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Governing transitions in the sustainability of everyday life

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ABSTRACT

The literature on sociotechnical transitions and their governance tends to concentrate on the introduction of new technologies and systems of supply. In this paper we seek to extend the scope of debate, introducing aspects of practice theory as a means of also conceptualising the dynamics of demand. Rather than treating 'human need' or 'societal functions' as given, we consider how variously sustainable practices come into existence, how they disappear and how interventions of different forms may be implicated in these dynamics. We use the two cases of daily showering and the congestion charging scheme in London to consider the distinctive challenges of understanding transitions in practice and of governing these so as to engender more sustainable ways of life.

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1. Introduction

The literature on sociotechnical transitions is marked by an intellectual ancestry rooted in studies of science, technology and innovation (Grin, 2008; Smith et al., 2010), and by empirical studies of infrastructures and systems of provision. This ancestry shows through in research and writings that distil and describe the steps, stages and actors involved in configuring systems like those of energy supply (Correlje and Verbong, 2004; Geels and Raven, 2006); sewerage (Geels, 2006); transportation (Elzen and Wieczorek, 2005); water infrastructure (van der Brugge et al., 2005), and 'new technological, institutional or cultural patterns in utility provision' (Voß et al., 2006, p. 175). Consistent with this emphasis, commentators specifically interested in sociotechnical transitions toward sustainability (Elzen et al., 2004) routinely concentrate on issues of resource management and ecological modernisation. Whether the focus is historical or forward looking, the challenge is for the most part one of understanding and sometimes promoting more resource efficient ways of meeting existing social needs and functions. In this context, the *socio* element of *socio*technical change typically refers to the fact that innovations are shaped by social processes rather than to the ways in which technical systems are implicated in defining and reproducing daily life. Partly because of this tendency to focus on questions of supply, somewhat less attention has been paid to patterns of demand inscribed in what remain largely technological templates for the future. Where the *socio*- of sociotechnical does refer to forms of practical know-how and to routines and expectations that sustain and are part of incumbent regimes, the driving interest is in how these arrangements configure the conditions of future innovation: not in how they evolve themselves.

This is limiting in that significant movement towards sustainability is likely to involve new expectations and understandings of everyday life and different forms of consumption and practice (Redclift, 1996; Wilk, 2002). Accordingly, questions about how the 'mobility burden' of achieving effective societal participation has increased, or about how resource intensive trends like those of showering every day have taken hold are at least as important as those dealing with the design of more efficient systems of provision. As we hope to make clear, this is not just a matter of paying closer attention to users or of emphasising their role within existing supply oriented narratives.

Following Giddens (1984) our ambition is to take *practices*, rather than individuals, citizens, societies, social groups or even sociotechnical systems – as the unit or focus of attention. The notion of attending to social practices is not in itself novel. Commentators like Spaargaren (2003) and Southerton et al. (2004) have, for instance, argued that relations between consumers, producers and systems of provision are mediated and co-produced 'through' practices. Building on these ideas, Spaargaren uses what he terms 'The Social Practices Approach' to make the point that consumer behaviour is enabled, constrained and contextualised by systems of provision. In this account, 'social practice' refers to a domain of daily life, such as 'food' or 'cooking' (Spaargaren, 2003, p. 696), these being sites in which systems and behaviours interact. In this paper we explore the more radical proposition that social practices are not merely 'sites' of interaction but are, instead, ordering and orchestrating entities in their own right.

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In trying to conceptualise transitions and innovations in everyday practice we identify dynamic processes that are not much debated in the transitions literature and not adequately represented in the multi-level perspective (see Smith et al., 2010). This is the case whether the multi-level perspective is deployed as a framework for capturing historical change in terms of agency and structure; used as a device for representing forms of irreversibility; or as a template for the intentional governance of change through transition management (Grin, 2008; Shove and Walker, 2007). Specifically, we draw attention to the horizontal circulation of what we describe as the 'elements' of practice and comment on the extent to which images, meanings, technologies and forms of competence travel within and between 'regimes'. We suggest that opportunities for effective intervention may lie in the generation and circulation of elements of which variously sustainable practices are made.

Our intention is also to underline the extent to which systems of practice are subject to continual, ongoing reproduction. This is again in contrast to the more hierarchical aspect of the multi-level perspective which suggests that regimes constitute the selection environments in which niche innovations fail or flourish, and which emphasise processes of alignment and path dependence. Amongst other things, a 'strong' emphasis on practice dynamics points to a new set of problems to do with the governance of seemingly uncontrollable processes that characterise the emergence, reproduction and disappearance of more and less sustainable patterns of daily life.

Before turning our attention to whether and how innovations in sustainable practice might be deliberately induced and to the forms of governance at stake, we begin by outlining the basic ingredients of our approach. We do so with reference to two cases, brief discussion of which allows us to give a sense of what the task of conceptualising transitions in practice entails. First we consider the move from weekly bathing to daily or twice daily showering, using this as an example through which to introduce key ideas about the elements of everyday practice and their integration. We then turn to questions of mobility and to the systemic interconnection of practices in space and time, considering these themes with reference to a discussion of London's congestion charging scheme – a top down initiative designed in the name of sustainability. We suggest that the changes this scheme stimulated are better understood as the emergent outcomes of a dynamic system of interacting and co-evolving practices than as the knowable products of policy intervention. We work with these illustrative cases in order to catch sight of the distinctive challenges of understanding transitions in practice and of governing these so as to engender more sustainable ways of life.

2. Transitions in the bathroom

In the UK, the amount of water used for personal hygiene is rising and set to outstrip the proportion used to flush the toilet (approximately 34%). A generation ago, a weekly bath was normal in contrast with the now much more resource intensive pattern of showering once and sometimes twice a day (Hand et al., 2005).

As defined by Rotmans et al., a transition

> '. . .is the result of developments in different domains. In other words, a transition can be described as a set of connected changes, which reinforce each other but take place in several different areas, such as technology, the economy, institutions, behaviour, culture, ecology and belief systems. A transition can be seen as a spiral that reinforces itself; there is multiple causality and co-evolution caused by independent developments'. (Rotmans et al., 2001, p. 2)

What people do in the privacy of their own bathrooms is environmentally vital, sociotechnically embedded and subject to processes of multiple causality and co-evolution. In addition, bathroom routines appear to have arisen and disappeared as an outcome of connected changes – in concepts of health, in investments in mains water supply, in beliefs and notions of propriety – all of which reinforce each other. Despite fitting the definition provided above, bathing is not a usual topic for transition studies. Nor is it one that fits easily in the scheme of the multi-level perspective.

The weekly bath was not, as far as we can tell, overcome in a battle of competing sociotechnical configurations nor does it seem that habits of daily showering took hold in a protected niche (or cubicle!) strategically managed by promoters seeking to establish this practice against the flow of an incumbent regime. If we were adopting a multi-level perspective we might expect some such struggles to be part of the process of transition, yet none are to be found.

The bathroom is nonetheless a site in which many relevant actors come together, including commercial organisations selling gels and shampoos, building merchants and contractors, and at a certain level the state which has retained a stake in promoting concepts of health, well being and personal hygiene. It is also true that the habit of daily showering has grown from being the routine of a few to one that is adopted by many. But is it so that showering has become locked in and stabilised through a process of alignment and increasing momentum? (Geels and Schot, 2007).

Social theories of practice (as distinct from those of sociotechnical innovation) offer other ways of conceptualising the processes involved. Writers as diverse as Bourdieu, Giddens, Schatzki, Latour and Foucault have made relevant contributions but as Reckwitz's useful summary makes clear, efforts to theorise social practice are defined more by a sense of diffuse affinity than by the existence of any clear and systematic analysis (Reckwitz, 2002). In an attempt to pin down the common features of such approaches, Reckwitz locates practice theory as a version of cultural theorising, distinguishing it from norm (homo sociologicus) or purpose oriented (homo economicus) theories of action and from other cultural variants including those that are, in his terms, grounded in mentalism (locating the social in the human mind); textualism (the social operating on the level of signs and symbolic structures) or intersubjectivism (the social being located in interactions). In contrast to these positions, practice theorists share the view that '*A practice is social, as it is a 'type' of behaving and understanding that appears at different locales and at different points of time and is carried out by different body/minds. Yet, this does not necessarily presuppose 'interactions' – i.e. the social in the sense of the intersubjectivists – and nor does it remain on the extra-mental and extra-corporal level of discourses, texts and symbols, i.e. the social in the sense of the textualists*.' (Reckwitz, 2002, p. 250).

For purposes of the present discussion we take a slimline approach consistent with this interpretation of practice theory and with the related observation that '*the existence of a practice depends upon the specific inter-connectedness of many elements – forms of bodily activities, mental activities, things and their use, background knowledge in the form of understanding, know-how and notions of competence, states of emotion and motivational knowledge*' (Reckwitz, 2002, p. 249). While this list of elements resembles the catalogue of 'areas' in which the interconnected changes described by Rotmans et al. (2001) take place, their conceptual status is not at all the same. Rather than being fields or domains (e.g. belief systems, institutions, the economy etc.) elements are quite literally the ingredients of practice. In relation to daily showering these might include:

(a) complexes of bathroom technology (things and their use);
(b) repertoires of meaning e.g. freshness, well being, health (mental activities, emotional states);

(c) conventions of propriety, procedure and bodily activity e.g. getting ready, preparing for the day ahead (bodily activities, background knowledge).

Considering each in turn it is indeed difficult to imagine how contemporary forms of showering could be sustained without reliable supplies of water and electricity, dedicated space (tiles, screens, curtains), and specific developments in plumbing and shower technology. That said, it is obvious that the practice depends upon more than a good supply of resources and hardware. Historically specific meanings of showering – like those associated with morality and propriety, or more recently with freshness, invigoration and relaxation – have a history of their own and one that is not necessarily or perfectly synchronised with changes in the material culture and infrastructure of the home. Equally, the actual doing of showering is itself tied into the temporal ordering of the day and now often associated with a host of other rituals like those involved in 'getting up' or in 'going out'. In effect, the material, the symbolic or cultural meaning and the procedural constitute co-existing elements that are actively and recurrently integrated through and in the process and practice of doing showering (Hand et al., 2005).

Conceptualising showering in this way makes it possible to analyse the dynamics of convention without reifying technological, cultural or social processes and without necessarily resorting to a multi-level perspective. In essence we suggest that it is the practice itself, the doing and 'knowing how to do competently' that provisionally holds the analytically separable elements of materiality, conventionality and temporality together. By implication an analysis of changing practice – like the emergence of resource intensive forms of washing – requires an analysis both of the history of the elements involved and of the dynamic and often uncontrollable or emergent relation between them.

Such an account does not deny the possible existence of powerful interests deliberately seeking to reconfigure the details of daily life, but it does shape the way in which we understand their role. As suggested above, daily showering is carried, enacted and reproduced by cohorts of 'ordinary' people, without whom it would obviously not exist as it does today. At the same time, the elements that are so routinely integrated (and thereby reproduced) have trajectories of their own. For example, numerous private and public actors and agencies – and even governments – have been involved in specific and deliberate efforts to discipline the 'great unwashed'; offering grants to renovate and 'modernise' bathrooms; seeking to instil specific habits of hygiene; relating cleanliness to godliness and civilisation and promoting and advertising a barrage of innovative bathroom products. None of these contributions alone makes showering what it is today, but all are involved in configuring not so much the practice itself, but the elements of which it is made. In other words, commercial and state interests do not directly govern what goes on behind the bathroom door, but in making infrastructures, including shower units, soaps, sponges and in circulating specific ideologies, they are actively and sometimes jointly implicated in making practices of personal hygiene (see Burke, 1996, on marketing soap in Zimbabwe).

We have more to say about how state and other actors are involved in configuring seemingly private ways of life and about the challenges of intervening in order to promote sustainability. Before embarking on this discussion we turn our attention from the dynamics of one particular practice to relations between intersecting practices like those that generate the movement of people and things in space and time. In discussing patterns of mobility within an urban system we introduce a rather different case, analysis of which forces us to think about how practices interact and about what it means to actively shape the direction in which entire complexes of practice evolve.

3. Transitions in London

Flows of traffic like those studied by transport engineers are generated and occasioned by many people reproducing all manner of different practices, the successful accomplishment of which frequently requires specific forms of physical proximity or co-presence (Cass et al., 2003). From a bird's eye view, the movement of people and things into, around and out of a city like London is, in effect, a consequence of the ongoing enactment of frequent and not so frequent practices. In combination, the spatial and temporal characteristics of effective societal participation – including visiting friends or relatives, being at work, obtaining household provisions, having fun, going to school, and so forth – results in what we might think of as the 'mobility burden' of contemporary London life. Where, when and how a particular instance of movement happens (or doesn't), is wrapped up in the sociotechnical fabric of means, modes and timings of potential movement, but also in cultural expectations, images and histories, the temporal ordering of the day and the parallel and intersecting patterning of obligations (Lefebvre, 2004).

We have already suggested that specific practices like daily showering are usefully understood as an outcome of the active integration of constitutive elements. To this we add the further proposition that patterns of mobility and associated environmental costs reflect and are occasioned both by the spatial-temporal demands of many social practices and by how these shape each other in space and time.

It is in these terms that we consider the impact of London's congestion charging scheme. On 17th February 2003 the Mayor of London, Ken Livingstone, introduced a 'congestion charge' of £5 to be paid by people driving into a central charging zone on week days between 7.00 am and 6.30 pm. This scheme, which also included a parallel programme of investment in public transport, represents a highly visible, very deliberate, very political effort to reduce car use and congestion in the capital. Although represented here as a 'one off' intervention, congestion charging constitutes one moment in a more ambitious endeavour – that of limiting car travel in London. As such it forms part of a longer term process of reflexive governance even if not one that is explicitly presented as such.

Regarding the scheme itself, entry into the charging zone is policed by a system of cameras and the charge to cross the cordon, initially £5 and now £8 has apparently made a significant difference. Four years after the scheme was introduced, Transport for London reports that "*when compared to conditions without the scheme, Congestion Charging is continuing to deliver congestion relief that is broadly in line with the 30 per cent reduction achieved in the first year of operation*". Transport for London also reports... "*An increase in cycling within the zone of 43 per cent and reductions in accidents and key traffic pollutants in and around the charging area*" (Transport for London, 2007).

By these and other measures, the scheme has been an economic and environmental success and has improved the lives of those who live and work in London and who visit the city. Congestion charging represented a major top down scheme inspired by a number of policy goals, but it is important to recognise that its success was by no means guaranteed. On that first day in February the system designers held their breath. Would there be massive and catastrophic refusal to pay; would the surrounding streets be grid-locked; for all the monitoring and planning what would actually happen? Mr Livingstone marked the 7.00 am start of the scheme with a visit to the London Traffic Control Centre where he admitted: "I'm just waiting for something to go wrong." (BBC News, 2003).

Congestion charging in fact crept in 'calmly and quietly' but Ken Livingston had every reason to be anxious not because the scheme was inherently flawed but because the imposition of the cordon and the charge represented an intervention in the complex 'living'

system that is London. How the scheme actually worked – and in many respects what the scheme really was – depended above all on how Londoners collectively responded to it. While congestion charging seems to be a thoroughly conventional case of deliberate policy steering towards a set of clearly defined goals, the fact that it succeeded does not detract from the point that understanding the scheme in action requires an understanding both of mobility (and hence of practices and relations between practices) in London and of the governance and self-governance of systems that are themselves perpetually in transition.

In this context it is relevant to notice that the direct effect of the charge varied widely: being different for those who were not in any case accustomed to using a car in central London in charging hours; for those who did so as a matter of course, for those living in areas well or poorly served by public transport and for those who were or were not obliged to travel to the centre of the city within charging hours. Other features like whether or not the charge improved the environment in general or made London an easier or more attractive place in which to live and work were also only selectively relevant or meaningful. Critically, 'effect' was strongly mediated by existing routines, by location, by both the sociotechnical fabric of actual and potential mobility (means, modes, times etc.) and by a parallel patterning of destinations, obligations and related practices. Responses to the scheme were, in turn, coloured by existing habits and commitments – visiting friends and family; working, leisure etc. – each marked by social histories and path dependent trajectories.

These details are revealed by a programme of social impacts monitoring, commissioned by Transport for London, which found that 67% of inner London respondents (those living near to but outside the charging zone) made some change to their travel pattern as did 36% of respondents living within the charging zone (the charge is significantly discounted for those living in the zone itself) (MORI, 2004). The impact monitoring studies compare flows and 'not-flows' of cars, buses, bikes, pedestrians and trains before and after the introduction of the scheme and provide a sense of the extent to which these arrangements and re-arrangements reflect a multitude of local/personal/household configurations of doing, all of which have effects on each other. More qualitative elements of the impact monitoring point to the existence of endless circuits of feedback (positive and negative) in which people modify what they do (where they go, when, and how) in anticipation of how others might respond, and modify these arrangements again in light of what jams and troubles they in fact encounter.

In discussing congestion charging as an intervention designed to facilitate a transition towards more sustainable patterns of mobility, the issue is not simply one of remembering to include reference to those who use or who are affected by congestion charging or of adding their response into an evaluation of the impact of the scheme as part of a process of reflexive monitoring and governance. It is not just that one system has differential impacts, though that is obviously so: the further point is that London's congestion charging scheme is part of a living and dynamic system. Accordingly, our more challenging suggestion is that the scheme – though designed in detail by Transport for London – was in other very practical ways made by the cumulative responses and reactions of those subject to it. Whether to take the train not the car, to switch appointments outside charging hours; to share journeys not shared before, and to do different things in different places and at different times – these and other possible responses involve sometimes subtle, sometimes radical revision to the texture and the rhythm of daily life. In addition, reconfiguring one aspect of a daily routine, for instance, leaving earlier or later in the morning, often has consequences for a host of interlocking habits including showering, breakfasting and getting ready. As noted above, such readjustments, repeated by many, have cumulative and themselves emergent consequences for the location and timing of bottlenecks and flows and – in the longer run – for strategies (personal and political or institutional) designed to manage or alleviate the new challenges that ensue.

At one level, policy makers think the congestion charging scheme has made a difference and it is true, there are tangible consequences. It is also evident that intervention-in-effect is an unstable, dynamic and emergent outcome of the way in which constituent elements of London life (cars, bikes, information systems, data, regulation, time, destination and attendant practices) fit together. This observation raises further questions about how to conceptualise the governance of relations between practices and of systems like congestion charging that have no single system builder. It is to these topics that we now turn.

4. Multi-level perspectives and the governance of practice

What does a discussion of showering and congestion charging reveal about the multi-level perspective and the possibilities of deliberately engineering transitions in practice?

According to Geels and Schot, 'transitions come about through interactions between processes at these three levels (a) niche innovations build up internal momentum, through learning processes, price/performance improvements and support from powerful groups, (b) changes at the landscape level create pressure on the regime and (c) destabilization of the regime creates windows of opportunity for niche innovations. The alignment of these processes enables the breakthrough of novelties in mainstream markets where they compete with the existing regime' (Geels and Schot, 2007, p. 400).

The cases we have considered suggest that there is more at stake than the 'vertical' relation between emerging niches and incumbent regimes, and that one might sensibly enquire into the range of elements (material, but also of meaning and skill/procedure) in circulation in any one society. For example, the prevalence and global circulation of ideas about freshness and bodily hygiene is evidently relevant for the potential diffusion of daily showering. One task, then, is to figure out how such ideas travel, and to ask whether material elements circulate in similar or different ways. This is important in that effective innovation (in practice) is likely to be an outcome not (only) of producing, promoting, adopting or aligning technologies, not (only) of cultivating novelties within existing regimes, and not (only) of enlisting users but, crucially, of adding to the repertoire of elements available for integration.

If they are to persist, practices like daily showering require recurrent reproduction: this is as true for those that are adopted by the few as for those adopted by the many. In other words the widespread diffusion of a social practice does not necessarily change the circuits of reproduction that hold it in place. In emphasising the horizontal circulation of elements and in arguing for a flatter model characterised by multiple relations (rather than hierarchical levels) of reproduction across different scales we are definitely not denying the existence of strong inequalities in the availability of requisite elements, in access, or in the capacity to promote, mobilise and configure. We are, however, suggesting that lines of enquiry inspired by innovation studies have a tendency to over emphasise processes of (market) competition and selection resulting in stabilising levels or moments of provisional closure.

According to the multi-level perspective, relatively stable regimes set the scene in which radical innovations do and do not take hold. By implication, movement from the micro to the meso-level represents a qualitative step change characterised by forms of path dependence and increasing alignment with existing arrangements. Such movement is often associated with a change of scale, as when previously novel sociotechnical arrangements enter the

mainstream. In other words the two processes of diffusion and embedding are thought to be intertwined. As indicated above, this connection is not self evident when dealing with social practices that are permanently provisional precisely because they depend on the integration of elements that are themselves dynamic. Enduring and relatively stable practices (and complexes of practice) do exist but only because they are consistently and faithfully reproduced, not because they have achieved some kind of closure.

We now turn our attention to the governance of social practice. Governance in its broadest sense is about shaping society in desired directions. It has purpose and intent, but in contrast to modernist expectations of governmental power and rationality, the notion of governance emphasises the need to enrol multiple actors in processes of intervention and to work with more complex understandings of the intrinsic non-linearity of dynamic sociotechnical systems. Advocates of 'reflexive governance' for sustainable development (Voß et al., 2006) recognise that this implies not one moment of intervention but an ongoing sequence in which adjustments are made as environmental conditions change, these changes being, in part, the outcome of previous interventions. Feedback, monitoring and circuits of action and reaction are integral – being necessary in order to handle the interdependencies and unpredictabilities of systemic change, and because interpretations of what is sustainable and definitions of the system itself, are inherently fragile, becoming more or less ambivalent and requiring re-specification as understandings, knowledges and values evolve (Walker and Shove, 2007). Whilst such notions of governance engage with ideas of systemic change, emergence and interaction between actors, it is not immediately clear how they might apply to environmentally significant transitions in *practice* of the kind we have described.

A first and fundamental problem has to do with the representation of those who are governed and those who do the governance. Much of the governance literature, including that of a more reflexive bent, supposes a distinction between 'us' and 'them', implying scenarios in which one set of actors is governed by another (Shove and Walker, 2007). In our discussion of changing practices, it is clear that consumers and practitioners are as central and vital to change as producers and promoters of one kind or another. This is an observation echoed in recent discussions of the role of lead users and of the extensive influence of enthusiastic practitioner-promoters in product development (Franke and Shah, 2003; Shove and Pantzar, 2005).

A related insight is that innovations in practice do not materialize unless enacted by those who do – whether that doing involves showering, visiting friends at the week-end, taking up canyoning, snowboarding or whatever. Accordingly it is misleading to reproduce a distinction between 'us' and 'them' – when practices change they do so as an emergent outcome of the actions and inactions of all (including materials and infrastructures, not only humans) involved. Rather than locating Londoners as either victims or beneficiaries of congestion charging, we have instead argued that their responses and reactions constitute the scheme itself. Accordingly, they are as implicated in related forms of governance as is Transport for London.

Rip makes a similar point when distinguishing between 'modernist steering' in which governance actors sees themselves and their goals as outside of the system in which they intervene and 'non-modern' steering in which governance actors recognize they are part of evolving patterns, and that they can at best modulate them – 'just as all the other actors are modulating the patterns through their actions and interactions, intentionally or unintentionally' (Rip, 2006, p. 83). We go along with this and contend that when dealing with transitions in everyday life, it is misleading to imagine or suppose the existence of sources or forces of influence that are somehow external to the reproduction and transformation of practice. Instead of figuring out how to involve more or different stakeholders in an externalized process of design, the more substantial challenge is to understand how consumers, users and practitioners are, *in any event*, actively involved in making and reproducing the systems and arrangements in question.

This does not mean that all participants are equal or that the roles of producers, promoters and practitioners are equivalent with respect to the reproduction and transformation of social practice. Companies manufacturing shower gels and related products cannot simply make people shower every day any more than Ken Livingstone can singlehandedly re-design the spatial and temporal ordering of practices or of relations between them. Yet these actors can and do influence the availability and circulation of elements knitted together in the course of daily life. Efforts to transform images of bodily hygiene are not certain to have the effect of transforming a practice as a whole or of reconfiguring relations between practices, but material arrangements can and sometimes do configure their users (Akrich, 1992; Winner, 1980). From this point of view sociotechnical systems like those of city design or bureaucratic procedure are themselves usefully understood as complexes of elements that may function, indirectly but sometimes effectively as instruments of governance. Developing this theme, writers including Foucault (1977) and Miller and Rose (2008) conclude that forms of power, responsibility and accountability are invisibly woven into the design of arrays of materials and services like those which constitute regimes of family life (Donzelot, 1979), the medical and educational ordering of the body (Armstrong, 1983), and so forth.

For policy makers interested in promoting sustainability this possibility keeps open the prospect of engineering new sociotechnical forms but since other elements are also required, and since practices have emergent and uncontrollable trajectories, this potential is always complicated and qualified. In retrospect it seems that congestion charging has indeed affected what Schatzki refers to as the interwoven timespaces (of shopping, schooling, working, living etc.) that 'form a kind of infrastructure through which human activities coordinate and aggregate.' (Schatzki, 2009, p. 35). One small example of this is that people outside the charging zone are now visiting friends and relatives in central London outside charging hours (e.g. on week-ends) and that the temporal pattern of visiting is more limited than it was before the charge was introduced (MORI, 2004). This points to a re-arrangement of calendars and social diaries for those who live within the zone *and* for those who visit them. Over time, these little adjustments may add up, new patterns of sociability may emerge (or new forms of isolation) that in turn entail specific burdens of mobility.

There are several features to highlight here. First, schemes like congestion charging are quite literally made on the ground, each new instance representing the outcome of locally specific starting points. Second, precisely how emergent patterns develop depends upon the circulation and conjunction of other people and things in space and time – in effect it depends upon self-organising and to a degree self-regulating forms of self-governance the outcomes of which are sometimes mistaken for the unmediated results of top down modes of intervention. Third, whatever form they take, new configurations of timespace set the scene in which further adaptations to congestion charging in-action unfold.

This line of argument might lead to the conclusion that practices and systems of practice have lives of their own – that practitioners are somehow captured by the arrangements they sustain and to which they devote finite amounts of time, attention and resources – and that there are therefore no reliable means of steering or governance to be applied. On the other hand, we have observed and described cumulatively effective and often deliberate interventions that have modified the circulation of people and the distribution of destinations. In moving between these two positions we have

begun to outline a distinctive agenda for a discussion of the governance of practice and of the possibilities and practicalities of goal oriented steering in the name of sustainability.

5. Summary and conclusion

We began by suggesting that the literature on sociotechnical transitions and their governance tends to concentrate on the introduction of new technologies and systems of supply. In response, we have sought to extend the scope of debate, introducing aspects of practice theory as a means of also conceptualising the dynamics of demand. Rather than treating 'human need' or 'societal functions' as given, we have asked ourselves how variously sustainable practices come into existence, how they disappear and how interventions of various forms may be implicated in these dynamics.

Partly because large-scale technological examples command so much attention, commentators take it for granted that policy and corporate actors are key players, even if the necessary involvement of other groups and interests, including those of 'users' is repeatedly acknowledged (Elzen and Wieczorek, 2005, p. 653; Smith, 2006, p. 319; Hoogma et al., 2002, p. 5; Webber and Hemmelskamp, 2005, p. 1). One consequence is that much of the literature on transition management, or the governance of transitions toward sustainability, draws upon a narrow slice of what is in fact a much wider debate about social systemic change.

In particular, discussions of sociotechnical transitions and their governance routinely obscure the central role that practitioners themselves play in generating, sustaining and overthrowing everyday practices. There is more to this than merely recognising the role of users. As we have sought to show, focusing on practices, their trajectories and their interconnections, obliges us to attend to processes of ongoing transformation, feedback and related circuits of reproduction.

In addressing these topics we have arrived at a number of related observations. One is the importance of attending to *all* requisite elements of practice, to forms of practical know-how, bodily activities, meanings, ideas and understandings, as well as to materials, infrastructures and sociotechnical configurations. A second is the question of how patterns and practices of daily life interrelate, erode and reinforce each other. These are key themes for any understanding of innovation, let alone transition in practice. They are also themes that do not fit neatly within a multi-level perspective in which 'vertical' relations between niches, regimes and landscapes take centre stage, and in which sustainability is thought to depend upon competition between variously efficient sociotechnical systems of provision.

References

Armstrong, D., 1983. Political Anatomy of the Body: Medical Knowledge in Britain in the Twentieth Century. Cambridge University Press, Cambridge.

Akrich, M., 1992. The description of technical objects. In: Bijker, W., Law, J. (Eds.), Shaping Technology/Building Society: Studies in Sociotechnical Change. MIT Press, London, pp. 205–224.

BBC News, 2003. Congestion charge comes into force. http://news.bbc.co.uk/1/hi/england/2764565.stm (accessed on 10.01.10).

Burke, T., 1996. Lifebuoy Men, LUX Women: Commodification, Consumption, and Cleanliness in Modern Zimbabwe. Duke University Press, North Carolina.

Cass, N., Shove, E., Urry, J., 2003. Changing infrastructure, measuring socio-spatial inclusion/exclusion, a report prepared for the Department of Transport, London. http://www.lancs.ac.uk/fass/sociology/activities/715/ (accessed on 10.01.10).

Correlje, A., Verbong, G., 2004. The transition to gas in The Netherlands. In: Elzen, B., Geels, F., Green, K. (Eds.), System Innovation and the Transition to Sustainability: Theory, Evidence and Policy. Edward Elgar, Cheltenham, pp. 114–134.

Donzelot, J., 1979. The Policing of Families. Random House, New York.

Elzen, B., Wieczorek, A., 2005. Transitions towards sustainability through systems innovation. Technological Forecasting and Social Change 7 (2), 651–661.

Elzen, B., Geels, F., Green, K. (Eds.), 2004. System Innovation and the Transition to Sustainability: Theory, Evidence and Policy. Edward Elgar, Cheltenham.

Foucault, M., 1977. Discipline and Punish: The Birth of the Prison. Vintage, New York.

Franke, N., Shah, S., 2003. How communities support innovative activities: an exploration of assistance and sharing among end-users. Research Policy 32, 157–178.

Geels, F., 2006. The hygienic transition from cesspools to sewer systems (1840–1930): the dynamics of regime transformation. Research Policy 35 (7), 1069–1082.

Geels, F., Raven, R., 2006. Non-linearity and expectations in niche-development trajectories: ups and downs in Dutch biogas development (1973–2003). Technology Analysis & Strategic Management 18 (3–4), 375–392.

Geels, F., Schot, J., 2007. Typology of sociotechnical transition pathways. Research Policy 36, 399–417.

Giddens, A., 1984. The Constitution of Society. Polity, Cambridge.

Grin, J., 2008. The multilevel perspective and design of system innovations. In: van den Bergh, J., Bruinsma, F. (Eds.), Managing the Transition to Renewable Energy: Theory and Practice from Local, Regional and Macro Perspectives. Edward Elgar, Cheltenham, pp. 47–80.

Hand, M., Shove, E., Southerton D., 2005. Explaining showering: a discussion of the material, conventional and temporal dimensions of practice, Sociological Research Online 10(2). http://www.socresonline.org.uk/10/2/hand.html (accessed on 10.01.10).

Hoogma, R., Kemp, R., Schot, J., Truffer, B., 2002. Experimenting for Sustainable Transport. Spon Press, London.

Lefebvre, H., 2004. Rhythmanalysis. Continuum International Publishing Group, London.

Miller, P., Rose, N., 2008. Governing the Present. Polity, Cambridge.

MORI, 2004. Central London Congestion Charge: Social Impact Surveys 2002–2003. Available at: http://www.tfl.gov.uk/assets/downloads/Social-Impacts-Survey-Report-2002-2003.pdf (accessed on 10.01.10).

Reckwitz, A., 2002. Toward a theory of social practices: a development in culturalist thinking. European Journal of Social Theory 5 (2), 243–263.

Redclift, M., 1996. Wasted: Counting the Costs of Global Consumption. Earthscan, London.

Rip, A., 2006. A co-evolutionary approach to reflexive governance and its ironies. In: Voß, J.P., Bauknecht, D., Kemp, R. (Eds.), Reflexive Governance for Sustainable Development. Edward Elgar, Cheltenham, pp. 82–100.

Rotmans, J., Kemp, R., van Asselt, M., 2001. More evolution than revolution: transition management in public policy. Foresight 3 (1), 15–31.

Schatzki, T., 2009. Timespace and the organization of social life. In: Shove, E., Trentmann, F., Wilk, R. (Eds.), Time, Consumption and Everyday Life. Berg, Oxford, pp. 35–48.

Shove, E., Pantzar, M., 2005. Consumers, producers and practices: understanding the invention and reinvention of Nordic walking. Journal of Consumer Culture 5 (1), 43–64.

Shove, E., Walker, G., 2007. CAUTION! transitions ahead: politics, practice and sustainable transition management. Environment and Planning A 39, 763–770.

Smith, A., 2006. Niche-based approaches to sustainable development: radical activists versus strategic managers. In: Voß, J.P., Bauknecht, D., Kemp, R. (Eds.), Reflexive Governance for Sustainable Development. Edward Elgar, Cheltenham, pp. 313–326.

Smith, A., Voß, J.P., Grin, J., 2010. Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. Research Policy 39, 435–448.

Southerton, D., Chappells, H., van Vliet, B., 2004. Sustainable Consumption: The Implications of Changing Infrastructures of Provision. Edward Elgar, Cheltenham.

Spaargaren, G., 2003. Sustainable consumption: a theoretical and environmental policy perspective. Society and Natural Resources 16, 687–701.

Transport for London, 2007. http://www.tfl.gov.uk/corporate/media/newscentre/archive/5474.aspx (accessed on 10.01.10).

van der Brugge, R., Rotmans, J., Loorbach, D., 2005. The transition in Dutch water management. Regional Environmental Change 5 (4), 164–176.

Voß, J.P., Bauknecht, D., Kemp, R. (Eds.), 2006. Reflexive Governance for Sustainable Development. Edward Elgar, Cheltenham.

Walker, G., Shove, E., 2007. Ambivalence, sustainability and the governance of socio-technical transitions. Journal of Environmental Policy and Planning 9 (3–4), 213–225.

Webber, M., Hemmelskamp, J. (Eds.), 2005. Towards Environmental Innovation Systems. Springer, Heidelberg.

Wilk, R., 2002. Consumption, human needs and global environmental change. Global Environmental Change 12, 5–13.

Winner, L, 1980. Do artifacts have politics? Daedalus 109 (1), 121–136.