigation.

5. Conclusion

The policy imperative for low carbon futures or tackling the unexpectedly stubborn urban air quality problems in cities across Europe has led to policy prescriptions which focus on a low carbon technology transition. Taken in isolation and focussing on the achievement of the prescribed goals, the policy prescriptions (if achievable) promise to tackle spatial environmental injustices and to contribute to reducing the inter-generational injustices which climate change in particular implies. We have shown however in this paper that examining justice from an issue specific perspective is to marginalise the wider impacts of policies on notions of justice more generally. Specifically, the choices being made at the start of this transition reinforce the unwillingness of solution sets to challenge automobility for the most well off and exemplify a wider problem that the current framing of policy problems and solutions seems to present for more just interpretations of policy. Still worse, the policy options pursued to kick start the transition not only exemplify why injustice is perpetuated but amplify this injustice through the allocation of financial resources and space to the most well off in society. Unless we take a more comprehensive understanding of mobility justice there is a risk that in attempting to address one problem, injustice is inadvertently (or deliberately) widened.

We suggest a move to more reflexive governance could provide a means to navigate through this complex policy period to ensure that the future imaginings of society and the policies designed to support that narrow, rather than widen, injustice. Unless thought is given to the ways in which resources are used and conditions created, then de facto privileging of activities (and some people's choices) leading to stark inequalities is likely to occur. We do not underestimate the challenges of furthering such an approach from both a practical (limited governmental resource) and political (limited interest in reframing the choice based narrative). It might indeed be difficult to create effective deliberative processes. However, the alternative is to accept a range of significant yet implicit policy outcomes which, were they to be open to reasoned debate would be deemed unpalatable, we hypothesise, by many.

⁵ It should be noted that this is not an argument for ethical relativism: we are saying that non-relativist notions of justice imply that we need to make the collective judgements about the value of different activities.

⁶ Attempts by philosophers of science to describe small parts of the world in terms solely of observable phenomena showed the almost overwhelming difficulty of working without theory—see Refs. [34,88].

⁷ As we note in Section 2, this view of knowledge is adopted by communitarians and virtue ethicists.

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