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Conceptualizing connections: Energy demand, infrastructures and social practices

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Abstract
Problems of climate change present new challenges for social theory. In this article we focus on the task of understanding and analyzing car dependence, using this as a case through which to introduce and explore what we take to be central but underdeveloped questions about how infrastructures and complexes of social practice connect across space and time. In taking this approach we work with the proposition that forms of energy consumption, including those associated with automobility, are usefully understood as outcomes of interconnected patterns of social practices, including working, shopping, visiting friends and family, going to school, and so forth. We also acknowledge that social practices are partly constituted by, and always embedded in material arrangements. Linking these two features together, we suggest that forms of car dependence emerge through the intersection of infrastructural arrangements that are integral to the conduct of many practices at once. We consequently explore the significance of professional – and not only 'ordinary' – practices, especially those of planners and designers who are involved in reconfiguring infrastructures of different scales, and in the practice dynamics that follow.

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As this and other special issues demonstrate, there is no shortage of social scientific interest in methods of conceptualizing and responding to climate change. While some bring established positions and perspectives to bear on these concerns, others suggest that challenges like those of dramatically reducing CO_2 emissions, and of doing so on a societal scale, present equally substantial challenges for social theory. In this article we home in on a series of questions generated by the need to shape future patterns of energy demand. It is now widely accepted that this is not only a matter of improving energy efficiency, modifying lifestyle choices or establishing national agreements and targets. In recent years, social practice theory has been increasingly prominent in debates about how energy demand and demand for other resources might be curtailed. In this context, a key contribution is to recognize that since energy demand is an outcome of what people do, any radical change depends on reconfiguring the practices that comprise everyday life.

Despite its extensive use and development, practice theory has yet to fully engage with the repertoire of theoretical challenges generated by practical and policy questions about methods of promoting energy demand reduction. In what follows we explore one of these themes, arguing that practice theory can and should develop a better understanding of how complexes of social practices and infrastructures develop together, and of the multiple connections involved.

We address aspects of this agenda with reference to contemporary forms of car dependence. In the UK, what Urry refers to as the 'system' of automobility (2004) accounted for 13.4% of greenhouse gas emissions in 2012.[1] Any really significant reduction in this figure implies sweeping changes in the use of the car. However, it is generally agreed that this will be difficult to achieve because driving is so deeply embedded in daily life (Mattioli, 2014). Within transport studies and the mobilities literature, some refer to the 'car dependence' of individuals, i.e. those who rely on the use of a car. Others use the term to characterize either a location or a society as a whole. A third possibility – and one that we develop here – is to understand car dependence as a feature or characteristic not of people or of places but of practices. That is, to consider it as the consequence of the extent to which driving has become integral to the conduct of an increasing range of social practices, including shopping, commuting and getting to school.

With this as our starting point, we confront and engage with a series of more fundamental issues about how infrastructures reflect and shape multiple social practices, and about how infrastructures are, in turn, shaped by past and present forms of planning and design. In taking this approach, this article serves two purposes at once. One is to provide an account of how energy demand is inscribed and reproduced through the combinations of practices and infrastructures of which contemporary forms of car dependence are made. A second ambition is to extend and bridge between current methods of conceptualizing social practices (Schatzki, 2010a), and the material arrangements on which they depend.

More concretely, this exercise leads us to suggest that car dependence is, to an extent, shaped by infrastructural arrangements and by the spatial and temporal connections between practices that these enable. These systems do not arise by accident. As we show, past and present practices of planning, normalized metrics and methods, taken-for-granted understandings of welfare and well-being and sometimes contested local and national politics are also important. In exploring these connections and in considering them from different points of view we catch sight of how patterns of energy demand are made in practice, and of how they might be changed.

The five sections of the article develop these ideas, one step at a time, starting with a brief discussion of concepts mobilized by authors interested in understanding the social significance of the car and of automobility in general.

Cars, driving and systems of automobility

As might be expected, sociological interest in cars and systems of automobility reflects and contributes to broader debates about modernity, innovation systems, performativity, practice and complexity. In taking stock of just some of this writing, our aim is to show how prior theoretical interests drive the necessarily selective lines of enquiry that follow, and to identify questions that are important for an understanding of car-dependent practices but that currently fall between the cracks.

Various commentators discuss the rise of *the car* as an expression and an outcome of modernity, arguing that over the twentieth century, and in some societies, automobility has become 'one of the principal socio-technical institutions through which modernity is organised' (Böhm et al., 2006). Others point to the decisive 'character of domination' (Heidegger, in Sheller and Urry, 2000: 737) that follows a seemingly unstoppable process in which the demands of the car seep into the fabric of social life. Such accounts work with a largely tacit analysis of what we might think of as societal trends unfolding on a truly macro- scale.

Precisely how such trends come about is a central concern for the second strand of literature on which we comment, and which is rooted in the tradition of innovation studies. Geels' (2004) multi-level perspective (MLP) represents a widely cited model of sociotechnical transitions, emphasizing the co-evolution of technologies, regulations, 'users' and markets, and highlighting the phases and stages through which novel configurations become normal. When applied to the project of conceptualizing transitions in automobility (Geels et al., 2011), this model is of value in showing how the car displaced other methods of personal mobility (cycling, horse riding, walking) and in detailing the emergence and persistence of a car-based regime. Given that the aim is in essence that of explaining processes of stability, change and innovation, there is an understandable emphasis on the institutions and arrangements that surround the car and its position as a dominant mode of transport.

From this perspective, there is no obvious reason to go deeper, to explore the embodied experience of *driving* or to consider the symbolic status of the car within contemporary consumer culture. By contrast, these fine-grained features of 'user experience' are precisely the aspects that are foregrounded in more cultural and anthropological literatures. For example, Cresswell (2010) considers the politics of mobility, focusing on the

representation, velocity, rhythms and practices of movement itself. Miller's (2001) excellent collection, entitled *Car Cultures*, provides further compelling insight into the meanings of cars and into the social and cultural diversity of car driving. Laurier's work zooms in closer still, using novel forms of video ethnography to capture movements and conversations within the distinctive bubble of space defined by the car itself (Laurier, 2004; Laurier et al., 2008). Such exercises, which are informed by an interest in the performance of daily life rather than in processes of sociotechnical regime change, highlight the socially negotiated order and cultural anchoring of driving.

The doing of driving is also important for Warde who writes about motoring as a means of exploring the relevance of social theories of practice for the sociology of consumption. In this case, the focus is on describing how skills are shared and reproduced both in the performance and the immediacy of doing driving, and over the longer run, as the practice itself evolves (Warde, 2005). In addition, and as Shove et al. (2012) suggest, the idea that social practices entail the active integration of heterogeneous elements, including competence, materials and meanings provides a means of tracing the changing contours of motoring over time, and of identifying contemporary differences in what it involves. In this writing, as in similar strands of relational theory, the car figures as an active part of the doing of driving to the extent that the person and thing are thought of as being hybridized, hence Dant's notion of the 'driver-car' (Dant, 2004; see also Thrift, 2004).

Urry's influential characterization of the *system of automobility* brings a number of these traditions together, using complexity theory and a repertoire of concepts including path-dependence, increasing returns and tipping points to explain how the various processes outlined above coalesce and co-emerge (Urry, 2004). Urry's central contention is that there is a 'system' of automobility which has something of a life of its own, and which is capable of self-expansion and of restructuring time and space such that 'it generates the need for ever more cars to deal with what they both presuppose and call into question' (Urry, 2004: 27). As he explains, 'cars extend where people can go and hence what they are literally able to do' (Urry, 2004: 28), affording forms of flexibility which then become necessary features of contemporary social arrangements.

There is more that could be said, but as the preceding paragraphs make clear, sociological analyses of cars, of driving and of systems of automobility are surprisingly disconnected from potentially important matters of routes and destinations and from related questions about where, when and why people travel by car.[2] For example, in writing about the symbolic significance of driving and the cultural meaning of the car, and in showing how both reproduce and enact registers of social distinction, Warde fixes attention on *motoring* as a practice in its own right (Warde, 2005), rather than on how it makes other practices possible.

Ironically, attempts to conceptualize systems and regimes of automobility are similarly bounded by their focus on 'the car' and that which sustains its position in society in general. While this strategy provides some insight into long-range trends, it fails to show how cars become embedded in some areas of daily life and not others, how driving-to-specific-places fits into more extensive temporal rhythms and sequences of practice, and how particular journeys come to be journeys made by car.

What is missing is an analysis that recognizes that much of the time driving does not happen for its own sake, but is bundled with many other aspects of daily life such as commuting to work, taking children to school, going to the shops, etc. To some extent, understanding how this bundling works depends on also understanding the social role of material infrastructures. While the hardware of driving – not only the car, but also roads, traffic lights, garages, a global system of oil refining, urban space, etc. – has a central place in the literature on transitions and systems of automobility, these analyses do not show how spatially extensive networks are implicated in the situated reproduction of many practices at once (and vice versa). In sum, if we focus on the problem of explaining how forms of car dependence take hold and evolve, we need to develop theories and methods that are capable of conceptualizing the relation between infrastructures and the various practices to which they relate, as these change over time and space.

In the coming pages we make some headway in understanding how practices and infrastructures constitute each other by commenting on existing methods of representing material elements and arrangements within recent contributions to social theories of practice. This informs further discussion of the distinctive qualities of infrastructures, including their capacity to connect, their role in the conduct of many practices at once, and their obduracy. Our account of how infrastructures and practices interact helps in understanding how car dependence is constituted. It also draws attention to the role of those involved in making and modifying infrastructures – including origins, destinations and the networks that connect them – and to the question of whether these people have a special hand in shaping the ways in which practices of shopping, commuting and driving hang together. In the final part of the article we consider the practices and politics of planning and whether complexes of social practice and related patterns of energy demand can be engineered by design.

Materials and social practices

It is by now impossible to overlook what Latour described as the 'missing masses' of social life (Latour, 1992). The socially constitutive roles of artefacts, devices, things, objects and human-non-human hybrids are underscored and repeatedly analyzed across science and technology studies and within the fields of material culture, consumption and cultural studies. They also figure prominently in social theories of practice.

For Reckwitz (2002) and for Shove et al. (2012), material entities (such as cars) represent elements that practitioners mobilize, along with relevant meanings and forms of competence, in the doing of a practice like driving. From this point of view, the technical details of a car, the skills needed to set it in motion and the concept of driving itself are interwoven and reproduced each time someone pulls out into the traffic. Driving, viewed as a recognizable social practice in its own right, is an outcome of these many separate performances. More than that, the doing of driving constantly evolves as the constitutive elements change independently and in relation to each other. This understanding of practices as active integrations of materials, meanings and competences has become known as the 'three elements' model (Shove et al., 2012). This simple framework has proved useful in understanding what it takes to accomplish a practice at a given moment and place, and in showing how practices emerge, develop and die, but it is also limited.

While it provides a means of conceptualizing the constitutive role of seemingly bounded objects with which practitioners interact (cars, hand tools, sports gear, etc.), it does not do justice to the many co-existing forms of materiality on which the functioning of these objects depends. On the face of it, Schatzki's (2010b) very much broader concept of *material arrangement* does a rather better job of acknowledging diverse and diffuse configurations like the road network or the electricity grid. However, it is important to recognize that this concept situates materiality in a very different relation to the performance of practices.

In brief, the notion of a *material element* locates materiality within and as part of practice. By contrast, for Schatzki, material arrangements are what practices transpire amidst: while they are co-dependent on practices, they are ultimately distinguishable from practice itself. In addition to this basic ontological difference, the two terms represent alternative ways of framing the realm of 'the material'. In effect, the concept of material element collapses infrastructures and fuel supplies into the car, and thus into the practice of driving. By comparison, the concept of a material arrangement is clearly broad enough to include infrastructures, but it does not differentiate between things which have a background role (the road, the place of origin, the destination, the petrol) and those which are more obviously or more directly mobilized in the conduct of a practice (such as the car). This is not necessarily a problem for Schatzki who is interested in explaining how material arrangements, broadly defined, are implicated in the conduct of social practices via various forms of causality, prefiguration, constitution, intentionality and intelligibility (Schatzki, 2010a). However if we want to know how practices develop in ways that call for more resource consumption, it is essential to understand how infrastructures are variously implicated in the conduct of multiple social practices.

In the next section we identify what seem to be salient features of infrastructures, highlighting those that are relevant for the persistence, evolution and interconnection of practices which have come to depend on the car.

Infrastructures and social practices

The etymological roots of the term infrastructure come from the Latin – infra – meaning below, underneath, later than, smaller than, and inferior to. It is true that many infrastructures are massive and easy to spot, but whether above ground or below, and whether large or small, in normal use, infrastructures remain relatively invisible. They are 'background' both in their daily function, and their status within social theory.

There are, of course, excellent social histories of how infrastructures have been designed and built, and of the politics of their production (Winner, 1985). Hughes' account of the development of the electricity systems in Berlin, Chicago and London is a classic example (Hughes, 1983). In part, because much of this work engages with specific installations, individual cities and particular projects, it fails to consider the shared characteristics of infrastructural arrangements (Graham and Marvin, 2001; Hård and Misa, 2008; Coutard and Rutherford, 2011), or to discuss the social and cultural properties of infrastructures-in-use. As a result, there are as yet no recognized terms with which to analyze infrastructures as parts of living systems of practice, and no refined

account of the distinctive forms of materiality that they represent. However, there are some shared characteristics.

First, infrastructures are often (but not always) *connective* – linking different places and having both entry and exit points and usually more than one of these. As a result, they are generally also *extensive,* bridging between many sites of practice. In the case of electricity, the scale of this connectivity varies, from the national grid to the rooms of an individual house in an off-grid infrastructure. The road network is connective in a slightly different sense, tying many origins and destinations to each other. In this case, it is the criss-crossing of routes, motorways, trunk roads, lanes and tracks that constitutes the value and the affordance of an individual stretch of tarmac, and of the network as a whole. As discussed below, these qualities have a bearing on the distribution of different social practices, and on the potential to move between them in space and time.

A second feature is that, unlike many appliances and devices, infrastructures typically sustain a range of different practices at once. It is true that certain artefacts have a multiplicity of uses, simultaneously figuring as material elements in several practices. What is distinctive about infrastructures is that this multiple aspect is a reflection of their *infra* character and a consequence of their location in the background of social action. In simple terms, roads accommodate cyclists as well as cars, enabling journeys to work as well as to hospital or to school. At the same time, practices like shopping or commuting depend on the coexistence of multiple material arrangements. For example, supermarket shopping depends on the car and road network, on extensive systems of food provisioning, cold storage (Hand and Shove, 2007), and on systems of trolleys and carrier bags (Cochoy, 2009).

Third, infrastructures are generally *collective* – the services they provide are usually for more than one user. Partly because of this they are often subject to, and a consequence of, deliberate planning and intervention by local and national governments. They are so in that they often constitute the preconditions for other (desired) arrangements, such as economic growth, family well-being and social contentment. Such goals are materialized in various ways: in the development of high speed rail to facilitate flows deemed essential for a successful economy, and in building bypasses designed to divert traffic and create congestion-free towns and villages.

Fourth, infrastructures are often relatively obdurate. This takes different forms. Some infrastructures are massive and composed of durable materials – concrete pipes, stone bridges, steel pylons, etc. Some represent major investment, the sunk costs of which have implications for rates and forms of future change. More abstractly, infrastructures embody and carry historically specific ideas about normal and appropriate ways of living, effectively transporting these from one generation to the next.

These four qualities are of consequence for, and are not really separate from, the lives of the various social practices with which infrastructures connect. They are also of consequence for attempts to understand and perhaps steer or shape patterns of stability and change. For example, the fact that different practices have the same infrastructure in common represents a potentially important point of bond between them. To illustrate, roads sustain driving as well as passengering and cycling; they enable the relatively smooth passage of all sorts of vehicles, and of pedestrians and runners. Roads also afford and enable practices like transport planning, sweeping, digging and resurfacing – on

which their own continued existence depends. In addition, they constitute spaces and sites for wider fields of practice such as playing, street partying and political action. These many road-related practices are in constant flux, attracting and losing practitioners over time and consequently changing in the manner and in the extent to which they are performed, transformed and reproduced. While the road provides a shared point of reference, that commonality is precarious and always in motion. This flexibility-in-use goes hand in hand with the fact that infrastructures frequently endure beyond the life of one or more of the practices for which they were designed and of which they were once a part. In effect, infrastructures are characteristically resilient. It is because they enable and are sustained by multiple social practices at once that they are able to withstand the disappearance of previously critical practices, and accommodate and adapt to the arrival of new roles and purposes.

In acknowledging these complexities, recent discussions, both of driving and of systems of practice, point to the need for a more subtle and a more differentiated account of how infrastructures interact and of how they figure in the dynamics of social practice (Watson, 2012; Spurling et al., 2013). Further consideration of how infrastructures support complexes of practice defined by their reliance on the car represents a step in this direction

Infrastructures and car-dependent practices

As we noted earlier, descriptions of driving as a practice (Warde, 2005) do not provide much insight into *what driving is for*, yet this is precisely what is required if we are to understand how the car has become so embedded in daily life. From this point of view, figuring out how car dependence takes hold is a matter of explaining how combinations of practice interlink and change 'en masse'.

Existing discussions of complexes and bundles of practice provide some clues as to what this might involve. For example, Shove et al. (2012) suggest that practices which are co-located in space and/or time co-exist in the form of loose knit *bundle*s, and that such bundles sometimes become co-dependent, forming much stickier *complexes* in which the performance of any one practice literally depends on the performance of others. Although this analysis points to some relevant spatial and temporal dimensions – for example, that practices can be spatially co-located or temporally sequenced – a more refined account of how relevant infrastructures reflect and enable such conjunctions is required.

Returning to the case of car dependence, it is obvious that roads connect places and sites of practice. As car ownership has grown, different forms of land use and hence different relations between place and practice have become plausible and possible. One consequence is that certain practices which used to be spatially co-located are no longer so. As cars enable the spatial distribution of grocery shopping, school and work, daily life is – of necessity – more spread out. Despite their increased distribution in space, some of these practices remain tightly-knit together in time. For example, highly synchronized rhythms of work and school generate pressures of scheduling which are often managed with the help of a car. Together, these ideas suggest that car dependence in part stems from, and in part enables specific forms of temporal co-dependence and spatial

proximity/distance and that it is through these routes that car-related infrastructures and practices interconnect and multiply.

This is a simple but powerful conclusion. It is consistent with an approach which refuses to focus on automobility as such (or on systems of cars, roads and drivers) but which works with a more embedded concept of car-dependence – underlining the point that roads and cars are used in the course of and as part of enacting diverse practices and that places and destinations are as vital as the more obvious hardware of the road itself. It is also a conclusion that builds on previous analyses of materiality and practice, but that takes such discussions further, arguing that infrastructures (including roads, origins and destinations) serve to connect practices in space and time, thereby constituting new relations of car dependence.

Although it is useful to show how these connections are made, it is important to recognize that contemporary configurations of time and space are not simply consequences of new infrastructural arrangements of place and practice. As Owens (1995) points out, practices do not always take place in the nearest appropriate venue: people travel miles to work, and travel past other schools on route to the one to which their children go. It is clear that other dynamics are involved in the sequencing and spacing of daily life, including the rise of dual income families, or government policies that promote parental choice.

While infrastructures have a role in bridging between social practices, it would be wrong to think of them as static entities, or to imagine that this bridging relationship is one-way. We know that material infrastructures often have obdurate qualities (Hommels, 2005), and we know that some social practices are reproduced in very similar ways for relatively long periods of time. However, we also know that despite their physical size, mass and often enduring form, infrastructures do not simply hold the spatial and temporal fabric of social life in place. Rather, infrastructures enable a variety of dynamic processes. For example, roads enable driving to bundle with an ever increasing number of practices, which in turn create new demands on the infrastructure. In broad outline, this phenomenon is recognized in the transport planning literature in that strategies of predicting and providing for future demand are known to produce more traffic (Banister, 2008). What is missing is a more refined explanation of how this works, or of how such developments engender or are a consequence of quite specific changes in the range of social practices that are enacted, and in how those practices evolve. For instance, the car dependence of specific practices is likely to be important for who takes part in them (only those who have use of a car), and hence for the ways in which such practices develop and are socially distributed. In addition, infrastructures are likely to fall into disrepair if they are not used in practice.

The key point is that patterns of obduracy and change in infrastructures and practice-complexes intersect and shape one another. This opens up new questions for research, for example, does the character and pace of infrastructural development hold particular complexes of practice in place or help make some complexes more possible than others? In considering these questions, it is as well to remember that infrastructures do not appear by chance. The fact that large technical systems embody the politics of their production is routinely recognized in the historical literature. However, such accounts rarely go on to investigate the consequences of infrastructures-in-use or to consider their

ongoing and changing implications for the formation and dissolution of entire complexes of social practice.

Understanding how professional and everyday practices constitute each other represents a new line of enquiry, but one which is important to follow if we are to figure out how institutional forms of power work out in practice, and where opportunities for configuring lower carbon societies might lie. There are different ways of thinking about this topic, and about how designers' and planners' working methods might be included in theorizations of the infrastructure–practice relationship (Spurling and Blue, 2014).

One route is to argue that people involved in debating, financing or fighting against infrastructural projects or in the routine work of planning are somehow 'outside' – and thus capable of steering – the systems they make and the many areas of daily life to which these connect. In effect this supposes that those who have a hand in infrastructural design have a special hand in enabling, or perhaps limiting the formulation and erosion of more extensive complexes of practice that others enact. From this point of view, methods and processes of transport and urban planning are politically charged. Infrastructural developments often constitute sites of visible struggle, for example, between public and private sector interests or between local communities and national planners and policymakers. Whether schemes are controversial or not, institutional procedures, along with national and international standards, regulations, guidelines, models and metrics of impact assessment and evaluation organize the ways in which strategies are formulated and implemented. Like the material systems they help shape, these soft technologies affect both the substance and the form of planning processes and the outcomes that follow. In this, they act as normalized, routinely invisible but nonetheless powerful mechanisms of continuity and change. Far from being neutral, they reproduce variously shared ideas – for instance, about well-being, economic growth, local and national priorities – along with the special interests of politicians and of industry and other lobby groups. By implication, patterns of car dependence and energy demand are in part a consequence of these complicated but recognizable forms of political and ideological power. For those who want influence, this seems to be where it lies.

On the other hand, we have repeatedly made the point that infrastructures-in-use depend upon, and reflect, the ongoing enactment of practice complexes and bundles, the specific combinations of which change over time. This line of argument leads to other conclusions. Rather than determining outcomes, infrastructures at best represent something of a trellis-like framework through and around which the combining and loosening of practice complexes occurs. Quite often, forms of infrastructural change represent belated attempts on the part of national or local planners to catch up with processes that are already underway: as when councils sanction the construction of out of town shopping centres *in response to* increasing car dependence. The observation that design and policy-making can work in both directions – reacting to trends in practice and/or providing conditions in which new trends might take hold – leads to the more subtle proposition that methods of infrastructural development are themselves implicated in wider systems of practice dynamics. By implication, planners' working methods, their models and the criteria they use in designing and evaluating schemes and proposals act as vectors or carriers through which certain visions and practices of working and family life gain ground. From this perspective, those involved in policy and planning are themselves enmeshed in

a maelstrom of practice dynamics. In other words, planners have a distinctive role in shaping infrastructures but the sources of change in what people do, in how practices connect and in the energy demands that follow cannot be simply attributed either to infrastructures in isolation or to those who make them and keep them in working order.

Insights and implications

This article has the dual ambition of bringing social theories of practice to bear on the problem of understanding and limiting car dependence as a means of reducing energy demand and of exploring some of the conceptual challenges that this problem generates.

We began by suggesting that people use cars, energy and natural resources not for their own sake but in the course of accomplishing social practices. This move channelled attention in certain directions. In particular, such an approach implies that forms of car and energy dependence cannot be abstracted from the emergence and reproduction of complexes of practice, or from the material and infrastructural systems on which these complexes depend. This conclusion begs further questions about the relation between infrastructures and the social arrangements they enable and sustain. In commenting on these themes we suggested that infrastructures like road networks and electricity grids constitute forms of materiality that share a handful of distinctive features: they are typically connective, multiple – in the sense that they are implicated in the conduct of several practices at once, collective and obdurate.

The first two of these qualities are especially important for understanding how infrastructures are implicated in the constitution of bundles and complexes of social practice. The idea that bundles and complexes form when practices are linked together in time and/or space provided a way into the problem of understanding how different practices come to depend on the car (i.e. they form a car-dependent complex) and how infrastructural arrangements are implicated in these essentially recursive processes. Again we recognize the looping back of infrastructures on practices and vice versa. As Urry also notices, the temporal flexibility of car travel and the fact that cars allow people to travel further in a given unit of time than other previously important modes (involving horses, bicycles or walking), has transformed time–space, reshaping lives and geographies around these new capacities (Urry, 2004: 28). The point, for us, is that these transformations are situated and realized across and through social practices, including shopping, commuting and going to school. Understanding car dependence is thus a matter of understanding how these areas of daily life evolve, separately and together, and in their collective relation to infrastructures and systems of automobility.

Such arrangements do not occur at random, hence our interest in planners' and designers' roles in shaping the material elements and arrangements of which multiple practices are constituted, and amidst which they transpire. It is tempting to conclude that the professionals and policy-makers who influence infrastructural provision have some privileged status in steering what people do. While we are definitely interested in the relation between professional and political practices, on the one hand, and the changing contours of everyday life, on the other, we are wary of suggesting that one directly shapes the other. Instead, we consider methods of planning and policy-making as practices in their own right, and as arrangements that are part of rather than outside the

ongoing flux of daily life. This does not deny the possibility of influence or impact but it does not presume that this is exclusively or even especially in the hands of those involved in making and shaping infrastructures, critical though these are for the constitution of practice complexes, and for the energy demands that follow.

These observations underpin what amounts to a distinctive account of how patterns of car dependence take hold and change. In piecing this account together, we have drawn upon, and at the same time contributed to recent developments in social theory. One contribution, especially relevant to studies of technology and material culture, is to highlight some of the special features of infrastructures, as these enable and constitute bundles and complexes of social practice. Although we have focused on arrangements that relate to the use of the car, our key insights – that infrastructures sustain different practices at the same time; that because of this they are often characterized by distinctive forms of obduracy and that infrastructures-in-use are, for the same reason, sites of constant change – would apply also to other settings and contexts. Such ideas are, for instance, relevant for those who study networks of water, gas, electricity, telecommunications and wireless or broadband data, and the various social practices to which these systems relate. In writing about how infrastructures and practices connect, we have identified different dimensions or aspects of material involvement. This is an important move in that it enables us to see, and to then discuss how cars (or more generally, appliances and artefacts) depend upon and/or call for more extensive systems and technologies of provision, including roads along with origins and destinations.

A second related contribution, and again one that is of wider relevance, is to provide further insight into the constitution and formation of bundles and complexes of practice. There are numerous empirical studies of how social practices develop and change, but fewer that focus on how practices are conjoined, or on the nature of the links and bonds involved. In this article we have elaborated on Shove et al.'s (2010) attempt to characterize the types of connections through which practices are held together in space and time. More specifically, we suggest that some of these relationships are underpinned and to an extent formed by infrastructural arrangements that are more or less deliberately planned.

Neither of these two contributions are specifically related to questions of climate change. They are, however, a consequence of an attempt to figure out how car dependence, and related emissions of CO_2, become embedded and how this might change. In terms of method, this article therefore represents a kind of worked example, exploring a selection of social theoretical challenges – comprehending different forms of materiality; figuring out how diverse social practices hang together – that have arisen, and that have come to the fore from engagement with one small part of the climate change agenda. Such an exercise is again of more generic significance, simultaneously reminding us that social theory develops through and not apart from practical engagement with the challenges of the day, and that the manner in which problems like those of climate change, or more specifically car dependence, are framed and understood is itself an outcome of contemporary paradigms and schools of thought. In seeking to conceptualize connections between energy demand, infrastructures and social practices we hope to have contributed to this double process of problem framing and conceptual innovation.

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Notes

1. This is despite increases in fuel efficiency: http://www.smmt.co.uk/co2report/total-co2-emissions/
2. Transport studies have been concerned with such questions for a long time, though social theory has not engaged with this work.

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