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An ethnography of energy demand and working from home: Exploring the affective dimensions of social practice in the United Kingdom



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ABSTRACT

The practice of working from home has become widespread in developed countries, and the numbers of regular home workers are steadily increasing. There are potentially positive implications for energy consumption associated with home working, but these depend on myriad variables. This qualitative study, based on interviews with regular home workers, provides a more in-depth perspective on how and why energy is used compared with quantitative models of household consumption. Ethnographic research data is analysed using insights from practice theory. Placing the practice at the heart of analysis, it explores meanings, materials and competences involved in home working, and attends to the affective experiences of practitioners. Considering working from home as an integrative practice, it explores how dispersed practices are incorporated into individual performances, bringing about affective satisfaction. Findings show that the practice of working from home is characterised by themes of comfort, control and flexibility, with implications for energy demand. It is argued that the synthesis of practice theory and affect can provide valuable insights for energy research. The paper discusses the implications for demand reduction, demand shifting and ‘smart’ controls, with reference to the role of employers, researchers, policy makers and home workers themselves.

1. Introduction

The practice of working from home has become widespread throughout the ‘knowledge economy’ of Europe and North America and is steadily increasing in both developed and developing countries, led by the expansion of internet access [1–3]. In the UK, more than 25% (7.7 million) of those in employment reported in 2014 that they sometimes work from home as part of their main job, while 4.2 million (13.9%) reported their home as their main place of work, an increase of 2.8 percentage points since 1998 [4,5]. Motivations for individuals working from home include eradicating the commute, facilitating flexible child-care arrangements, aiding concentration and mental health benefits [6,7], while opportunities for employers include increased productivity and energy savings [8].

Achieving reductions in energy consumption in domestic and commercial buildings is a universal priority for policy makers. Focusing on the practice of home working represents an opportunity in this regard, with potential savings of up to 1.4 tCO₂e per year per home-based employee, according to UK estimates [8]. Further, reducing energy demand from small and medium sized enterprises (SMEs) is a significant policy challenge: with nearly 60% of all SMEs based in domestic premises, achieving energy reductions through supporting

efficient home working practice offers a way of addressing this sector of the economy while potentially avoiding politically unpalatable ‘red-tape’ for small enterprises.

However, data on energy consumption associated with the practice is subject to uncertainty due to the difficulty of separating consumption data from other domestic practices, being outside the scope of corporate energy portfolios, and with a significant proportion of home-based businesses undeclared due to legal and tax concerns and therefore ‘invisible’ to public authorities [9]. Efforts to quantify the environmental impacts of home working have been made in technical and transport focused literature [10–14]. On the one hand, when substituting for a commute, working from home can represent significant energy and emissions savings [14]. On the other, the heating and lighting of a domestic space in addition to an unused desk at work, or the use of technologies such as cloud computing services can lead to increased energy consumption and environmental impact [8,10]. In attempting to calculate a net balance of energy demand, key factors include the mode, length and energy intensity of the commute; the ability of employers to manage desk-space flexibly; and the technologies and practices involved in heating and lighting the home space [13]. Whilst many empirical studies find net energy and emissions reductions associated with home working [10,12–14], considerable methodological difficul-

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ties and the highly contingent nature of the practice prevent generalisations about its benefits [15].

Several calls have been made in this journal for research which tries to understand the messy dynamics of energy demand within the home, seeking greater analytical depth than quantitative models permit [16,17]. Stern [18] points out that as actors in the energy system, householders have multiple roles, requiring a range of research approaches. Home workers span several of Stern's categories, as domestic consumers of energy, participants of institutions and as practitioners whose activities have implications for the wider energy system. Seeking to capture their hybrid practice, this paper develops an account based on ethnographic data, placing home working at the 'heart of enquiry' [19]. The three-element model of practice theory provides a theoretical framework for investigating elements of working from home and the role of energy [20,21]. The analysis also draws on discourses of affect to provide insights into the experiential nature of the practice [22–24]. This approach offers a number of valuable insights. First, it encourages an in-depth look at how constituent elements of practice circulate through repetitive performances to form and continually configure practice entities. Second, it expands the field of enquiry to account for the *interaction* between bundles of practices, highlighting the 'affectively satisfying' effects of incorporating 'dispersed practices' into home working [25]. This allows characteristic themes associated with working from home to be identified, providing insights into the energy consuming behaviours of home workers. These themes emerge through findings which describe achieving comfort when working from home, the exertion of control over material assemblages, and the performance of flexibility through the space-times of practice. Finally, these insights have ramifications for efforts to reduce demand and encourage demand-side flexibility: challenges for energy systems in transition throughout the world. In accordance with this expansive approach, this paper is guided by two broad research questions: 1) what are the characteristics of working from home as a practice? 2) what are the implications for energy demand?

The rest of the paper is structured in five parts. The next section describes the insights provided by practice theory as it has been applied in studies of energy consumption in the domestic setting. The concept of affect is introduced and links are drawn with a practice perspective. Section 3 outlines the methods used for this study and its analytical approach alongside a discussion of the challenges of researching practices. In Section 4, findings are structured according to characteristic themes which emerge from empirical data. The first part of the discussion in Section 5 develops insights from the theoretical approach employed, before outlining implications for energy systems and identifying possible areas for further research. The conclusion argues that practice theory and affect together offer a fruitful theoretical framework, with implications for researchers, employers and policy makers.

2. A practice theory perspective on working from home

Practice theory has its roots in philosophy [26], but has been widely adopted by sociologists [21] in seeking to understand how widespread, everyday practices are established and maintained. The practice perspective decentres the individual as the unit for social analysis [27], instead, developing a model of 'distributed agency' [28] which highlights the ways in which 'elements' such as meanings, materials, skills, technologies, rules and embodied knowledge configure everyday social practices [29,30]. With a shift in emphasis away from the individual as the principle agent of consumption [31], this theoretical framework has been widely applied within social scientific studies of energy demand [19,21,29]. Practice theory expands the field of enquiry beyond a narrow emphasis on individual choice, identifying the role of physical elements such as technology, materials and building design in mediating everyday energy-consuming practices [19,21]. It also encourages research into how social and cultural meanings and forms of embodied and intellectual knowledge are reproduced through everyday

activity. Practice theory has been widely employed in studies of energy consumption in the household, for example in efforts to understand quantitative observations regarding the diversity of energy demand patterns within even identical houses [29]. Empirical studies since the 'practice turn' have analysed elements of practice within the household including lighting [32]; the use of appliances, technologies and interfaces [33,34] and thermal comfort [29,35,36].

A small number of studies in energy research have examined workplace practices using practice theory, identifying insights into energy consumption by looking beyond the user as the unit of analysis. Garabau-Moussaoui [37] argues that building 'occupants' are constructed as actors within a 'technology script' by a combination of corporate, architectural and social logics, finding that an attention to practices helps to uncover the material, social and ideological elements of comfort in the workplace. Similarly, whereas studies of organisational energy demand conventionally focus on the corporate entity and individual users, Janda [38] argues for a 'building communities' approach, identifying the potential for change in energy management practices through a focus on social – rather than technical – potential. Also focusing on practices rather than organisational units, Powells et al. [39] find potential for active network management amongst SMEs. Despite its growing incidence and significance for energy demand however, no studies since the 'practice turn' have addressed the practice of working from home.

This paper builds on three theoretical constructs developed in the literature to guide analysis of empirical data. Firstly, it follows a number of recent publications adopting the 'three element model' as a means of clustering elements of practice [20,40]. Led by the work of Elizabeth Shove, this approach groups elements of practice into meanings, materials and competences. These categories assist with analysis of qualitative research findings, helping to uncover the complex characteristics of practice [20,21].

Secondly, it draws on Schatzki's account which describes the field of practice in two dimensions [41]. In the 'organisational dimension', the constellation of elements constitute the 'practice-as-entity': a relational network existing in the realm of potential. This constellation is 'integrated' through performance, which takes place in the 'activity dimension'. Practice entities become recursively reconfigured through repetitive performance, as new elements are recruited and others discarded. These two dimensions help to highlight how practices are influenced by spatial and temporal settings, as performances are conducted in different material environments and interwoven with other practices. This paper explores how the characteristics of working practices change as work is brought into the domestic setting. It follows a number of studies which have sought to identify the characteristics and changing dynamics of practice, for example in the development of digital photography [42]; the spread of Nordic walking [20], or everyday mobility [43].

A third theoretical construct used in this paper is Schatzki's distinction between *integrative* and *dispersed* practices [26]. Dispersed practices are small scale activities such as following rules [31], tinkering [36] or consuming energy through appliances' standby mode [33]. They can be conducted without context and incorporated into more complex social practices, taking on different meanings. Integrative practices are broader activities including business practices, shopping or cooking. In Schatzki's account [26], these practices have their own 'teleo-affective structure', which is to say they hold meaning and significance both for the performers of practice and in the wider social world. This distinction has been used effectively by Cass and Faulconbridge [43] to delve into the integrative practice of mobility, into which a variety of dispersed practices such as listening to music and navigating are incorporated. The authors argue that these purposive incorporations produce 'affective satisfaction' in otherwise mundane patterns of mobility, such as commuting. This paper applies this construct to the practice of working from home: an integrative practice increasingly performed, reproduced and reconfigured in millions of

homes throughout the world. Drawing on a sample of UK home workers, it focuses on the incorporation of the dispersed practices of achieving comfort, controlling material elements, and expressing flexibility. This bundling is shown to animate the practice of working from home, and produce affective satisfaction.

Cass and Faulconbridge's paper is one of relatively few in the energy research literature that directly seek to address the *affective* elements of practice. In studies of household consumption this is somewhat surprising, given the undeniable impact of building design and architecture on inhabitants' affective sensibilities. Affect is a concept with origins in psychology [44], but has been adopted and developed in the social sciences [23]. Geography has led the way in a discourse which also draws on non-representational theory in efforts to highlight 'the ways in which the world is emergent from a range of spatial processes whose power is not dependent upon their crossing a threshold of contemplative cognition' [45].

For studies of comfort in the home, Andersons' [24] account of 'affective atmospheres' provides rich theoretical insights, describing how affect emanates from the circulation of bodies and elements of the material environment. Vannini and Taggart's account of domestic warmth [46] draws on these principles to explore the precognitive, embodied characteristics of thermal comfort. The authors demonstrate how, in off-grid homes in Canada, active involvement with the material technologies of heating intensifies inhabitants' affective sensitivity towards thermal conditions in the home environment.

There are clear parallels between geographers' use of affect and the concept of distributed agency developed in ontological accounts of practice theory [28]. Just as practice theory decentres the individual from the focus of analysis, affective literature attends to the precognitive, embodied and transpersonal dimensions of experience [23]. This paper explores the synergies between both theoretical perspectives by attending to the affective dimensions of the practice of working from home, finding implications for energy demand. For example, it responds to Ellsworth-Krebs and colleagues' call in this journal for further empirical explorations of the links between home and comfort [17]. The next section sets out the methods used for investigating the practice of working from home, and discusses the challenges of conducting research on affect.

3. Methods

The empirical study was designed according to Bryman's 'steps in qualitative research' [47]. A mix of qualitative methods were used, including semi-structured interviews with 20 UK based home workers, conducted in January–June 2016. Participants were recruited from personal and professional networks and all worked in professional services in Oxfordshire, UK: 10 each in the public and private sectors. Seven were self-employed and another seven were responsible for managing at least one employee. Three participants identified home as their main place of work, with the remainder working from home for at least one day per week. All participants were usually alone when working from home, and where possible interviews were conducted in their homes. In some cases, meetings took place in cafés where participants would bring their work on home working days for a change of scene. Additional data was collected in the form of photographs and personal reflection on several years of regular home working. In placing the practice at the heart of enquiry, interviews focussed on the meanings, materials and competences involved in working from home, with questions about energy consumption woven into conversations about home, work, boundaries and work-life balance. Energy related questions focused on how home workers achieved comfort and used electrical appliances during their working day. Interviews were recorded and notes taken to draw out the main points from the discussion. Following the interviews, notes were added to by revisiting recordings and transcribing key passages. Data were compiled and analysed in a spreadsheet, where themes relating to the two

research questions began to emerge. Participants were recruited to the study until themes and even specific phrases began to recur, reaching what Bryman [47] refers to as 'theoretical saturation'. Respondent validation was then sought through additional interviews with a sub-sample of five participants, in which emergent themes associated with home working were discussed.

The aim of this methodology was not to establish a representative sample of home workers, nor to draw universal conclusions about energy consumption patterns in the home: the sample is both too small and non-random. Nonetheless, the sample focuses on geographies and sectors where home working is prevalent. The highest proportion of home workers in the UK work in professional services, and in 'affluent towns and cities and their rural hinterlands in Southern England' [9]. What follows is abductive analysis [48], informed by home workers' reflections on their practice, subsequent interpretation of their narratives and participation as a regular home worker. It follows Flyvberg's call for social scientific research to 'drop the fruitless efforts to emulate natural science's success in producing cumulative and predictive theory', and instead to 'contribute to society's practical rationality in elucidating where we are, where we want to go, and what is desirable' [49]. Such guidance is pertinent for the practice of working from home, given the optimism which it inspires in those aiming to reduce the environmental impact of working practices [8,50].

This paper explores the 'teleo-affective' structuring of working from home by analysing how the integrative practice incorporates other dispersed practices in multiple performances. However, seeking to account for affective dimensions of practice presents a methodological challenge, as the realm of affect is said to exist both prior to and beneath the 'sociolinguistic fixing' of conscious reflection [51]. The reliability of asking interviewees to linguistically reflect on aspects of their practice is a subject of debate, particularly in geography, where non-representational theory and affective approaches remain controversial in this strong empirical tradition [49,50, see also 40, and 51]. Adopters of non-representational theory have used a variety of alternative methods to access affective registers, including dance [45], images [55] and 'sensuous ethnography' [46]. Conversely, both Bonnington [56] and Hitchings [52] make compelling arguments for the role of reflexivity and the interview as a source of empirical data for research on practices. In one of his more recent works, Schatzki has sought to clarify the 'teleo-affective' dimension of practice, arguing that affective structures can be 'to varying degrees allied with normativized emotions and even moods' [57]. Although language and reflexivity cannot completely account for the affective dimensions of practice, these contributions from Hitchings, Bonnington and Schatzki indicate the value of personal narrative and observation as sources of research data.

Seeking to capture the affective sensibilities of home workers, this paper analyses interview data not as a source of objective insight, but as an artefact of narrative sensemaking carried out in a staged setting [48]. Sitting down for an hour and attempting to explain to a researcher the variety of meanings, materials and skills required to conduct one's work from home is surely an unusual experience. In seeking language, insights and narratives to reflect on their practice and the role of energy, interviewees are required to step outside the normal doings and sayings of the practice: a process which can both be illuminative and transformative for the 'carrier' of practice [27]. Interviews are therefore considered performative occurrences in which the researcher is crucial: in framing the discussion, interpreting meaning and representing results. Follow-up interviews also offered a sub-sample of participants a chance to reflect again on their practice and how it might have changed since the first interview, as well as on the nature of the interview process itself. How did they feel about describing the nature of this solitary, private practice, perhaps for the first time? Had their accounts surprised them at all? The findings that follow should be considered as products of participatory research, in which reflections on home working emerged through a process of collaborative discov-

Table 1
How the characteristic themes of working from home intersect with elements of practice.

	Comfort	Control	Flexibility
Meanings	<ul style="list-style-type: none"> • Linked with concept of home • Opposite to work environment • Creativity/unconventional means • Energy conservation 	<ul style="list-style-type: none"> • Alone vs shared environments • Waste, inefficiency • Others' expectations • Company policy/'Thermostat wars' 	<ul style="list-style-type: none"> • Break from routine • Freedom to choose work tasks • Frees time elsewhere • Blurred boundaries • Isolation • Household appliances • Weather • Bodily conduct e.g. chores
Materials	<ul style="list-style-type: none"> • Clothing and blankets • Bodies • Hot drinks, wood fires, wheat sacks • Unconventional materials e.g. pets • Daylight 	<ul style="list-style-type: none"> • Others' bodies • Thermostats, radiator controls, heating timers • Unconventional materials e.g. pets 	
Competences	<ul style="list-style-type: none"> • Using heating controls • Bodily movement • Heating single room vs whole house • Targeting warmth – fingers and toes 	<ul style="list-style-type: none"> • Know-how of managing heating and personal comfort • Intellectual knowledge of building fabric e.g. insulation, piping 	<ul style="list-style-type: none"> • Scheduling and sequencing • Self-management e.g. breaks • Delineating home and work • Employer energy management

ery. The analysis draws on Cass and Faulconbridge's [43] notion of 'affective satisfaction' as a means of capturing teleo-affective fulfilment expressed by home workers. In the data cited below, the identities of research participants are anonymised.

4. Characteristics of an integrative practice

Three themes emerge from interviews with home workers, based on incorporating dispersed practices into working from home. These are comfort, control and flexibility; themes which may be seen as characteristics of the teleo-affective structure of working from home. Each is presented in turn, including a summary of related literature and insights from empirical data. The meanings, materials and competences associated with these themes are discussed and summarised in Table 1.

4.1. Comfort

Thermal comfort is a subject of interest across disciplines, with this journal demonstrating the breadth of approaches even within social sciences, through publications applying psychological approaches [58], practice theory [36,59] actor-network theory [60], building models [61] and behaviour change theory [62] to studies of household heating and cooling. Beyond the social sciences, in literatures concerned with building design and energy engineering, comfort has become technically specified, as 'optimal' conditions are defined in relation to human physiology and embedded in building energy management [e.g. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE); 63]. In contrast to relatively fixed ideas of comfort, the notion of 'adaptive comfort' has been developed to highlight individuals' ability to achieve comfort in flexible ways by making psychological, physiological and behavioural adjustments [64,65]. Social scientists employing practice theory have expanded on technical and behavioural discourses on comfort, illustrating the variety of materials and technologies [30,36]; cultural norms [35]; forms of knowledge [29]; and power relations [66] involved in the everyday practices that formulate comfort.

How comfort relates to practices is an area for debate [67]. Can it be considered a practice itself, an element, or an outcome of other practices? The findings below and subsequent discussion consider it as an *attribute* of practice, emerging from the incorporation of dispersed practices in multiple performances. For working from home, these include tinkering with heating controls and materials in the home, as well as bodily movement and clothing.

All participants reported having high levels of control over the temperature when working from home, citing the unconstrained ability to adjust thermostats, radiator controls and timers in their own homes.

Despite this, 14 of 17 occasional home workers reported maintaining *lower* temperatures when working from home when compared with their normal place of work, while 17 of 20 also tolerated cooler temperatures when working at home compared with other times spent in their homes. When reflecting on this, some participants were surprised to realise this was something they did. Between the first and second interview for example, Peter had become increasingly aware of his tolerance of cold when working from home having put this into words for the first time previously. He had subsequently adjusted his practice to ensure he had all the clothing and materials he needed to prevent him becoming gradually – and imperceptibly – more uncomfortable. When attempting to explain their motivation for tolerating colder temperatures, the most common explanations cited a desire to conserve resources; not having to respond to the needs of others; staying alert for work and reducing environmental impact.

18 respondents reported using clothing and blankets to offset the need for heating when working from home, including Mick who wore 'big fluffy socks and a hoody' and Emma who found satisfaction wearing her 'leopard print onesie'. Materials such as hot-water bottles, hot drinks and microwaveable wheat sacks were utilized for comfort by several participants, whilst Anne was one of several interviewees who reported making use of bodily movement:

'My main cure is to move... I have a small little trampoline in the garden so if the going gets really rough I'll go out and bounce on that! Then it feels warmer when you come in. You know, I've never told anyone all these secrets!'

Home workers seemed to relish the opportunity to make use of materials, technologies and bodily movement in ways that would be inappropriate in workplace environments. Practising adaptive comfort presented an apparently satisfying challenge, requiring forms of embodied competence and a variety of materials in order to avoid the use of central heating.

Anne's revealing of 'secrets' is an example of how interviews provide a unique platform for reflections on practice, as well as highlighting the intimate nature of comfort practices in the home. While all interviewees conducted the same broad set of work tasks in both home and office environments, it was the incorporation of different dispersed practices into working practices which starkly delineated their practice in the two settings. In their workplace environments, Jade and Dorothy, two senior managers in a large organisation, spoke of the importance of projecting authority and how draining it could be to 'push certain agendas'. Clothing, the use of language and the embodiment of authority through physical competences such as posture are all important in these environments. For Dorothy, home working offered the opportunity to 'reconcile'

herself in a 'safe and cosy' environment. Like Anne, Jade revealed the private nature of her practice with a show of vulnerability, admitting 'I might get back into bed if it's really cold... please say I'm not the only one who's said that!'

These illustrations of dispersed practices show that affective sensibilities are central to the experience of home working, and that the notion of comfort was constituted by more than a physiological response to thermal conditions. Isabelle, for example described how 'light... in some way it sort of compensates [for heat]. Looking out over beautiful views... part of being warm is about a feeling of well-being'. This quotation may be considered a 'non-rational' account of affective experience. One might typically think of warmth or comfort as a prerequisite for well-being, but put the other way around, Isabelle reveals that the word warmth holds significance for her beyond physiological sensation. Her account was mirrored by other interviewees who had trouble finding words to describe how the concepts of home and comfort were linked. When asked about the meanings of home, more than half of the participants used words like 'comfy', 'cosy' and 'comfort', however, long pauses, expressions of contemplation and sometimes even discomfort were evident when attempting to elaborate on this relationship.

If we understand working from home as a particular iteration of wider working practice, then it becomes clear that its distinctive characteristics emerge from the incorporation of dispersed practices in the activity dimension. Affective satisfaction is generated through the creative use of materials such as clothing, mugs of tea and hot water bottles, movement and avoiding the use of central heating, incorporated into the performance of home working. The next section describes how a sense of control is a central characteristic of working from home, and how the process of incorporating dispersed practices can itself bring about affective satisfaction.

4.2. Control

In research on adaptive comfort, personal control has been shown to increase tolerance of a wider range of thermal conditions [68]. The corollary of this is that energy savings could be made through the provision of greater personal environmental controls in workplaces [69]. All but one participant reported having greater control over thermal conditions when working from home as opposed to workplace environments. This was both due to having better access to technologies such as thermostats and radiators in the home, as well as being unconstrained by the perception of others' needs for comfort when cohabiting space. In some cases respondents reported colleagues actively expressing discomfort, while others cited co-workers' needs based on gender, body-mass-index or ethnicity:

'Sharing with three women, they like it on full tilt.' (James)

'Some of those guys, they're really big... they're actively really hot... you can tell they are.' (Dorothy)

'We have an Italian contingent that have been known to wear their coats full time.' (Michael)

Temperature was reported as a common source of tension in shared environments. Josh indicated that this had been a topic of much debate at his workplace, where 'no one seems to agree on anything about heat', leading to senior management intervening on the use of thermostats: 'the policy is we don't touch them'. In Michael's ethnically diverse workplace, culturally mediated notions of comfort had led to 'thermostat wars'. In all but one case, days spent working from home offered participants a rare opportunity for controlling the temperature of their working environment.

Whereas most interviewees usually worked from home alone and tolerated lower temperatures when doing so, several cited the occasions when family members or housemates were home as times when they might put the central heating on. Rita's account corroborated the notion

of 'social loading' [70]:

'If I'm alone in the house, I try to avoid turning on the main heat, just because... I'm alone. But if my housemate is going to stay at home then I'll probably turn on the heat.'

The question 'to what extent do you have control over the temperature when working from home', prompted some surprising responses. Describing the means of control, technologies such as thermostats, programmable timers and radiator valves were cited as key elements of this dispersed practice. However, more surprisingly around half of the sample responded to this question by choosing to talk about waste and inefficiency:

'It's a very old Victorian terrace, so it's probably leakier than it should be.' (Anne)

'Bizarrely, even though it's quite a new flat, it's not particularly good at saving heat... the windows... even though its double glazing, it's not great double glazing, and you get a bit of a draft under the door.' (James)

'There must have been about 15 metres of copper piping... it was immense, just piping everywhere.' (Dorothy)

It is clear from these responses that the inefficiency of building materials and meanings of waste were intertwined with home workers' perceptions of temperature control.

Different forms of competence were reported as elements of the dispersed practices of comfort, including forms of intellectual knowledge and embodied know-how [33]. Dorothy for example, took a real interest in the technologies of her domestic heating system and had recently upgraded her boiler:

'Now I feel like I have a lot [of control] because I spent a lot of time training up on heating systems.' (Dorothy)

It is clear that Dorothy's sense of control is made up of more than an ability to set the temperature in her home, but encapsulates a sense of intellectual and affective satisfaction gained from the learning process, getting to know the materials and technologies in her home. As well as the *intellectual* knowledge described by Dorothy, interviewees recruited material objects using forms of *know-how* that Royston terms 'tinkering' and 'bricolage' [36].

'You can tweak a Labrador [to warm your feet]' (Isabelle)

'I notice that I get cold fingers, so I find myself going downstairs for a hot drink literally to warm up my cold fingers again... its more targeted'. (Peter)

Isabelle and Peter's descriptions of targeted comfort were accompanied by a visible sense of glee relating to their inventive means. As was Liza's description of working on the floor in front of the fire, using its periodic demand for new logs as moments for reflecting on her work and refocusing. During a tour of their homes, Emma and Martha showed pride in having created homely, brightly decorated home-offices, choosing the location of their desk to maximise passive solar gain. These examples illustrate the distribution of agency in practice, shared between bodies, materials and influenced by the logics of fire or the weather. As a form of dispersed practice, tinkering with the material assemblages of the home space to establish comfort brought about affective satisfaction.

The perception of ownership was important for some participants in producing affective satisfaction, giving homeowners like Nathan the power and freedom to curate their environment:

'I've upgraded it slowly over the years. So I've got central heating, I've got double glazing, (I could do with more insulation), but all of that allows me to control it, and makes working from home a more realistic option. I would feel a lot less comfortable if I was sharing. It would be like *perching*. Whereas I feel like this is a workspace where

I'm in control of it. The energy side is part of that... part of my broader personal situation.'

It is clear from the examples above that control is a key characteristic of working from home, associated with positive affective sensibilities, and as Nathan says, bound up with the consumption of energy. Focusing on the incorporation of dispersed practices relating to heating, these findings show that thermal conditions are not solely responsible for producing affective satisfaction. Instead, recruiting materials, reducing waste, performing know-how, expanding one's knowledge and upgrading one's own home are expressions of control which can bring satisfaction and even glee. It is the *processes* of incorporating dispersed practices into home working such as interacting with pets, making hot drinks or even getting back into bed, which give character and affective satisfaction to the practice.

4.3. Flexibility

Flexibility is a concept gaining increasing attention in studies of energy demand and social practices, in response to challenges raised by the need to decarbonise the electricity grid. In future scenarios where thermal power plants are replaced by large amounts of intermittent renewables, peak demand is predicted to become a significant challenge, requiring flexibility in various forms on both the supply and demand sides of the system [71]. It is unclear to what extent domestic users of electricity will offer flexibility as a service to the wider system, or what the mechanisms for achieving this might be [72]. However, a prerequisite to developing policies to shift domestic demand is an understanding of flexibility in everyday life [73–75].

Every home worker interviewed expressed satisfaction with the flexibility afforded to them in their practice. As we have seen so far for comfort and control, one form of flexibility relates to the ability to *selectively* incorporate dispersed practices and their constituent elements in the performance of integrative practices. However, there are many forms of flexibility [76]. A practice can take on the attribute of flexibility for example, when it affords the opportunity to be performed in different spatial settings, or interwoven with the sequencing and scheduling of other practices [73]. Enabled by computer technology and the internet, company policy and forms of self-discipline, this section explores the spatial and temporal dimensions of flexibility reported by home workers.

Many respondents described their motivations for working from home in the context of having a break from routine. For example, several managers cited the demands of always being available and interruptible, or tied up in meetings with little time for themselves:

'In the office, everybody wants a piece of me... Working from home is my sanity time.' (Jade)

Home working provides the opportunity to be flexible with participants' time and focus, for instance by changing normal working hours. My sample of home workers would often start later, take a longer lunch break and work into the evening:

'I might have a break and assemble the dinner at half past 4 or 5, then put it in the oven and go back and do some work.' (Isabelle)

These forms of flexibility were described alongside reports of blurred boundaries between domestic and working practices with both positive and negative implications. On the one hand, conducting household chores during the working day afforded home workers more time in evenings and on weekends for other activities, while on the other, many struggled to manage the transition from *doing* work to *being* at home. Managing this divide was reported by many interviewees as a challenge requiring self-discipline. This often took the form of symbolic acts like Dorothy's ritual of shutting the laptop and putting it away in her work bag as a way to demarcate work practices from home. Mick felt it was 'unhealthy' to work at the kitchen table, instead using a spare

bedroom to which he was able to shut the door at the end of the working day. Simon even had a sign on his spare room saying 'work', and resisted entering outside of his self-allocated working hours. For many, the challenge was in managing the relationship with computing devices which encroached on 'home time', particularly if they were used for both work and social activities. Jade for example felt it was important to remind herself that 'we operate technology, it doesn't operate us'. While flexibility was overwhelmingly described in positive terms, these examples indicate some of the tensions associated with bringing work into the home environment, highlighting the importance of self-discipline as a form of competence.

All 20 respondents described interweaving household chores with desk-based work, citing laundry in particular. Loading the washing machine, dryer, or hanging out washing were tasks well-suited to break-times, sometimes acting as prompts for taking a pause.

'There's usually a day [in the 3 days per week working from home] ... where the weather is going to be pretty reasonable... so I would actually go with the weather...it's a bit of a break from sitting in front of the computer.' (Rupert)

Living alone in a small flat, Josh uses his home-working day to do the laundry, but finds the washing machine to be distractingly noisy, so typically takes his work to a café for a couple of hours before coming back and hanging up his wet clothes. The examples from Rupert and Josh highlight how flexibility is not simply the ability of the individual to dictate the circumstances of practice, but that sequencing of bundles of practice can be influenced by appliances, the 'needs' of the house and the weather. They demonstrate the agentive role of material assemblages in giving shape to practices, issuing their own demands for a range of competences, including coordinating schedules and interweaving practices.

Three kinds of flexibility emerge from these findings. The first involves the ability to *incorporate different dispersed practices* into home working, for instance those practices involved in adaptive comfort: targeting warmth, tinkering with materials and conserving energy. In this form of flexibility, different materials, meanings and competences are mobilised in each incorporative practice-as-performance. Second, flexibility is manifest for home workers in having the freedom to *choose when and where to work*. Home workers are able to transcend the logic of institutional rhythms [74], for instance getting back into bed with a laptop, going to a café, or working into the evening. Finally, flexibility can be seen in the ability to *coordinate daily schedules involving multiple integrative practices*, for example interweaving work with household chores. Each of these forms of flexibility bring affective satisfaction for home workers.

4.4. One-sided flexibility?

For interviewees who had another regular place of work, over 75% reported that their desk would be unoccupied – but heated and lit – when they were working from home. In these circumstances, the energy used for heating and lighting when home working constitute *additional* consumption. Only one employer was identified as mitigating this effect by providing a flexible 'hot-desking' arrangement, allowing them to downsize and cut leasing costs. The solution in this case was reported with dissatisfaction, as Jade said that the result was a cramped working environment. She also cited the requirement to carefully coordinate the schedules of flexible workers, which was not always done successfully, often requiring her to give up her home working day to attend meetings. While hot desking has clear energy reduction potential, its affective implications are under-researched.

This study shows that for the employer, the benefits of flexibility often go unrealised, or present management challenges when energy and cost savings are made. For most interviewees, flexibility was seen as a benefit *provided* by employers, enabling workers to avoid a stressful commute, or even to compensate for uncompetitive pay. Although

flexibility was largely described positively, one participant described the problem of feeling isolated and disconnected from colleagues due to home working. These affective impacts are explored extensively in organisational and psychological literature [77], and have implications for the uptake and sustainability of the practice.

Table 1 collates the various elements of practice identified from this qualitative analysis, grouping them into the three characteristic themes. Energy is implicated in each performance of practice as elements are integrated.

5. Discussion

Using theoretical tools offered by practice theory, key characteristic themes associated with the teleo-affective structure of working from home have so far been identified, each of which provide affective satisfaction for practitioners. The findings presented above demonstrate *how* these characteristics are generated in practice, through mechanisms such as incorporating dispersed practices, selecting elements and spatial settings, and interweaving performances into temporal sequences. But what is the *value* of identifying affective satisfaction in practices, and what does all this mean for energy demand? This discussion tackles these questions in turn, first making four assertions about the value of attending to affect in practices, before exploring implications for contemporary challenges faced by energy systems.

5.1. Insights from an affective perspective

Cultural conventions of comfort have been widely discussed in energy literatures, expanding discourse beyond technical and physiological specifications. However, in discussions of comfort and energy consumption in buildings, the affective dimensions of practice have rarely been analysed in depth [46]. The first assertion builds on affective literature developed in geography, framing comfort as an *affective capacity* [23]. Understood this way, comfort becomes more than a physiological or even psychological state; an ‘atmospheric attunement’ [78], produced by the coming together of human and non-human elements in the always-emerging, enveloping ‘affective atmosphere’ of the home [24]. This theoretical framing holds that comfort is a *relational* capacity, flowing and radiating from the interactions of materials, memories, smells, doings and sayings associated with the home [23,28]. Data in this study has shown how, by (1) curating elements, (2) interweaving practices and (3) incorporating dispersed practices into working from home, these relations can be orchestrated by practitioners to produce affective satisfaction.

A second assertion is that an attention to affective sensibilities provides insight into the apparently ‘non-rational’ behaviours of home workers in relation to energy consumption. Avoiding the use of central heating and achieving comfort by creative means appear to be valuable activities for home workers, carried out to produce affective satisfaction and to define the teleo-affective characteristics of their practice. As such, affect offers a theoretical complement to efforts made by energy researchers using practice theory to move beyond the notion of demand being a result of individual attitudes, behaviour and choice [79].

The third assertion relates to the conduct of research on affective dimensions of practice. If affective satisfaction emanates from the integration of elements in particular spatiotemporal settings [24], then care must be taken in seeking to capture affective sensibilities in the course of interviews. This study has taken heed of discussions on the methodological challenges of researching affect [52,53] by considering the staging of interviews as potentially transformative events in the lives of practice. Evidence for this was found in examples of home workers being surprised by aspects of their own accounts, and making adjustments following our first conversations. Emma, for example, is a regular home worker and part time singer. Her band often experiments with the process of song-writing, with Emma improvising lyrics over backing music. During one such exercise carried out between our first

and second interviews, Emma found herself singing about meanings of home and comfort. Having completed the song, she was certain that our discussion two months previous about work, home, comfort and self-management had infiltrated her unconscious, playing out in this affective experiment.

Fourthly, putting affect in the analytical scope, researchers are encouraged to identify the *mechanisms* by which affective sensations are generated. This in turn can help to uncover broader characteristics of practices. Widespread, integrative practices such as work take on different attributes as they are performed in distinct spatiotemporal settings, enrol unique bundles of elements and incorporate dispersed practices. In the case of working from home, comfort, control and flexibility are attributes which help home workers to distinguish the practice from other performances of work, such as those contained in structured, ‘thermally monotonous’ office environments [66]. Understanding how these attributes become established and the role of energy in the process may even help to identify possibilities for steering future configurations of practice towards lower energy consumption [50]. The next section discusses the implications of this range of insights for energy systems challenges.

5.2. Implications for energy systems challenges

Five implications for the challenges faced by the energy system arise from this paper. These relate to the policy objectives of reducing energy consumption in domestic and commercial buildings and encouraging temporal demand shifting.

Firstly, the sample of home workers overwhelmingly reported a tendency to tolerate lower temperatures when working from home compared with office environments or at other times in the home. Data highlighted that home workers were actively willing to achieve comfort in creative ways, experiencing affective satisfaction in differentiating their practice from office based work. While adaptive means of achieving comfort represent a potential source of energy reduction, these creative practices are often invisible to academics and policy makers; not being captured in energy models for example. Not only does this lack of information make policy design challenging, there are undoubtedly further difficulties to be encountered when thinking through the kinds of measures that might be involved to stimulate adaptive comfort practices. Despite the prevalent use of materials such as hot water bottles and thermal clothing in achieving comfort when home working, policy makers are likely to be wary of commissioning campaigns to encourage their use [see [80] for a recent example]. Nonetheless, further research verifying these adaptive comfort findings would help to build the case for a more expansive policy paradigm, ‘more in proportion with the challenges faced’ [50].

A further challenge is that despite evidence of adaptive comfort practices being incorporated into home working, these only bring about net demand reductions if paralleled with flexible energy management practices undertaken by employers. This leads to a second practical implication: the need for employers to develop the capacity to respond to variable occupancy in buildings with flexible heating, lighting and ventilation controls, in order to prevent unnecessary energy services being provided to unoccupied workspaces. Organisational policies are also required to support coordinated schedules and the deployment of technologies such as motion sensors and high quality videoconferencing services. In this sample, only one large public sector employer had implemented these practices. Smaller businesses and those leasing space are likely to face greater difficulty in developing this capacity for flexibility [81].

Thirdly, evidence from interviews suggested that some home workers valued their days spent at home partly due to the avoidance of a lengthy commute. Quantitative studies have shown that this can lead to significant energy savings. However, where this benefit is incorporated into long term decisions such as where to live, the ‘rebound’ effect can further serve to offset any positive energy reductions associated with

home working [82]. Targeting employee commuting could be an effective way to reduce environmental impacts associated with working practices, but can be problematic. Carbon footprinting protocols for corporations and public bodies typically exclude commuting from core calculations [83], while many employers would consider this outside the scope of their responsibility. Given that the net energy consumption of working from home pivots on the commute [8], there is a strong case for accounting for its length and carbon intensity when negotiating telecommuting arrangements. Exploring the possibilities and pitfalls of tackling employees' commutes is an area that warrants further empirical study [see for example 84].

A fourth implication arising from this paper relates to the design of 'smart' household energy systems. This sample of UK home workers all had central heating systems with a condensing gas boiler and individually controllable radiators in each room. However only two respondents would bother to turn down radiators in other rooms when home working, with the remainder preferring to control the heating for the house as a whole, and a majority actively conserving energy by keeping it turned off. The additional effort required to isolate radiators may have encouraged adaptive comfort practices and contributed to the conservation of energy. In coming years, as 'smart' heating systems deployed in domestic buildings allow occupants to control individual radiators with internet-connected devices, there is potential for *increased* energy consumption [85]. It is the responsibility of social scientists to highlight these contingencies of practice and, as seen in the case of the UK's smart electricity meter rollout, to draw the 'non-rational' tendencies of householders to the attention of policy makers [86].

Finally, the ability and willingness of householders to adapt to signals to shift their consumption over time has economic and environmental implications for the electricity system [71]. Working from home represents an opportunity to use energy more flexibly, as the ability to shift demand in the domestic setting has unsurprisingly been shown to be correlated with occupancy [87]. Moreover, this paper has demonstrated that flexibility is a characteristic theme of the practice of home working which is often performed in relation to the use of energy consuming appliances such as washing machines, dishwashers and cookers. Demand shifting is *already* undertaken in performances of home working, producing affective satisfaction and performatively delineating home working from 'normal' work and home activities. Whereas Friis and Haunstrup-Christensen [74] have highlighted how time shifting of energy demand can 'challenge the temporality of households' routinised everyday practices', this finding highlights the possibility of harmonising demand-response with naturally-occurring flexibility. Targeting home workers with demand response policies may therefore be a fruitful enterprise for electricity suppliers and grid operators, and warrants empirical research.

6. Conclusions

Despite the steady growth in working from home across developed countries, the practice has been under-researched within social scientific energy research since the 'practice turn'. Most research concerned with energy and home working has focussed on the difficult calculation of net consumption and associated emissions, finding myriad contingent variables. This paper has explicitly drawn on practice theory, using theoretical constructs to aid analysis of ethnographic data. By investigating the meanings, materials and competences associated with home working, and the mechanisms by which the constellation of these elements are configured, characteristics of the practice have been uncovered, with significance for energy consumption and the wider energy system.

This is one of few studies to incorporate the notion of affect into practice-based analyses of energy demand, attending to the experiential dimensions of performance [43,46]. The analysis benefited from this approach in helping to deepen understandings of comfort, and explain

'non-rational behaviours'. Attending to affect necessitates methodological judiciousness, demanding close appreciation of the emergent nature of interview data and the processes of narrative sensemaking. This theoretical approach also highlights the mechanisms by which affect is produced, through the coordination and interweaving of practices for example, which in turn help to uncover the dynamics of practice and identify potential avenues for change.

In combining ideas from practice theory and discourses of affect, this paper demonstrates the synergies between these conceptual frameworks. This theoretical synthesis has helped to identify three characteristic themes associated with working from home. Comfort, control and flexibility help to construct the practice as a distinct ontological entity, helping to demarcate home working from other forms of work. By analysing these, energy was found to be integral to the practice, being consumed and conserved as home workers tinker with the technologies and materials of their environment, or interweave the use of appliances such as washing machines with stretches of desk-based work. These findings challenge the idea that convenience trumps energy conservation, or that demand shifting necessarily comes at a cost to householders. With implications for contemporary energy system challenges, these insights cannot be captured by models of household energy consumption, rational economic decision-making or by standardized definitions of comfort.

Working from home has potential to bring about net energy and emissions savings, and is often referred to with optimism in academic and grey literature concerned with sustainable business practice. Aspects of practitioners' performances of home working appliances are crucial in determining the balance of energy consumption. Home workers' tolerance of lower temperatures, the degree of mobility 'rebound' and the incorporation of dispersed practices are key determinants of demand; as is the ability of employers to alter energy management practices. By identifying the nuances of practice which may help to realise this potential, social scientific studies such as this can offer insights to those in a position to steer future configurations of practice, such as policy makers, regulators and employers.

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