

This is a repository copy of *The grit in the oyster: using energy biographies to question socio-technical imaginaries of 'smartness'*.

White Rose Research Online URL for this paper:
<http://eprints.whiterose.ac.uk/99374/>

Version: Accepted Version

Article:

Groves, Chris, Henwood, Karen, Shirani, Fiona et al. (3 more authors) (2016) The grit in the oyster: using energy biographies to question socio-technical imaginaries of 'smartness'. *Journal of Responsible Innovation*. ISSN 2329-9037

<https://doi.org/10.1080/23299460.2016.1178897>

Reuse

This article is distributed under the terms of the Creative Commons Attribution (CC BY) licence. This licence allows you to distribute, remix, tweak, and build upon the work, even commercially, as long as you credit the authors for the original work. More information and the full terms of the licence here:
<https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

The grit in the oyster: questioning socio-technical imaginaries through biographical narratives of engagement with energy

Christopher Groves*¹, Karen Henwood¹, Fiona Shirani¹, Catherine Butler², Karen Parkhill³, and Nick Pidgeon⁴

*Corresponding author, grovesc1@cardiff.ac.uk

¹ Department of Social Sciences and Understanding Risk Group
Cardiff University
51a Park Place
Cardiff University
Cardiff
CF10 3AT
UK

² Geography Department
College of Life and Environmental Sciences
University of Exeter
Amory Building
Rennes Drive
Exeter
EX4 4RJ

³ Environment Department
University of York
Heslington
York
YO10 5DD

⁴ Understanding Risk Group
Department of Psychology
Cardiff University
70 Park Place
Cardiff
CF10 3AT
UK

Acknowledgements

This research was funded through grant RES-628-25-0028 from the UK Economic and Social Research Council (ESRC).

Introduction

In this paper, we argue that one of the ways in which responsible research and innovation (RRI) can benefit from qualitative social science research is through its capacity to open up and extend the critical space around socio-technical future imaginaries. We follow Yolande Strengers (2013) in proposing that an important site for RRI-related qualitative work is the ‘thick’ contexts of people’s practical engagement with technologies. We depart from Strengers’ ethnographical approach by exploring the extent to which narrative, biographical interviews can shed light on how subjective investments in particular forms of technology-enabled agency are an important part of this context, in addition to the shared practices she studies.

The importance of the critical investigation of socio-technical future imaginaries (Fujimura 2003) for RRI has been argued for in recent science and technology (STS) studies literature (e.g. Simakova and Coenen 2013), reflecting broader interests within the STS scholarly community in the political significance of technological expectations (Borup et al. 2006). By disciplining shared technological expectations, socio-technical imaginaries help to shape and constrain choices between distinct technology pathways. In the process, they may obscure unquestioned social priorities which have helped to shape these options. Critical assessments of the assumptions that underlie imaginaries have thus been positioned as an important contribution to the ‘upstream’ assessment of socio-technical innovation.

Rather than remaining at the level of debates about the potential hazards and benefits of different socio-technical options, focusing upon their implicit imaginaries demands we consider what social and material infrastructures may accompany them (Grove-White, Macnaghten, and Wynne 2000), and also that we explore the desirability of the ‘worlds’ which may coalesce around these future socio-technical arrangements (Macnaghten and Szerszynski 2013). This has been referred to as a ‘hermeneutic turn’ in technology assessment that moves the emphasis away from foresight focused on anticipating possible events – away from ‘future developments of technology’ towards ‘future societal developments *with* technology’ (Grunwald 2014). Deliberation on, for example, the extent to which imaginaries reflect particular definitions of social priorities and thus exclude others may thus be seen as a central aspect of RRI conceptualised as ‘taking care of the future’ (Stilgoe, Owen, and Macnaghten 2013). It follows that such deliberation must necessarily be as inclusive as possible of a diverse range of societal perspectives on the values implicit in socio-technical arrangements. Questions then arise around what techniques of elicitation are best suited to draw out such perspectives.

While deliberative fora such as citizens’ juries and consensus conferences, as well as explicit technological controversies have been identified as important arenas for deliberation, the idea that the social assessment of technologies and their imaginaries can only take place through such explicitly constituted public arenas has been questioned (Delgado et al. 2011). An alternative route is offered by qualitative sociological research on the lifeworlds of technologies. An example of such work is Strengers’ (2013) analysis of the ‘smart utopia’ that, she argues, is a central part of both technological and policy discourses around energy transitions. Moving towards a more sustainable society is, within these discourses, often represented as being dependent on ‘smarter’ energy systems, which will require a larger role for networked ICTs in enabling individuals and organisations to make better decisions about the amounts of energy they use, or in moving ‘decision-making’ into the background through automation.

Strengers shows how this imaginary renders the intangible future more tangible and legible by selecting and emphasizing some aspects of social reality in the present to use as a key to understanding emerging trends. In particular, it makes use of particular concepts of subjectivity (what Strengers calls the hyper-rational, optimizing ‘resource man’) and specific ways of thinking about the relationship between technical devices and action (as a process by which data is translated into feedback effects within an energy system). Strengers goes on to question the coherence of the smart imaginary and its organising logics by using practice theory (Shove, Pantzar, and Watson 2012) and ethnographic research to explore the hidden meanings of energy and expose ways of performing practices which undermine and question discourses of smartness. Work on the lifeworlds of practice, such as Strengers’, may help us to understand the ethical and political significance of future imaginaries by exploring how and why practices and social arrangements *matter* to people (Sayer 2011).

In this paper, we build on these insights by exploring how a different qualitative approach that combines narrative, biographical interviews with multimodal elements can help to open a critical space around dominant future imaginaries by focusing on the ‘thickness’ of engagements with the material infrastructure of everyday life. Narrating biographical experiences of how practices that use energy change over time allows affective and emotional elements of how and why people engage in practices to be explored. We show how, when combined with a multimodal approach that uses films as stimulus material, it is possible to move within narrative interviews from individual biographies into the exploration of social futures, creating a dialogue between individual experiences and shared technological expectations. We explore how, within these dialogues, participants recount how practices and technologies afford opportunities for different kinds of bodily and affective engagement with the world. In particular, we find distinctions being made between forms of engagement that provide ‘friction’ and those which are relatively ‘frictionless’. Based on a psychosocial reading of our interviews that builds on STS literature dealing with concepts of care and attention, we show how interviewees make links between opportunities for ‘frictive’ engagement and the emergence of valued modes of subjectivity and identity. Friction therefore appears as the ‘grit in the oyster’. We propose that this combination of psychosocial analytical framework, narrative interviewing, and presentation of shared imaginaries offers, we suggest, a form of deliberative engagement with future imaginaries and the ‘worlds’ they project that draws on affective, emotional and embodied dimensions of meaning. In this way, the hermeneutic turn in technology assessment is expanded. Our analysis leverages social-scientific insights into the affective and embodied nature of sense-making that offers new ways to be ‘inclusive’ in RRI, by mobilising these in the evaluation of the ‘worlds’ projected within future imaginaries.

Analytical framework: convenience, care and engagement with the world

RRI proposes that it is necessary to evaluate innovations, not just as instrumental means to achieve particular pre-chosen purposes, but as bound up with particular ways of life and social relationships, and also as potentially transformative of what we take our purposes to be. The products of innovation are not simply tools; they also legislate forms of life (Feenberg 1999). They thus enfold within them particular answers to the age-old political (and philosophical) question ‘how shall we live?’ Understanding technologies and forms of life as entangled together (Ozaki and Shaw 2014) requires that we develop an account of how these entanglements change in ways that avoid reducing change to determination either by the technical or social and affirm instead that culture and technology co-produce each other (Jasanoff 2004). Practice theories (e.g. Schatzki 1996, Shove, Pantzar, and Watson 2012)

represent such processes as non-linear, characterised by the evolutionary emergence, transformation or decay of practices, as they gain or lose participants over time.

Questions remain, however, about how social actors contribute to the tangling of technologies and forms of life. What exactly motivates people to engage in particular practices in the first place or defect from them, for example, is not clear. Recruitment to practices (such as becoming a vegetarian) may be shaped by the lifecourse transitions which may bring things, emotionally speaking, to a head for an individual and prompt decisive shifts in the practices one s/he engages in (Hards 2012). People are not just ‘dupes’ of practices, as practices also matter to people in specific ways (Sayer 2011), and therefore may also cease to matter to them in changing circumstances. This is recognised by some practice theorists in their discussion of the ‘internal rewards’ associated with practices (Shove, Pantzar, and Watson 2012, 75). But to understand what these rewards are, we need to ask questions about who the subjects of practices are.

Previous analytical work on [Project Title] [Authors] has built on psychosocial (Hollway and Jefferson 1997, Marris 1991) and anthropological (Turner 1974) literature to show how a psychosocial perspective can help understand the ways in which complex subjective processes of identity-formation and the emotional investments which emerge out of them may influence what practices people engage in. Practices matter to people in ways that are instrumental (‘I have to do x in order to achieve y ’) but are also constitutive (‘I am the kind of person who does x ’) of identity and agency. Such identities are not isolated. Instead, they are relational. Engagement in practices is always undertaken within relationships of interdependence, which are relationships of material interdependence (enabling sustenance and survival, for example) but also of symbolic and emotional interdependent. Practices are matters of concern (Latour 1993), being bound up with creating and securing futures, but are also therefore matters of *care*, of active concern for these futures (Groves 2011) that are necessarily the futures of particular forms of life and the meaningful worlds of which they are part.

That future-orientedness is central to the making and remaking of identity within interdependence is affirmed both by a range of recent work in the sociology of risk and uncertainty (Henwood and Pidgeon 2013) and more broadly by the ethics of care, which foregrounds relational concepts of subjectivity in which interdependence and active engagement is affirmed as the basis of flourishing (Groenhout 2004). The subjects of practices are thus not only ‘carriers’ of practices through which interdependence is created, but are actively concerned with their interdependence and about the others they are interdependent with to greater or lesser degrees. They are evaluative beings, concerned with their own flourishing and that of others, whose evaluative stance is therefore relational and mediated in a variety of ways, including by practices and their supporting technologies. If care is always mediated by practices (Ruddick, 1989), it nonetheless remains an evaluative, future-oriented and therefore ethical stance regarding ‘how the world should be’, and is not simply, as De la Bellacasa (2012) insists, an ontological condition of interdependence.

That practices are not simply ways of getting things done is recognised by Shove, Pantzar, and Watson (2012), who discuss how the meaning of practices is dependent on the ‘internal rewards’ that come from performing a practice well, that is, in accordance with certain shared standards. These rewards, they suggest, provide a motivation but also a reason for individuals to engage in practices. Internal rewards do not therefore simply attract participants, they give them grounds for evaluating a practice as worth doing. However, if we view practices as a

necessary condition of care, and therefore of the evaluative stance towards the world which care implies, then we can understand why people participate in practices, and evaluate them positively, in relation to other forms of internal rewards. Practices (and technologies), in mediating and giving form to our concern and care with interdependence, help to shape subjectivity itself and the investments we have in particular ways of acting in the world.

This contribution of practices to the production of subjectivity is identified by Bernard Stiegler through his concept of *attention*, in which a subject's diverse capacities for cognitive, emotional and affective engagement are gathered together to focus upon an object of care and upon the practices through which care is mediated and realised (Stiegler 2010). This echoes established ways of thinking in care ethics about relational subjectivity as attentive, patient, but also as respectful of the otherness of that for which one cares (Engster 2007). Stiegler adds to this, however, an understanding of care as creating a particular kind of relational environment in which individuality (or rather what Stiegler refers to, after Gilbert Simondon, as 'individuation', an open-ended becoming) is produced, and which the characteristics of practices and technologies may either suppress or help to create. The attention involved in care

permits the individual to have her own experience, that is, to learn something by herself in her constant confrontation with the real. (Stiegler 2012: 2)

Borgmann (1993) identifies particular kinds of technologies as 'focal objects', whose social constitution solicits and fosters care. These objects (Borgmann uses a hearth as an example), are ones which 'of themselves have engaged mind and body and centred our lives' (Borgmann 1993: 119-20), acting as loci for a variety of practices, concentrating around them concern and care and often involving groups of subjects – in the case of the hearth, for example, gathering around it the activities of a family who share a house. If some practices and objects solicit care, however, others may suppress it.

Stiegler contrasts attention, for example, with the fragmented forms of subjectivity solicited by forms of ICT-enabled communication, such as social media, which he names (after Katherine Hayles) 'hyperattention' (Stiegler 2010). Hyperattention obstructs individuation because the subject becomes absorbed in monitoring fragmented signals originating from a device on which a practice (like communicating via social media) is dependent. A similar attenuation of subjectivity, and with it, of identity, is identified by Casey (2001), who associates it with a broader socio-technical tendency to delegate agency to devices and infrastructures, which he argues 'thins out' bodily engagement both with devices that facilitate activities and (most importantly) the places in which they are carried out and in which everyday life is anchored.

The use of technologies, then, can involve individuals, alone or together, in distinct forms of bodily, emotional, imaginative and intellectual comportment towards the world. In psychosocial terms, subjects therefore become invested in different ways, over time, in the diverse modes of comportment supported by specific socio-technical arrangements. For example, the directedness to 'objects' of care as sources of meaning brings particular satisfactions from painting a landscape, playing with a child, or cooking a meal for friends. The periodic 'hit' produced by incoming emails, instant messages and tweets on one's smartphone, coupled with the autonomy configured by the freedom to connect and disconnect with others facilitated by the device brings other satisfactions. Subjectivity emerges through engagement in practices, and through this engagement the subject's satisfactions become

entangled in an ecology of practices and technologies, shaping its perspective on how the world should be.

By conceiving of subjectivity as complex, and shaped by affective investments in this way, we can look again at the question of how to understand the entanglement of technologies and forms of life, by focusing on the forms of engagement that stitch them together. If technologies and forms of life co-produce each other, then their evolution can be seen as entrenching or transforming particular forms of engagement, and with them, forms of evaluative subjectivity that coalesce around distinct kinds of investments. If future imaginaries project nascent 'worlds' around entanglements of future technologies and forms of life, then one question that suggests itself is how desirable these worlds appear from the point of view of evaluative subjects, cultured by their own characteristic forms of engagement, and why.

As Strengers shows, 'smartness' is an imaginary that projects from within it a set of entanglements of technologies and forms of life, which imply specific modes of engagement with the world. In the analysis of our data set out below, we read draw out from our narrative interviews reflections from interviewees that cast light on the meaning of imaginaries of smartness in relation to their evaluations of everyday forms of practical engagement. We read these reflections in relation to the concept of subjectivity developed above, and through both Strenger's work on smartness and Shove's (2003) analysis of the historical emergence of ideals of convenience.

Shove shows that convenience, as a value, implies a belief that it is better to have the mechanisms through which services and goods are provided integrated as far as possible into the background, as infrastructure. It has therefore developed, historically speaking, in tandem with the reduction of human interaction with systems, and with increasing automation. If something is 'convenient', it often therefore involves pushing buttons to initiate a sequence and nothing more. The aim is to remove from socio-technical systems human agency as much as possible, and thereby to reduce the possibility that outcomes other than those intended by their designers will result (Wynne 1992: 116). It is therefore necessary to design technical systems that 'obviate the human sources of friction' (Ellul 1964: 414). A key design goal must therefore be *frictionlessness*, often achieved by reducing engagement to the making of simple choices between predetermined options.

Shove describes how convenience therefore tends to become more than an instrumental value, as a result of a dynamic of spiralling or ratcheting, through which the introduction of convenience into one area of life induces it to spread more widely. It represents a value around which technologies are designed, but also around which practices dependent on these technologies then evolve, requiring in the process further re-orderings of socio-technical arrangements. It therefore becomes a shared imaginary behind which are gathered the contingent entanglements of technologies and forms of life that are characteristic of advanced industrial and post-industrial societies.

'Smartness', as a future imaginary, Strengers suggests, represents a new mutation of convenience, often presented as centred around making devices (rather than people) 'smart about energy' (2013: 117-18). In the process, energy management is imagined increasingly as data management (2013: 30), a largely friction-free process of choice and priority-setting. Smartness promises to extend the patterns of socio-technical change noted both by Casey (2001) and by Shove (2003) in which distributed, automated and often largely intangible

infrastructures increasingly become part of how interdependence is mediated and structured. The dynamic of ‘spiralling’ which Shove describes produces ‘thin’ engagement and associated forms of life which echo those described by Stiegler and Casey. As Shove and Southerton (2000) suggest, the evolution of convenience is often associated with an imaginary of efficient time-management, in which time is thought to be ‘freed up’ to be used for other things, as in the case of the relationships between microwaves, frozen ready meals, and domestic freezers. Yet such imaginaries translate, in practice, into more fragmentation of lived time. More and more convenient devices and services make constant and diverse demands upon our attention, thus ensuring that our attention and engagement is split across distinct and often conflicting practical contexts. An orientation towards convenience removes some forms of onerous labour, but with it, a different form of comportment is solicited from subjects of the *world* of convenience, one that mirrors the forms of life analysed by Stiegler and Casey, and represents a ‘thinning’ of the lifeworld, requiring less sensual involvement and bodily engagement with how things get done (Vannini and Taggart 2014: 111).

In the analysis of our data in the following sections, we show how narratives of lived lifecourse transitions can bring into focus the different forms of life which, the literature surveyed above suggests, may be associated with the intermingled yet contrasting worlds of care and convenience. We explore how beginning with narratives of lived experience can open a critical space for engaging with and reflecting on the meaning and desirability of the ‘worlds’ associated with different socio-technical arrangements and imaginaries. We show how, as a result, friction can be seen as a positive characteristic of care-full engagement rather than an obstacle to abstract efficiency. As such, the qualitative approach taken on [Project Title] is shown to offer a way of eliciting rich perspectives, rooted in everyday experience, which can feed into the deliberative social assessment of socio-technical innovations. In particular, this allows us to open up a critical space around future imaginaries by drawing attention to the distinct ontologies implicit in interviewees’ perspectives on lived and imagined experience (Law 2009).

Methodology

The [Project Title] project has examined how individuals from four different communities across the UK make sense of their everyday energy use in relation to their life histories. The project employs a mixed methods qualitative approach, supplementing longitudinal narrative interviews with showings of two film clips as stimulus material to explore the entanglements of practices, meanings and materials through which everyday life becomes dependent on energy.

Across case sites, interviews were conducted with a total of 74 individuals (pseudonymised) in the first round. A sub-sample of 36 was selected to take part in two subsequent rounds of interviews and the multimodal activities. At the most mainstream of our sites, the Royal Free Hospital (RFH) in North-London, we recruited interviewees from the hospital’s employees. Still towards the mainstream are two areas in Cardiff; Ely and Caerau; a socially-deprived inner-city ward, and Peterston-Super-Ely; an affluent commuter village on the city’s outskirts. Finally, the most niche case site was the Lammas/Tir-y-Gafel ecovillage in Pembrokeshire. Residents live off-grid, have built homes from sustainable materials, and have land-based livelihoods.

While a biographical focus brings the past into the present, it also allows an exploration of anticipated futures, which presents specific challenges and difficulties [Authors]. Each of the three longitudinal interviews featured distinct ways of focusing on the future through the lens

of energy use, exploring both how individual experiences of biographical transition shape anticipated futures, and the links between how people imagine their own lives changing and shared future imaginaries. The project's multimodal approach exploited different ways of making the future more tangible to address the challenges presented by talking about the not-yet [Authors]. For example, after participants in the sub-sample had taken part in a photography task, they were asked, following discussion of the photos they had taken, to imagine life fifteen years in the future. Then, as part of the final interview, respondents were invited to view short films containing examples of future homes that featured a variety of ways of using energy. The first of these was a video from 1957 demonstrating the Monsanto 'house of the future', an exhibit originally part of Disneyworld's 'Tomorrowland'.¹ To initiate discussion, interviewees were asked to consider the differences between the present and how the future had been imagined in the clip, and whether there were features of the home shown in it that appeared particularly attractive or unattractive.

Following this, the second clip, from the 2012 UK Channel 4 (Ch4) series 'Home of the Future' featured the refurbishment of a multi-generational family's home with a range of technologies (including for energy generation and demand management). The programmes then documented the family's experience of everyday life in this environment. To initiate discussion, interviewees were asked to reflect on comparisons between the two films, and between the second film and their everyday lives in the present. Although we did not explicitly identify 'smartness' to interviewees here as a theme for reflection, a variety of technological innovations and practices relating to 'smart living' were highlighted within the programme. Interviewees' responses to these videos forms the main focus of our analysis below.

We opted to use videos as they provided a broader view of relevant issues, for example, depicting a number of technologies whilst also showing people's reactions to and interactions with them, which would not have been feasible to capture using static images. Whilst being an image and sound based medium, video can also capture and represent other senses (Pink 2003).

Interviews: care, engagement and smart imaginaries

A dominant theme: convenience and ambivalence

Throughout all three rounds of interviews, respondents often registered an ambivalent relationship with convenience. Particularly among older interviewees, biographical narratives often identified an orientation towards convenience as a significant trend in social life after WWII, even as a 'centre of gravity' for the growing interdependence between everyday practices and increasingly advanced domestic devices. Such stories of growing interdependence have long become established social science narratives in the decades from the 1940s on. Technologies are often held, for example, to have had far-reaching effects on household management and particularly on the role of women in the home (Greenwood, Seshadri, and Yorukoglu 2005), although the oft-claimed liberatory effect of domestic technologies has been questioned (Cowan 1983).

Older interviewees often recounted memories of the advent of gas or electric heating. The internal emotional and symbolic rewards of the practices of heating supported by such

¹ Available on Youtube at <https://www.youtube.com/watch?v=VowfYuhx1-o>

technologies (using the boiler, charging storage heaters) were represented as very significant for people used to cold houses and open fires.

It's the best thing in the world that happened to me, was going from coal that we had over in Hywel Dda there. But when I first moved from Cambria Road to Heol Deva that was a house of, it was unbelievable, we had central heating and I was only 10, in all the rooms, a steel house, wonderful, wonderful. (Jeffrey, 60s, Ely)

In these narratives, older practices that had died out were seen as involving a kind of effortful engagement that was often described as drudgery or mere 'hard graft' (Jeffrey), such as shovelling coal for open fires. Interviewees were glad such practices had died out in the face of a drive for convenience that created more time- and labour-efficient ways of cleaning, heating, cooking and so forth. The transition 'from pretty manual type of living to very automated type of living' (Brian, 60s, RFH) was widely seen as associated with making more time available for other, more intrinsically rewarding activities.

This aspect of convenience was explicitly connected by some with the future imagined in the Monsanto film:

Well you have more time for your career and less time in the kitchen, everything is more automatic in the kitchen you know you don't have to spend so much time washing and cleaning. [...] (Marie, RFH)

Marie also found in the material environment of the Monsanto house, dominated by the new plastics industrial chemistry had made possible after WWII, a specific aesthetic of convenience.

It's more clean, I'm surprised there aren't more gadgets nowadays for more cleanliness. I think there could be incinerators in houses especially when you have babies and you have nappies and things it's disgusting, (Marie, RFH)

In this way, she associated convenience not just with labour-saving, but with values beyond the instrumental level. Automation of cleaning, and the absence of dirt, are both seen here as the centre of a form of life that is aesthetically as well as practically better. Monica (RFH) here remarks on how comparable contemporary everyday life is to the 'push-button' future vision of the Monsanto house.

And then did I say, yeah, everything is really easy and convenient I mean you want the TV on you hit a button and it's on and you've got like 500 channels at your fingertips should you want to watch them and then you've got all your music players and you've got not just one but maybe one in each room these days so you've got like five in a house and then you've got, you've got Wi-Fi and internet and stuff and everything is just really easily amenable and cheap and available for pretty much anyone who can pay for it. (Monica, RFH)

Monica affirms here societal dominance of convenience as a kind of super-value produced by incremental waves of socio-technical change described by Shove. Alongside reflections on the instrumental and not simply instrumental value of convenience, other more ambivalent statements can be found, however. Monica, having talked about the extent to which convenience orders everyday life, goes on:

We don't think about it twice I mean putting the microwave on or the kettle on or the cooker on is not, you don't kind of hmmm do I really need to do this? You just kind of do it and then even if you don't drink the cup of tea or you change your mind later the kettle has boiled and what's done is done and that's it and you move on with life. I think yeah just a bit more blasé about yeah well it's there, and it will always be there and it won't.

Here, convenience is seen as encouraging care-lessness. Monica, who recycles and talks of the wider costs of energy, sees convenience as associated with a lack of care for the consequences of what one does. Convenient arrangements are configured around human needs and preferences, and are thus manifestations of concern. Yet they do not necessarily also manifest care, in the shape of attentive engagement. Other interviewees who actively identify as interested in sustainability see this as a moral failing inherent in dominant forms of life made possible by convenience. Jonathan (Peterston) linked his personal biographical experiences of frugality in childhood to what he saw as his adult attachment to 'simplified' lifestyles ('you distrust and disdain and look down on profligacy and flashiness'). In the third interview, he expressed disquiet at the futures imagined in both films, noting a central similarity between them: intensive energy use. Reflecting on the Ch4 film, he noted that:

Even if all the electricity was coming from renewable, Green sources I think it would still bug me a little bit because it's the heedlessness of it and the lack of mindfulness and the [...] just that, that kind of carelessness of it all.

In the Ch4 film, 'smartness' is present in transport (the home-charging electric car) and networked appliances (such as fridges that re-order food). Monica's identification of carelessness with convenience is mirrored in Jonathan's observation that a 'smarter' future risks fostering 'heedlessness'. Even more emphatically, others picked out additional negative aspects of the Ch4 film's depiction of smartness.

Like the fridge that re-orders [...] I still think it sort of dumbs us down as a kind of society and replaces our you know ingenuity and our thinking, free thinking with controlled you know thinking and you know computerisation of everything (Dennis, RFH)

I don't know really what they are trying to do, I suppose they are trying to weaken you in a way you know kind of make you less and less able and capable of looking after yourself! You know you become so dependent on hi-tech gadgetry to survive.. (Joseph, Lammas)

Vanessa (Lammas) extends this theme of helplessness into that of fragility.

Yeah I mean [talking about the Monsanto house] it's hilarious in the whole kind of electricity of it isn't it? It's like you know [laughs] you're starving and the electricity is broken and you can't get into the bloody fridge or into the cupboard! [...]

[talking about Ch4 film] all the gadgets I mean that was you know similar to the bloody [Monsanto] house you know you're hungry and the electricity is down and you can't, you know you can't have a shower because you can't turn on the tap you know! (Vanessa, Lammas)

She points out that the historical evolution of forms of life centred on convenience have certainly erased certain onerous practices, but have in doing so created a new problem: the prospect of malfunctions somewhere in the largely intangible material fabric of the

environment that sustains the lifeworld of convenience. Even the aesthetic of convenience mentioned by Marie can be seen as self-undermining, Vanessa suggests: ‘plastic degrades and gets dirty and gets mouldy’. A number of interviewees recognise that convenience goes along with the invisibility of a multiplicity of processes that can have unintended consequences for the material viability of convenient living.

Care-full practices: valuing friction

As well as its material viability, however, many interviewees questioned the contribution that convenience makes to a life genuinely worth living. It is here that the theme of attention and attentiveness, discussed earlier, emerges within interviews. Interviewees often contrasted what they saw as a tendency for convenience to encourage disconnection and distraction with other forms of interdependence, described through biographical narratives about practices, that encourage connection, and with it, forms of personal and interpersonal resilience.

For example, Sarah (RFH), having viewed the Monsanto and Ch4 films, discussed heating. She made a link between the absence of ‘homeliness’ from the Monsanto house and heating technologies.

[...] a log fire’s is quite homely but obviously they didn’t picture that in the future because its hard work making a log fire whereas they just press a button and they’ve got warmth or coolness or you know whatever they needed. Yeah there was no character or you know clutter or anything, everything was perfectly put away and a dishwasher yeah.

Interviewer: And you said about making a log fire that it involves work but is it a good kind of work or?

Sarah: Yeah like it’s, it’s rewarding you know just sit back and you look at a nice log fire [...]

Although there is an opposition here between an aesthetic of homeliness and one of convenience, this is not the ultimate focus of Sarah’s reflections. The multimodal element of the project also made it possible for interviewees to talk about the modes of engagement afforded by practices and technologies. Sarah goes on to distinguish between the heedless, disempowered, fragile, convenience-focused form of life mentioned by Jonathan and Dennis (see above) and another mode of living centring on a kind of care-full engagement.

I think we were saying about the log fire, its rewarding when you sit back and see the log fire whereas if you just flick a switch and it’s there it’s not as rewarding so who knows you know on how it effects our happiness in the long run things like that, don’t know. (Sarah, RFH)

Discussing the Ch4 film’s vision of a smart future, she mentions that it ‘seems like becoming obsessed with technology and not being able to do things for ourselves’. This connects with how themes related to care appear in earlier interviews in Sarah’s descriptions of an important lifecourse transition: how having a child led her to seek to make ‘more of a home’ and that warmth and comfort became for her key parts of the feeling of how ‘home’ feels, particularly in a hard-to-heat rented flat. Simultaneously, however, she contrasts different ways of heating as care-less versus care-full, as shown in the second extract above. She describes how she loves taking her daughter to visit her mother’s house nearby, as it ‘it’s always so cosy, whereas my flat’s always so cold’ but that her mother’s house is so warm because she ‘will leave her heating on twenty four hours a day in the winter’.

Where convenience, in the sense of easy control over services (like heating), has a certain value which her own material circumstances make plain, Sarah sees in it a danger resulting from an implicit heedlessness and *lack* of control, as in her mother's relationship with her central heating. While it is always possible to take care to 'switch things off', a deeper and broader heedfulness comes from a more meaningful, engaged relationship with domestic technologies in which more personal emotional and imaginative investment is possible – whether tending a log fire or being 'self-sufficient' with household solar energy, which is at the centre of one description she gives of her ideal lifestyle, in which she would 'go and live by the sea'.

Other interviewees place in the foreground conceptions of a more engaged, attentive and focused relationship with technologies that use energy. Some refer, as does Sarah, to practices associated with tending wood fires and the fire as the locus of at-homeness (echoing Borgmann's description of the hearth as 'focal'). For Robert (Peterston), the attraction of building and tending a fire holds an attraction which often seems (at least in conventional terms) rather 'inconvenient', even irrational.

Yeah well that's, my partner says I'm obsessed with it because I'm always off up the woods looking for wood and things like that, 'I'm going to light it tonight', 'oh no you're not are you?' I mean it's only that big. But it is, its quite nice sitting in front of a fire watching telly and my daughter plays in there with her Lego and things when we sit there and it's quite nice.

Dennis (RFH) describes experiencing together with his son pleasures of direct, embodied engagement with the use (and production) of energy.

[...] We have wind up radios, wind up torches. They are not really, yes they're wind up but the action is different. And I think he actually likes that aspect, I think he gets very sort of excited that he can actually create the kind of energy to use that. (Dennis, RFH)

In these examples, we find described varieties of interdependence, fostered by specific technologies, which make possible valued kinds of agency. This kind of agency is not that of Strengers' 'resource man'. Instead, it embodies a contrast with convenience and smartness that takes on a particularly stubborn character in Robert's narrative, emphasizing instead the constitutive value of the bodily and sensory engagement with energy along with the effortful practices that solicit it. Interviewees from Lammas affirm the connected and relational nature of such forms of agency.

The best bits oh! I love growing my own food, it's such a kick out of growing my own food and feeding myself off of the land. I love the seedling stage where everything is just coming up and it's all these lovely neat trays and nothings been eaten by slugs yet [laughs] [...] So yes, I like the connection, I really enjoy that connection to the earth; it's like it's direct and meeting my needs directly and I'm managing my waste directly, those kinds of things for me is really, that's important, so I enjoy that. (Vanessa, Lammas)

Here and elsewhere in her interviews, Vanessa celebrates a kind of autonomy which is supported, not by dominant forms of convenience, but by systems organised around the tangibility and presence of things which sustain life and which are, in turn, dependent for their own flourishing on care-full engagement. She describes how her investment in such

forms of engagement is related to lifecourse transitions, such as leaving home in her youth to live on a boat with her then-boyfriend.

[...] you are on a boat, the water will run out, the batteries need charging up, the food is going to last you so long and that thing about limited resources and having to really manage your resources cos, which is a metaphor for the whole planet in a way, that thing of having a limited amount and being aware of that and using it responsibly.

Here, interdependence is represented as a condition in which individuation (in Stiegler's sense) is made possible by particular material relationships of interdependence.

Importantly, such relationships are described as being sustained by a variety of socio-technical arrangements. Jonathan (Peterston), viewing the Ch4 film, links 'the world I'd come from', mentioning childhood walks with his father in the Welsh countryside, gardening and food growing, to small-scale hydroponic technology shown in the film (the Aerogarden™). He finds in the device not only the seeds of new forms of urban agriculture 'to feed 9 billion people' but also socio-technical arrangements that foster sensory and embodied human engagement with nature both inside and beyond the urban home.

Every day I would look at these plants growing in my kitchen or indoors somewhere, I would have a relationship with them as living beings. [...] No I think you know if you take that, go down that route nature then becomes a spiritual and a leisure resource because food growing, food production is decoupled from wild nature so wilderness becomes preserved and maintained for its own intrinsic value [...]

What draws together these descriptions of care-full practices of growing, tending and attending from Sarah, Robert, Dennis, Vanessa and Jonathan is the theme of engaged attention. Close involvement in these practices is necessary in order that a subject may understand and take care of the needs of something that is dependent on it (whether this other is a fire, a plant or a functioning electrical device). An ongoing relationship (of tending, whether fire or plant is the object) fostered by a practice offers the opportunity, in Stiegler's words quoted earlier, for a subject 'to have her own experience, that is, to learn something by herself in her constant confrontation with the real.' Such practices offer internal rewards that are not just tied to performing them well, but to the experience of absorption within them and the emergence of identity from out of this engagement.

I find it pleasurable to see things happening. I always found it really wonderful when I see anything growing and just planting a seed and seeing it growing on my windowsill, I've always enjoyed, I like birds singing and sunrises and sunsets and the stars and not having so much light pollution that I can't see the stars [...] I find the fact that I can design my plot and my own life in the way that I can without having to have the lifestyle of going to work every morning and earning money in that way and stuff like that; that is pleasurable but it's a challenge as well. (Anna, Lammas)

Anna identifies features of a kind of subjectivity that she traces to experiences of emotional and sensory connection and which she associates with the demanding challenge of caring for other entities with which she finds herself interdependent. Part of care is the 'resistance' of the other. Such experiences are inherently effortful, because the other remains *other*, with singular needs and vulnerabilities that are not necessarily immediately knowable by the 'carer'. Inseparable from care-full engagement is therefore a kind of affective and emotional

friction, which contributes form to an ongoing narrative of care. This friction is the source of individuation in Stiegler's sense, the becoming-active of the subject as an agent and thus a source of investments around which an active identity can emerge. This friction, if it grows too intense, due either to e.g. the need for onerous physical effort or to emotional conflict, may result in a desire to withdraw from a practice and the 'thing' for which one cares (a withdrawal which may of course not be possible). If there is a significant lack of such friction, however, this appears also to be associated by interviewees with a desire to disconnect from engaging in practices (especially where these are practices depicted in the films). This is stressed by interviewees from every site, particularly in the contexts of the consumption of energy and food,

[..] and people don't, in this country particularly not so much in other European countries, they don't touch their food, they don't you know they don't have a link with it. It turns up as an industrialised product and that's the sort of dream, the easy dream, lots of spare time, disposable packaging you know nothing to do apart from sit and watch the telly and you know I, I think there's still a big percentage of people who are bought into that yeah? (Roy, Lammas)

Here, Roy associates convenience with an *absence* of things demanding engagement, with having literally 'nothing to do'. The contrast between the form of life he sketches here and the allusions to comfort, homeliness, engagement and connection made in the interviews examined above is striking. It echoes Borgmann's description of television, in which he draws attention to the 'holes' that both television, as a 'device that devours time', and 'timesaving devices' create within traditional practices and the lifeworlds woven around them (Borgmann 1993: 112)

From individual biographies to social futures: friction and imagination

Convenience is, in the quotation taken earlier from Ellul, the elimination of 'the human sources of friction' and the unpredictability they create. Care, however, requires certain kinds of effort that bring with them a particular sort of unpredictability (that comes from the otherness of the other). This effort and unpredictability contribute to the meaningfulness of and our investment in practices. This contribution is affirmed in interviewees' biographical narratives about how care-full practices move material but also emotional interdependence from the background into the foreground of everyday life.

At Lammas, 'devices' are explicitly dependent on the quantifiable, metered inputs of energy derived from off-grid hydro- or solar microgeneration. Attentiveness is encouraged to spread and connects a range of practices and devices in the home, ranging from washing machines and cookers to tablet computers and mobile phones.

Yeah definitely, definitely I like the fact that there are kind of, there are natural limits. So for example at one point during that week or during this period we had a week of rain and during that week we had very limited electricity and so she wasn't able to do that, partly cos the actual tablet takes electricity and also cos the internet power takes electricity and so during that week there were you know more restrictions on what she could access in that way than normal.

[...]we're just so used to checking the readouts we kind of know now and it makes a massive difference whether it's sunny or not so we know that if it's sunny Harry can play his music full blast and you know it's not a problem he can play his music all day and into the evening and

if it's been gloomy like today for three or four days we know that we'll probably need to check before turning on the computer for a film you know, or whether we watch a film on Faye's little small laptop or whether we use Harry's big LCD screen [...] (Peter, Lammas)

In Lammas interviews, contemporary technologies are fully represented. Yet the services provided by devices (washing, cooking, communication, education, entertainment) appear materially but also symbolically inseparable from other objects (meters, the home, vegetable and fruit plots, coppiced woodland, renewable power) that are objects of effortful care. Here, devices are emphatically not just devices. They become focal things through which relationships of interdependence are brought before subjects as objects of attention. It should be remembered that this biographical (but at Lammas, also shared) experience is at the heart of an experimental communal transition whose future goal is the 're-assembling of domestic life' (Vannini and Taggart 2014). A shift emerges within interviewees' narratives regarding how concepts central to the imaginaries of convenience and smartness, such as 'controllability' are understood. Comparing her family's use of a wood burning stove to her parents' central heating, Emmanuelle notes that the central heating system offers push-button controllability, but immediately qualifies this statement:

Yeah but I don't like that. I look back and I think actually I see for me how I had no connection with it, no connection you know, whereas when the wood's there and you see the fire going you think maybe I'll just turn the fire down cos the pile of wood is shrinking. Yeah I think it's very easy if you have no connection with it and the bills just go out by direct debit and there's no connection with the fuel that is actually being burned to produce this heat (Emmanuelle, Lammas)

Emmanuelle echoes here Sarah's comments about log fires versus central heating. She sees her wood-burner as controllable but *differently*, a focal object whose meaning is conditioned by its relationship to other parts of a system that are equally within her sphere of influence and that of others she trusts. By the time of the third interviews, the availability of solar- and hydroelectricity meant that households could reconnect appliances that were 'traditional' conveniences, like washing machines. But these too were foregrounded and focal, rather than hidden in the background.

I can't get over [Laughs] how wonderful my washing machine is. I think I've had it for maybe three weeks now. It's just incredible, just incredible. [Laughs] [...] We have fan heaters. Which is very wonderful [...] We've got a kettle, an electric kettle. It's very lovely. We have music. Stereo player, oh it's lovely. (Emmanuelle, Lammas)

Emmanuelle's enthusiasm and joy here undoubtedly reflect a long period (over a year) without readily available electricity. However, her story is not simply about a return to familiar comforts. Part of the satisfaction of the return of conveniences like the washing machine came from the fact that they had been installed as part of a system designed and built by her and her partner. The meaning and significance of the devices therefore changes. As in the extracts from Peter's interviews above, the meaning here of the materials upon which everyday practices rely derives from what Ingold calls 'haptic' rather than 'optical' engagement with things, a form of engagement of a 'mindful body at work with materials [...] "sewing itself in" to the textures of the world' (Ingold 2011: 133). The fuel for the fire, or the electricity measured by Peter's meter, are not merely abstract resources, but concrete symbols for the texture of everyday life, the maintenance of which involves the friction that comes with imaginative, emotional and physical effort. In addition, such relationships are not

felt to expose subjects to uncertainty and unpredictability arising from processes buried in a complex, largely invisible system (as examined in the previous section). The scale of the systems involved is such that uncertainty is largely localised and controllable within the sphere of influence of the household and community.

Lammas interviewees draw on these biographical experiences in their reflections on the imaginaries manifested within the films. Convenience and smartness are discussed as examples of an over-complexified, fragile form of living which, even if ‘green’ is not ‘sewn into’ everyday life is maintained. Instead of focal objects, there are disconnected commodities. Discussing the aerogarden, Emmanuelle exclaims:

[...]there’s no cycle is there? You can’t, you know, if I ever grow a pepper plant in a pot at the end of the season; throw it on the compost; soil and all. The exhausted soil can go in the compost and the pot gets washed out and used again. Well what are you going to do with that [the aerogarden]? Where’s the compost?

Similarly, talking about ICTs (prompted by the Ch4 film), Vanessa reflects that

I do think there is a danger that, a bit like the plastics in that [Monsanto house] film, where people completely disregard their immediate environment and their immediate social life in lieu of you know Facebook or Twitter or whatever and actually the disconnect happens [...]Its 80% of communication is non-verbal, is non-spoken, it’s not the actual words you know it’s body language, it’s eye contact and it’s tone of voice, that’s the bulk of communication and you just don’t get that when you’re on a computer, you don’t get any of that.

Here, Vanessa links the imaginaries of both films, not in terms of their similar visions of an energy intensive future (as many others across different sites did), but on the basis of their respective blindness to disconnection – disconnection from the extra-social world and from the haptic world of human contact.

Discussion

Earlier, we proposed that qualitative social science has an important contribution to make to the ‘hermeneutic turn’ in technology assessment, and particularly to the assessment of visions and imaginaries. As an example, we mentioned Strengers’ use to ethnography to open a critical space around the smart imaginary. The extracts from biographical narrative interviews from [Project Title] we have presented above offer another example of how qualitative social science can make a contribution to technology assessment. Narrative interviews, coupled with multimodal resources, can link together biographical experiences and social imaginaries in ways that solicit deliberation on ‘future worlds’. The critical space our data opens up around the smart imaginary centres on the themes of effortful engagement and friction and its contribution to the significance of practices and of technologies. In particular, such friction appears to be an example of what Shove et al (2012) call an internal reward of practices. As our previous work on [Project Title] suggests [Authors], this reward is connected with the production of valued identities and forms of agency through active engagement in practices, a process identified by Stiegler as individuation. Interviewees identify examples from their own experience of how such processes are part of their own lives, and draw attention to how the forms of life depicted in the two films promise the further attenuation of these kinds of valued experiences.

Friction, in a related sense, has been foregrounded in design research in recent years as an alternative value to convenience, in the design of device interfaces, as well as by advocates of an ethics of technology that is attentive to themes like care and emotional investment (e.g. Verbeek 2011). Convenience, such perspectives recognise, is one design value, which reflects particular contingently-evolved social priorities. Löwgren (2007) identifies another, alternative priority as ‘pliability’, an aesthetic quality that allows the user to shape what information s/he is able to access from a device. Udsen and Jørgensen (2005) suggest that ambiguity in the relationship between user and device interface can be a positive quality, creating the possibility of an educative interaction through the production of ‘emotional friction’. Just as these analyses of cognitive and emotional friction expose the contingency of convenience as an interface design value, the narratives of practice change given by our interviewees extend into reflections on the contingency of convenience and smartness as socio-technical values more generally.

Furthermore, the narratives provided by Lammas interviewees in particular can be read as examples of what Vannini and Taggart (2014: 116-19) call the ‘Thoreau effect’. Vannini and Taggart show how delinking from power and/or water grids thickens the lifeworld (in contrast to the thinning of the lifeworld in Casey’s analysis of convenience) once more through opportunities for care-full engagement. In the process of re-assembling everyday life, off-gridders become invested in objects through shaping their own environments, understood as lifeworlds into which they ‘sew’ (in Ingold’s language) themselves and their practices (Vannini and Taggart 2014: 96-8). Rather than renouncing the trappings of the mainstream entirely, Vannini and Taggart find off-gridders re-imagining and re-inventing the meaning of convenience and comfort in forms that are refracted through the privilege they accord to frictive engagement. The Thoreau effect is the name Vannini and Taggart give to the investments the subjects of their study have in the processes, devices and products of this re-modelling. Convenience is no longer imagined as enabling the efficient use of time or of being able to have anything whenever it is desired. Instead, convenience comes to mean connectedness and the ability to reshape one’s environment in line with a desire for connection (having food and renewable energy sources close at hand, ordering activities to avoid unnecessary haste, relative simplicity, and so on).

This questioning of values is also present in our interviews from (off-grid) Lammas. At the same time, it also appears in interviews from more mainstream sites. It is present in how Emmanuelle, for example, reinterprets the meaning of controllability by comparing a wood fire to central heating. But it also appears, for example, in Jonathan’s assessment of the aerogarden, and in Sarah’s discussion of heating. While interviewees at Lammas are undertaking a wholesale ‘re-assembling’ of everyday life in a way other respondents have not, the forms of agency they have pursued are mirrored by the emotional investments other people have in particular practices. These investments are made manifest within accounts of frictive and care-full engagement that shape one’s environment, whether undertaken individually or with others. As the Lammas interviews make clear, such forms of subjectivity tend to bring into the foreground interactions with supporting devices and infrastructures. The multi-dimensional friction we have been describing may therefore be identified as a kind of ‘grit in the oyster’ of processes of identity creation (Stiegler’s ‘individuation’) that are embodied, emotional and affective. Through friction are created creating recurrent patterns of experience around which subjectivity forms.

From established perspectives in STS and practice theory, the emphasis in these findings on subjective experience may appear suspiciously like a return to a form of theory which views

the interior world of the subject as enjoying a special status in relation to material reality. Our emphasis on care, however, affirms on the contrary that subjectivity is complex and often fragmented, and perhaps dispersed into embodied practices, emotional responses to others or disconnected reflections. At the same time, it also recognises the equally important point that such a subject is nevertheless an evaluating subject which lives through a diverse and sometimes perhaps conflictual set of forms of life, supported by complex entanglements of objective social and material relationships (Soper 1990).

Conclusion

In this paper, we began from the idea that social technology assessment requires a critical space in which to explore the ‘worlds’ of future imaginaries. We have argued that particular kinds of thick qualitative data about the forms of life that technologies make possible is therefore equally as necessary to inform deliberation as are technical analyses of the viability of technologies. The combination of narrative biographical interviews and documents of social imaginaries (such as films) that we have presented here has allowed our interviewees (and us) to explore the implications of visions of future lives that centre on new realisations of convenience and smartness.

Convenience and smartness are imagined as good ways of living. This is because they are seen as promoting easy access to services or optimising the social allocation of resources. Yet as we have shown, many interviewees’ reflections on future imaginaries manifest concerns about these values that appear to be related to investments in particular kinds of practices that are reflected widely across very different case sites. An appreciation of the role of care and friction as the ‘grit in the oyster’ of constitutively-valuable forms of subjectivity may awaken us to other priorities and ends, and indeed to other ways of imagining what concepts like convenience and comfort could come to mean. By building links between individual biographies and social imaginaries, we have demonstrated how a novel qualitative methodology can help us explore how different socio-technical arrangements can foster or undermine widely-valued forms of engaged, embodied agency through practices that solicit attention and focus.

We have shown that the assessment of imaginaries within social technology assessment can benefit from an approach which attends to the questions concerning how and why people, considered as complex, embodied subjects, engage in particular ways of doing things. In particular, this approach can show how the involvement of subjects with their world, conceptualised through notions of care that draw on distinct social-theoretical and philosophical traditions, is a constitutive part of how they evaluate potential socio-technical change. Further, experiences of this involvement within individual biographies, can usefully be explored via narrative longitudinal methods. In particular, the use of multimodal resources in opening up a space for reflection on future imaginaries has been shown to be of value. The role of qualitative social science in supporting the inclusiveness and responsiveness of innovation under RRI has been recognised (e.g. Eden, Jirotko, and Stahl 2013). Here, we have demonstrated that insights from qualitative, narrative research can contribute to defining substantive frameworks that can guide the deliberative activities which form part of RRI processes. One potential result could be to enrich RRI approaches to socio-technical assessment by facilitating deeper deliberation on the forms of life that socio-technical change may make possible, and on how assumptions about the meaning of concepts like convenience, comfort and control are open to change both now and in the future.

References

- Borgmann, A. 1993. *Crossing the Postmodern Divide*. Chicago: University of Chicago Press.
- Borup, M, Brown, N., Konrad, K., and H. Van Lente. 2006. The sociology of expectations in science and technology. *Technology Analysis & Strategic Management* 18 (3-4):285-298..
- Casey, E. S. 2001. Between Geography and Philosophy: What Does It Mean to Be in the Place-World? *Annals of the Association of American Geographers* 91(4):683-693.
- Cowan, R.S. 1983. *More Work for Mother*. New York: Basic Books.
- De la Bellacasa, M. P. 2012. 'Nothing comes without its world': thinking with care. *The Sociological Review* 60 (2):197-216.
- Delgado, A., Kjølberg, L. and Wickson, F. (2011). "Public engagement coming of age: From theory to practice in its encounters with nanotechnology." *Public Understanding of Science*, 20(6), 826-845.
- Eden, G., M. Jirotko, and B. Stahl. 2013. Responsible research and innovation: Critical reflection into the potential social consequences of ICT. Paper read at Research Challenges in Information Science (RCIS), 2013 IEEE Seventh International Conference on, 29-31 May 2013.
- Ellul, J. 1964. *The technological society*. New York: Vintage.
- Engster, D. 2007. *The heart of justice: care ethics and political theory*. Oxford: Oxford University Press.
- Feenberg, Andrew. 1999. *Questioning Technology*. London: Routledge.
- Fujimura, Joan. 2003. Future imaginaries: genome scientists as cultural entrepreneurs. In *Genetic Nature/Culture*, eds A. H. Goodman, D. Heath and S. M. Lindee, 176-99. Los Angeles, CA: University of California Press.
- Greenwood, J., Seshadri, A., and M. Yorukoglu. 2005. "Engines of Liberation." *The Review of Economic Studies* 72 (1):109-133.
- Groenhou, R.E. 2004. *Connected Lives: Human Nature and an Ethics of Care*. Lanham, MD: Rowman & Littlefield.
- Grove-White, R, Macnaghten, P., and B. Wynne. 2000. *Wising up: the public and new technologies*. Lancaster: Centre for the Study of Environmental Change.
- Groves, C. 2011. The Political Imaginary of Care: Generic versus Singular Futures. *Journal of International Political Theory* 7 (2):165-189.
- Grunwald, Armin. 2014. "The hermeneutic side of responsible research and innovation." *Journal of Responsible Innovation* no. 1 (3):274-291.
- Hards, S. 2012. Tales of transformation: The potential of a narrative approach to pro-environmental practices. *Geoforum* 43 (4):760-771.
- Henwood, K, and N. Pidgeon. 2013. *Future Identities: Changing identities in the UK the next 10 years*. London: Government Office for Science/Foresight.
- Hollway, W, and T. Jefferson. 1997. The Risk Society in an Age of Anxiety: Situating Fear of Crime. *The British Journal of Sociology* 48 (2):255-266.
- Ingold, T. 2011. *Being Alive: Essays on Movement, Knowledge and Description*. London: Taylor & Francis.
- Jasanoff, Sheila. 2004. "The idiom of co-production." In *States of knowledge: the co-production of science and the social order*, edited by Sheila Jasanoff, 1-12. London: Routledge.
- Latour, B. 1993. *We have never been modern*. Cambridge, MA: Harvard University Press.
- Law, J. 2009. Seeing Like a Survey. *Cultural Sociology* 3 (2):239-256.
- Löwgren, J. 2007. Pliability as an experiential quality: exploring the aesthetics of interaction design. *Artifact* 1 (2):85-95..

- Macnaghten, P., and B. Szerszynski. 2013. Living the global social experiment: An analysis of public discourse on solar radiation management and its implications for governance. *Global Environmental Change* 23 (2):465-474.
- Marris, P. 1991. The social construction of uncertainty. In *Attachment across the life cycle*, eds Colin Murray Parkes, Joan Stevenson-Hinde and Peter Marris, 77-90. London: Routledge.
- Ozaki, R., and I. Shaw. 2014. Entangled Practices: Governance, Sustainable Technologies, and Energy Consumption. *Sociology* 48 (3):590-605.
- Pink, S. 2003. Representing the sensory home: ethnographic experience and anthropological hypermedia. *Social Analysis*:46-63.
- Ruddick, S. 1989. *Maternal Thinking: Toward a Politics of Peace*. New York: Beacon Press.
- Sayer, A. 2011. *Why things matter to people* Cambridge: Cambridge University Press.
- Schatzki, T.R. 1996. *Social Practices: A Wittgensteinian Approach to Human Activity and the Social*. Cambridge: Cambridge University Press.
- Shove, E., M. Pantzar, and M. Watson. 2012. *The Dynamics of Social Practice: Everyday Life and how it Changes*. London: SAGE Publications.
- Shove, E. 2003. Converging Conventions of Comfort, Cleanliness and Convenience. *Journal of Consumer Policy* 26 (4):395-418..
- Shove, E., and D. Southerton. 2000. Defrosting the Freezer: From Novelty to Convenience: A Narrative of Normalization. *Journal of Material Culture* 5 (3):301-319.
- Simakova, E., and C. Coenen. 2013. "Vision, Hype and Expectations: A Place for Responsibility." In *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*, eds R. Owen, J. Beasant and M. E. Heintz, 241-268. Chichester: John Wiley & Sons.
- Soper, K. 1990. *Troubled Pleasures: Writings on Politics, Gender, and Hedonism*. London: Verso.
- Stiegler, Bernard. 2010. *Taking care of youth and the generations*. Stanford, CA: Stanford University Press.
- Stiegler, Bernard. 2012. Relational Ecology and the Digital Pharmakon. *Culture Machine* 13, <http://www.culturemachine.net/index.php/cm/article/view/464>, accessed 15 April 2015.
- Stilgoe, J., Owen, R., and P. Macnaghten. 2013. Developing a framework for responsible innovation. *Research Policy* 42 (9):1568-1580.
- Strengers, Y. 2013. *Smart Energy Technologies in Everyday Life: Smart Utopia?* London: Palgrave Macmillan.
- Turner, V. 1974. Liminal to liminoid in play, flow and ritual: an essay in comparative symbolology. *Rice University Studies* 60 (3):53-92.
- Udsen, L. E., and A. H. Jørgensen. 2005. The aesthetic turn: unravelling recent aesthetic approaches to human-computer interaction. *Digital Creativity* 16 (4):205-216.
- Vannini, P., and J. Taggart. 2014. *Off the Grid: Re-Assembling Domestic Life*. London: Routledge.
- Verbeek, P.P. 2011. *Moralizing Technology: Understanding and Designing the Morality of Things*. Chicago: University of Chicago Press.
- Wynne, B. 1992. Uncertainty and Environmental Learning - Reconceiving Science and Policy in the Preventive Paradigm. *Global Environmental Change-Human and Policy Dimensions* 2 (2):111-127.