This is an Accepted Manuscript of a book chapter published by Routledge in The Nexus of Practices: connections, constellations, practitioners in 2017, available online: https://www.routledge.com/The-Nexus-of-Practice-Connections-constellations-and-practitioners/Hui-Schatzki-Shove/p/book/9781138675155

Matters of practice

Elizabeth Shove

It is obvious that the lives of things and practices are mutually constituted and densely interwoven. It is also obvious that really significant trends like the massive increase in CO2 emissions over the last few decades are outcomes of what Schatzki (2010a) describes as 'practice-arrangement' nexuses. Situated in the space between these two opening sentences, the purpose of this chapter is to develop a practice theoretically compatible account of material relations that helps conceptualise rapid increases in per capita energy demand.

The grand scale of this ambition is in part a critical response to those who contend that theories of practice are especially and perhaps only good for analysing daily routines and localised patterns of consumption (Welch and Warde, 2015; Geels et al., 2015). For the moment, and particularly in the environmental field, empirical work inspired by practice theory tends to focus on end consumers: on those who do the cooking, have daily showers or twiddle with heating systems. However, this is *not* a necessary feature of taking practices to be the central topic of enquiry. As I hope to show, systematic consideration of the matters of practice provides a means of connecting otherwise separate realms of producing, manufacturing, making and doing. Moving in this direction has the further advantage of demonstrating the relevance of practice theory for understanding processes that are commonly taken to be the preserve of disciplines that deal with resource economics, environmental politics, world trade and global energy demand.

In other respects, the chapter is deliberately limited in scope. The methodological decision to think about how energy demand is constituted informs the way in which I characterise and slice material-practice relations and the examples I use. Although many of the issues discussed below are of wider relevance, what follows is not designed as an all-purpose exercise in mapping the many routes and processes through which practices are materialised, and vice versa. Accepting that materials and practices *are* interwoven, and that humans, artefacts, organisms and things of nature are variously but unavoidably enmeshed in social life (Schatzki, 2010a), I focus on the problem of understanding the emergence of configurations and practices that are distinctly resource intensive. This depends on developing a more detailed account of how specific flows of 'matter-energy' are formed.

With this challenge in mind I start by considering three *roles* that things can play in practice.[1] Some things are necessary for the conduct of a practice, but are not engaged with directly. I suggest these have an 'infrastructural relation' to practice. A second category includes things that are directly mobilised and actively manipulated. I count these as 'devices'. Third, there are things which are used up or radically transformed in the course of practice and that figure as 'resources'. This way of thinking about things is distinctively practice-centric. It is so in that identical objects can have different roles and thus fall into different categories, depending on how they are positioned within and in relation to different practices.

The main business of the chapter is to explore the relevance of such an approach and to show what it might have to offer within practice theory and beyond.

More specifically, can this three-part classification help in disentangling and describing the packaging of material-practice relations across sequences and chains of production and consumption? I write about house building, home heating and watching television as a means of detailing relevant processes of connecting and prefiguring.

A second ambition is to use this scheme to think about how the status of things changes in practice. For example, when and how do device-oriented relations become infrastructural and vice versa? As I show, the shifting status of things like larders, fridge-freezers and frozen food chains are part of making and reproducing multiple distinctions and flows. I suggest that transitions of this kind are relevant for understanding how resources, including forms of energy, circulate and how 'demands' are built. In the third part I comment on how things which tend to have infrastructural, object-oriented or resource-based roles figure in the spatial and temporal patterning of practices and vice versa.

I finish by taking stock of what this method of dissecting material practice relations allows us to see and to say. Before getting into these cases and questions, I briefly introduce the lines of thinking on which this approach draws and from which it departs.

Material relations in practice

Although there have been careful and detailed expositions of things within and as part of social practices (Reckwitz, 2002b; Schatzki, 2002), there is rather less analysis of the range and variety of material relationships involved or of precisely how material entities figure in what people do.

To date, the most significant difference is between discussions of material *elements* which are treated as being integral to the conduct of a practice (Shove, Pantzar and Watson, 2012) and material *arrangements* amidst which practices transpire (Schatzki, 2010a). For Shove, Pantzar and Watson, the material elements of car driving might reasonably encompass the road network, a system of petrol stations and the steering wheel itself. All are accorded the same material status. Meanwhile, Schatzki's concept of material *arrangements*, amidst which practices transpire, does not distinguish between things which are directly, routinely or only distantly and occasionally implicated in the conduct of a practice. This is not in itself a problem. In both cases broad brush representations of 'material' are sufficient and consistent with the similar but not equivalent ambitions of the authors involved.

However, this language of elements and arrangements is of limited value if we want to know how and why specific patterns of production and demand arise and are engendered by correspondingly specific conjunctions of practice. Warde's (2005) observation that things, including energy and other resources, are consumed in the course of practice provides the starting point for a more differentiated account. The statement that 'the enactment of any one practice (for example, cooking a meal or travelling to work) typically depends on the prior existence and availability of a range of energy sources (gas, electricity, oil), infrastructures (grids, pipes, roads) and devices (cookers, cars, bicycles)' suggests that objects can be classified, in advance, under one or another of these ready-made headings (Shove and Walker, 2014: 50). This is a rather literal account.

A more subtle approach, and one that I develop here, is to distinguish between *the roles* that materials play in the enactment of any one practice. This is in keeping with those who view objects not as isolated entities, but as always integrated within and always inseparable from more extensive assemblages (Appadurai, 1986; Ingold, 2007; Introna, 2013; Shove, Walker and Brown, 2014). It is also consistent with Rinkinen, Jalas and Shove's (2015) method of characterising 'object relations' in daily life. Rather than taking objects to have a fixed status, Rinkinen, Jalas and Shove adopt a relational approach, distinguishing between the various ways in which people describe and engage with the materials involved in keeping warm in winter. Although I work with a more bounded and also more pragmatic view of things, the shared proposition is that materials are defined, constituted and positioned with respect to each other through their role within specific practices.

This method makes it possible to show how things switch between roles and to recognise that things which have a background or infrastructural relation to certain practices may be more directly engaged in the conduct of others. These theoretical moves are important, but they do not prevent me from appropriating concepts and insights from disciplines and fields which define resources, artefacts and infrastructures in other ways and which focus on them for different reasons. As well as picking out useful points of connection, the next few paragraphs provide a reminder both of the complexity of the material world and the specialisation of academic research dealing with infrastructures, devices and artefacts or resources.

Writing about things in the background

Defining things which have an *infrastructural relation* to a practice as those which are necessary but that are not interacted with directly, results in a situationally specific but potentially extensive list of possibilities. Depending on the practices at stake, homes, kitchens and a good supply of oxygen would be as likely to qualify as 'infrastructure' as power grids, harbours or pylons. There are no hard-and-fast rules about what to count as necessary background: as is usually the case, this is a matter of judgement and purpose. In the examples discussed later in the chapter, an interest in conceptualising escalating energy demand provides one filter.

Although many things can have an infrastructural relation to practice, the systems and arrangements through which power, data and water are provided and distributed often figure in this role. As such, sociological and historical literature on infrastructures provides a useful point of reference. Classic contributions to this field including Hughes (1993), Nye (1992), and Hård and Misa (2008) focus on the social, technical and institutional processes involved in establishing what are typically complicated, geographically distributed, relatively expensive and often relatively durable networks. Coming at similar issues but from a different angle, writers like Coutard, Hanley and Zimmerman (2005), Bulkeley et al. (2012) and Graham and Marvin (2001) focus on institutional actors (cities, utilities, etc.) and the political interests involved in the (re)development of networked and decentralised forms of provision. Writing of this kind tends to consider infrastructures-in-the-(re)making as distinct from infrastructures-in-use. This is intriguing and also ironic. When infrastructures become invisible in daily life, that is when they are functioning normally, academic interest in them seems to wane. Whilst there is widespread agreement that electricity, communication and data systems constitute an essential backdrop to contemporary life – breakdowns and failure provide tangible evidence that this is so (Nye, 2010) – questions about how different practices become and remain electrified, or internet-dependent, and about what these

processes mean for resource consumption, currently fall between the cracks of established disciplines and debates.

Grand observations about '[t]he growing dependence of modern societies on technological systems… [and] the steady increase of systemic vulnerabilities and risks due to the growing complexity of these systems' (Silvast, Hänninen and Hyysalo, 2013: 4) indicate what appears to be a collective transformation in the material relations of many practices at once. By implication, infrastructural transitions do not occur in isolation. As Edwards et al. note, 'the actual infrastructures of people's real work lives always involve particular configurations of numerous tools used in locally particular ways' (Edwards et al., 2009: 370). In other words, networks of water, power or data are only of value and only develop and expand when they connect with and enable a proliferation of devices and appliances that are in turn enmeshed in practice. Things in the background are of necessity tied to things in the foreground and to the ongoing mobilisation of things in action.

Writing about things in action

It is fairly straightforward to identify things which have a device-oriented role in relation to the conduct of a practice and that are visibly and actively used in the process of doing. The more complicated task is to conceptualise the conjunctions of human and nonhuman competence and capacity that follow.

Giard and de Certeau's discussion of the 'instrumentation relationships' that exist between practitioners and things and through which practices are configured, highlights a number of features that are picked up in related literatures and that are especially relevant for a discussion of energy demand. They write about how an influx of appliances 'born of an intensive use of work in metals, plastic materials and electrical energy has transformed the interior landscape of the family kitchen' (Giard, de Certeau and Mayol, 1998: 210), modifying the skills of the cook and his/her gestures and actions in practice along with the relation between bodily and other forms of energy.

Going into a bit more detail, there are clearly different ways of representing the relation between cook and appliance. One option is to view such combinations as hybrid entities: part cook, part appliance. From this point of view, cooking is done not by the cook alone but by what Wallenborn describes as an 'extended' body (Michael, 2000; Wallenborn, 2013). A related but slightly different approach, also rooted in actor network theory, is to consider the manner in which the appliance and its designers script the cook, defining a programme of action that he or she may find difficult to resist (Akrich, 1992).[2] As well as bringing product and tool designers into view, this strategy raises further questions about how aspects of knowing and doing are integrated, delegated and divided and how aspects of practice become 'black boxed'.

The common point is that things which are mobilised in practice are not merely 'used'. Rather, such things are implicated in defining the practice itself. In this role, things-in-action matter for the division of labour in society, for the extent to which practices depend on human or other forms of power and related patterns of resource consumption.

One aspect of the instrumentation relationship which is largely overlooked by Giard and de Certeau and in much other writing about scripts, hybrids and consumption in general is that many, though certainly not all, practices involve making, repairing, adapting or somehow

intervening in the lives and flows of things. Acknowledging the material outputs of practices, including the uses of objects and infrastructures in the reworking of resources opens the way for a more dynamic account of material transformation, circulation and exchange.

Writing about things that are used up

It is again not too difficult to itemise things that are consumed, in the sense of being used up, in the course of a practice. Staying with examples from the kitchen, making bread requires a predetermined list of ingredients: yeast, flour, water, etc., along with fuel to power the oven. Although sociologists of consumption have had relatively little to say about the unglamorous world of consumables or the materially transformative outcomes of practice (Gronow and Warde, 2001; Shove and Warde, 2002), such topics are of greater interest to those who write about waste.

Key themes here have to do with the changing status of things as they are consumed, used and reconfigured. For example, Strasser (1999) writes about how the (low value) by-products of certain practices figure as (high value) inputs to others (O'Brien, 2012). As well as drawing attention to the ways in which practices are linked by material interdependencies and by chains of waste and want, this literature underlines the persistence of the material world. Though constantly transformed, there is a sense in which materials are not literally used 'up'. This is also true for energy: technically defined as the capacity to do work, it is the quality and not the quantity of energy that changes through 'use' (Funtowicz and Ravetz, 1997).

Alongside but detached from these detailed representations of using and transforming and far from any social theory of practice, economists often treat resources, including things like oil, steel, sugar, coffee, etc., as unchanging commodities the circulation of which reflects seemingly abstract political and economic processes. In the environmental field, increasingly elaborate methods have been developed to quantify and allocate carbon emissions (relating to the use of energy) associated with increasingly complicated supply chains in which ready-made components are exported, assembled and shipped on as 'resources' and as input to subsequent stages of production (Daudin, Rifflart and Schweisguth, 2011). Building on previous efforts to describe international or cross-regional flows of trade, such techniques record inputs and outputs across various units/scales in an attempt to track the spatial/institutional location of emissions associated with the production and assembly of materials, parts, components and finished goods (Tukker and Dietzenbacher, 2013). Though critical for allocating national and sectoral responsibility for carbon emissions and for showing how these patterns are shaped by, and also part of, world trade, analyses like these concentrate on flows of material but without reference to the roles that resources or end products play in daily life or to the history of these arrangements. Economic historians with an interest in culture and consumption pay more attention to the mutual making of 'needs' and markets and to the emergence of exchange and not just use value (Mintz, 1986; Fernández-Armesto and Sacks, 2012). However, these accounts are rarely matched by parallel discussions of accompanying devices, forms of knowledge or related infrastructures.

Though analysed and conceptualised in different ways and within different disciplinary traditions, infrastructural, device-oriented and resource-based relations are thoroughly inseparable, being welded together in various combinations across a myriad of different practices. As the preceding paragraphs indicate, aspects of these relations have been selectively addressed by a range of academic interests, each driven by distinctive preoccupations and paradigms. In borrowing from across this repertoire of ideas and fitting

them into an account of the roles things play in practice, the next parts of the chapter are haphazardly interdisciplinary. Organised around the same basic question – Do distinctions between infrastructural, device-oriented and resource-based relations help in detailing material-practice relations that matter for energy demand, and if so, how? – each section focuses on a different theme. The first examines the sequential packaging and prefiguring of material relations, the second considers the fluid status of things within and between practices and the third comments on spatial and temporal configurations of infrastructures, devices and resources.

Material relations in combination and in sequence

In his 2010 article entitled *Materiality and social life*, Schatzki writes about how materials prefigure practices. In his words, prefiguration should be 'understood as a qualification of possible paths of action on such registers as easy and hard, obvious and obscure, tiresome and invigorating, short and long and so on'. He goes on to say that 'the particulars of material arrangements prefigure the course of practices in indefinitely complex ways' (2010a: 140). The question for me is whether there are methods of narrowing this complexity down, not in general, but in relation to the specific issue of how such prefiguring matters for energy demand.

One method of exploring this question is to use the distinctions introduced above – that is, to consider things which have an infrastructural, device-oriented or resource-based relation to practice – as a means of detailing connections between house building, keeping a house warm and watching television.

<Table 1: Material relations in combination and in sequence>

Table 1 outlines some of these possibilities. Predictably enough, each practice – building, warming, watching – is defined by its own combination of infrastructural, device-oriented and resource-based relations. A more interesting and also less obvious feature is that some of these material relations are sequentially linked and shared in common.

For example, reading down from the top of Table 1[3], we see that house building today requires a power supply and scaffolding in the background. These infrastructural features enable the safe operation of an armoury of power tools (devices) that are used in linking and transforming resources and components through the construction process. This is not the end of the story in that the finished house, including features of size, layout, insulation, etc., acquires an infrastructural role with respect to the practices of heating. In in this context, the boiler counts not as a resource to be installed and 'consumed' in the construction process, but as a device that is directly engaged with. The nicely heated living room then combines with the national broadcast network in constituting an infrastructure that enables occupants to watch TV in comfort.

This method of distinguishing between different yet connected material relations suggests that paths of action are *successively* and *repeatedly* qualified. This is relevant in that certain sequences of prefiguring may turn out to be self-reinforcing, potentially combining in ways that channel overall patterns of resource use. Although Akrich (1992) does not discuss unfolding or cumulative series of 'scripts', nor does Latour (1992) consider how 'programs of action' might be partly shaped or 'written' by those which precede them, these diachronic relations are evidently important.

Taking a more lateral or synchronic view, what Giard and de Certeau (1998) refer to as 'instrumentation relationships' feature in each of the practices described above. And in each case, electricity is involved. This is not just a matter of recognising that energy is embodied in the materials of which homes are made and in the process of their construction. Rather, the point is that powered devices (which bridge between infrastructural relations and resources) have transformed the extent and the division of human labour on the part of the building contractors *and* of the future homeowners for whom they build. From this point of view, practices like those of building, heating and watching TV are collectively involved in establishing and reproducing the 'need' for networks of power.

Figure 1 works with similar ideas but extends them, incorporating processes of manufacturing (especially of appliances) together with resource manufacture and power generation, this time indicating how these might variously constitute cooking, laundering and watching TV.

<Figure 1: Patterns of making and doing>

This more elaborate image implies that domestic, professional and manufacturing practices interact in concert. It is an obvious point but what is involved in doing the laundry depends, in part, on what the washing machine can do. And what the machine can do in turn depends on how and of what it is made. In this way, the skills and practices of washing machine making are quite directly tied to those of washing.

Second, whilst the specialisation of devices is also evident (TVs are not used in laundering), some of the manufacturing and resource-related relations that lie behind these objects overlap. For example, small electric motors and other components – LEDs, switches, etc. – are embedded in a range of otherwise diverse appliances. This is relevant in that the development and use of standardised parts has widespread and not practice-specific implications.

Third, and as is increasingly evident, energy demand is constituted right across the map. Electrified instrumentation relationships occur in factories as well as in kitchens; appliance designs matter for the relation between human and other forms of power (as in cooking and laundry); and with electrical wiring in place, new practices (TV watching) are enabled. More than that, forms both of automation and delegation (to machines and nonhuman forms of power) collectively reconfigure the distribution, definition and constitution of competence (Shove et al., 2007).

Categorising and defining things in terms of their *role* in a practice helps bring these topics to the fore and provides a means of thinking about forms and types of interconnection and of prefiguration. However, it is important to remember that material roles are often ambiguous and always provisional.

Material relations in flux

How do things come to have the roles they do, and how do these relations vary and change? In this section, I comment on instances in which things switch status, for example between device-oriented and infrastructural roles and in which they flip between background and foreground depending on the practices within which they are situated.

Some of these movements are extensions of processes discussed above. For example, the 'full' automation of heating or lighting systems removes the possibility of direct interaction, meaning that these services are actively provided by building managers and designers, but passively encountered by building occupants. Distinctions between things that have an appliance or device-related role and those that figure as background infrastructure quite often mirror other boundaries, including institutional roles of management and responsibility.

One currently controversial example concerns the status and hence the design, ownership and provisioning of electric vehicle charging points (Grandclement, Pierre and Shove, 2015). Should these be conceptualised as part of the background and as something which enables the use of an electric car, but which is not in itself 'used'? Alternatively, does the charging point figure as a discrete device that is actively used as part of a new practice, namely that of charging the vehicle? It is not yet clear how the material politics will evolve, but it is evident that whatever the outcome, it will be an expression of a shuffling of practices between households, car manufacturers and utilities. More subtly, concepts of state and market, and of consumption and production, are made real through interactions of this kind.

A second insight, again arising from this exercise in thinking about how things figure in practice, is that certain entities simultaneously occupy different roles. The fridge-freezer is one such item. To elaborate, the entire frozen food sector and the systems of agriculture, manufacturing and distribution of which it is comprised depend on the background co-existence of millions of home freezers. From an industry point of view, these appliances have an infrastructural role in relation to practices of producing and distributing frozen food. Meanwhile, each individual freezer has a more localised and also a more foreground status within a specific complex of shopping, cooking and eating practices. Recognising that the freezer's device-oriented role (in the home) defines and depends on the freezer's infrastructural roles within practices of production and distribution enables us to detect the interpenetration of material relations threading through the complexes of practices that together constitute frozen food systems – and the forms of global trade associated with them.

In brief, tracking material roles as they span and flip between practices and across supply chains helps explain how large technical systems are multiply sustained and how such infrastructures become embedded across different areas of daily life. Moves like these promise to counter what remains a rather lopsided emphasis on the social and institutional processes involved in establishing and reconfiguring networks of provision and power. As mentioned above, energy demand is constituted right across the map. Paying attention to the ways in which material relations (infrastructural, and device-oriented) are arranged and bundled promises to reveal the contours of this map as formed both by flows of energy through sequences of practice, as discussed in the previous section, and by the demarcation and switching of material roles, as considered here.

Material relations in time and space

Given that consumption occurs in the course of social practices, the spatial organisation and timing of such practices matters for the spatial organisation and timing of consumption and for the circulation, distribution and storage of the many materials involved. What this means, in detail, again depends on the various parts things play in practice. For example, consumables which are 'used up' need storing and replenishing. By contrast, things which stand in a background or infrastructural relation to practice, or which have a device-

orientation are rarely depleted in the same way.[4] Such things are, however, crucial for the range and extent of resources involved, for how these are distributed and for when and where they are consumed.

Systems that often have an infrastructural role, like gas and electricity grids along with networks of roads, railways or of data and communication, are typically designed to meet present and sometimes future 'needs': the common logic being that of 'predict and provide'. Since the scale of energy/resource demand depends on the number and the type of devices in use at any one time, infrastructures have to cope with daily and seasonal fluctuations related to *when* and also *where* multiple practices are enacted. Systems are consequently sized for moments when lots of people are simultaneously engaged in travelling, exchanging data or in doing things that draw energy/resources through the system.

In terms of practice theory, understanding how peaks and troughs of energy demand come to be as they are dependent on thinking not about one practice at a time, but about how complexes of practice relate to each other and how sequences and rhythms are formed. From this point of view, the sociology of time has a potentially central role in understanding and explaining patterns of energy consumption and in characterising relations between resources, devices and infrastructures at different spatial and temporal scales. Although not written with such questions in mind, Zerubavel's (1979) sophisticated account of the ebb and flow of people and practices in hospital life is, at the same time, an account of organisational and societal synchronisation. Since practices often depend on, and are in part defined by, co-existing infrastructures (electricity and data; water and gas, etc.), their coming together and their separation in space and time is felt across different systems of provision (Shove, 2009). This is significant in that the strategy of designing systems to cope with the peaky-ness of rhythms and complexes of practice depends on building in redundancy and on systematically 'over' sizing. By implication, energy use, in aggregate, is not only an outcome of the enactment of specific practices: it also relates to spatial and temporal relations between practices.

Doing any one practice typically depends on the coming together of devices, infrastructures and resources. However, things which figure in one or another of these roles are often distributed differently, in social as well as geographical terms. This is relevant in that uneven patterns of ownership and access are significant for discussions of social inequality and of what some refer to as 'fuel poverty' (Sovacool, 2015). For example, the fact that infrastructural arrangements and necessary background features are in place is of limited value if potential practitioners lack either the devices or the resources/consumables required. Also important, certain infrastructural arrangements are designed to prevent the use of certain devices and to thereby exclude specific practices/practitioners. For example, motorways exclude the safe, comfortable or legal use of bicycles, and as in Winner's (1985) classic example, bridges can be constructed to keep buses and bus passengers at bay.

As these few examples indicate, disaggregating material roles promises to be of value in analysing the social-spatial qualities of arrangements that make certain practices harder or easier to enact. Realising that potential depends on developing methods of accounting for the separate spatial-temporal 'coordinates' of devices, resources and infrastructures, whilst recognising that practices reflect and depend on their conjunction and active integration in space and time.

Discussion and conclusion

Theories of practice have made important contributions to the analysis and understanding of social life and will continue to do so *without* distinguishing between different material roles. However, this chapter suggests that it may be useful to tease the world of things apart as a means of developing a practice theoretical approach to problems like those of understanding patterns of resource consumption. The series of thought experiments outlined above highlight the possibilities and limitations of such an exercise and draws attention to a handful of themes that deserve further attention within practice theory.

One is the point that many of the things that people do – at work, in design, in manufacturing and in the home – involve making or modifying materials that feature in other practices. Following sequences of material conjunctions and transformations represents a fresh way of conceptualising consumption and production and the threads of matter and inter-practice relationships that bind these seemingly separate spheres together. As described above, capturing and characterising these connections depends on recognising the fluid status of things and their role in the foreground, in the background and in spanning between different practices.

Second, there is something intriguing about how material relationships are implicated in bounding what count as separate practices and in related processes of merger and hybridisation. The margin between device-oriented and infrastructural roles appears to be especially critical in this respect. For example, the 'line' between device and infrastructure is sometimes subtly, sometimes dramatically repositioned through processes of automation and delegation.

Third, the approach outlined in this chapter makes it plain that the production and circulation of goods and commodities is thoroughly and unavoidably embedded in the ongoing conduct and transformation of social practices around the world. In so far as energy use and patterns of consumption are consequences of what it is that people do (Shove and Walker, 2014), theories of social practice could and should occupy a central and not a marginal place in explaining international trade and the carbon emissions that follow.

To put this more concretely, the 9.6 billion tons of stuff that was transported in container ships in 2013 along with the estimated 93 million barrels of oil and liquid fuels that are on average consumed each day (United Nations Conference on Trade and Development, 2014; International Energy Agency, n.d.) should not be interpreted as expressions of macro-economic and political forces or the circulation of capital or outcomes of multilevel or any other kinds of transition, as if these were somehow detached from the realm of social practice. Instead, these flows of goods and transformations of energy are expressions and consequences of the multiply materialised character of what Schatzki (2002) describes as the 'plenum' of practice. This argues for a re-reading of input-output models, particularly if these are used as methods of quantifying and characterising the 'responsibility' for carbon emissions (whether directly or in the form of embodied energy) or of informing policy on this topic (Daly et al., 2015). If we take a step or two back, it becomes obvious that such methods focus on the 'symptoms' – that is the flows of goods and of energy – and in so doing fail to enquire further into the different registers, scales and dynamics of practice on which the global choreography of material (infrastructures, devices, resources) actually depends.

Established methods of modelling, accounting and policy making have the further disadvantage of overlooking the extent to which infrastructures[5] and systems of provision

interlock with the uses of devices and hence the consumption of resources. Following the account of material-practice relations developed here, energy demand is made at multiple sites and moments: it is certainly not an outcome of consumer 'need' as if this had an independent life of its own. At a minimum, this argues for a more joined-up form of policy analysis that acknowledges the co-constitution of supply and demand.

Two other observations point to new ways of thinking about how energy demand increases and how it might reduce. I have argued that infrastructures have a background role and that because of this they have what seems to be a distinctive part to play in configuring, prefiguring and multiply enabling many different practices *and* relations between them. In this context it is important to notice the escalatory effect of the concept of predict and provide. In many cases the idea that infrastructures should be capable of meeting foreseeable forms of demand constitutes what amounts to a self-fulfilling prophecy. This is not the only option.

Since practices are always on the move, the material configurations associated with them, and on which they depend, are not fixed in stone. Following the argument developed here, intervention at the level of infrastructural relations represents a form of intervention that matters for many practices at once. Current infrastructures will not last forever and how they are repaired, re-shaped or renewed over the next few decades will have a major impact on other aspects of material-practice relations and hence on future energy demand, whether for good or ill.

In conclusion, the strategy of characterising things *in relation* to practices makes sense theoretically and is analytically productive, providing a means of revealing sequences of production and consumption and the different implications of these processes for things in the background, in action and that are 'used up'. As a methodological position, it is decidedly but perhaps necessarily slippery: in this analysis, things-in-relation-to-practice are always multiple, never stable and never fully defined. However, this is not the main problem. If the aim is to draw on the reach and power of social theories of practice and to exploit their potential in accounting for global transitions in resource consumption, trade and carbon emissions, the more pressing and more obvious challenge is that of engaging with, or acting alongside, incumbent models and theories of economics and of resource and carbon accounting which conceptualise materials and resources – whether in the role of consumables or as temporally embodied in devices and infrastructures – in terms that are abstracted from an understanding of their relative and fluid roles in multiple practices. For the moment, there is a basic theoretical divide between a relational account of things in practice (as developed here) and 'fixed' interpretations of goods and services of the kind that underpin discussions of resource economics and energy demand. Looking ahead, one way and perhaps the only way out is to develop forms of environmental policy analysis and intervention that do not take demand for granted and that are capable of confronting fundamental questions about what materials and related forms of energy are for.

Notes

[1] Other roles are no doubt possible.
[2] Infrastructures and things in the background also 'script' and make some programmes of action easier or more difficult to follow, but they do so in different ways.
[3] There are other ways of defining top: the table illustrates just a few links in a series of more extensive chains.

[4] Of course things in an infrastructural role often require ongoing maintenance and repair (involving resources and 'consumables') if they are to continue functioning in the background.
[5] Here taken in a literal sense, meaning power grids, etc.