Potential pathways, human activities and multiple time(-)spaces: expanding understandings of energy demand geographies

- Allison Hui and Gordon Walker
- DEMAND Centre, Lancaster University
- Contact: a.hui@lancaster.ac.uk

Abstract

The idea that human activities are best understood in relation to emerging and evolving pathways has become established within multiple strands of social scientific thought. Despite the dominance of mobility-related cases, for example in transportation research, there has been limited exploration of how these ideas might contribute to broader understandings of energy demand. This paper argues that further conceptualisation and investigation of pathways in relation to the temporal and spatial patterns of energy-demanding activities offers important contributions. In particular, it develops an understanding of 'potential pathways' drawing upon Schatzki's work. After differentiating this concept from understandings of constraints within time geography, it argues that 'potential pathways' highlight both objective and non-objective spatio-temporalities, as well as both individual and shared dynamics, all the while ensuring that potential pathways (and energy demand) is seen as more than the remainder left behind after considering constraints.

The idea that human activities are best understood in relation to emerging and evolving pathways has become established within multiple strands of social scientific thought. For Giddens, an "adequate account of human agency must… situate action in *time and space* as a continuous flow of conduct" (1979: 2). Activities have thus been understood as performed within a "matrix of places and paths" (Schatzki, 2002: 43), and as inextricable from complex and meaningful patterns of movement or mobility (Sheller and Urry, 2006). Engaging with "the concept of *path* …[can also] help us to appreciate the significance of continuity in the succession of situations", as Hägerstrand notes: "People are not paths, but they cannot avoid drawing them in space-time" (1996: 651). Human life, Ingold therefore suggests, should be understood as "laid down along paths of movement, of action and perception" (2000: 242). Acknowledging this intrinsic dimension of social (inter)action has proven extremely useful for studying everything from situated negotiations of walking (Ingold and Vergunst, 2008) to the organisation of transportation around spatially-dispersed activities (Ellegård et al., 1977). Yet the dominance of movement- and mobility-related cases in the literature also raises questions about whether prominent understandings of pathways have been too narrowly focused upon travel dynamics through objective time-spaces.

We argue that this loose family of ideas has a much broader applicability, but one that will only be realised through the exploration of alternative cases and the expansion of theoretical understandings of pathways. We take as our starting premise that the understandings of pathways articulated by the authors above are broad ontological statements about how pathways in principle underlie multiple realms of human activity. While understanding and studying pathways may

therefore involve documenting or tracing where and how people move through objective time-space, it may also be concerned more generally with how such patterns of interwoven mobility and activity contribute to other social phenomena. In order to explore this assertion, we take up the case of energy demand, highlighting how a conceptualisation and investigation of the temporal and spatial patterns of energy-demanding activities might be underpinned by working with the notion of pathways. This discussion leads us to argue that developing an understanding of *potential* pathways – those that are possible but are not taken – will extend the analytic potential of the concept of pathways in this and other realms of study. The remainder of the paper develops our understanding of potential pathways, clarifying how it departs from similar approaches, such as the modelling of time-space prisms in time-geography-informed transportation research (Neutens et al., 2011).

Before proceeding, it is important to note that we are not arguing that there is already a coherent set of literature outlining understandings of pathways. Indeed, discussions of paths and pathways have emerged from varied disciplinary contexts, and in relation to different ontological starting points. Our position is that due to the emphasis of multiple authors upon 1) an interest in how social life is continually enacted through the performance of activities and practices and 2) an interest in how human activities unfold through/alongside space and time, these understandings of pathways can be treated as a loosely related set, within which further complementarities or differences are explored. In terms of the first point, we follow Giddens and Schatzki, drawing upon practice theories which see social practices as the stuff through which social life is (re)produced (Giddens, 1984, 1985; Schatzki, 1996, 2002). This position can be contrasted with the less formalised approach taken by Ingold, who is concerned less with identifying particular social practices and more with understanding activities as not taking place 'on' the world, but as part of the ongoing becoming of the world (2008). Differences in how space and time are understood in relation to pathways are taken up explicitly in a later section of the paper. Before that, however, we turn to the case of energy demand to argue that conceptions of pathways have greater analytic potential than has been explored in existing literature.

Energy demand and pathways

To suggest that pathways have, until now, been largely ignored within research on energy demand could seem either extremely contentious or blindingly obvious, depending upon how the relevant literature is defined. The vast body of transportation research drawing upon time-geographic understandings of pathways suggests that transport demand has a longstanding relationship with the concept (Ellegård and Svedin, 2012; Neutens et al., 2012; Neutens et al., 2011; Peters et al., 2010). Exploring the energy implications of taking different modes of transport or chaining different sets of activities could therefore seem an obvious extension of these sets of discussions. In another sense, however, understandings of energy demand developed within interdisciplinary literatures have routinely ignored the importance of pathways. Discussions of both levels of energy demand and the patterns of activity underpinning them are regularly segmented in ways that obscure the continuity of people's paths.[1] For example, work-related demand is routinely separated from home-

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[1] We are aware of one article by Hallin that considers energy use in relation to time-geography (1991), but find it to problematic in a number of ways. It considers multiple forms of energy and how to limit them, but as such ends up looking at flows of energy more than the interconnection of multiple human activities. Moreover, the paper adopts a very individually-centred concern for rational choice and psychological motives for action that does align with our more practice-focused understanding of social action. In addition, an article by Røpke and

based demand on the basis of who pays or where activity occurs, transportation-related energy is addressed in a completely different literature than energy used for other more activities, and representations of different forms of energy – coal, gas, electricity – produce understandings of multiple peaks and problems that have little to do with the experiences or negotiations within people's everyday lives. If one of the central contributions of understandings of pathways is to emphasise human activities as situated and spatio-temporally continuous, then ongoing research on energy demand could engage much more substantially with these dimensions.

A range of social transformations, however, make pathways a productive analytic unit for better capturing the shifting dynamics of energy demand. The increasing visibility and take up of flexible working arrangements, for example, highlight how work activities are not necessarily spatially fixed, presenting complex implications for levels, timings and locations of energy demand. If people's pathways have changed to no longer involve transport to work in a personal car, this suggests the potential of an overall energy demand reduction. Yet working at home involves heating and lighting a space that might otherwise not be occupied, and the increase in these energy services may not be matched by a reduction of heating or lighting in the workplace one is absent from. Seeing people's activities in multiple spaces and times as interconnected and potentially interdependent is thus crucial for understanding the implications of such transformations on aggregate patterns of energy demand as well as when and where the elements that make up that demand are situated.

The understandings of pathways articulated by authors such as Giddens, Schatzki, Hägerstrand, and Ingold thus highlight how bracketing off particular spaces (home/work) and times (commuting/not-commuting) in which to investigate energy demand risks distorting underlying social dynamics. It is the continuity of people's experiences, they rather argue, that is important. Building upon these ideas, we therefore see energy demand as arising in the course of performing a range of social practices (Shove and Walker, 2014) that are arrayed along ever-emerging pathways. The flow of practices is an inevitable facet of social life, and thus becomes central to understanding the energy-related consequences or implications of what people do.

Instead of studying energy use in the home or at work, one might therefore set out to study how energy use is embedded in people's pathways. As an example, we can consider one of the authors' pathways on a Tuesday in February. He left his office at 5:45pm and walked to a bus stop on the university campus in order to catch a bus, which took him into town via a pre-set route. Getting off in the city centre, he then walked from the bus stop to his yoga class, a distance of about 0.3 miles, arriving at 6:20pm. Along with about 20 other people, he fell into the shared rhythms of a yoga class until it finished at 8pm, when he walked back into the city centre. On his way home, he stopped at the supermarket closest to his route home. He shopped there for about 10 minutes, and then completed the journey home, where he stayed for the rest of the evening.

While transport geography might stop at this level of detail and reflect upon the transport choices, speeds, and distances involved, in order to consider energy dynamics we can turn instead to think about how movements and activities along this section of a pathway were intertwined with energy in a variety of forms. His office was well heated, but not lit as the sun was brightly shining that day.

Christensen (2012)makes connections between time-geography, practice theory and ICT use. While they discuss how the space-time constraints of practice are changing in relation to ICT use, the energy implications remain minimally developed.

When he left it, he stopped using the computer and phone that had previously occupied him. The bus into town was similarly heated, but not lit, and during the ride he used his mobile phone, and along with it the services provided by 3G networks. After arriving in town, he used traffic lights to cross the street, and noticed that the street lights were just beginning to turn on. During his yoga class the room was hot, with all of the heaters on and the lights on for the majority of the class. The body heat of the participants increased the room's temperature even more as the yoga class progressed. Walking away from yoga class, he checked a text on his phone, and walked along streets lit by both street lights and ambient light from shops and pubs. The supermarket was not only heated and lit, but fridge units were keeping some food cold and a range of other technologies such as check-out tills were being powered. Finally, upon arriving home, he turned on heating, lights, a television and computer. Hot water was already ready and waiting, with other technologies on standby or already running, such as the fridge.

This example provides a very different picture of people's interactions with energy-derived services (movement, heat, light, communication, refrigeration, entertainment) than studies which focus upon activities surrounding one technology or one space. Starting from an understanding of continuous pathways of activities highlights how just as we cannot help but make pathways, we cannot help but encounter and benefit from energy services in a range of spaces and times – those privately controlled and managed as well as those publically provisioned. The use of energy in these terms is less about discrete choices to turn devices on or off, up or down – as clearly in many spaces those ostensibly using energy-derived services have little power to affect their provision – than it is about encountering landscapes of energy-derived service provision as we wind our way through a series of paths and activities.

This initial link between pathways of activity and how the use of energy is integral to sequences of practice performances is helpful, but there are further dimensions to be explored. If we are concerned with capturing how energy demand is built into the many interweaving pathways of multiple people within a given area, then that becomes a more complex task of tracing the separate and combined moments along pathways at which energy-derived services are being accessed. Yet even this would not give a full picture of aggregate energy demand because narratives of pathways, such as the one above, focus upon paths taken and energy services that were interacted with for a particular period of time. Missing from this is a sense of the moments and spaces in which energy services were being provided, yet may not have been a part of anyone's pathways: streets where lights were on but no one was walking down them; shops that had illuminated window displays but no one looking at them; supermarkets that were open but with no customers present. Such uses of energy contribute to overall levels of demand, yet they cannot be easily recorded through a consideration of actualised pathways – the ones that people did enact in a particular space and time.

What is required to understand such dynamics is instead an attention to potential pathways – those that could have been enacted in particular space-times, but were not. Such pathways might, on other occasions, be taken. While the closest supermarket was visited upon this occasion, it is also a small 'local' one, and therefore on another Tuesday it might have been necessary to visit another supermarket and purchase an item only found there. Equally, on another Tuesday a trip to the supermarket might not be necessary at all. All of the energy services used by supermarkets to be ready and open for potential customers thus have an ambiguous relationship to even the pathways of those who are, on occasion, customers. Understanding how overall patterns of energy demand

are constituted thus necessitates attention to both the actual pathways that people enact on any one day and to the potential pathways that they may or may not enact on other days, which when aggregated have consequences for energy. Taking both actual and potential pathways into account thus allows further consideration of the accumulation of pathways over time, and the range of variations that are normal parts of people's activities and travel. This line of thinking also brings forward important ongoing shifts in institutional and commercial arrangements – such as hours of opening, patterns of leisure and retail provision and the enabling of consumer choice – with which pathways interact, again with implications for the space-time patterning of energy demand.

In the rest of the paper, we further develop this idea of potential pathways in dialogue with both the case of energy demand and existing literature. Firstly, the following section contrasts our understanding of potential pathways with understandings of 'constraint' within time-geography. The subsequent section then turns to understandings of space and time, arguing that concepts from Schatzki's work on practices can be used to discuss other characteristics of potential pathways and their energy implications.

Potentials and constraints

To those already familiar with time-geography, the brief outline of 'potential pathways' above may seem to offer little that is new. After all, even Hägerstrand's initial discussion of time-geographic concepts made clear that his approach was not to be based upon solely present phenomenon or to ignore aggregate patterns. His initial exploration of what was to become time-geography stemmed from a frustration with work that discussed aggregates without any reference to the individual people's lives that composed them. Yet he also recognized that one of the dangers of collecting observational or diary data on people's pathways was that "one risks becoming lost in a description of how aggregate behaviour develops as a sum total of actual individual behaviour, without arriving at essential clues toward an understanding of how the system works as a whole" (Hägerstrand, 1970: 11). It was from this awareness that his emphasis upon constraints thus grew, as he saw defining "the time-space mechanics of constraints" as a means by which to "determine how the paths are channelled or dammed up" (Hägerstrand, 1970: 11). Focusing on potentially shared constraints, that is how limitations of space and time affect the formation of paths, thus provided a means of understanding shared dimensions shaping the emergence of many people's pathways.

Hägerstrand and others have thus developed detailed understandings of different types of constraints that affect the constitution of pathways. Capability constraints relate to the limitations of people's bodies and available tools, and how these affect distances at which they can act (Hägerstrand, 1970: 12). While various communication technologies allow people to interact at-a-distance, for more embodied activities consideration must be given to where people are and how far they can get in any period of available time. When commitments are made to be at certain spaces at certain times – such as being at home in order to go to sleep at the end of the day – then there is a constrained prism of possible paths that can be traversed while still allowing for this return. Within transportation geography much work has been done to consider how different modes of transportation change the size of potential prisms by facilitating faster or slower movement through time-space. A second set of constraints are coupling constraints that "define where, when, and for how long, the individual has to join other individuals, tools, and materials in order to produce, consume, and transact" (Hägerstrand, 1970: 14). The importance of shared, predetermined

timetables and schedules becomes apparent in relation to this set of constraints, as well as how these coupling constraints affect the size of time-space prisms available to people. The third type of constraints Hägerstrand names are authority constraints, which have a significant spatial component in terms of individuals or groups controlling particular areas (Hägerstrand, 1970: 16). Such control can affect patterns of accessibility (e.g. some 'public' parks only being open during set hours) and can be of a more permanent or temporary character (e.g. the authority to access a particular hotel room may last for only one night vs. the more enduring access to one's own bedroom). It is important to note that these constraints have often been summarised in terms of what people interact with – e.g. authority constraints as about the laws and rules of powerful groups, coupling constraints as agreements with other people, and capability constraints as about various tools and skills (e.g. Ellegård and Svedin, 2012). Yet in Hägerstrand's original description it is more important to understand their distinct spatio-temporal characteristics – the authority to access spaces, the temporal-spatial scheduling needed in order to couple effectively, and the affect tools and technologies have upon the size of prisms of possible time-space pathways. Constraints, like pathways, are time-space phenomena.

If understandings of constraints grew from an interest in explaining aggregate patterns, then one might ask: what is so different about engaging with the idea of 'potential pathways'? For some, there might seem to be little difference – indeed Ellegård and Svedin suggest that "constraints refer both to phenomena that have occurred in the past and to the possible paths that can be trodden in the future material world" (2012: 23). While we acknowledge that discussing constraints does not preclude a consideration of potential paths, starting from and emphasising the role of constraints prematurely narrows the realm of possibility for such discussions. People's potential to act is delimited by what are treated as conceptually and temporally pre-existing constraints.

The first reason for this is that the aim of identifying constraints in order to then define particular prisms and possible paths has often led to a focus upon only those constraints that can be clearly articulated. Coupling constraints, for example, have often been interpreted in relation to clock times, sometimes even assuming punctuality in relation to these (e.g. see discussion in Schwanen, 2008: 338-340). Yet when probed further, people can hold very different understandings of what, for instance, is an appropriate arrival time. Schwanen illustrates this in research on parents collecting children from childcare, showing how even when a child is collected before the last appropriate clock time set by the institution, a parent can feel 'too late' if the child is the last one to be collected from a class (2008). Understandings of appropriate arrival times are thus "constituted relationally", morally charged, and "more complex than common sense suggests" (Schwanen, 2008: 351, 352). More complex understandings of the temporality of coupling constraints, such as this, are however challenging to incorporate into the plotting of possible time-space prisms, as the latter depend upon representations of clock time. Dominant interpretations of the kinds of time that matter for coupling constraints have thus perpetuated understandings of possibilities and potentials that are far clearer-cut and independently constituted than research on everyday experiences suggests is appropriate.

While this limitation in spatio-temporal interpretations of constraints is concerning, perhaps more significant again is the way taking constraints as a primary concern restricts imaginings of what potentials might be and the role they might play. In Hägerstrand's formulation, possibility can only exist as the remainder of constraint – what is left over after limitations have been identified. Yet this establishes a temporal sequence between the two concepts that may well prove inappropriate.

While the time of a yoga class can be seen as a constraint that limits the potential pathways taken before or after it, for a variety of reasons one might not go to the class and instead do yoga at home. Possibilities for other activities or other couplings – meeting a friend who is temporarily in town – can thus raise questions about the permanency or power of constraints. Giddens sums up this point aptly: "All types of constraint are also types of opportunity, media for the enablement of action" (1985: 270). In his interpretation, Hägerstrand's approach to constraints is too closely aligned with an understanding of them "as scarce resources": "There is more than a hint in Hägerstrand's writings of the notion that allocation of scarce resources of the body and its media have some sort of determining effect upon the organisation of social institutions in all types of society" (Giddens, 1985: 270). While this approach can be useful – for example in thinking about how the limited clock hours in a day are parcelled out to different activities and movements – it is also inherently conservative. Understandings of appropriate arrival times are not a scarce resource – they can be generated in continually varying forms by different groups of people. Moreover, when discussing resources such as energy there is no ultimate total limit to be parcelled out to different people – this becomes particularly apparent when tracing the evolving understandings of what forms of energy use might be needed for supporting a minimally sufficient standard of life (Walker et al., forthcoming). The temporalities and spatialities of resources such as energy therefore have different dynamics than those of travel – and are not limited to the bounded scarcity of clock time.

It is therefore important that we also consider the possibility that opportunities precede constraints – at least in our analyses, if not always in social life. Doing so opens up space to question when scarcity is important, and to recognize the potential to generate paths that disregard or reconfigure previously acknowledged constraints. Depending on what courses of action people pursue, different dynamics become recognized as constraints. Just as the proliferation of mobile technologies and devices has reconfigured communications (Couclelis, 2009), so too people have a range of resources (of technological and other forms) for improvising new pathways that will variously enrol diverse energy-derived services into their trajectories. In addition, thinking more broadly about potential pathways ensures that their temporalities are not just those left after clock time constraints are considered, or their spatialities not just those left after accessibility constraints are taken into account. As the next section explores, we see further engagement with an understanding of potential pathways as part of a move to expand the spatio-temporal dimensions and dynamics under consideration when looking at the resource implications of human activities.

Spatio-temporalities of potential pathways

As the discussion above highlighted, the exploration of pathways in time-geographic research has often drawn upon limited understandings of both the times and spaces they involve. This stems in part from the prominent aim of creating time-geographic graphs wherein space is represented in a two-dimensional (x-y) plane from which the third dimension of time rises (z). In such representations, space and time are dimensions within which people are clearly and unambiguously located at any instant. This understanding positions both space and time as objective – in terms of being "measur[able] by a metric that applies continuously and equally throughout" and being "at least to some extent independent of human existence" (Schatzki, 1991: 651). Yet as Ingold notes, the danger of representations such as maps, and their objective renditions of space, is that they erase and obscure the pathways and activity through which even they are made:

> In effect, mapmaking suppresses, or 'brackets out', both the movements of people as they come and go between places (wayfinding), and the re-enactment of those movements in inscriptive gesture (mapping). It thereby creates the appearance that the structure of the map springs directly from the structure of the world, as though the mapmaker served merely to mediate a transcription from one to the other. (Ingold, 2000: 234)

The power that maps can wield to circulate particular understandings of the world is therefore important to recognize and question (Latour, 1987: ch. 6). In this section we turn then to engage with alternative understandings of the spatiality and temporality of pathways.

The discussion of Schwanen's work above already touched upon an understandings of time that is not dependent upon clocks – parents' relational understandings of arriving 'too early' or 'too late' to pick a child up from childcare. This exemplifies but one of a range of other temporalities that could be considered in relation to pathways – shared rhythms and sequences (such as those established between yoga practitioners enacting a flowing series of movements), the bounds of acceptable durations ('overstaying one's welcome' when visiting someone else's home), or the synchronicity of multiple simultaneous activities (the length of a meeting corresponding with the time it takes to recharge a mobile phone).

Space too can be understood apart from its objective representation on maps. Schatzki, following Heidegger, defined social space "as the opening and occupation of sites for human existence" (1991: 651). Social space is therefore inseparable from human agency and "by its nature present only so long as human life occurs" (Schatzki, 1991: 651). This understanding differs from those focusing on how space is experienced – while "experiential space is always some individual's experiential space," social space is shared (Schatzki, 1991: 652). Like what we might call social time, social space is contextually and relationally constituted, and thus variable.

Before going further, it is important to be clear that the critique of time-geography's tendency to focus upon objective time and space is primarily a critique of dominant trends in empirical research, rather than of its underlying theoretical tenets. As Sui argues, despite starting off with an emphasis upon objective time and space, Hägerstrand progressed through his career to acknowledge the necessity of addressing social dimensions of time and space, in part due to his increasing emphasis upon seeing people as embedded in nature (2012: 7). Like Ingold, in his later work Hägerstrand argued that the perspective presented in maps is not akin to that of people's lives (2004). He thus moved from an emphasis upon abstract space to a consideration of place and landscape (Sui, 2012: 7-8). Similarly, Hägerstrand's understandings of temporality started from an early preoccupation with "symbolic time (such as clock or calendar time), [wherein] the present is interpreted as a sharp now-line that moves forward into a not yet existent future" (Sui, 2012: 8). This understanding was later supplemented, however, by a concern for "embedded time" – which does not have a "clock-sharp present common to everything" but rather is "time folded in the visible and tangible reality" (Sui, 2012: 8). As Sui argues, the predominant engagement in time-geographic research with earlier, objective framings of time and space, occasionally supplemented by references to social time or space, cannot therefore be seen as representative of the breadth of Hägerstrand's thinking (for examples see Sui, 2012: 11-12). Sui therefore argues, and we concur, that further exploration of such understandings of time-space paths and their multiple dimensions are warranted.

Developing Schatzki's understanding of places, paths and activities

How then can potential pathways be understood in relation to *social* spaces and times? In order to address this question, we will provide a fuller account of Schatzki's work and argue that even though 'paths' is only one of many concepts within his schema, his account of the timespaces of human activity offers significant resources for enriching accounts of potential pathways. Moreover, we suggest that working with Schatzki's concepts makes it possible to consider both objective and social dimensions of time and space as they relate to the interrelations and implications of possible pathways and energy demand.[2]

The relationship between times, spaces, and human activities is a longstanding theme within Schatzki's work, but one marked by notable shifts over time. From early discussions that address only the spatial dimensions of social life (Schatzki, 1991), he moved on to follow Heidegger in arguing that time and space are not a "conjunction" of "separate phenomena" but a unity (2010: 45) – what Schatzki refers to as timespace. Alongside this shift in attention one finds the gradual accretion of a set of interlinked terms. In his early discussion of social space, Schatzki introduces his understanding of places that does not, as in other geographers' work, suggest emotional attachment, but rather "simply places to carry out particular activities" (1991: 653): "A place is a place to X, e.g., a bed is a place to sleep, a table a place to eat, and a bus stop a place to catch the bus. As these examples demonstrate, places are defined by reference to human activities" (1991: 655). The term 'path' then appears as a sub-type of this broader category: paths are "places on which to reach Y from X (routes)" (1991: 655). Rather than being located definitively at some location, places and paths are spaces within/along which particular types of activity are possible. Paths for a footrace might therefore be performed around a marked indoor running track or in the midst of a large grassy field. Building upon these terms, Schatzki emphasises the importance of seeing social phenomena, and in particular spatial aspects thereof, as tied to human activity.

By the publication of *Social practices* in 1996, Schatzki's concern has moved on from spatial ontology to understanding social life in terms of social practices. The only development of these concepts is found in his reference to a "space of places" (Schatzki, 1996: 115) – a reformulation and specification of what he earlier called social space. In a short discussion of the space of places, Schatzki connects places to the idea of intelligibility – that is, he acknowledges explicitly that people's understanding of places as possible locations for certain activities is central to their existence (1996: 115). One makes sense of places then through reference to the "normativized interrelated meanings" of practices that have intelligible places to be performed (1996: 115). The discussion of a space of places is short lived, however, and in Schatzki's next book he turns instead to think about how places are interrelated, discussing "activity-place space": "a matrix of places and paths where activities are performed" (2002: 43). This move allows him to consider more specifically how places might be interrelated. Some practices, such as hosting a baby shower, involve a range of activities – sending invitations, buying gifts and wrapping paper, making games from craft supplies, preparing and laying out tables of food and drink – and in such cases where activities are "interdependent, sequenced, and nested", so too are the correlate places (2002: 43) – places for purchasing gifts must be visited before places for wrapping them, and places for laying out and eating food must necessarily overlap.

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[2] In the following discussion there remains a difference between Schatzki's discussion of 'paths' as non-objective spaces and our consideration of 'pathways' which have both objective and non-objective temporal-spatial dimensions.

In his 2010 *The timespace of human activity*, the term activity-place space then disappears as he considers the conjunction of temporal and spatial aspects of human activity. All activities, for Schatzki, are temporal because they involve responding in the present to knowledge or motivations from situations in the past, in order to try and realise goals or aims in the future. Put together with his understanding of places and paths, this forms his understanding of the timespace of human activity (Schatzki, 2010: 60).

As this brief summary highlights, the terms places and paths continually reappear throughout Schatzki's work, but as basic concepts that support his attempts to build up increasingly complex understandings of how human activities are organised. By the time we get to his extended discussion of timespace, it is fully apparent that this architecture of concepts is not oriented around objective time or space – indeed Schatzki compares timespace instead to Greek understandings of kairos-topos[3] (2010: 64). Yet unlike in time-geography where understandings of kairos-topos dynamics are not well integrated alongside considerations of more objective chora-chronos (Sui, 2012: 11), Schatzki makes clear how places and paths relate to objective space. All places and paths are "anchored" at, and "conditioned and constrained by", a range of objects: "Hence… the possibilities of locales and regions are conditioned by the properties of, and the objective spaces formed by, objects" (Schatzki, 1991: 655). This anchoring thus establishes the "objective locations of places and paths" (Schatzki, 2010: 59), connecting map-able spaces with places that are intelligible for particular activities. In terms of time, Schatzki acknowledges that objective understandings built upon principles of succession of moments exist, and that even the terms past, present and future can be related to such successions (e.g. see discussion in 2010: 64-68). His understanding of timespace, however, depends upon an interpretation wherein past, present and future are not located in relation to some clock or calendar, but rather highlight how all of our activities call upon the past and future in the present due to their motivations and their aims. He thus acknowledges (objective) succession "while treating dimensionality (past-present-future) as an essential feature of a different *kind* of time, one seated in human life" (Schatzki, 2010: 65, emphasis in original). Multiple types of time and space are thus valid and seen to be interwoven in Schatzki's conceptual framework.

Schatzki's understanding of timespace offers not only a means of acknowledging multiple types of time and space, but also articulating how they are interconnected and shared. Places, paths, and timespaces are shared to the extent that activities like sleeping or grocery shopping are understood by many different people to be anchored at particular types of objects (beds, grocery stores) and to have similar motivations and ends (tiredness, a goal of re-stocking the fridge). Yet at the same time, "activities of any given type can be individuated… by their position in objective time and space" (Schatzki, 2010: 68). While sharing an understanding of the places where sleeping (as a practice entity) occurs, we can identify individual performances of sleeping by reference to their specific objective times and spaces. In addition to talking about timespaces that are shared, or common, we can then also discuss "activity timespace [that] is the property of a person" (Schatzki, 2010: 69) – this concept being the closest Schatzki gets to addressing anything similar to the individual time-space trajectory in time-geography, as it incorporates a sense of individual collections of timespaces that could be identified in objective time and space. Whereas in time-geography understandings of

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[3] Schatzki summarises kairos as human time or the right time to act, and topos as a place of human dwelling, and these contrast with chronos (clock time) and chora (abstract space).

shared pathways are dependent upon being in the same objective space or time as someone else – e.g. being at the same work or childcare location simultaneously – Schatzki's work provides alternative possibilities for understanding shared pathways. Types of pathways might increase and differentiate over time – for example with places for charging mobile devices including both covertly plugging devices into sockets meant for cleaning devices as well as corporate-provisioned stations where you pay to charge. Schatzki's understanding of pathways also provides space to consider how pathways might be shared in objective time but not objective space (or vice versa) – as with people commuting on different roads at the same time, or using the same lane of a pool to swim laps but on different days. Freeing pathways from a strictly objective understanding of time and space thus opens up new opportunities for thinking about how pathways are shared.

While the complexity of Schatzki's conceptual framework has perhaps acted as a barrier to its adoption and application in empirical cases, we see considerable potential in this regard. By connecting places and paths not to activity in general but to specific types of activities and human practices, Schatzki provides a means of grounding more detailed considerations of what objects, materials, and resources are needed to support practices. Places for purchasing groceries, for instance, are anchored at different objects depending on what is for sale. Weekly outdoor market stalls could be anchored at simple foldable tables arrayed with ice packs to keep any meat or fish cool for the few hours the market is open. Purpose-built supermarkets, however, have a range of more energy-demanding infrastructures built into them which allow for both the longer-term cooling of products and a wider range of cooling (or heating) options (e.g. for frozen uncooked chicken vs. cooled pre-cooked chicken vs. warm chickens cooked in-store). Starting from a consideration of places thus helps to highlight the variation that exists in the energy resources associated with the activity of purchasing groceries, while also revealing the specific energy services required for the storage of some items (e.g. freezer units for frozen food items). Furthermore, subsequent questions can be asked about the relationship between the temporalities of these energy services and the activities of purchasing goods that they support – while stores are only open for a limited number of hours, in order to remain appropriate places for purchasing frozen items, in-store freezers must remain on at all times. The energy implications associated with the potential of purchasing frozen goods are thus not co-terminous with the temporality of a customer's presence in the store. The potential for people to enact pathways involving particular activities can depend upon the use of energy at temporalities connected to, but different from, their own interactions with the spaces within which energy-derived services are being provisioned. In this way, engaging with Schatzki's places and paths provides prompts that help to consider the variation in energy services connected to and enabling of people's pathways, as well as the potential for various forms of disconnection between the temporalities (and spatialities) of energy-use patterns and the patterns of people's activities.

Starting from a consideration of places and paths for activity also creates opportunities for mapping potentials that are not *a priori* limited by capability constraints. That is, in contrast to time-geographic approaches, one's present location is no longer taken as the referent against which potential paths or places for activity are to be measured. One might, for example, list all of the possible places for grocery shopping – including outdoor markets, independent purpose-built stores or those sited in train stations, or any place where one has access to a computing device, the internet, and appropriate websites. These places and paths could then be located in objective space based on the anchoring of related objects and given hours of operation or access. Such a map is a

distinctly different type of resource for discussing the potential pathways someone might take in their everyday life because it can be considered in relation to not only one person but a group of people and not just a particular day's pathway, but to a set of pathways accumulated across multiple days. The time window during which one might need to shop at a grocery store could sometimes be a week instead of just one day, and which one of several potential places is visited could therefore be negotiated based on awareness of a range of other practices and where their places are anchored in time and space. Potential pathways are thus not limited to the time-space prism defined by one's current location in objective time-space, but opened up to a consideration of alternative arrangements and longer-term considerations based on knowledge of relationships between different places and how they are anchored.[4] This kind of approach would explore more of the terrain Hägerstrand outlined in his definition of coupling constraints (see above), rather than just the temporal scheduling that has often been emphasised, and would also approach it more flexibly – acknowledging the variation that is possible in the types of places or paths that might be deemed appropriate (e.g. deciding not to purchase frozen food if it is preferable to give this up than to arrange the next day's pathway to visit a supermarket stocking it).

In addition, building upon Schatzki's work allows for discussions focused upon not the potential pathways of individual people, but the shared dynamics and stakes of places and paths, as well as the energy uses (and resources) upon which they depend. Looking back historically, for example, we might reflect upon how places and paths for grocery shopping have transformed - for instance the freezer units that are now regular features of grocery stores were at one time unusual (Shove and Southerton, 2000). We might also consider how the proliferation of easily accessible electricity sockets in workplaces, cafes, trains, and increasingly airplanes relates to the proliferation of places for both charging and using information and communication technologies such as laptops, tablets and mobile phones. Such places that at one time were more permanently anchored – at desktop computers, or at landline phones – may now be found along paths, anchored to different types of technologies. This transformation of course has implications for energy resources – both those flowing through electric sockets and through wifi and mobile telephony infrastructures. Thinking about such patterns of change therefore creates an opportunity to engage with questions about how changes in the total number or dispersion of potential places and paths interact with and have consequences for people's individual pathways. If, for instance it seems that some places and paths are transforming to become more energy intensive and energy dependent, then what if any mechanisms exist for individuals to shape or resist this trajectory? Or to what extent is the provision of shared energy services, linked to the facilitation of certain types of places or paths, variable depending on the number of actual pathways making use of them? By creating space to discuss how places and paths are shared and shaped by social dynamics, this approach opens up the ability to consider how potential pathways are themselves encouraged and facilitated by shared, and not only individual, actions and developments.

Conclusion

In this paper, we have further developed understandings of human activities and pathways both in relation to the case of energy demand, its dynamics and shifting patterning in space and time, and in

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[4] Engaging with Schatzki here allows the possibility of considering not only what Pred calls 'daily paths' (1977), but also the dynamics that exist between paths on multiple days.

relation to understandings of potential pathways. An initial consideration of energy demand highlighted that while well-developed conceptual resources offer some insights into how the use of energy is underpinned by a range of activities, they fail to address important dynamics underlying patterns of how demand varies and accumulates. We therefore turned to less-often applied understandings of paths in order to develop a vocabulary for discussing potential pathways that is not dependent upon, or a remainder of, existing understandings of constraints.

Potential pathways, as outlined here, redress the disproportionate attention to objective time-spaces, and to transport-related questions that is found in time-geography literature. While Hägerstrand's formulation of constraints suggests non-objective dynamics such as the importance of synchronicity and co-presence in coupling, research has rarely taken these spatio-temporal dimensions as worthy of extended attention. Engaging with Schatzki's vocabulary of places, paths and timespaces thus refocuses attention upon under-considered dynamics.

As the discussion has highlighted, engaging with this understanding of potential pathways need not necessarily leave behind objective time-spaces. Indeed, as we illustrated, it might instead open up opportunities for considering time periods not easily addressed or represented in time-geography maps, such as those dynamics stretching out over multiple days or those involving variations in resource-use over years or decades.

Neither has our emphasis upon potential pathways meant to replace an engagement with constraints. Indeed, pursuing a focus upon potential places or pathways offers new means of imagining constraints – as for instance potentially following from rather than preceding pathways. In terms of energy demand, further discussions of the range of places all offering access to the same energy-derived services at the same time could for example prompt suggestions of creating new social constraints upon the spatio-temporal availability of such services in order to lower overall levels of demand. It might be the overall number, or nature of places available then that could become a target for constraint, rather than the specific windings of individuals' time-space paths.

Our discussion of potential pathways also goes beyond existing work in time-geography to foreground that it is not only constraints that might be shared – places and paths (in Schatzki's sense of these terms) are also shared. Exploring these shared qualities of places and paths is vital as it provides space in which to consider the distributed agency and orchestration of energy-derived service provisions that are intertwined with any one individual's pathways. This is particularly important for ensuring that the 'solutions' to problems of excessive or wasteful energy demand are not seen to lie solely with individual actions and choices.

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