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Commuting practices: New insights into modal shift from theories of social practice

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ABSTRACT

The automobile commute makes an important contribution to carbon emissions but has proven stubbornly resistant to modal shift policy initiatives. In this paper we use theories of social practice to develop insights into why this stubbornness might exist, and what might help accelerate transitions to bus- and cycle-commuting. By analyzing qualitative data about everyday mobility in two UK cities, we examine how the availability of the constituent elements of bus- and cycle-commuting practices is crucial for modal shift to occur, but they are often absent. We also draw attention to time-space contingencies that render recruitment to low-carbon commuting practices more or less likely, including how commuting is sequenced with other social practices and how the sites of these practices interact with the affordances, and spatial infrastructure, of bus- and cycle-commuting. These insights lead us to argue that choice and land use planning focussed policy initiatives designed to invoke modal shift need to coexist in integrated policy configurations with initiatives designed to reshape both mobility and non-mobility practices. This means addressing the structural barriers caused by the lack of availability of the elements that constitute bus- and cycle-commuting, and intervening in the timing and spatiality of a range of social practices so as to reduce the tendency for commutes to have spatial and temporal characteristics that militate against the use of bus and cycle modes.

1. Introduction

It is now widely recognized that in the context of targets to reduce global greenhouse gas emissions, the transport system and its decarbonization has a major role to play (Cohen, 2010; Schwanen et al., 2011). Of course, it is also widely recognized that changing travel behaviors from automobile to lower carbon bus, cycling and walking mobilities is extremely difficult (Cabinet Office, 2009; Whitmarsh and Kohler, 2010). In this context, a now large body of research examines how significant change might be achieved through policy initiatives. Policies informed by rational choice economics, social psychology, and 'nudge' theories have gained particular traction in the UK and other European contexts, fitting with neoliberal logics which encourage the shaping of individuals' choices, rather than direct policy interventions in the conduct of everyday life (Barr and Prillwitz, 2014). Initiatives targeting transport infrastructure have also been important; although it is recognized that investing in transport systems alone is unlikely to lead to rapid moves to low carbon modes (Hickman and Banister, 2007). Hence, structural interventions that use urban planning to make low carbon travel more feasible, through reductions in travel distance and time in particular (Handy, 1996; Naess, 2012), and policies that render car travel either more difficult or more expensive (Fujii et al., 2001; Thøgersen, 2009) have also been deployed. Such multi-dimensional approaches to policy necessarily take account of the effects of broader societal structures on mobility behavior (Banister, 2008; Marsden et al., 2014).

In this context, this paper builds on growing interest in what a 'theories of social practice' perspective (Reckwitz, 2002; Schatzki, 1996; Shove et al., 2012; Shove and Spurling, 2013; Watson, 2013), hereafter 'practice theory', reveals about both the production of high carbon mobile lives, and about how significant change might occur towards lower carbon, more sustainable mobilities. Using the case of one type of mobility – the commute – and empirical examination of commuting by bus, car and cycle, this paper addresses two main questions. What unique insights can practice theory provide into factors affecting commuting mode, and therefore the uptake of low carbon commuting? What does a practice theory perspective tell us about the configurations of policy (i.e., coexistence and collaborations between different policies) needed to invoke significant shifts to low carbon mobility? In dealing with these questions, two distinctive and interrelated contributions of practice theory are drawn upon and developed.

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First, we show that a practice theoretical perspective stresses the way bus-, car- and cycle commuting are distinctive practices in their own right, involving different social and material conditions than other forms of bus, car and cycle mobility respectively. Through an analysis of the 'elements' of different commuting practices, we show that the more social (competence and meaning) aspects especially are tied to the specificities of the practice of commuting by a particular mode. We suggest that societal structures currently constrain the widespread existence of the competencies and meanings that would lead to greater uptake of low carbon commuting practices, necessitating policy that addresses such issues. Second, we demonstrate that practice theory highlights hitherto underemphasised relations between practices, time and space (Schatzki, 2009, 2013; Shove et al., 2012). Empirically examining the sequences of practice of which commuting forms a part suggests that the timing and spatiality of practices sequenced with commuting need better consideration in policy. This involves recognizing the value of land use and transport planning, but also the potential of different forms of intervention which allow the retiming and relocation of sites of practice: policy that extends beyond concerns with transport *per se*, and which considers the influence of factors such as educational, leisure, shopping and healthcare practices on modal choice for commuting (Spurling et al., 2013). Together, these two insights point towards a more holistic approach to low carbon mobility policy. This involves policy configurations which in part exploit already recognized strategies but in more integrated ways. However, developing new policies that target the unique competencies and meanings of low carbon commuting, and the timing and spacing of practices that generate demand for travel, is also important. Towards the end of the paper we, therefore, present a spectrum of policy interventions that holistic policy configurations might include.

The remainder of the paper proceeds as follows. In the next section we consider existing literature on travel behavior and behavior change, and transport policy approaches towards commuting modal choice. In the subsequent section we identify how a practice theory informed analysis provides new insights into commuting. The second half of the paper, following an explanation of our qualitative methodology and methods, is structured around two empirical sections that in turn identify: the practices of car-, bus- and cycle-commuting and the elements brought together through their performance, and; the spatial and temporal contingencies that affect recruitment to bus- and cycle-commuting practices. The penultimate section of the paper draws out these insights' relevance for policies to promote sustainable behavior change and lower carbon mobility and we conclude by reflecting on their implications for policy (re)configurations.

2. Modal shift and low carbon travel policy

Informed by early research designed to forecast demand through modeling travel behavior (Ortúzar, 1994) and assess the economic rationality of transport infrastructure investments, a foundational body of transport policy rests on an understanding of travel as a utility-maximizing behavior, with rational choice models (Gardner and Abraham, 2007) helping predict responses to particular policy interventions. Such work has inspired a vast array of elaborations and critiques, with collections such as those edited by Banister et al. (2013) and van Wee et al. (2013) offering comprehensive overviews of perspectives on what influences how people travel, and the implications for policy. Here we focus on two commonly acknowledged prime influences on travel behavior, given their relevance to the insights provided by practice theory and the impossibility of comprehensively reviewing all of the different literatures: a) perceptions of and attitudes towards costs, the value of time, and transport modes themselves, and; b) the physical environment (and transport infrastructures) within which these choices are made. Of course, this means taking account of what the literature tells us about the recursive relationship between the two, the latter potentially influencing the former, e.g. as situational influences, and vice-a-versa (Klöckner and Blöbaum, 2010).

In terms of perceptual and attitudinal influences on travel behavior, 'situational factors' such as cost and travel time (Noland and Polak, 2002), beliefs, norms, values and attitudes (Heinen and Handy, 2012), and the effects of altruistic or egotistic attitudes (Heinen et al., 2011) have been incorporated into models, and also compared and contrasted with approaches such as the theory of planned behavior (Ajzen, 1991) and the norm-activation model (Schwartz, 1977). More recently the Comprehensive Action Determination Model (Klöckner and Blöbaum, 2010) combines "intentional, normative, situational, and habitual influences" (574) and concludes that not only attitudes but constraints and habit are at least as important as active choice (or norms or deliberation), confirming that changing habits can activate modal shift (Verplanken and Orbell, 2003).

In light of such models, a range of transport policy initiatives have been developed which seek to change attitudinal and habitual influences on travel behavior, often together (Fujii and Kitamura, 2003), with habit change viewed as a more permanent form of attitudinal shift (although see Schwanen et al., 2012 on the complexities of the links between attitudes and habits, and the way policies change one, another or both). Interventions in infrastructure designed to remove choices, e.g. through road closure (Fujii et al., 2001), increased pricing of car parking (Thøgersen, 2009) or congestion (Shiftan and Golani, 2005) etc. have played some role, but 'soft' interventions designed to influence or 'nudge' choices (Thaler and Sunstein, 2009) have become more prevalent in recent years, these not changing the alternatives available or their costs, but seeking to raise awareness of already existing low carbon possibilities and promote their use through (often personalized) marketing. Such approaches seek to 'voluntarily' (Cairns et al., 2008) change behavior, with smarter choices (Barr and Prillwitz, 2014), sustainable travel town (Sloman et al., 2010), and Personalized Travel Planning initiatives (Bamberg et al., 2011) exemplifying this. Such approaches have grown in popularity as they are politically palatable, because they fit neo-liberal agendas of choice (Jones et al., 2011; Marsden et al., 2014; Pykett, 2012). Recent assessments of such voluntary behavior change policies suggest that there is disagreement over their effectiveness (Bonsall, 2009; Brög et al., 2009; Chatterjee and Bonsall, 2009). However, they are a central plank of UK and many European policies promoting low carbon travel.

It is, though, known that "individualistic, rational paradigms fall short on understanding certain complexities of travel behavior" (Carrasco and Farber, 2014: 1). Whilst not completely discounting the kind of policy approaches outlined above, a growing body of writing has called for recognition of how social (Lin and Wang, 2014) and spatial and temporal (Yoon et al., 2014) contexts also influence travel behavior and could be addressed through policy. Revealing the importance of spatial and temporal factors, the activity-based approach (ABA) (Axhausen and Gärling, 1992; Jones et al., 1983; Kitamura, 1988; McNally and Rindt, 2008; Shiftan, 2000) highlights the 'derived demand' for travel as people access and accomplish activities. This approach helped to move transport policy from a 'predict and provide' mode to demand management (McNally and Rindt, 2008) in which a focus on temporal and spatial constraints features center stage, with "where and when the activities can be carried out and how they may be scheduled" (Algers et al., 2005: 767) becoming recognized as fundamental to producing travel patterns. The intellectual roots

of this approach have been ascribed to the time-geography studies of Hägerstrand (1970) and an understanding of mobility "as embedded in how people have to negotiate space and time in the course of weaving together the activities which comprise their days" (Watson, 2012: 491). Studies concerned with low carbon travel thus acknowledge that increasing travel times tied to increasing distances between workplaces and homes (Handy, 1996; Næss et al., 1996; Rye, 2002; Shaw and Gallent, 1999) can create car dependency (Dickinson et al., 2003). The trend of 'decentralized concentration' in urban spaces (Bertolini and le Clercq, 2003), resulting in complex and diverse travel patterns with growing 'spatial reaches' (Curtis, 2008), has thus been identified as a major structural barrier to low carbon travel.

The question thus becomes, how can policy remove spatial and temporal barriers to low carbon travel? In this regard, land use and transport planning policies have been identified as crucial complements to choice-based initiatives (Aditjandra et al., 2013; Ben-Elia and Shiftan, 2013). Urban form (particularly density and the distribution of home and work sites) has been shown to structure travel behaviors in ways that enable as well as inhibit low carbon travel (Handy, 1996; Naess, 2012), with shorter distances more suitable for cycling and walking (Ben-Elia and Shiftan, 2013; Pucher and Buehler, 2008). The need for dense development linked to public transport infrastructure (Banister, 2002, 2008; Bertolini and Dijst, 2003; Curtis, 2008; Kingham et al., 2001) to be encouraged through land use planning and other policies (Crane and Scweitzer, 2003) has also been highlighted. Others argue, however, that a radically different policy approach to managing temporal and spatial constraints is needed if significant change is to be achieved (Tennøy, 2010). This involves extending from land use planning to policies designed to allow "activity/travel schedules to be fulfilled" (Schwanen et al., 2012: 527) using low carbon travel. Below, we consider how insights from practice theory can inform such developing policy perspectives relating to commute modes.

2.1. Commuting

Our focus in the analysis below is on the specificities of commuting in the UK. The literature has identified three important trends which set the context for policy promoting low carbon commuting:

- more commuters making less frequent commuting trips (reflecting increasing flexible and home-working practices);
- cars dominating the commute except in London (where they have 42% of modal share);
- an increase in commuting distances, including a decrease in shorter [<2 m] and an increase in longer [>15 m] journeys (Lyons and Chatterjee, 2008).

These trends correspond with the three main foci of sustainable transport policy. First, is reducing the need to travel (*substitution*), which we have not yet discussed. Given our focus on bus- and cycle-commuting, substitution is of less concern to us, however we note that home-working is seen as a major means of reducing transport carbon emissions. Second is *modal shift* through transport policy measures, our main concern here, and third is *distance reduction* through land-use and planning policy (Banister, 2008), an integral part of modal shift in our analysis below.

Much of the commuting policy literature focusses on the promotion of public transport or active modes of walking and cycling (Khan et al., 2014; Schneider, 2013) or even motorcycling (Chen and Lai, 2011), with the exact method of 'promotion' dependent on which factors are seen as most influential on commuting behavior. It is notable that, in much of the literature, generic understandings of attitudinal and situational influences on travel behavior, as reviewed above, are transposed onto commuting and inform policy. Hence, policies often focus on costs and pricing (Azari et al., 2013), especially of parking (Van Malderen et al., 2012), and the quality of public transport provision (Hensher, 1998), with workplaces being seen as key sites for behavior change initiatives (Kingham et al., 2001; Van Malderen et al., 2012). Numerous studies suggest that combining policies, preferably including both 'push' factors such as car park pricing disincentives (Azari et al., 2013; Börjesson et al., 2012) and 'pull' factors such as the provision of free public transport for a set period (Abou-Zeid and Ben-Akiva, 2012; Abou-Zeid et al., 2012; De Witte et al., 2008; Thøgersen, 2009) is more effective than implementing single policies alone (Habibian and Kermanshah, 2013). We return to such questions of policy configurations again below.

A different kind of policy intervention is associated with spatial and temporal concerns. Housing and work locations are clearly relevant (Broberg and Sarjala, 2015; Delmelle and Delmelle, 2012; Frost et al., 1998; Shiftan and Barlach, 2002; Zhou, 2014), as are associated travel times (Shannon et al., 2006). Choice of residence is seen to interact with commuting distance and mode, (Plaut, 2006: 561), affecting both workers in dual earner households. Housing and location choice creates a situation in which "[j]ourneys to work are defined as individual travel decisions, but in fact are dictated in large part by the household's choice of housing location" (ibid: 569), although other studies question the direction of causality between these choices (Aditjandra et al., 2013; Handy et al., 2005), and residential selection does not necessarily take place outside of modal choice considerations: modal preferences may be key in selecting e.g. a dense, public transport serviced neighborhood (Naess, 2012).

It is not clear, therefore, from the existing literature that commuting is addressed as a unique form of travel (behavior), even when acknowledging complex, multifactorial influences on modal choice (Nkurunziza et al., 2012). Below, we specifically explore how viewing the commute (and travel more broadly) through the lens of practice theory reveals increased possibilities: for addressing the specificities of this form of travel through modal shift, and; for effectively configuring the types of policy outlined above to address material and social deficits, and temporal and spatial complexities, which inhibit shifts to low carbon commuting. We also consider how practice theory renders visible issues that existing transport research has not fully unpacked, and in turn promotes new types of policy intervention. We suggest this involves policies that take account of the specificities of commuting, and that operate at the societal as much as the individual level, aiming to create an enabling environment for low carbon commuting, given that transport research and practice theory agree that mobility is "a result of people's resources, needs and wishes, as modified by the constraints and opportunities given by the structural conditions of society" (Naess, 2009: 294).

3. A practice theory perspective on the commute

Practice theory, with its origins in philosophy (Schatzki, 1996) and sociology (Shove, 2003), seeks to understand the connections between routinized everyday practices, e.g. commuting, and the social institutions and material infrastructures that produce and sustain them. The application of practice theory to mobility, and to potential transitions to low carbon mobility especially (Shove et al., 2012; Spurling et al., 2013; Watson, 2012, 2013), is useful because "by reframing both trips, and the activities enabled by them, as performances of specific practices, both are opened up to practice theory's distinctive analytical insights" (Watson, 2012: 491). We focus on two of these analytical insights here.

First, practice theory allows questions to be asked about how certain forms of mobility allow valued practices (Sayer, 2013) to be successfully accomplished. In this sense, practice theory extends the 'derived demand' logic that considers mobility to be a product of other practices (Mokhtarian, 2005; Mokhtarian and Salomon, 2001; Mokhtarian et al., 2001). In doing so, however, it also highlights how the value of a practice, or its *teleo-affectivity*, is not simply an individual-level phenomenon. The teleo-affective structure' of a practice emerges from its aims, purposes, ends, and the emotional desire associated with it (Schatzki, 1996), these being tied to wider societal understandings of practices and what is considered as important as part of a 'normal' everyday life, in a functional but also culturally symbolic sense (Southerton, 2012). Barr and Prillwitz (2014: 9) thus suggest that the practice approach helps reveal how the teleo-affectivity of practices and their shared, social meaning implies that "the living of everyday life necessitates forms of unsustainable mobility". This suggests that choosing lower carbon mobility is not feasible for many people given the practices they 'need' to achieve, which require car based travel. Spurling et al. (2013: 29–30) therefore argue that from a practice perspective:

"Rather than viewing this mobility as given—as in policies of modal shift—we might intervene in the wider system of practices which produces the need for mobility. In other words, patterns of mobility, or private car use, might have nothing to do with transport policy at all, but be connected to how households are provisioned, where children go to school, how work and leisure are conducted, and so on."

We develop this suggestion through a focus on how the temporalities and spatialities – hereafter timespaces-of valued practices affect demand for different modes of commuting mobility. We draw on practice theory's understanding that time and space are *produced* through practices to analyze how the sites and times of working, but importantly also other sequenced and valued, practices, determine the nature of mobility that is 'needed' and therefore the possibilities for modal shift to bus- and cycle-commuting.

Secondly, practice theory proposes that different modes of mobility, such as driving or cycling, are distinctive practices in their own right. As a practice, 'bussing', cycling, driving, etc. can be said to be comprised of interdependent constitutive elements, Shove et al. (2012) label these *materials*, *meanings* and *competences* (for other typologies of practice elements see e.g. Gram-Hanssen, 2011; Reckwitz, 2002; Røpke, 2009). The materials of mobility practices are simple to identify. For instance the car but also roads, petrol stations and garages are all crucial for driving (Geels, 2005; Urry, 2004), with related material systems needed for buses and cycling to operate. Meanings ascribe social significance to a practice, associating it with things considered valuable in wider society, and making performances coherent to others. Individuals perform practices in ways they and others value and consider legitimate, this often hardening into what Birtchnell (2012: 498) calls a 'dominant practice-consensus'. Competences include knowing how to drive a car or safely negotiate automobile traffic when cycling, while 'bussing' requires timetable-reading and hailing know-hows. Whether an individual uses, or in the language of practice theory is *recruited* (Shove and Pantzar, 2007) to, a particular mode of travel depends amongst other things on having access to the materials, having developed the necessary competences, and recognizing the societally valued meanings that together constitute and define the practice. We, therefore, consider in the analysis below what a focus on the materials, competencies and meanings of different practices of commuting can reveal and suggests for modal shift and low carbon commuting policy.

This analysis also requires overcoming a limitation of recent practice theory inspired work, which focuses on *mode* in isolation from *activity;* this also established as important by work on derived demand. Numerous practice theory authors (Shove and Pantzar, 2007; Shove et al., 2012; Warde, 2005; Watson, 2012) examine cycling, driving, Nordic walking, snowboarding etc as mobility practices in the abstract but do not consider how these modes become meaningful only when they are tied to and allow the completion of activities. This means that bussing, driving or cycling become truly meaningful – what some practice theorists have called genuinely *integrative* practices (Schatzki, 2013; Warde, 2013)-when they are associated with a particular activity such as getting to work. Making the conceptual shift to study *mode-activity* integrative practices, such as bus-commuting, is thus important because of the implications of the specificities of bus- and cycle-commuting for low carbon policies: these practices are potentially not the same as bus- and cycle-shopping (or any other practice).

4. Methods

The analysis presented here is based on original empirical data collected as part of a longitudinal qualitative study of everyday mobility practices in two UK cities (see Table 1). Quantitative methods and methodologies are more familiar in transport research and policy making and so it is worthwhile explaining the purpose and value of our qualitative approach. In transport research, qualitative methods are often used before, in conjunction with, or after quantitative surveys (Grosvenor, 2000). However

Table 1
Study city contexts. *Sources*: Office of National Statistics (2013, 2014a, 2014b)

Feature/City	Lancaster	Brighton and Hove UA
Population (ONS, 2014a)	139,665	275,762
Density (km^2: people/km^2) (ONS, 2014a)	576: 243	83: 3336
Average house price 2013 (ONS, 2014a) (UK average £251,000)	£175,000 (North West)	£305,000 (South East)
Average wages 2011 (ONS, 2011) (UK average £26,244)	£18,911 (Lancaster and Fleetwood)	£21,525 (Brighton Kemptown) £23,200 (Brighton Pavilion)
Urban form	Historical post-industrial small city. Little urban sprawl, rural perimeter. Linked ribbon development through to coastal resorts.	Coastal ribbon development, circled by hills, Victorian holiday resort. Suburban fringe.
Road infrastructure	A6 passes through, M6 parallel, central circular one-way system, pedestrianized core. Limited river crossings.	Bypassed by A27, A23 link to London central to town. One way streets in central shopping areas, no gyratory.
Rail infrastructure	On West Coast line linking London-Scotland, one station. Branch lines to Morecambe/Heysham.	Regular services to London. Links to coastal lines. 4 stations in main urban area.
Cycling infrastructure	Cycling Demonstration Town. Good leisure paths by river and canal, links to coast and to long distance paths, city provision patchy.	Cycling Demonstration Town. Some excellent lanes on A roads, others patchy.

they can also be used independently to provide breadth and depth of research – to identify the extent, variety, quality and nuance of beliefs, understandings, explanations, empirical details, supporting societal narratives and discourses, and identity-related justifications for social action. They are ideally suited to exploratory research (Clifton and Handy, 2001). Qualitative research draws out explanations in context, by probing contextual factors and underlying motivations, and can bring into consciousness norms, values, attitudes, and other factors lying behind 'unthinking' routines (Lucas, 2013; Schwanen et al., 2011). It elicits explanations for behavior, rather than testing the influence of any particular factor, tailoring questions to responses with the "opportunity for clarification, explanation, and elaboration of questions and responses" (Clifton and Handy, 2001: 8). In open-ended discussions the knock-on effects, consequences and limits of behavior change options can be followed through in thought experiments in which researcher and participant interactively explore the broad array of contextual factors through which travel behavior is constructed and change happens, something often obscured at the aggregate level of surveys (Lucas, 2013: 9). As such, qualitative research is designed to provide insights that quantitative surveys are ill-equipped to provide (Chatterjee, 2009) but which are crucial for understanding the multiple influences on behavior change processes (Cohen, 2009; Thøgersen, 2009). Reflecting this, the Activity Based Approach (ABA) arose in part from ground-breaking use of qualitative methods in exploring activity-related motivations for travel (Jones et al., 1983). Focus groups have recently been used to uncover the factors lying behind modal choice in young people (Simons et al., 2014), and in-depth, semi-structured interviews have been used to address both modal choice in general (Beirão and Sarsfield Cabral, 2007, $n=24$) and in commuting specifically (Gardner and Abraham, 2007, $n=19$, car drivers only).

In the study reported here, following the rationale outlined above for using qualitative methods, our aim was to reveal the richness of interrelated contextual factors influencing commuting practice. 61 individuals, comprising 23 families were studied (36 individuals and 16 families in Brighton, 25 individuals and 8 families in Lancaster). This included children to retired people. A mixed-method longitudinal ethnographic approach was used. The majority of participants were interviewed at least twice over a two-year study period using semi-structured interviews ($n=101$, Brighton 42, Lancaster 59). As with the semi-structured interview studies noted above, our participants were asked about all modes of travel, even if they were not regular users, to explore reasons for use and non-use and the contextual factors influencing modal choice and possibilities for change. Similarly to Jones et al. (1983), we provided participants with the option of a suite of methods to record their daily travel, including email journals, blogs, photography and video, scrapbooks and diaries, and GPS tracking, and like them we discovered that such 'freeform' collection provided data that was rich but unstructured. Hence quotes in the analysis below are from interviews unless otherwise specified. Participants are identified by pseudonyms.

Participants in our study were recruited through a combination of advertising through email and posters, attendance at events at schools and community centers, and snowballing: a non-probability approach often used in qualitative research (Simons et al., 2014). Such an approach was not intended to be representative, as what is sought is a range of experiences that could be explored in depth. See Table 2 for details of key characteristics of our research participants and the bias created by the sample. Note that census figures are for the UK as a whole and there is double-counting in the employment statuses of several participants when they had multiple occupations (e.g. both employed part time and in education).

The data we collected is highly detailed, contingent and complex. Clifton and Handy (2001) suggest that heuristic theoretical frameworks are appropriate for exploring such data through interpretive analysis, and practice theory provides us with just such a heuristic framework, addressing micro- and macro-scales of action and social structure through the mid-level concept of 'practices'. The results below were thus developed through an analytic approach combining inductive and deductive techniques (Mayring, 2004). All interviews were transcribed and analyzed using QSR Nvivo qualitative software, coding and grouping the data segments according to themes arising from both a theoretical framework developed from the research project's literatures of interest, and on-going analysis in a manner comparable to grounded theory (Glaser and Strauss, 1967). All data was analyzed by two members of the research team to check thematic coding. The data segments quoted have arisen from 'querying' the dataset and cross-referencing different codes relevant to commuting and modal shift. The analysis is not intended to be generalizable. Rather it produces understandings and interpretations, and allows the further production of hypotheses and policy options. We remained sensitive throughout the analysis to differences between

Table 2
Selected sample characteristics and comments.

Employment status	% of sub-sample	Number	Census 2011* (%)
Employed	43	29	69**
In education	26	18	10
BLANK	3	2	
Retired	12	8	16
Self-employed	11	7	**
Unemployed	4	3	4.8

Caring responsibilities	Number	% of total
Child(ren) in household	19	37
Chil(ren) in household and children outside household	3	5
Child(ren) outside household	2	4
Child(ren) in and older people in household	1	2
Child(ren) outside household	1	2
Older people and child(ren) outside household	1	2
Older people outside household	2	4
Grandchildren outside household	2	4
None	31	61

Car ownership	Number	% of total
Car owner/driver	29	48
Driver with access	9	15
Driver no access	7	11
Non-driver	16	26

Distance to work/school	Cumulative	Number in category
Less than half mile/0.8 km		3
Half a mile–1 mile/0.8–1.6 km	7	4
1–2 miles/1.6–3.2 km	17	10
2–3 miles/3.2–4.8 km	22	5
3–4 miles/4.8–6.4 km	31	9
4–5 miles/6.4–8 km	41	10
5–6 miles/8–9.7 km	42	1
6–10 miles/9.7–16 km	46	4
10–20 miles/16–32 km	47	1
20–50 miles/32–80 km	49	2
50–100 miles/80–160 km	51	2
More than 100 miles/160 km	52	1

Around half of our participants had caring responsibilities, with the majority of those with no such responsibilities being youths and children (14/51 or 27%). Four retired older people reported no caring responsibilities.
For comparison, in the UK in 2010, 75% of households had access to a car, with 73% of eligible age having a driving licence, meaning that our sample is highly representative of the driving population, but over-representative of car-less households (DfT 2011). * See ONS 2014c.
** including self-employed.

the two cities, comparing data and checking for the effects of factors such as density, transport infrastructure provision etc. Here we report findings at the level of practices which, according to our analysis, are relevant to commuting in both cities. We are unable to test the relevance to other cities; this would be an important line of future research to build on the qualitative depth provided by our dataset. Below we, therefore, present insights into the barriers to modal shift that are rendered visible when: practices are taken as the unit of analysis and; (a) the materials, competences and meanings associated with different modes of commuting practice are unpacked; and (b) practice theory's insights into the timespaces of practices that create demand for mobility are considered.

5. Elements of commuting practices

We begin by using practice theory to identify how, as mode-activity integrative practices, bus-, car-, and cycle-commuting are each associated with particular materials, competences and meanings. Table 3 summarises the elements that comprise such assemblages according to insights from the data collected. As described above, this data was generated by talking to participants about their commuting practices and analyzed conceptually through the lens of practice theory. The results reveal that commuting by a particular mode involves materials, competences and meanings generic to the use of that mode, but also to varying degrees the addition of a number of further commuting-specific elements of practice (those in *italics* in Table 3). These elements are the aspects that were unique to commuting, and which did not appear in participants' descriptions of bussing, cycling, and driving to achieve other activities.

In considering policies designed to promote lower-carbon commuting, Table 3 suggests that, firstly, recruitment to generic *modal* practices matters. This is the focus of existing literature on mobility practices where historical defection from walking and cycling and recruitment to driving is discussed (Shove et al., 2012; Watson, 2012). It is also the focus of commuting modal shift policies which, as noted above, have a tendency to transpose generic understandings of travel behavior onto the commute. This suggests that existing policies address important issues of concern, such as cycle lane provision, but, as Table 3 shows, also potentially miss some of the particularities of bus- and cycle-*commuting* integrative practices. Table 3 suggests that promoting bus and cycle-commuting requires particular strategies to ensure that the unique materials and competences required for the commuting variants of these modal practices are available to potential practitioners, and also that the meanings which act as powerful mechanisms of recruitment 'capture' them.

To explore the significance of this distinction between generic and commuting-specific elements, consider the case of car-commuting practice: the dominant mode from which policy efforts seek to move commuters. Those commuting by car in our study suggested that (re-)routing to achieve timeliness is a crucial competence, based on the need to arrive at/leave work at set times and the fact that commutes often take place at rush hour, are more subject to traffic disruptions, yet remain tied to various time fixities. There was, however, little else novel to say about car-commuting as a *distinct* practice, and the specificity of this competency to commuting is debateable. Indeed, parking is often considered an issue in car-commuting and known to influence it. However, this is also not a unique aspect of car- commuting as a practice, applying to driving more generally (e.g., also car-shopping). Thus a key point arising from practice-inspired analysis is that car commuting recruits easily because of the commonality of its elements with most other driving practices (see Table 3). This reflects the wider dominance of the logics of driving in society and the complex ways in which systems of automobility structure all aspects of everyday life (Cohen, 2012; Geels, 2005; Urry, 2004).

In contrast, the significantly higher number of italicized elements in the bus- and cycle-commuting sections of Table 3 reveals that for recruitment to occur, unique elements are required in addition to those required for generic bussing and cycling. To consider material elements first, timely commuting by bus relies on dense networks of provision-multiple and/or direct routes with regular and/or reliable frequencies-and knowledge of how to use them to achieve a fundamental norm of commuting-arriving at work on time and being able to leave promptly (Noland and Polak, 2002). Timely arrival often matters even to those with flexible working hours, who define a target arrival time personally. High frequency services mean a missed (or no-show) bus does not have significant implications for timely arrival, and a multiplicity of routes allows arbitrage and car-like flexibility and autonomy in the face of traffic disruptions. Similarly, several materials beyond the generics of a bike and a suitable pathway are of significance for cycle-commuting. Lights and waterproof clothing facilitate morning and/or evening travel in the dark regardless of weather: leisure-cycling by contrast mostly occurs at a time of choice, usually in fine weather and daylight. Panniers suitable for commuting are different to panniers used for e.g. cycle-shopping. Material elements allowing storage of the cycle and related equipment (lockers, racks, clothes, shower and towel etc.) are unnecessary for a circular leisure ride, but important at the workplace.

However, it is not practice theory's insights into material elements that are of most interest here. Transport research recognizes the importance of material elements, with high quality bus provision and cycle storage being common policy measures. Of more interest is the focus on *competences* and *meanings*. For instance, bus- (and train-)commuting is associated with productive time use, understood economically in the sense of working or checking emails or as exploiting time for leisure and relaxation (Jain and Lyons, 2008; van Wee et al., 2014). This is productivity that cannot easily be achieved whilst driving. But this productive time is also in part at least tied to the competency of passengering and shielding whereby an individual learns how to travel in a comfortable way, undisturbed by other travelers and shielded from distractions and annoyances such as others' conversations. Cycle-commuting meanings combine and transform outdoor, embodied, and emotional experiences (Jones, 2012) with the need for a transition between home and work; time spent cycle-commuting gains a particular meaning that helps recruit individuals to the practice. But appreciation of such time requires competencies that achieve comfort in all weather (not just having the right equipment, but knowing how to use it), and organizing work in a way that does not require cumbersome items to be carried (for example using electronic rather than paper documents). Re-routing (as by car) to avoid congestion and achieve punctuality could also been seen as a competence of cycle-commuting, but this was not reported by our participants, who instead selected routes by weather and season.

What are the implications of our data revealing unique bus- and cycle-commuting practices which are only likely to recruit when specific material-competence-meaning elements are in place? At one level, we suggest it means that choice-based policies, seeking to 'nudge' people into choosing low carbon bus and cycle mobility as a smarter choice (Barr and Prillwitz, 2014), or tempting them using rational or behavioral economic logics (Marsden et al., 2014) so as to break the automobility habit (Schwanen et al., 2012), are likely to be limited in their effectiveness if the necessary materials, competences and meanings for recruitment to bus- and cycle-*commuting* do not exist, or are not valued. This implies that the solution to sustainable transport

Table 3
The elements of bus-, car-, and cycle-commuting practice. *Italic text* indicates element unique to commuting mode-activity assemblages (non-italics being generic to the mode).

Mode/ practice element	**Materials**	**Competencies**	**Meanings**	**Quotes exemplifying commuting-specific elements of practice**
Bus	Buses	Reading of bus timetables	Environmentally friendly	Dense networks: *"bus to Lancaster to [work] and [then] Bridge game in pm. Quick easy route from door, known times" (Joe travel diary)*
	Roads	Paying of fare		*"I just get any bus into the centre of Brighton and I will pick up […] preferably the Lewes bus because it's fast […] Yeah, hitting at the right time's really important." (Mary)*
	Bus shelters	*Arbitrage between routes to allow timely arrival*		Arbitrage between routes*:* "*on the way back there's more of a choice, there's the 25 or the 28 I think it is, and the 28 goes to Churchill Square, and the 25 […] Palmeira Square or Portslade, so [that] means I can get one bus straight home" (Evelyn)*
	Umbrella/rain coat			
	Dense networks of bus service provision	*Passengering and shielding to allow productive time*	*Productive time*	Productive time: *"it was quite easy to just walk up to the bus stop and get on, sit and it was quite nice to read a book and spend some minutes before you got there" (Abigail)* Passenegering and shielding (and why it matters): *"Unfortunately that plan went slightly wrong because I'd forgotten to charge up the laptop! I didn't even have anything to read or to write on, so the time went quite slowly." (train) (Eleanor, Diary)*
Car	Car	Driving license (and multiple competencies it represents)	Freedom, temporally and spatially	Avoidance of delays: *"a month or two ago they said there was a problem at the junction of the motorway. So […] I thought well let's just go completely the back way. […] or if it's fine I've just gone a different way home […] it doesn't even wind me up and I've already decided, I've got in my car I'm going this way." (Niamh) (email note, journey home)*
	Roads	Road comportment	Autonomy	
		Navigation	Private space	
		Avoidance of traffic delays	Indoor comfort	
Cycle	Bicycle	Cycling proficiency (and various competencies it represents)	Environmentally friendly	Equipment and competency to use: *"On Friday I had to wear full waterproofs to cycle to and from work […] I don't mind cycling in the rain. I have a weatherproof jacket, over-trousers, over-shoes" (Andrew travel diary)*
	Safety equipment (e.g. helmet)	Road comportment		*"if I could also not only store my kit day to day […] things like clothing, towels and stuff like that […] but also get a shower reasonably quickly, yes I would [cycle-commute more often]" (Ron)*
	Lights and visibility equipment	*Maintaining comfort in all weathers*	Interaction with nature	*"I had a computer at home so I could put stuff on a stick. I tried to do my marking in the school, occasionally bringing books home in my bag" (Ron)*
	Wet weather protection			
	Suitably sized panniers	*Organizing work to minimize items to be carried*	*Health, exercise, and transition time*	Health, exercise and transition: *"…a blast of fresh sea air first thing in the morning […] when you get to your desk after you've cycled to work you feel awake and ready to take on the day's tasks, so a nice way to start the day" (Adam)*
	Storage facilities at destination			*"it's never the same twice. So I see different birds, you might see the heron, you might see if you're lucky a kingfisher […] it's just like very much like a bit of leisure at the beginning of the day" (Rachel)*
				"Feels like my brain has shutdown for the day. Maybe a wet ride home will wake me up." (Andrew, blog)

involves more than invoking different over-arching choices about mobility (Chatterton et al., 2015): as noted above, transport behavior research recognizes this. For instance for cycle-commuting Heinen et al. (2013) identify similar meanings (in their research related to positive attitudes and colleagues expectations) and material (cycle storage and clothing) requirements and propose workplace strategies to increase uptake, such as cycle storage provision. We develop such work by focussing not only on the workplace as a site for intervention, as Heinen and colleagues do, but also on how both generic and commuting-specific elements of practice might be addressed by policy operating at the societal level. To address societal institutions that have led to the absence or devaluing of the elements needed for recruitment to bussing or cycling practices (Pooley et al., 2011; Watson, 2012) implies policy which, rather than targeting individuals, seeks to alter the socio-economic landscape in which demands for, and choices about, mobility are made. As discussed in the penultimate section, such policy particularly seeks to ensure that the meanings and competences of bus- and cycle-commuting are widely shared; materials matter but are dealt with through existing transport infrastructural policy. Before reflecting further on this point, we consider how practice theory's insights into the timespaces of practice and commuting identify further forms of societal-level policy intervention to promote modal shift.

6. Time, space and the contingencies of bus- and cycle-commuting recruitment

As Watson (2012: 491) puts it, "a practice perspective enables analysis of the co-evolution of practices of mobility with other practices [with which] they are bundled in space and time". This focus on co-evolution leads practice theory to view time and space as being *produced through practices*, revealing links between the ABA and a practice theory approach, particularly with regards to how modes of travel "become coupled to and enrolled in the space-time paths (time-geography) and activity/travel patterns (activity-based travel behavior analysis) of individuals, or in social practices (practice theory)" (Schwanen, 2014). For practice theory, places at which different practices are performed and paths between them define the spatiality of everyday life (Schatzki, 2009: 36). In particular, spatiality is defined by how individuals commit to practices which society views as important and occur at multiple sites (Shove et al., 2012; Southerton, 2012). The bundles of practices underlying and producing the spatiality of everyday life, such as working and associated commuting, education, shopping, socialising etc., have become ever more complex as people 'squeeze in' as many practices as possible: participation in multiple practices being highly valued in consumer society (Southerton, 2003). Spatiality has thus become more complex, a point we return to below.

The spatiality of practices is also intimately related to the production of temporality (LeFebrvre, 2004; Shove et al., 2012). The temporal rhythms of everyday life are generated by the social coordination and squeezing in everyday practices bundled together. Schatzki (2009: 37) thus notes that the relationships between past, present and future practices matter in defining temporality. The need to travel between sites of past, present and future practice determines both when travel occurs but also, in the context of the timing of different practices, how much time is available for each journey. Schatzki (2009: 38) refers to *timespace* to characterise these intimate relations and the coordination required when practices demand presence at particular places at particular times. The effects of timespace coordination and scheduling (Southerton, 2003, 2006) on recruitment to bus- and cycle-commuting emerged clearly from our data. However, these effects have subtly different dimensions to the time-space focuses in most transport research. The emphasis is not only on distances between home and work or sites of practice, but on topological timespace features of *sequences* of practice. The implications for modal shift relate, therefore, to how even shorter distances between sites of practice militate against low carbon commuting when certain temporal pressures exist. We explore these topological features of timespaces in the following sub-section.

6.1. The timepsaces of the commute

For many of the individuals studied, commutes were defined by the temporal sequencing of multiple practices in and around getting to/from work and home. At first glance, this sequencing, illustrated by the quotes below from two of our participants, appears an innocuous story of trip linking:

> *"Had to go to a clinic appointment then straight to work" (Rachel, travel diary)*
> *"…straight from work […] about quarter to six, drive into town, park at Sainsbury's because it's free at that time of the evening, and then drive home after the gym." (Jemima)*

These quotes are representative of the trend more broadly in our data: commuting commonly involved getting to/from home or work as part of a sequence that included other practices such as shopping, exercise, recreation, leisure and, perhaps most impactful, parenting or education – the school run especially but also extra-curricular activities. Typical of the role of the car was data revealing that:

> *"going straight after work […] we used the car quite a lot more […] and ferried children around […] if Joseph's got cricket we've got use of the car, we'll drive him there" (Felicity).*
> *"I needed a car […] to drop the kids off at school and get to work in time […] it was a logistical way to get to work on time." (Rachel)*

The pressures to coordinate multiple practices in day-to-day life, creating a temporal rhythm with significant effects on bus- and cycle-commuting is particularly noteworthy. The journey to/from work must be performed in line with the temporal rhythms of work, while also facilitating other practices timed to occur before/after work. Typical of such scheduling effects are the following:

> *"We had to fit in […] me being on Saturday duty so at work 12.30-5.00; D needing to go to see his Dad; both of us wanting to go to town [for specialist shopping]" (Jemima, blog)*
> *"rather than scheduling my day around the public transport, […] I would just go for convenience and drive" (Cilla)*

Significant, therefore, are the effects of working and other practices that have temporally fixed start and/or end times, and that are sequenced together with limited time between the end of one and the start of another. In this regard, the school-run is the archetypal mobility form affected and given rhythm by temporal fixities and sequencing pressures, in turn affecting and giving rhythm to other practices such as commuting, as two of our participants noted:

> *"…everything fitted in between the hours with nursery […] I'd drop them off, and then go to work" (Jean)*
> *"THE thing that meant I had a [modal shift] choice, was once I no longer had to get them to school in such a tight turnaround. […] that was it: drop them off then get to work on time to walk in the office" (Rachel)*

The mobility rhythms created by the fixities and/or sequencing

Table 4
Key practices that define temporalities and spatialities affecting commuting.

Practice	Nature of temporal structuring	Nature of spatial structuring
School/nursery run	Fixed school start/end times create non-negotiable compulsions of presence at a particular place at a particular time every weekday	Choice agendas result in the local school being substituted with what considered the 'best' school which often some distance from home and work
Healthcare	Limiting of healthcare appointments to 9–5 working day foreshortens time window in which commuting can be performed	Concentration of services on clinical quality grounds leads to reduced local provision and greater need to travel to centers of excellence (affecting GP care through to hospital based treatment)
Recreational classes (sports/exercise, hobby clubs etc.)	Common timing of 'just after work' (6–7 p.m. window) prematurely curtails time window in which commuting can operate	Omnivorous lifestyles lead to the searching out of more and more exotic recreational/hobby activities, and an apparent compulsion to participate (whether it be to fulfill parental responsibility or because of symbolic status). This involves more and more traveling to access the 'right' classes
Shopping		Domination of peripherally located supermarkets gives rise to en route car dependent shopping.

pressures of work, education and other practices are crucial in pushing individuals towards the use of the car as the least time-consuming mode for traveling from one site of practice to another (Dowling, 2000; Murray, 2008; Skinner, 2005). Capturing this, one participant described how "I'm still a cyclist but just haven't had time […] I'm going to be driving a lot more" (Christoph). Table 4 examines how such practice timespaces affect commuting. Although shopping is included in Table 4, in the UK's contemporary retail environment in which many supermarkets are open 24 h a day this is a more temporally flexible practice and thus less impactful (see also van Wee et al., 2014). There are, however, spatial implications of shopping to which we turn below.

As far as temporal considerations are concerned, if bus- and cycle-commuting are to successfully recruit, the practices outlined in Table 4 must be either: a) not be sequenced with commuting; or else b) be organized temporally in ways that render the rhythms of everyday life manageable by bus- or cycle-commuting. This implies either flexible start and end times or timings that do not impose limited time for movement from one site of practice to another. This suggests that one of the major challenges for modal shift is to create a context in which the temporal rhythms generated by practice sequencing do not prohibit the often longer or less precise timings of bus- and cycle-commuting. How might such a context be created? We return to this question after considering the co-related effects of spatiality.

At its simplest, the importance of spatiality is highlighted by a number of our participants only adopting low carbon commuting (or defecting from car-commuting) in the context of relatively short metric distances between sequenced sites of practice. This is a subtly different finding to transport research's predominant emphasis on the distance between home and work. It relates to the spatiality generated by movement between multiple sites of practice, beginning and ending at home/work but not involving a direct a-to-b journey. Equally important is how the temporal pressures of sequenced practices can make even short distances difficult to negotiate by low carbon means. What we call 'enabling timespace matrices' emerge and facilitate bus-and cycle-commuting when all of the different sites of sequenced practice are located in close proximity to one another, with enabling timings (e.g. not being sequenced in a way that limits time to travel from sites of practice). Often this means bus- and cycle-commuting allows travel between sequenced practices sites *as* (or nearly as) quickly as car-commutes. As one of our participants noted:

> *"I quite like the proximity of work to home because it doesn't involve excessive travel […] it's just a 15 minute commute on the bike really" (Norman)*

Conversely, inhibiting timespace matrices involve sequences of more spatially distanced sites with compressed or fixed temporalities, in which the expedience of the car becomes important, and grows exponentially with distance:

> *if I did that job, I'd need to get a car […] up until now, because […] I've worked locally, I've not had need for… you know, I've not needed to commute using a car." (Christoph)*

Enabling timespace matrices can also emerge and facilitate bus- or cycle-commuting when there are combinations of middle-range distances *and* loosened timing pressures imposed by sequenced practices, meaning additional time required for bus- and cycle-commuting is acceptable. Hence it is not just a question of *metric* distances between sites of practice; topologies produced by the timespaces of sequenced practices also matter. Table 4 illustrates that sequenced practices can have spatial locations that alone or in combination with temporal pressures produce timespace arrangements that militate against recruitment to bus- and cycle-commuting. In such arrangements, linking sites of sequenced practices sometimes requires prohibitively high levels of fitness as a competence for cycle-commuting, as well as imposing unmanageable scheduling and coordination demands within the temporal rhythms and pressures outlined above. For bus-commuting, the likelihood of sites of sequenced practices intersecting with dense bus provision reduces as the complexities of commuting and other spatialities grow, and when combined with temporal pressures bus-commuting may require too much time, as one of our participants described:

> *"there isn't a bus! I'd have to go on a bus from Asda, to town and a bus from town all the way back along the prom to get home." (Helena)*

These findings in many ways reflect existing research on commuting that highlights a tendency for longer and more complex commutes (e.g. Lyons and Chatterjee, 2008). This implies that one solution to temporal pressures is spatial compactness: again, not necessarily a new finding for transport research given the recognized role of land use planning in dense urban form. Indeed, greater distances between the ultimate start/end points of commuting-home and work-tend to generate greater complexities of practice sequencing. Those living a long distance from work, particularly in peri-urban or 'rurban' fringes (Rouge et al., 2013), described the need to sequence commuting with as many other practices as possible (e.g. shopping, going to the gym, socialising) to achieve topological efficiency: avoiding additional journeys to/from home. The net result is commuting sequenced with diverse practices connecting multiple sites, creating awkward spatialities, in turn greater temporal pressures, and ultimately much less viability for commuting by low carbon modes. However, practice theory provides a unique way of interpreting the implications of such trends for policy, in doing so moving beyond land use planning as a solution to issues of time and space. It is to the implications of this perspective that we now turn.

7. Bringing practice theory's insights into policy

Two main insights from practice theory into factors inhibiting commuting modal shift arise from this paper. First, we have shown that modal shift/recruitment to bus- and cycle-commuting is dependent on access to, and active incorporation of, generic modal *materials* (bus services, equipment for cycling), *competences* (knowing how to navigate bus timetables or ride a bike safely), and *meanings* (exercise through cycling, relaxation when bussing), but also elements associated with specific commuting mode-activity integrations (e.g. wet weather equipment for cycling, passengering, shielding and productive time-use on buses, transition time). Second, we have shown that there are important timespace contingencies affecting recruitment to bus- and cycle-commuting practices. The absolute distance between work and home practice sites is important, but we have also shown that timespaces are related to practice sequencing: commutes are more likely by car when other sequenced practices create the need to move between spatially distanced sites, and/or when sequenced practices impose inflexible time constraints, meaning journeys cannot be completed otherwise. We thus highlighted the need for enabling timespace matrixes, these being topological rather than metric due to their definition by both temporal and spatial factors and the way that the benefits of short distances between home and work can be undermined by temporal pressures associated with sequencing.

To some extent transport policy already considers these kinds of issues highlighted by practice theory. For instance, bus quality partnerships and cycle lane provision address material issues, and cycling demonstration towns have helped promote cycling as healthy (meanings). In terms of time and space, the insights of practice theory align with transport research which emphasizes shorter distances as more suitable for active modes (Ben-Elia and Shiftan, 2013; Pucher and Buehler, 2008), and encouraging dense development linked to public transport (Banister, 2002, 2008; Bertolini and Dijst, 2003; Curtis, 2008; Kingham et al., 2001) mainly through land use planning (Crane and Scweitzer, 2003). A practice analysis suggests, though, that it is crucial that policies are configured to address *all* of the elements of a practice, and in particular the specifics of low carbon commuting mode-activity integrative practices, and timespace considerations concurrently. If, for example, material interventions (such as cycle lanes) neglect competence and meaning-related elements, and target only generic practices of cycling, whilst also not considering how sequences of practices produce timespace pressures that need alleviating, they are unlikely to be successful. Indeed, the practice theory perspective suggests policies need to strive to shift meanings, competences and timespace structures in society more broadly, a point we return to below (Banister et al., 2013). Put another way, as Banister (2008) notes, reducing volumes of mobility is crucial but without compromising the ability to engage in valued practices. Practice theory offers a new way of thinking about making such interventions, suggesting that *reshaping practices* may be fruitful.

In terms of reshaping commuting practices, an important starting point is recognition of the absence of elements of low carbon commuting practice, as a result of decades of under-investment in the material infrastructures required, as well as reductions in opportunities to both develop the competences needed for, and to become captured by the meanings associated with, bussing and cycling. A good example of this is the demise of cycling proficiency in schools and the linked dominance of car-based school journeys. Practice theory thus suggests that it is crucial to develop policies which work at the level of societal structures and institutions of provision to create an environment that enables bus- and cycle-commuting practices to recruit. The much lauded case of Amsterdam's cycle commuting culture illustrates this point well: policies and norms that ensure all of the elements of cycling practice are available help cycling to 'capture' commuters (Geels, 2012).

More broadly, shaping other practices which are sequenced with commuting is also important. This implies considering how modern practice timespaces such as weekly bulk grocery shopping at out of town stores, distant schooling based on parental choice, the concentration of healthcare provision at a few peripheral sites, and increasingly complex patterns of youth recreational activities, need re-timing and spacing if bus- and cycle-commuting are to recruit more effectively. Transport policy needs to be about non-transport practices which have implications for mobility demand and the possibility of low carbon commuting. Strategies might include reducing the fixed timings that lead to temporal pressures, and/or reconfiguring spatialities so that sites of practice and paths between them are navigable by low carbon means. In other words, the aim should be to reshape practices so that timespace matrices which enable bus- and cycle-commuting develop. Similar policy approaches have been proposed involving the 'synchronization' of transport networks and activity locations through time-related policies (van Wee et al., 2014: 1–4). Exemplifying how such interventions may be productive, in our research the appearance of local 'corner shop' branches of the major supermarkets acted to reduce travel for shopping (Aditjandra et al., 2013; Barton et al., 2012), as 'top up' shopping *en route* to/from work at these local shops complements the car-dependent weekly shop, thus preventing extra trips to out-of-town supermarkets.

Suggesting that modal shift is addressed through such non-transport foci is notably different to existing transport policy relating to the commute which places emphasis on home and work locations, and on policies targeting workplace infrastructure provision (e.g. cycle storage, car park pricing) or behavior (e.g. travel plans). But how might policy achieve such reshaping of practices, and the provision of the materials, competencies, and meanings needed for practices such as cycle-commuting? This is where the importance of societal-level policy becomes relevant. Fig. 1 identifies potential policy interventions designed to enable the practices of bus- and cycle-commuting: both those inspired by a practice perspective, and existing policies recognized by transport research that can also contribute to this agenda when suitably configured. The policies outlined in outlined in Fig. 1 recognize the limitations of approaches which solely "tackle the symptoms (e.g., provide cycle facilities) but fail to tackle the underlying problems (distance, complex trip characteristics)" (Dickinson et al., 2003: 65). As such, Fig. 1 presents an agenda for an ecology of policy, in which policies are configured in ways that enable low carbon commuting (and mobility more broadly), through interventions in the organization, timing, and spacing of societal services and institutions. Crucially, the kinds of policies sketched in Fig. 1 are not stand-alone tactics. Rather, they are interdependent means of ensuring that the elements of bus- and cycle-commuting practice are available, and that the timespaces of sequenced practices enable defection from the car. The mark of success of such an approach would be "to have successfully reconfigured the elements of practices, transforming collective conventions rapidly and on a significant if not societal scale" (Shove et al., 2012: 150). This would require having widespread circulation of the elements of bus- and cycle-commuting practices, and sequences of practice associated with the commute that were commonly characterised by timespaces conducive to bus- and cycle-commuting. In Fig. 1 we identify in *italic* text how the policies would contribute to either the elements or the timespaces of practice discussed above as being crucial to bus- and cycle-commuting.

This does not deny that policies which influence choices are never beneficial. Indeed, such policies would still be needed alongside practice theory inspired interventions such as those

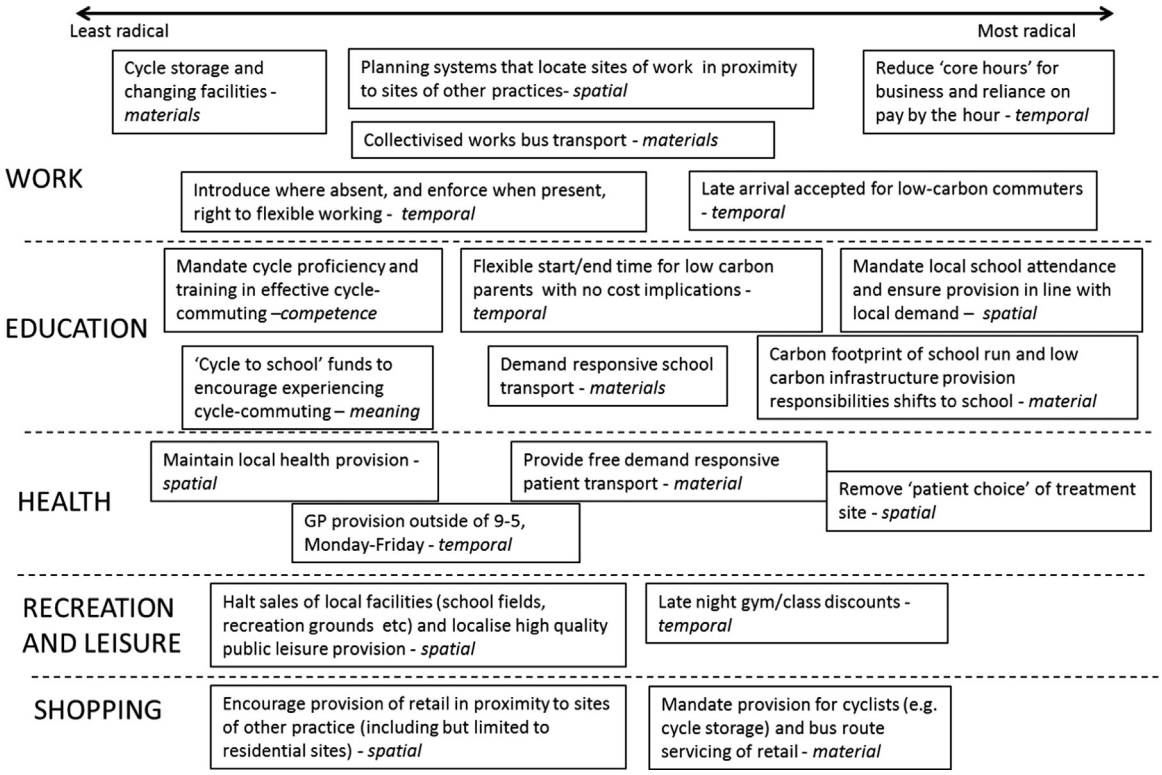

Fig. 1. Spectrum of potential societal interventions designed to provision elements of and timespaces conducive to bus- and cycle-commuting practices.

outlined in Fig. 1: 'nudged' modal shift can synergise with calls for societal-level practice based change. Policies which constrain automobility, such as road closures and car park pricing, would support such an approach, given that they would provide incentives for investment in the elements of low carbon commuting and in retiming and spacing practices (by employers, service providers etc). In some cases they would also help provide elements of reconfigured practice (e.g. road space for cycle lanes). However, there is a need to decenter policy targeting choice and transport infrastructure, and to acknowledge that meeting targets for carbon reduction from transport demands more radical forms of policy targeting structural-societal barriers to bus- and cycle-commuting and low carbon mobility in general.

Of course, such an agenda means that some of the proposed interventions in Fig. 1 strike to the heart of key 'conventions' of normal life (Shove, 2003) in neoliberal modernity, and are radical in suggesting policy should intervene directly in societal institutions. Choice, in education for example, has led inexorably to competition and a form of 'splintering urbanism' (Graham and Marvin, 2001) with hot and cold spots of provision. These inevitably generate awkward spatialities, pressurized temporalities, and the increasingly compelling relative convenience of the car. Policies equalising service provision geographically, and removing parental school choice (Mackett, 2013: 71), would represent solutions to the carbon burden of ever more complex school runs, as would removing modal choice altogether through school responsibility for collective transport. However, the dominant neoliberal orthodoxy of a minor and shrinking role for the state in coordinating everyday life may have to be challenged to make the kinds of interventions outlined in Fig. 1 possible. The example of making the commute an employer responsibility would similarly require rethinking the relations between capital and labor, overturning the neoliberal model of individualization and flexibilisation in the latter. As such, practice theory raises some difficult questions about the implications of neoliberal governance logics for mobility. If addressed these might change the structural landscape inhibiting transition to low carbon mobilities, but they require new thinking about both the configurations and types of policy deployed.

8. Conclusions

In this paper we have used practice theory to consider the challenges that policy initiatives face in attempting modal shift in commuting. We have highlighted how societal structural contexts militate against low carbon modes being adopted. In drawing attention to how bus- and cycle-commuting exist as distinctive practices in their own right, and are constituted of elements that need to be in circulation for recruitment to them, we have thus identified the importance of policies that operate at a societal level to ensure that constituent materials, competences and meanings exist. We have also highlighted how sequences of practice generate temporal and spatial influences on commuting mode, and in turn the need to consider policies that reshape practices such as education and healthcare in ways that generate timespaces conducive to bus- and cycle-commuting.

The approach taken in this paper has two implications that can act as the basis for further developing modal shift policies. First, the practice perspective highlights the importance of configurations of policy that address the elements and timespace issues discussed here in an *integrated* way. Configuration means considering how different types of policy, targeting different elemental and timespace factors, can be put into action as a package so as to ensure that impacts are maximized. Resolving issues associated with the absence of the elements of commuting practice is unlikely to yield modal shift impacts if timespace issues are not also addressed, and vice versa. Working at the level of an ecology of reconfigured policies is thus crucial. Second, the approach reveals the importance of new and more radical policies that can be used alongside existing approaches. Some of the issues we have drawn attention to here are recognized and addressed by existing

transport policy, and some of the more behavior change focussed initiatives can contribute to enabling bus- and cycle-commuting practices when configured with some of the societal interventions we propose. The paper thus reveals the need for an evolution in policy thinking, in ways that give more space and impetus to structural societal factors through new policies designed to re-shape practices, for example in relation to timespace, whilst not discounting but also moving beyond traditional concerns with land use planning and choice.

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