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Abstract

This paper complements the concept of embedded security by proposing disembedded security to capture consumers' energy practices when travelling across multiple domains of energy accessibility. Consumer mobility outside the home produces misalignments between infrastructure and portable technology experienced as 'hysteresis of the battery'. Hysteresis captures how respondents are subject to unpleasant unpredictability' about battery-based technology and infrastructure, which spurs hermeneutic reflection about energy, location, and sociality. Multi-domain energy practices therefore bring energy consumers to 're-embed' or create a sense of psychological comfort on the move. Charge levels on battery icons not only structure daily patterns of consumer life through planning efforts but become interpretively entangled in issues of duration, distance and sociality as energy demands in portable technology push consumers to avoid disruption.

> I am cautious with energy, but I am not actively monitoring it. (Penelope).

> I've got chargers here. I've got chargers at home. Portable chargers. I've got the lot. So, the only time I really panic is when the battery gets low and I am out on the city. (Penelope)

Introduction

Penelope provides conflicting statements about her energy practices. She insists on not getting involved with infrastructure, while also describing her life as permeated by urgent actions to manage energy. We suggest context explains this paradox (Askegaard and Linnet 2011). Some energy practices are 'embedded' in the home, which gives rise to 'smooth' routines and tacit understanding (Phipps and Ozanne 2017). However, Penelope is also subject to a 'mobility burden' (Shove and Walker 2010: 473) and lives in "a world without wires" (Greengard 2015: 79) where technologies are portable across multiple domains. Energy access becomes intermittent in such "disembedded" mobile circumstances (Giddens 2013, 79). We therefore ask: how does the difference between embedded and disembedded contexts shape consumers' energy practices?

Phenomenological experience of relations between technology and infrastructure have been described as 'fuzzy' (Stephenson et al. 2010). However, drawing on Giddens' (1986) concept of ontological security, which captures consumers' deep-seated assumptions about the predictability of contexts, Phipps and Ozanne (2017, 367) offer some clarity. They propose a sequence of ontological states that structure relations between consumers and infrastructure: 1) a stable bubble of inattention; 2) episodic disruption; 3) practices come apart; 4) reflexive reaction; and 5) return to equilibrium. However, Phipps and Ozanne show

not all relations to infrastructure are predictable. Urban mobility results in what Giddens terms an awareness of "misalignments" (Giddens 1979: 40). We propose that mobility gives rise to a sense of hysteresis, or an 'unpleasant unpredictability' at the micro level about specific technologies and energy resources (Bourdieu 1990b: 62), which in turn, spurs "hermeneutic reflection" on practices in relation to material and social contexts (Bourdieu 1977: 21). We explore hysteresis and hermeneutic reflection relative to background tacit knowledge through Bourdieu's practice theory.

We show that energy gauges on portable technology (e.g. battery icons in phones) are a key to energy hysteresis. Through "hermeneutic reflection" on the battery charge in portable technology and information about accessibility of infrastructure outlets in the city, consumers adapt practices (Bourdieu 1990a: 99) in order to 're-embed' or 'pin down' infrastructure, technology and social relations (Giddens 2013:79). The aim of these practices is to attain 'psychological comfort' in vulnerable circumstances (Giddens 2013: 155). However, rather than a return to equilibrium as in Phipps and Ozanne's (2017), single domain context we see energy consumption through portable technology as leading to a system of contingency planning that anticipates disequilibrium (see figure 1).

The literature review positions our work relative to previous discussions of technology and energy. In the methodology, we propose a sample of middle-class London commuters among whom use of portable energy-using technologies is ubiquitous. The analysis proposes that a sequence of practices structure multi-domain energy consumption that complement Phipps and Ozanne (2017). Our discussion links analysis to theory and proposes future research.

--Insert figure 1 about here—

Literature Review

Technology and Energy

Energy is consumed through technology, which would cease to function without it (Strauss, Rupp, and Love 2016). However, definitions and considerations of consumer technology often do not address technology as part of the materiality of energy. Mick and Fournier employ Joerges' definition of technology and note that it refers to 'artificial things' and specifically 'modern machines' (1998: 124). However, the definition is silent about the energy required to power technology. Tulloch and Lupton (2002) define technology as material 'artefacts', but do not address how energy activates it. Kozinets gives the most comprehensive definition of technology in CCT, defining it as 'systems of complex machines' but also issues of "science, advanced technique, and mechanistic precision being built into products and services" (2008: 865). However, this definition also omits the energy that propels it. A later paper on technology obscures the material relationship to energy in defining energy not as physical power, but as a psychological force, where desire is the energy that powers the libidinal economy of technology (Kozinets et al. 2016). Consequently, our focus is the material relationships between energy and technology.

Lately consumer literature (Hoffman et al. 2018) has shifted focus from single machines to complex, horizontal material configurations of artefacts drawing on Actor Network Theory (ANT) (Latour 2005). However, since Latour is silent on the role of energy and infrastructure to activate networks (Michael 2016), Law and Hassard point out that: "What is interesting are matters, questions, and issues arising out of, or in relation to, actor-network and the various approaches to thinking materiality, ordering, distribution and hierarchy with which it interacts" (1999: 6). Working solely through horizontal 'democratic' material configurations can therefore obscure vertical relationships that materiality may incorporate through energy infrastructure (Bryant 2011). It is therefore not surprising when

scholars periodically complain that theoretical understanding relating technology to energy is 'oversimplified' (Wilhite et al. 2000: 109). More knowledge is therefore needed about the role of energy infrastructure as a context for technology consumption, to which we make a modest contribution.

Energy Structures and Technology

The macro context of energy refers to infrastructures and markets exogeneous to consumer practice, which is often described as producing a 'global commons effect' (Bergh and Bruinsma 2008: 178). The macro approach focuses on institutions and structures, while de-emphasizing energy at the level of individual consumers (McDonagh & Prothero 2014: 1199). Proponents even claim that micro-managerial approaches to inducing more sustainable consumption are ill-advised as consumers are said to have "no clearly planned, measured and accountable system to monitor energy" (Connolly and Prothero 2008: 129). However, some studies do address end consumers of energy.

Kilbourne et al. (2017: 59) argue that consequences are felt at the individual level. While causes and causality are located at the macro level this paper merely posits an "assumption" that there is a vertical influence through social interaction within the institutional configuration. Likewise, Shove documents the re-ordering of temporal rhythms among consumers through infrastructure in the UK between 1937 and 2000, identifying the underlying causes of behavioural changes in macro-societal processes that mainly concern fixed institutional events (Shove, Trentmann, and Wilk 2009). Elsewhere Shove insists that what counts is the big, and in some cases, global swing of ordinary, routinized and taken-for-granted practice (Shove et al. 2012). However, designers do actually 'embed' human values into infrastructure at various scales to provide access (Austin 2014). Infrastructure therefore has an 'ergonomic' component which allows users to tap energy for their technology through

sockets at various locations (Geertman et al. 2015). Strauss et al. (2016: 21) therefore argue that theoretical insight will derive from understanding variation in how specific horizontal domains of technology practices connect with vertical energy infrastructure. Our study of consumers' energy practices in mobility adopts this perspective.

Domains, Misalignment, Re-embedding

Phipps and Ozanne's study of 'embedded security' (2017) provides a detailed examination of how consumers experience relationships between technology and infrastructure. Drawing on Giddens' concept of ontological security (Giddens 1986), which captures consumers' deep-seated assumptions about the predictability of contexts, Phipps and Ozanne (2017) argue that energy routines in the home are mostly tacit, being embedded in 'obdurate' materiality. 'Obdurate' captures how durable, fixed, and unalterable material infrastructures in the home shape practices. Practical understanding of infrastructure when using cookers or outlets is therefore based in tacit, embodied knowledge where routines are not fully revealed until disrupted. When a storm brings down electrical lines, the user must suddenly initiate adaptive responses (2017: 361). Force majeure situations therefore impinge on a single domain of use and inspire conscious, ad hoc reactions according to an elegant ontological sequence: 1) bubble of inattention, 2) disruption, 3) practices come apart, 4) self-conscious reaction, and 5) return to normalcy with new knowledge (2017: 367).

Practice theory defines domains as spatial 'regionalizations' that appear through demarcation (Bourdieu 1977: 16). The home is one such regionalization. Homes are therefore: "A particular class of material conditions of existence," that "generates determinate dispositions" that remain tacit unless disrupted (Bourdieu 1979: vii). However, portable, battery-based technology moves with the consumer across multiple domains. Many urban consumers are therefore regularly 'disembedded' or lifted out of local contexts, which

"disengages some basic forms of trust" as they navigate the city (Giddens 2013: 108). Consumers must therefore often renegotiate practices and rethink their access to energy infrastructure to maintain portable technology's functionality when on the go (Pistoia 2008).

According to Woerman and Rokka (2015: 1499) 'alignment' with a domain is where no element "sticks out," while misalignment demands attention, since it is experienced as "harming proper performance." This paper follows Bourdieu by defining misalignment as a relationship between habitus and field in mobility. In practice theory, misalignment between habitus and field is termed 'hysteresis' (Bourdieu and Passeron 1979). Hysteresis 'sticks out,' and is experienced as unpleasant unpredictability about how things relate, inspiring explicit reflection and intervention. As Bourdieu notes: "practices are always liable to incur negative sanctions when the environment with which they are actually confronted is too distant from that to which they are objectively fitted," in this case when the habitus established for the home encounters the various domains of the city (Bourdieu 1990b: 62). During mobility, consumers therefore: "emerge from the silence of ritual practice [about infrastructure], which does not aim to be interpreted, and they place themselves within a hermeneutic logic" (Bourdieu 1990a: 99). This hermeneutic logic draws energy consumption in the portable technology into a specific consideration of geographical, infrastructural accessibility on the go. This entangles energy practices for portable devices in what Shove and Walker term the 'mobility burden' since consumers must move to charge their devices. Portable technology is therefore entangled in the "Where, when and how a particular instance of movement happens (or doesn't), is wrapped up in the sociotechnical fabric of means, modes and timings of potential movement" (Shove and Walker 2010: 473).

We see the interpretation of energy gauges such as battery icons on mobile phones, laptops, or headphones as providing a contextual framework for Londoners mobility burden and potentially those moving across similar urban landscapes. In other words, practical

understanding that shapes engagement with multiple domains of energy can be discursive and explored as "cultural meaning", understood as "a dialogical process in which individuals are continuously engaged in an interpretive dialogue" (Thompson and Haytko 1997: 38). In exploring how urban mobility shapes consumers' energy practices, we discuss 'disembedding,' 'reembedding' (Giddens 1986), and the role of hysteresis and associated interpretive reflection. Reembedding captures a range of explicit reactions to attain 'psychological comfort' under vulnerable circumstances (Giddens 2013, 155), since it is a "recasting of disembedded social and infrastructural relations so as to pin them down (however partially or transitorily)" (Giddens 2013: 79). However, rather than a return to normalcy as in Phipps and Ozanne we see energy consumption through portable technology as leading to a system of contingency planning (see figure 1). In practice theory terms 'contingency planning' reveals "when the ordinary parameters of reference cannot deal with circumstances… deeper schemas have to be mobilized to cope" (Descola 2013: 109).

Methods

Research Context and Sampling

Jones et al. (2016) report that London commuting durations are considerably higher than the British national average. Indeed, London has the highest volumes of commuters and longest commuting times in Europe (Eurostat 2016). It is therefore not surprising that the London commuter has been termed 'a tragic hero': "Long-suffering, long-journeying and subject to lengthy delays, he survives through an iron will" (Moss 2013: 1). Patterns of commuting not only shape public culture (Cunningham and Barber 2007), but also individual engagements with the home and domestic life. Commuting times are for instance inversely related to time spent on domestic and household activities (Jones et al. 2016). Consequently, commuters in London and similar cities are likely to find themselves subject to demands in

transit that cut across multiple domains (Turner and Niemeier 1997). Coincidently, the first author's move to London in 2016 began a daily commute between Watford and Central London involving Overground and Underground trains which precipitated initial entry into the field. This added up to at least 2hrs 40min in transit every day. At the same time, this experience inspired reflection on the relationship between context and energy management practices. Informal discussion with co-commuters about charging patterns and energy consumption led to formal interviews. We sampled 22 Londoners, aged 23 to 57 who daily spend between 60- and 180-minutes commuting.

It should be noted that these are privileged, urban, middle class, white collar workers in London. This context (Arnould et al. 2006) is theoretically important as this profile is growing worldwide. Still, there are significant "variations in patterns of energy use across income classes" (Sovacool 2010: 199). Upper class Brits for instance engage in more extravagant energy practices such as frequent flying and possess more consumer technologies and more energy demanding homes, while the many homeless and poor people in London experience unique challenges of low energy lives, which lead to budgeting behaviours. Similarly, British rural populations engage in distinct energy practices from differences in built environment, geographical location, and types of work (Carroll 2014). Finally, our sample is distinct from other contexts, where geography, climate, cultures and economic development lead to variability in energy practices as already suggested by (Strauss et al. 2016). Car-centric lifestyles in Los Angeles for instance lead to energy practices different from the nomadic Bede river people of Bangladesh.

Data Collection

Respondents took part in 60 – 90-minute in-depth, semi-structured interviews between January and April 2017. Roughly 2/3 of the respondents participated in a follow up

interview lasting about 20-30 min in May 2017. Question design captured single and multiple domain practices towards energy infrastructure (House et al. 1995). Interviews aimed at: "engaging in a dialogue through questions and responses that encourage the researcher and co-inquirer to reflect together on the concepts that are emerging and taking shape within the interview" (Roulston 2010: 18). Seven structuring questions with 3 to 5 probes each made up the interview guide: 1) What kinds of energy do you use in daily life? 2) Where does your energy come from? 3) How would you define sustainability? 4) Tell me about your energy use to get around? 5) How often do you look at an energy gauge or meter? 6) What role does energy play in society? 7) What does energy say about your social standing? In short, the interview generates data by bringing the informant to articulate the discursive knowledge that shapes energy practices in multi-domain settings. When data reached saturation, we turned to analysis (Silverman 2011: 292).

Data Analysis

We examined energy practices in multi domain settings through an analysis of coded interviews. The formal analysis of the data is based on a comparison between single and multiple domain energy practices as two distinct contexts for our respondents, since comparisons also reframe difference and similarity in interesting ways (Arnould et al. 2006). More specifically, exploring how our respondents engage with single and multiple domain energy practices respectively makes it possible to foreground or background particular theoretical arguments (Arnould et al. 2006), in this case that domain differences give rise to a different set of energy practices summarized in figure 2 and discussed in the findings below.

--Insert figure 2 about here--

Our analysis begins by exploring engagement with energy practices in the home to form a basis for comparison. We find that energy practices in the home replicate Phipps and Ozanne's five stage ontology. We then move on to energy practices under urban, multi-domain contexts. Our focus was on 'mobility demands' and practices across multiple domains when engaging with energy infrastructure, for instance when Penelope mentions two domains by saying "I am out on the city" and "I have to commute back [home]." Our analysis focuses on energy practices in these 'transitions' (Shove and Walker 2010). First, we show how, in mobility, respondents begin from an awareness of misalignments between technological energy needs and energy availability. Then we move on to show how misalignment results in consumer hysteresis about the portable technology. To address hysteresis, our respondents engage in hermeneutic reflection on the meaning of the energy gauge (battery icon) by assessing contextual information about infrastructure access and suitable energy management practices such as conservation or seeking out sockets. Thus, the battery icon becomes part of the respondent's experience of the mobility burden. We then show how energy practices in mobility enter social re-embedding: energy access is inherently social. Mobility and energy access problematize social participation. Finally, we show how repeated experiences of mobility across domains produce practices of contingency planning to satisfy energy needs in mobility. In other words, while hysteresis and hermeneutical reflection lead from disembedding to re-embedding in specific instances of mobility, contingency planning constitutes more long-term learning over repeated circulation between home and cityscape (See figure 3). Together interpretation leads to four empirical themes: 1) misalignment, 2) hysteresis and hermeneutics of the gauge, 3) reembedding, and 4) contingency planning. Table 1 briefly characterises the empirical analysis of these themes and provides illustrative excerpts from data.

--Insert table 1 about here—

Findings

Single Domain Practices

Respondents are keenly aware that many of their domestic routines are dependent upon uninterrupted provision of electricity: "so much of what we do is based on having energy" Chardonnay points out (education consultant, 41). Routine practices appear through near seamless alignment between technology and energy infrastructure:

> "…you are using energy for almost everything. You've got cooking, cleaning – you've got the vacuum on, watching television, listening to music, talking on your phone" (Lucas, Administrator, 43).

The home facilitates emergence of practices that elide explicit articulation. When pressed, respondents recognize that energy infrastructure enables tacit (forgotten) intra-domain routines:

> I forget that when I am running a bath, I forget that this is costing me money, when I put my kettle on, this is costing me money, I forget that watching Netflix this is costing me money. I forget these things." (Logan, administrator 46).

Others note that "I'd never check" (Henrietta) the meter or fixtures, or "I don't get involved in that at all. I am cautious with energy, but I am not actively monitoring it" (Penelope). Reflexivity about energy is simply not a component of middle-class domestic routines. In the home, awareness of energy mainly occurs in cases of extraordinary disruption. Alistair for instance narrates how an outage provoked reflexive realisation:

> It was during those times you would really think about how much you use energy: the TVs gone, the mobile phone's gone, the cooker, computer... everything... it all runs on electricity. It would be during those times you'd kind of realise how much you take it for granted..." (Alistair, Administrator, 28).

Disruption and absence provoke reflection and ad hoc adaptive responses appear. Penelope for instance summarizes how power cuts intervene in consumption, giving rise to self-conscious reactions:

> Dig out the candles and actually have a conversation with the family, because I think we are so used to watching the television or listening to the radio that everyone found they suddenly had to talk to each other. What a daunting task [laughs]." (Penelope, Administrator, 27).

With single domain energy practices, the respondent's focus is – as Phipps and Ozanne point out (2017) - return to normalcy, where they can restore existing routines, since: "It was just a question of knowing that it was going to come back, that was our main concern, how long was this thing going to be…" (Michael 48). However, even in the domestic domain, portable technologies can inspire explicit ongoing adjustments to practical know-how without external interruptions.

Multiple Domain Practices - Misalignment

Energy practices become explicit when users must engage with multiple domains. David narrates how, in family interaction, energy practices become a central point of contention: "So when my daughter turned up and saw that her phone was disconnected in the living room in order for my son to put the thing in, all hell broke loose. And I have to intervene into this situation: "this is the end of round three" [laughs] … So it is a question of territoriality plus energy usage" David is clear that competing territorialities or misaligned domains of practice among family members give rise to tensions in energy management. Connecting and disconnecting crystallizes domestic micro-mobilities and micro-politics that give rise to explicit practical negotiation over energy ("intervene into this situation").

Olivia also describes how energy becomes a territorial issue in the home through micro-mobility, when her husband invades the wrong side of the bed to charge. She suggests

co-residents must formulate new rules when competing spatial demands appear and tacit rules prove insufficient to guide energy practice:

> There are sockets on my half of the bed that he is not allowed to use. I say: "why are you encroaching on my side of the room? I mean it is not your side! And his response is normally: "ok, you are behaving like a crazy person. Why does it have to be this side?" … Because there are rules that have to be adhered to, even when you charge (Olivia, educational management, 33).

"Encroaching" likewise, captures how micro-mobility and -territoriality induce the formulation of explicit energy know how. We find that domestic micro-mobility across the home spurs hysteresis, reveals conflicting teleo-affective goals ("behaving like a crazy person"), and leads to new explicit energy management practices such as divvying up bedroom outlets, rather than the normalcy Phipps and Ozanne envision in the concept of 'embedded security'.

Our respondents mainly experience multi-domain energy problems with portable technologies through mobility outside the home. They interact with a multitude of technologies that function across domains: "On the worktop in the kitchen we have a stack of things being charged: IPads, to mobile phones, to Kindles, to cameras all connected to the electricity sockets by wires" Elizabeth explains. These portable technologies are intended for use outside the home. For portable technologies intended for use across multiple domains energy disruptions are not exceptional but expected – it is the primary assumption of use:

> "I am more aware [of energy] if I am out and about than if I am in [the house], because you've got power points everywhere [in the house], whereas if you are about, it is more of a thing. The battery has to have a certain number or it is chaos (Alistair)

Since the 'bubble of inattention' across domains could lead to "chaos," portable technology users cannot rely on tacit systems of practical knowledge. The term 'chaos' suggests that our respondents are aware of misalignment between portable technology and energy provisioning infrastructure when moving across domains. Alistair expresses the ubiquity of energy in the

domestic domain. ‘Power points’ articulate an awareness that infrastructure is not omnipresent, but discreet and subject to variable accessibility, since between ‘points’ there are gaps. In the domestic domain, this is not a problem, but across other domains, gaps create practical challenges.

Unlike single domain technology where respondents say, “I’d never check” or “I don’t get involved in that at all”, ‘making sure’ captures the explicit strategies involved. The idea of misalignments between power points and technology results in awareness of the urban landscape:

> “So I said, where are we going next? You know what, let’s go to Westfield instead. And she was like “why?”, because I can charge my phone in Westfield the shopping centre […] But the fact that my phone was going to die freaked me out, so we had a detour, because we were going to Stratford in the first place at the other end of the tube line” (Olivia, education management, 33).

This quote well captures what we term ‘misalignment’, including the affective component of hysteresis (“freaked me out”), which draws energy issues into mobility. The “detour” articulates explicit knowledge that going to Stratford might result in a disruption and inspires purposeful action to assess infrastructure to avoid the phone’s depletion. The phone’s energy requirements combined with Olivia’s desire for connection and knowledge about charging opportunities in the wider environment created a disposition for additional mobility.

Similarly, Harry expresses awareness that technology entails domain misalignments. Harry explains how infrastructural gaps articulate twin dimensions of duration and distance in a visit to his dad: “so if I go see him, I know door to door: two and a half hours” where he cannot charge. Expressed as temporal duration and spatial distance, domain misalignment identifies a gap between power points; the portable technology’s energy demands structure Harry’s mobility burden. Awareness then gives rise to explicit energy practices:

> I would wake up at 8AM and I would charge my phone straight away, then get a shower, get ready. I’d get to my dad’s house and the first thing I would do would be: plug it in saying “hold on a second”, sit down and then say “how are you?” (Harry, Communications manager, 31).

Harry articulates misalignment across multiple domains (his home, the train, and his father's home). He says he charges "straight away" at the father's home; he says, "hold on a second" and plugs in at his dad's house. Awareness of multiple moments of misalignment gives rise to new energy management practices not to mention intervening in customary social interactions such as visiting and exchanging greetings.

Alastair also reflects upon distance and duration in domain misalignment by noting how energy access is part of his mobility burden, "I've got to get all the way home now without this thing going out. [Laughs]." Penelope also points to domain misalignment in terms of duration and directionality, since "I worry I might run out of battery by the time I get home." In other words, both Alastair and Penelope add energy security to the meanings of home as a by-product of disembedded insecurity recognized in mobility.

Felicity (Administrator, 39) attempts to "fill out the gaps" by adding portable infrastructure to her technological and social repertoire: "I've got battery packs in my handbag that are always charged. I have one in there now, but I have four. I've got one, because it does two battery charges. My partner's got one, my sister's got one and my mum's got one in the car." Felicity in other words draws geographical awareness of gaps into her management of power in her portable technology. Penelope (Educational Consultant, 35) likewise employs explicit strategies to manage the gaps that appear in misalignment:

> I've got chargers here, I've got chargers at home. Portable chargers. I've got the lot... So, the only time I really panic is when the battery gets low and I am out that evening, because I obviously like to have a phone with me if I am out on the city, because I have to commute back [home].

'Panic' captures the psychological urgency of energy hysteresis. Multiple domain contexts therefore give rise to hysteresis or a sense of "mismatch and time lag" between the energy

needs in the portable technology and the energy availability in the surroundings as a teleo-affective component (Grenfell 2008: 143).

Hysteresis of the Battery Icon

Our respondents describe the hysteresis of depleting energy gauges under conditions of misalignment through mobility, as giving rise to 'discomfort' or 'unsettled feelings' (Thatcher et al. 2015: 124). Scrutinizing a battery icon while waiting for a delayed train focuses this discomfort: "But I noticed it was 57% and it was going down, and by the time I was on the train it was like 15-20%. Shiiiiiit! So, every time a percent went down I really noticed" (Alistair). Unlike forgetfulness about infrastructure at home, Alistair's "really noticed" comment suggests that mismatch is at the forefront of our respondents concerns when navigating multi-domain settings.

When asked how often they look at the battery icon to monitor energy in mobility, participants thus concur: "Ehm, all the time to be honest. I'm always looking at the battery level on my phone." (Isabella, Manager, 39). Others say, "I really take notice of it" (Suzanne Office Administrator, 42), "All the time", since "[charging] has become a part of our culture" (Liam, Office Manager, 38). Our respondents are clear about the implications: "it makes you a damn sight more conscious of how you are using energy" (Emily, PR manager, 29). The awareness of mismatch between the gauge and surroundings renders economic costs salient, that is, "how much worth of energy they are going to need" (Michael, Communications Officer, 48). Respondents are therefore "critically aware of how much fuel we are using" in portable technology (Elizabeth, Manager, 53). Hysteresis thus plays a crucial role in shaping practices to realign technologies with energy infrastructure by interpretatively drawing in contextual knowledge about infrastructural access on the go.

Hysteresis inspires interpretation and coping practices linked to infrastructure. For example, Mia describes the depletion process in increasingly proactive terms ascribing specific practices and teleo-affective states to specific percentage readings:

> Full would be 'Yeah, ok great', good to go for the day'; 50% I'd be a bit: 'Oh God, I had better stop it from updating itself all the time in the background' Turn it on low battery life, turn off Instagram, e-mail or it would literally *die*. Then it would be at thirty percent and I would be like: 'Now I'm not having fun anymore'. And then I'd get a bit 'AHHHH'" (Mia, Administrator, 23).

In Mia's interpretation a full battery requires no interventions, whereas depletions involve explicit rules about lowering activity levels for energy conservation and ultimately an emotional urgency to charge. Through the metaphor of a bath, Carter describes the gauge's energy level and correlated rules of practice:

> "Yeah, so when you are in the bath on a cold day and somebody pulled the plug. Yeah that is what it feels like, somebody pulled the plug… you are like: 'Put the tap on, put the tap on!', because you are freezing and that's what it feels like from 100% and down to zero. Naked and cold. You do go through various kinds of emotions." (Carter, Manager, 35)

'Put the tap on' captures a practical orientation to seek out infrastructure as the battery reaches zero. For respondents like Mia and Carter, the progressive loss of energy in the gauge therefore becomes uncomfortable, which inspires seeking out power points.

Respondent interpretations of the gauge draw on metaphors of 'life' and 'death' at various indicators of battery charge. When fully charged, the battery icon: "becomes your lifeline", i.e. it enables all the routine practices that she engages in (Isabella 39). At the other end of the scale, respondents link battery depletion to metaphors of death. Terms such as "if it dies" (Lucas, Administrator, 43), or "if it starts flashing it means it is going to die" (Ethan, Coordinator, 29), or "what if my phone dies?" (Olivia), or "If it dies on me, when I am just in the midst of something, that's when I'm like just: "crap"!" (Emily). The metaphorical death of the battery instils a disposition to act.

While informants suggest that depletion equals a lack of possibilities, even risk that they must mitigate, the full battery gauge is equated with possibilities and comfort: "When it is full you are thinking: "I can go as far as I want, I can go as fast as I want. I don't need to worry about it" (Liam, graphic designer, 38). Echoing Carter and Mia, "The blink tells you something is wrong, it's a warning" says Michael (Communications Officer, 48). Some interpret each battery level as requiring intervention practices. Gauges or battery icons running down to empty induce the discomfort of hysteresis: "When I get close [to running out] I am freaking out, thinking: 'is it about to cut out'. It's horrible." (Chardonnay, education consultant, 41). Ultimately, the hermeneutics of the gauge brought about by disembedded hysteresis draws in contextual information to prolong the devices life, to "co-ordinate social activities" (Giddens 1986) as we discuss next.

Reembedding

Felicity (Administrator, 41) describes battery management practices in terms of beliefs about her husband's concern for her:

> "It panics me when I get the alert saying, 'the battery is low, do you want to put battery save on?' and I think it is at 20% that you get that. I'll immediately put it on to battery save and then get it plugged in, whether it be from the battery pack from my handbag or If I am driving in the car, it will go in. If it goes down and my partner, if he phones and can't get a hold of me, it is a major panic - it is like the whole world has come to an end. He'll phone my mum, he'll phone my sister: "where is she?"

Whether or not her partner really descends into "a major panic," Felicity deploys an extensive repertoire of practices related to battery management to avert this. Reembedding relations with family while crossing domains therefore informs the meaning of the battery gauge icon. Simon (Communications, 29) gives a similar account: "someone might need to get in touch with you, or cancel a plan, change a plan or find out how to get somewhere on the map" to meet up (Simon, 33). Managing energy levels properly affects relationship quality "my

girlfriend will always be having a go at me, asking me why I managed to run down my phone….” To avoid misalignment in social connections, David (Manager, 48) like Felicity, links friendships in mobility to maintaining a charged battery:

> If you are meeting someone you start to worry if it dies I might not find them, or they might not find me. They might think I stood them up or something, so you get quite wary about that. I might even turn the whole phone off for half an hour so when I get there I will be OK. I guess there is a bit of panic at that point.

Informants monitor the battery icon to ensure social relations in mobility. Is it too much to say, that electrical energy increasingly powers social life through portable devices dependent on the gauge?

The sinking gauge sparks negative emotions about the social implications of energy disruption. Penelope frequently socializes with colleagues through smoking which requires a charge “…my e-cigarette, don’t judge me [laughs], but that has a charger as well. I watch it, and it is just basically a light indicator, so if it flashes red, I know the battery is low.” An empty battery may cause missed social opportunities: “So, if my cell dies I worry: “oh my god, will I be able to get in contact with my mum, my dad, what if I need to get a taxi, what if I need to check something” (Emily 29). These are all imagined, social consequences of disembedding through a dead battery that must be countered through re-embedding activities by rationing power or seeking an outlet.

Respondents also address the role of charging in consumption communities such as gaming and entertainment: “I am more worried about what could happen without the phone being charged…. My phone is my only source of entertainment, if I don’t have that I can’t play my game, I can’t check my e-mails. What am I going to do?” (Alastair). Our respondents typically monitor the gauge with others in mind since otherwise “…. People panic when they can’t get in touch with you because we are so instantly available” (Penelope). In hysteresis, the discomfort of unpredictability, the ‘what’, ‘if’ and ‘might’ of

insufficient energy looms over gauge hermeneutics and re-embedding practices that sustain social coordination. The information on the battery icon is simply integral to intersubjective practices and social rules.

Because the hermeneutics of the battery is undertaken to "coordinate social activities", informants use the information to devise pre-emptive practices. Suzanne illustrates how the gauge structures practices to pre-empt the disruption provoked by domain misalignment and consequent energy loss: "So I texted, you always text a warning I think, to people. And when my phone goes down to 10% I worry. I would write to anybody who is waiting for me." (Suzanne). She articulates other anticipatory actions: "I just want them to know that I can't do that and hopefully I am still alive" (Suzanne). These comments exemplify the intersubjective rules that relate to mobile misalignment and energy. Depletion is not itself the bad outcome. The outcome of depletion are interruption of the potential for sociability (e.g., calendars, social media, gaming) and disruptions to accessing important virtual possessions that frame identity such as social media accounts, bank accounts, games, messages, etc. A competent social actor cannot ignore the role of the energy gauge in mobile re-embedding practices since "*All of this hinges on the battery!* (Emily).

Contingency Planning

In embedded situations, the energy consumer seeks a return to normalcy after an unexpected disruption. However, this is not a certain outcome in mobility where misalignment due to duration and distance or simple contextual unfamiliarity disembeds actors. In response, informants engage in anticipatory contingency planning. Alastair explains: "If it gets below 15% I charge it and I bring my charger in to work if I know it is going to run out that day". People want "more control and power, erhm, personal-power," over uncertain access to infrastructure in mobility Chardonnay points out. Our respondents therefore put a premium

on “managing” (Henry) and pre-empting energy availability when moving across multiple domains. Portable technologies therefore give rise to explicit systems of planning rather than reliance on tacit approaches: “I need to make sure that it is charged and ready for tomorrow morning when I need it” (Elizabeth 53).

Rather than a return to normal routine, multiple domain energy practices reveal informants’ awareness of the contingency of energy access. They report explicit skills and methods to avert depletion: “I definitely keep an eye on it, I always tend to have an idea, and that probably does reflect that I am quite organized.” (Chardonnay 41). Respondents express awkward pride in being “a control freak [laughs]” (Elizabeth 53) or being “quite anal” (Lucas 43) about charging electronics. Using the personality disorder spectrum to account for the relationship to the battery is ubiquitous: “I am a bit OCD […] a bit of a neat freak” admits Chardonnay. Olivia confesses: “Obviously, there is OCD there, definitely. I wouldn’t even be ashamed to admit it.[…] I’m a planner, I plan.” These planning skills involve anticipating the locations of energy for any given itinerary, drawing in infrastructural considerations into mobility demands. Rather than returning to a tacit routine, respondents engage with the immediate future.

Because energy needs do not occur in a social vacuum, contingency planning takes other people’s mobility and technology into account. Through coordination in mobility, a system of social accountability emerges from multiple domain energy practices. Negative or even derogatory attributions therefore attach to those who do not consider their energy obligations, “I am quite a planner” (Suzanne), but “My husband is not a planner, so his phone will run out. (Suzanne). Consumers express the normative binary of energy consumption practices in many ways: “My wife is pretty anal about it. She organizes it …organized yeah yeah yeah [Interviewer: And you?] disorganized” (Liam). When asked what they would think about someone who regularly ran out, respondents acknowledge:

> I would be frightfully frustrated by that and very surprised. I can just imagine myself rolling my eyes and tutting. I would think they were disorganized. I would probably think deep down that they were inconsiderate, perhaps implicitly expecting somebody else to sort them out. (Elizabeth, administrator, 53).

Repeated failure to charge, organize, plan, and anticipate energy needs is stigmatized. In sum, managing the battery or gauge becomes part of the social capital expectations of qualified social actors in mobility.

Discussion

Our review of literature suggested more knowledge is needed about the role of energy infrastructure as a context for technology consumption, to which we have made a modest contribution. Consequently, our focus has been on the material relationships between energy and technology through the battery gauge in mobile technologies. More specifically, we asked how the difference between embedded and disembedded settings shape consumers' energy practices. We found that domestic contexts with fixed technology give rise to tacit practices of 'embedded security.' Our results thus replicate Phipps and Ozanne (2017). However, our respondents are mobile and engage with energy in portable technology both within the home and through the city (Shove and Walker 2010). This gives rise to a different set of energy practices we term 'disembedded security,' particularly across domains outside the home. The infrastructure that produces trust and ontological security in homes (Phipps and Ozanne 2017) can also create "novel forms of psychological vulnerability" outside the home (Giddens 2013, 113). Vulnerabilities appear because mismatches between access to energy infrastructure and timing, duration and purpose in mobile, urban life gives rise to uncertain contingencies that invite consumers' hermeneutic reflection on the relation between technology (battery powered mobile devices and energy infrastructure) and mobility in line with their purposes (Bourdieu 1990a: 99).

Misalignment between energy infrastructure and personal energy requirements in mobility gives rise to a sense of hysteresis or unpleasant unpredictability (Bourdieu 1990b: 62), which spurs hermeneutic reflection about energy access. Because of 'unsettled feelings' in energy hysteresis (Thatcher et al. 2015: 124), our respondents seek to re-embed for 'psychological comfort' (Giddens 2013, 155). According to Grenfell Hysteresis is not a voluntary issue, but "a field condition affecting individuals within this social space" (p. 133). Hysteresis is therefore a "mismatch and a time lag between the change in each of the previously "well-behaved" elements that are ontologically distinct but interrelated" (p.134). It is exactly this time lag that pushes our respondents into contingency planning.

In contrast, Connolly and Prothero (2008: 129) argued that consumers have "no clearly planned, measured and accountable system to monitor energy." However, we show that the battery icons is interpretively drawn into an intersecting patterning of social obligations, which inspire mobility practices to access energy infrastructure and reduce misalignment, and thereby hysteresis (Shove and Walker 2010). For Phipps and Ozanne (2017, 367) the outcome of unexpected infrastructural disruption in the home is naturally that 'practices fall apart' or "failed attempts to integrate practical and discursive understanding" and feelings of discursive insecurity (2017, 371). However, for mobile respondents anticipated disruptions have different effects. While depletion is dreaded, the battery icon inspires mobility practices towards sockets to avoid depletion and thereby secure the comfort of re-embedding. The battery icon becomes part of what Shove and Walker term the 'sociotechnical timing of potential movement' (Shove and Walker 2010). Locations become carriers of hermeneutic narratives about energy access (home, the mall, the office, the Apple store, or the gym) which in turn shape the where, when and how of mobility. Respondents provide many examples of the battery icon informing mobility practices. They mention

sockets in a comedy club, charge stations at the gym, sockets in the train or airport that frame movement with reference to the battery's depletion.

While studies of consumer technology have focused mainly on the materiality of technology (Kozinets 2008; Martin and Schouten 2014), our findings show that behaviours instigated by the materiality of energy in portable devices are considerable. When asked how often they look at the battery icon to monitor energy depletion and energy availability in mobility, participants concur: "Ehm, all the time to be honest." (Isabella 39). Mobility induces awareness of infrastructure; it "makes you a damn sight more conscious of how you are using energy" (Emily). "It is horrible" as Chardonnay complains to monitor constantly. While 'range anxiety' is well known for cars (Graham-Rowe et al. 2012; Noel et al. 2019; Rauh et al 2014), our findings suggest that the multiplication of portable devices has expanded the number of contexts in which hysteresis about energy becomes a salient issue: cafes, work, the gym etc. More research could therefore be done on the contextualizing role of anxiety brought about by energy hysteresis from portable technology on general consumer experiences, focusing on customer emotion management in service experience (Caru and Corva 2003). Research could explore how energy choices for portable technology play a part in service encounters when the consumer uses the phone for: contactless payment; information searches during the service encounter; boarding passes at the airport; online shopping in mobility, or emergency contacts with customer service in unfamiliar contexts.

While Phipps and Ozanne's model ultimately leads consumers' to a new sense of normalcy or equilibrium (2017: 367), this is not the case for mobile energy consumption. Instead, our respondents learn to plan. In practice theory terms, 'contingency planning' occurs "when the ordinary parameters of reference cannot deal with circumstances… deeper schemas have to be mobilized to cope" (Descola 2013: 109). As Olivia admits, "Obviously, there is OCD there, definitely. I wouldn't even be ashamed to admit it.… I'm a planner, I

plan." (Olivia 33). At the heart of contingency planning is the battery icon, which is not merely an inert technology. As we have shown, it is a device imbued with the figurative power to induce ongoing and acute awareness of the energy infrastructure consumers generally ignore in the home; it stimulates purchase and use of complementary products; influence patterns of mobility; creates or mitigate conflict with intimate others; perpetuates or interrupts social connections; and expresses varying degrees of cultural propriety. Future research could investigate how and when consumers switch between tacit energy practices and contingency planning, but also how energy consumers mix these strategies differently under varying circumstances. Different kinds of urbanism exist and may affect the relationship between contingency planning and tacit energy practices (Nijman 2007) or rural and suburban contexts may give rise to differing mobility demands that affect the relationship to contingency planning for energy (Ilbery 2014). Understanding the specific conditions under which energy consumers switch between sedentary and itinerant strategies as they circulate between home and community could inform how designers 'embed' human values into infrastructure at various scales to provide access (Austin 2014) and thereby optimise the 'ergonomic' component of infrastructure which allows users to tap energy for their technology (Charytonowicz 2017; Geertman et al. 2015).

While respondents provide descriptions of mobility brought about by energy needs, we know relatively little about the actual movements undertaken by respondents or the explicit micro-practices that develop. In addition to Phipps and Ozanne's (2017: 378) proposal for data collection that focuses on participants' senses and emotions, which can help further unpack informants' embodied practical understandings, we propose exploring how mobility is shaped by energy practices using novel digital methodologies. Specifically, we propose integrating qualitative and GIS [Geographical Information Systems] methods (Brennan-Horley and Gibson 2009). Consumer Culture Theory currently has no methods for

incorporating geo-tagging to document how consumers' desire for energy and mobility play out across space and time. While the where, when and how of an instance of movement "is wrapped up in the sociotechnical fabric of means, modes and timings of potential movement", such methods could go some way to unpacking the details of such practices (Shove and Walker 2010).

Finally, while 'embedded security' provides "favorable conditions for aesthetic experiences such as those found in the study of taste regimes" (Phipps and Ozanne 2017, 375), we see disembeddedness as disruptive of taste regimes. Disembeddedness is individuated since respondents are likely to follow individuated itineraries and timetables, and variable experiences of charge levels in the portable device. Consequently, disembeddedness shapes individual conceptualisations and practices regarding infrastructure. Bauman's caravanserai is an apt metaphor for the transitory places linking multiple domains, "the place is open to everyone …. Guests come and go; none of them take much interest in how the site is run…"(Bauman 2013). This model is different from a shared household with its negotiated norms and routinized rules that allow taste regimes to appear. Consequently, future research could explore in greater detail the role of mobility and energy infrastructure in framing 'liquid consumption' which favours "values of flexibility, adaptability, fluidity, lightness, detachment, and speed," in other words the constant reconfiguring of taste to adapt to new contexts on the go (Bardhi and Eckhardt 2017). In extension, while we know that technology plays a role in creating and shaping desire and taste (Kozinets et al. 2016), we might seek a clearer understanding of the many ways that the 'long-suffering' commuter who survives through an 'iron will' (Moss 2013), in fact uses portable energy consumption in a series of defensive practices.

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Figure 1. Mobility Induced Hysterisis in Energy Practices and Redressive Reembedding and Contingency Planning

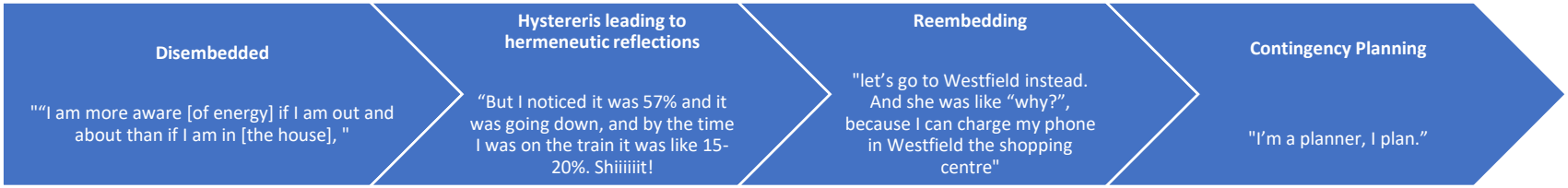
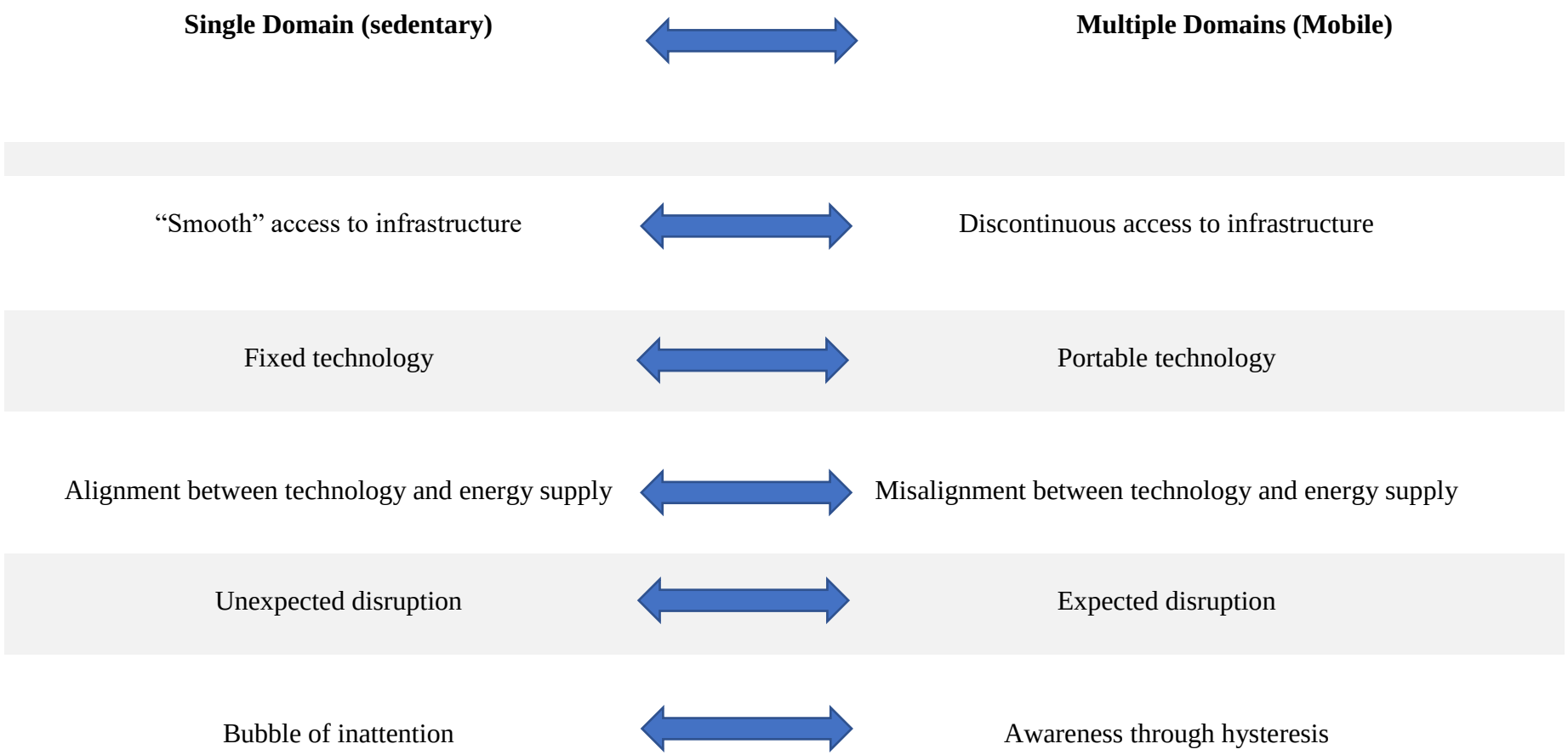


Figure 2. Differences between single and multiple-domains that inform the comparative analysis of energy practices



Tacit embodied knowledge  Hermeneutic reflection on energy demand and availability

Table 1. Disembedded Security: Empirical themes in mobile energy consumption practices

Practice	Characteristics	Examples
Disembedding from home	Recognition of domain misalignment through mobility	"I am more aware [of energy] if I am out and about than if I am in [the house], because you've got power points everywhere [in the house], whereas if you are about, it is more of a thing. The battery has to have a certain number or it is chaos." (Alistair)
Energy Hysteresis	Behaviours related to 'discomfort' or 'unsettled feelings' brought about by misalignment	"But I noticed it was 57% and it was going down, and by the time I was on the train it was like 15-20%. Shiiiiiit!" (Alistair 28).
Hermeneutics of the gauge	Interpretative efforts that shape mobility behaviour relative to infrastructure; re-appropriation	I noticed my battery was depleting and thought, ok that's fine it'll be ok. And then it got to about 25% and I went into the Apple Store in Covent Garden and totally charged my battery. I unplugged one of their show phones and plugged mine in. I stayed there for about 15 min "looking" at show phones." (Mia 23).
Reembedding	Social coordination of gauge and context. These behaviours are related to attaining psychological comfort on the go.	And I guess if you are meeting someone you start to worry if it [the battery] dies I might not find them, or they might not find me. They might think I stood them up or something, so you get quite wary about that. At that point I might even turn the whole phone off for half an hour so that when I get there I will be OK. I guess there is a bit of panic at that point (Dave).
Contingency Planning	Habituated anticipation of infrastructural gaps	"Obviously, there is OCD there, definitely. I wouldn't even be ashamed to admit it.[…] I'm a planner, I plan." (Olivia 33).