Rhythm, nature and the dynamics of energy demand

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Abstract

In this paper I consider what the insights of Lefebvre's ([1992] 2004) Rhythmanalysis can bring to our understanding of the intertwining of the natural and the social in the constitution and temporalities of energy demand. Whilst energy is as an ingredient of social practice and the material infrastructures and technologies through which energy is used are undoubtedly socially made, the rhythmic patterning of the social everyday is entwined with both corporeal and cosmological rhythms that have their foundation in nature, its beats, cycles and repetitions. Time, space and energy are the essential triadic, Lefebvre argues, an argument built on an understanding of rhythm which moves between the energy of energy systems, the energy of bodily entities and the energetic rhythms of cosmological cycles. This perspective I argue brings natural processes into the making of energy demand in multiple ways, including both through the everyday patterning of social practice and through the working of commonplace technological devices that regulate energy flows

Introduction

All social life has a time-based order (Adam 1990; Zerubavel 1981). That we can talk about routine and habituated ways of being, reflects how the everyday is made up of patterns that repeat (although never exactly), sequence and hold together in rhythmic orders which provide temporal structure of various forms and scales to the social world. The use of energy, in its produced and commodified forms, is intimately caught up such temporal patterning (Walker 2014), at least in contemporary urban-industrial societies. Through the powering of technologies – cars, clocks, microwaves, washing machines, computers and much else – energy is a necessary ingredient of the successful, routine and repeated performance of a multitude of different everyday practices (Shove and Walker 2014), which in their durations, sequences and synchronisations constitute and reproduce social time-orders (Edensor 2010, Shove 2009).

Such powered technologies have not simply become embedded in established rhythmic patterns in the social world, but are materially integral to how temporalities have been (and will continue to be) reworked or remade, variously accelerating or extending social time, making new schedules and (de)synchronisations, fragmenting the everyday or providing for new forms of temporal cohesion (Shove and Southerton 2000; Southerton 2012). Energy is used and flows therefore in time patterns

– traceable most clearly by 'load curves' (aggregated at household, business, neighbourhood or grid scales) - which follow the pulsing rhythms of 'what is being done' over daily, weekly and seasonal timescales. Take the flow energy away, as in a power cut, and not only are energy (or specifically electricity) consuming practice performances disrupted, but temporal structures are also (temporarily) remade, 'carved out of the normal flow of time' (Nye 2010). Practices then are integral to the making of social time, and energy use is (often now) integral to that relation. The dynamics of energy demand are therefore thoroughly immersed in the dynamics of social practice.

So far so good. However, the co-constitution of 'what is done'and its temporality and the related dynamics of energy demand, is not *just* a social matter, one located in sets of purely socio-technical arrangements. Nature, or more specifically the rhythms and cycles of natural beats, flows and fluxes, also has an agency that needs to be brought into a thorough conceptualisation of the temporal dynamics of energy demand. This bringing in of the 'timescape' (Adam 1998) of nature is not though just a matter of achieving a more complete or satisfactory theorisation of dynamics of demand, but is also central to the type of shifts being advocated in the relationship between energy supply and demand within low carbon transition processes. Bringing dimensions of 'the natural' into our scheme of thinking has, therefore, a practical relevance.

My route into this opening of how nature plays into the dynamics of energy demand is through Lefebvre's ([1992] 2004) 'Rhythmanalysis'. His last extraordinarily ambitious book is an account of what he calls '*a new science, a new field of knowledge: the analysis of rhythms: with practical consequences*' (ibid: 11), and has been the inspiration for a range of work focused in particular on the analysis of the rhythms of urban life (Crang 2001) and for thinking about the production of space and time very much together rather than apart. However, within its complex and compelling theorisation of rhythm as a 'general concept', Lefebvre explicitly introduces energy as the third element of what he refers to as the 'essential triadic' of space, time *and* energy. This move to bring energy into his ontology of rhythm has been little noted by commentators on Lefebvre's work, and appears as yet overlooked by those interested in energy and its theorisation.

Some care is needed in interpreting how Lefebvre is thinking about energy here, and in what follows I am taking some rather tentative steps in so doing. However, integral to Lefebvre's exposition on rhythm, and also to my particular interest in reading his ideas into conceptualising the dynamics of energy demand, is an unavoidable interweaving of social *and* natural rhythms. The energy through which (all) rhythms are made is therefore of many varied forms, from energy flows in the cosmos, to energy pulses within the body, not just the energy made and moved within the wires, pipes, generators and power stations of material, technological culture. It is through complex socio-natural rhythmic interweaving and inter-beating that the polyrhythmia of the everyday is produced - and also, I will argue, through which the temporal dynamics of the demand for energy (specifically here for energy *as* produced) are generated.

Rhythm as interaction between space, time and energy

In Rhythmanalysis Lefebvre seeks to reveal the essential rhythmic character of all that we experience, observe and seek to understand. Find the rhythm in all things he urges, look 'harder and longer' (Lefebvre [1992] 2004: 41), and rhythms of some type and meter will always be revealed. The setting he uses to explicate his philosophy of rhythm is in the City, and in a particularly evocative

passage of the book he observes the world before him from his apartment balcony in the middle of Paris:

> '*Towards the right below a traffic light. On red, cars at a standstill, the pedestrian cross feeble murmurings, footsteps, confused voices. One does not chatter while crossing at a dangerous junction under the threat of the wild cats and elephants ready to charge forward, taxis, buses, lorries, various cars …. Sometimes the old cars stall in the middle of the road and the pedestrians move around them like waves around a rock, though not without condemning the drivers of the badly placed vehicles with withering looks. Hard rhythms: alternations of silence and outburst, time both broken and accentuated, striking he who takes to listening from his window, which astonishes him more than the disparate movements of the crowds*' (ibid: 38-39)

While the rhythms he observes and listens to in this extract are of humans in action and interaction, of technology made and operated, it is fundamental to his conceptualisation of rhythm that it is not simply what can be immediately observed or sensed, and that rhythms are not only social in origin. Rhythms beyond the social, he argues have two origins. First, those that are of the body, corporeal and biological, found in the beating of the heart, the breathing of the lungs, the ageing, dying and replacement of cells, and in the chronobiology of cellular and organism functioning. Second, they are cosmological, found in the repetitive movement of the earth against the sun and the moon against the earth, giving patterns to day and night, the to and fro of the tides, seasonal movements through the year and the shift from one year to the next.

These different categories of rhythm he stresses are in constant interaction in the everyday. Social practice make rhythms that are linear, regulated, mechanistic, encompassing 'the monotony of actions and of movements, imposed structures' (ibid: 18). The cosmos, in contrast, creates 'great cyclical rhythms' that have their origin in the nature of the universe. There is then 'constant interference' or 'reciprocal action' (ibid: 18) between the linear and cyclical, for example in how day and night gives rhythmic structure to social practice, while practice has the capacity to resist and act against this. Linear, social rhythms he argues are also superimposed on the 'multiple natural rhythms of the body', though again not without interaction and consequence, such that 'the bundle of natural rhythms wraps itself in rhythms of social or mental function' (ibid 19). Lefebvre and Regulier (1985), in earlier work preparing the ground for Rhythmanalysis, capture the coming together of these three distinct but constantly interwoven rhythmic forms:

> '*Everyday life remains shot through and traversed by great cosmic and vital rhythms; day and night, the months and the seasons; and still more precisely biological rhythms. In the everyday this results in the perpetual interaction of these rhythms*' (Lefebreve and Regulier 1985)

This theorisation of rhythm, covers Lefebvre notes, 'an immense area' (p28) and immediately complicates our understanding of how energy enters into the core of his rhythmic ontology. As noted earlier, energy is seen by Lefebvre as absolutely intrinsic to rhythm, '*everywhere where there is interaction between a place, a time and an expenditure of energy there is rhythm*' (Lefebreve 2004; 15) and in another formulation '*that which connects space, time and the energies that unfold here and there, namely rhythms*' (ibid; 18). Beyond such declarations there is little discussion in the book that explains why this triadic is put together, or in what sense the term energy is being used. In his

description of the rhythms of Paris, we clearly see energised and fast moving traffic and lights of various forms, suggesting the produced energies of motor fuels and electricity. Elsewhere he also explicitly refers to the energy hidden within the machines of modernity:

> '*society underwent something that recalls the great changes in communications. It saw cylinders, pistons and steam jets: it saw the machine start up, pull, work and move. Electric locomotives only present to the eye a big box that contains and conceals the machinery. One sees them start up, pull and move forward, but how? The electrical wire and the pole that runs alongside it say nothing about the energy that they transmit*' (ibid: 24)

This technologized sense of the expenditure of energy in making rhythms is clearly though insufficient to encompass the diversity of rhythmic forms he brings into his polyrhythmic universe. Rather, taking on the natural rhythms of the cosmos and the body entails working with an understanding of energy that is rooted in a physical science approach to conceptualising what energy is, how it is held in 'potential' as stocks, is in movement as kinetic energy and is transformed from one energetic form to another. There is not space here to provide of fuller explanation, but it follows that all movement (however small), all light, all sound can be understood as energy. It is not clear whether Lefebvre was directly influenced by physics or physicists, but opening up the meaning of energy in these terms gives us a view of all that we recognise as rhythmic as necessarily energetic. All speech, music and dance (examples that he uses across the chapters of Rhythmanalysis), all the sounds as well as the movement of traffic, all of the movements of the body and the organs within it (through the energy in food powering muscles), all of the movements of the planet and the cyclical fluxes of solar radiation that generates, are instances of rhythm as expenditures of energy. Thus we can see how for Lefebvre, it is energy that animates time and space, without energy there is no animation, no happening or vitality, and it is through rhythm that space, time and energy connect.

The rhythms of nature and the dynamics of demand

Armed with this opening up of what we are able to understand as energy, and its fundamental status in rhythm, I now want to return to focus on the energy *demand* or energy use that is of concern to energy strategies, energy and climate transitions and the like. That is, the energy produced, generally sold and bought, and entrained into the powering of technologies which then constitute part of the material elements of social practice. In what ways does my concern for bringing the rhythms of nature into the foreground (rather than leaving them simply as part of the background of social existence) inform and maybe complicate how we understand the dynamics of energy demand? In a rather preliminary formulation, I suggest there are three such ways:

1) *Polyrhythmia and socio-natural rhythmic hybrids* - the notion of polyrhythmia is central to how Lefebvre sees the multiplicity of rhythms that come together, interact and generate emergent rhythmic forms, for example in city life. Within the temporal patterning of everyday life - the time positioning , sequencing and synchronization of different social practices - we can clearly see the continual imprint of cosmological cycles interwoven with social ones. Time use studies, for example, show that generally sleeping happens overnight and on a diurnal pattern, not for everyone all of the time, but a general pattern persists even if the details of the performance of sleeping may vary enormously. Hence the trough in energy demand that is a general feature of electricity load curves during the night time, during the period of sleeping, is a dynamic very

much made by a social-natural rhythmic hybrid. Similarly, whilst the detail of eating practices and their temporality varies even more enormously than those of sleeping, the bodily rhythm of needing food, expending energy, needing refeeding (refuelling) and so on, means that eating is normally at least a daily practice, not one that happens once a week or once a month. The rhythm of energy demand that comes from repeated instances of eating (and all that goes with that before and after) is then again, in a different way, a social-natural rhythmic hybrid. And indeed we could clearly relate these two examples in that the rhythm of sleeping is not entirely disconnected from the rhythm of needing to feed, and the relation between nightime and sleeping is one that connects to both the rhythm of the cosmos and the embedded chronobiology of the body.

In these and many other examples that could be worked through we can ask what are the different comparative strengths, force or influence of different rhythms, or in other words how hybridity is working. As a range of authors have discussed, part of the path and experience of human history has involved the increasing disentanglement of social from natural rhythms (Adam 1990), and, in rhythmic terms, an increasing dominance of the social over the natural. As a generality though that hides much differentiation and accordingly in any one dynamic of energy demand we will see a particular balance of socio-natural hybridity its rhythm. Take the fridge, for example, and we can see that the pretty steady constancy in its draw of electricity means that it appears disconnected from diurnal cycles of night and day. Seasonally though it will need to 'work harder' in the summer than in the winter to achieve the same level of internal cool, and patterns of eating (fuelling the body) and hence fridge stocking, door opening and similar will also shape its performance, so it is not entirely disentangled from natural rhythms both cosmological and corporeal. Neither are though at all strong or dominant.

For lighting the socio-natural rhythmic hybridity works differently. The demand for electricity for lighting has a strong diurnal as well as seasonal rhythm. Lights are switched on generally when it becomes darker in the late afternoon or evening (although not entirely, some lighting is on 24/7 or relates to other, for example, commercial rhythms), and the period of lighting is generally longer in the winter than in the summer (something that varies of space and time across the globe). However the use of lighting clearly also relates to the practices it is illuminating, and their patterning in space and time. Indeed a key temporal consequence of lighting becoming available has been (and continues to be in developing countries) to shift and lengthen the time periods within which a whole range of practices can be performed into the evening. Melbin (1987) sees this historically as a process of 'colonising the night' in which lighting – historically one of the first widespread uses of electricity – has been deeply instrumental. Lighting then has a complex and shifting socio-natural rhythmic hybridity that is closely related to wider economic and cultural dynamics.

2) *Rhythmic Energetic Substitution* – the example of lighting takes us into a second way in which the rhythms of nature and the dynamics of demand are related, that of substitution. When we speak of cosmological rhythms, these are rhythms that we experience (here on planet earth) predominantly and most directly as energy flows, as flows of light and warmth shifting in space and time diurnally and seasonally (although not in exact repetitions because of the complex interventions of climate and weather). The 'artificial' making of light and temperature (both heat and cool) are clearly two major forms of energy demand, and there is a direct substitution

relation at work in how flows of their artificially and natural derived forms are rhythmically structured. We can see this relation in the flows of profit that accrue to energy suppliers. For a company like British Gas in the UK the rhythm of its income and profit making is strongly seasonal, because of the predominant use of gas for heating, and annual profit announcements are routinely linked to whether or not the preceding winter has been mild or harsh (mild bad, harsh good!) – in other words how the cosmological rhythm of the seasons has been moderated by climatic effects at a regional level. This rhythmic energetic substitution is increasingly an automated one, technologically embedded in the working of thermostatic controls (and for lighting automatic light level sensors) so that the rhythmic diminishing and rise of natural energy flows is automatically compensated for and substituted with artificial ones. Thermostatic controls are set by human hands, adjusted (maybe) in relation to the rhythms of household occupation and activity, but their ongoing and invisible regulating of energy demand is in the agentive hands of nature and its energetic rhythms and fluxes. [There are other forms of substitution to be also be worked through here, for example between the bodily capacities for rhythmic movement and those of mobility technologies and systems].

3) *Rhythmic Predicting* – third, and again related, is the way in which predictive forms of knowledge serve to mediate the relationship between natural rhythms and energy demand dynamics. In traditional forms, this knowledge has been recorded in day-by-day tide tables (shaping timings of a range of coastal sited activities) and tables of sunrises and sunsets which then link to patterns of energy demand - in the UK specified 'lighting up' and 'lighting down' times have been long embedded in road traffic regulations specifying when different types of vehicle light should be switched on, and street lights are often similarly programmed. Such predicted/able rhythms of nature are now entering in more sophisticated forms into software and energy management systems at scales from grid level to individual buildings. These embed both the more certain expected cycles of natural light and the more variable and uncertain rhythms of 'external' natural temperature into software algorithms that seeks to predict forward (by hours or days) what future demand will be, and how, for example, that relates to predicted load on grid systems and to the intermittent supply of renewable energy technologies. Within these pieces of software then the polyrythmia that makes the dynamics of energy demand is being (at some scale and in some density) foretold, with consequences that then follow for how that demand is being evaluated (as normal, unusual, light or heavy) and managed.

Conclusion

There have been recent moves across various strands of thinking to properly recognise or, for some, reassert the agency of nature and natural processes that have an exteriority to culture. Clark (2011), for example, in tracing various lines of philosophical engagement with an 'earth that does its own thing' asks:

> '*can any approach that rebukes the exteriority or independence of nature, any theorem that restricts globality to an effect of human orchestration really get to grips with the full potential of the earth and cosmos ..*'? (ibid: 25-26).

In this as yet rather preliminary paper, I have argued that there is an independence of and agency in nature through rhythm, in how both the cosmological and corporeal rhythms of nature are

constantly in interaction with the multiplicity of social rhythms (as made through practice performances), and through that interaction have agentive consequences that are enduringly evident in the temporal patterning of everyday life. Drawing directly on Lefebvre's Rhythmanalysis , and the positioning of energy explicitly in his distinctive ontology of rhythm, I have argued that the dynamics of energy demand are constituted by both social *and* natural rhythms and their ongoing and shifting interactions. I have suggested three interconnected ways in which the energetic rhythms of nature figure in the dynamics of demand, first through being part of the emergent polyrhythmia of socio-natural rhythmic hybrids which shape the rhythm of what energy is used for and when; second through the energetic and rhythmic substitutions between natural and artificial energy flows (for light and heat in particular), increasingly relations that are automated by technological devices; and third in how predictive knowledge of natural energetic rhythms has consequences, including for various new technologies of energy management.

Whilst this line of thinking does some theoretical work it also has potential to underpin how we think about various of the means of decarbonising energy systems, and reducing and retiming energy demand that are currently being advocated (Walker 2014). Working towards forms of social-natural rhythmic relations and interactions in which the need for artificial substitutions for natural energy flows are reduced, or which better synchronise the rhythms of social practice with the natural rhythms which underpin more sustainable forms of energy production could be key for achieving more radical system transformations. A temporalizing of energy policy is therefore called for in which paying attention to the rhythms of nature and their immersion in the polyrhythmia of everyday life has a necessary part.

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