The costs of public involvement
Everyday devices of carbon accounting and the materialisation of participation

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Abstract
This paper seeks to contribute to the development of device-centred perspectives on public participation through an analysis of everyday technologies of carbon accounting. Such instruments are currently put forward, in the UK and elsewhere, as a way of locating environmental engagement in everyday practices, such as cooking and heating. The paper considers whether and how these technologies can be said to 'materialise' public participation. It argues that the materialisation of engagement entails a particular codification of it: as participation is located in everyday material practice, it comes to be defined in terms of its doability and the investment of effort. Material participation, then, does not just refer to its mediation by things: it involves the deployment of specific legitimatory tropes associated with liberal theories of citizenship and the domestication of technology, in particular the notion that the engagement of everyday subjects requires things to be 'made easy' (Pateman, 1989; Schwartz Cowan, 1983). To make sense of this confluence of political and technological ideals, the paper takes up the notion of 'co-articulation' (Callon, 2009). A distinctive feature of the everyday devices of accounting under consideration here, I argue, is their ability to 'co-articulate' participation with other registers: those of innovation and economy. In this respect, the spaces of participation organised with the aid of these technologies can be qualified as spaces of 'multi-valent' action. Different carbon accounting devices do this, however, in different ways, and this has consequences for how we understand the wider normative implications of the 'materialisation' of environmental participation. In some cases, materialisation entails the

minimisation of social, material and political changes, while in others it enables the exploration and amplification of precisely these modes of change.

Key-words
technologies of participation - everyday life – materialisation – environmental engagement - carbon accounting.

1. Introduction

Social and cultural studies of citizenship have long emphasised the important roles played by material entities in the performance and organisation of civic engagement (Foucault, 1975; Anderson, 1983; Akrich, 1992). This focus on the role of things was informed by a wider intellectual and normative project: these studies sought to return to citizenship and participation what they had been denied in theories that defined them primarily in abstract and linguistic terms: a sense of public engagement as an embodied activity, taking place in particular locations and involving the use of specific objects and technologies. Today, however, the attempt to 'materialise' citizenship is no longer limited to social and cultural studies: it now also takes the form of an *empirical effect*, one that is achieved - or aspired to – in a wide range of institutional and practical initiatives, projects and campaigns aimed at fostering public participation. This has various implications, I want to argue here, for how we conceptualise and value the materiality of participation: it invites, among others, an interrogation of the means by which participation is accomplished. Recent attempts to locate public engagement with environmental issues in everyday practice, in the UK and elsewhere, provide a case in point.

There has been in recent years a proliferation of publicity campaigns that promote practical forms of engagement with environmental issues such as climate change, resource depletion and biodiversity. A distinctive feature of these campaigns is the premise that everyday material activities, like heating, cooking, driving and washing, provide especially suitable sites for 'doing one's share' for the environment (Hinchliffe, 1996; Hobson, 2006). These campaigns thus define public engagement in ways that deviate from more customary framings of it in terms of 'literacy': rather than seeking to increase people's *knowledge* about the issues, these initiatives focus on *action and impact* - on what people do about the issues in question. This focus on action can be taken to suggest an alternative conception of public participation, but I want to emphasise here that this shift is

enabled by methods and techniques used to render public engagement visible. An example of these methods is the measure of people's 'willingness to take action' (IPPR, 2008; Berk and Fovell, 1999), as visualised in Figure 1, which is taken from a report accompanying 'DIY Planet Repairs,' a 2007 climate change awareness campaign convened by the Mayor of London. The diagram presents the results of a survey measuring different levels of environmental engagement among citizens of London, and takes the form of a list of changes in everyday routines that people may or may not be prepared to make. Ordering activities according to the amount of effort involved in them – from 'trying not to use my hose pipe' to 'installing a renewable energy source' – people's commitment to environmental issues is measured here in terms of the more or less laborious modifications of everyday habits and habitats that they are willing to undertake. In this respect, the figure can be seen to *codify* participation in material terms: it literally overlays a range of material activities with levels of environmental engagement, turning everyday material action into an index of public participation.

Q8a. Which of the following have you done in the last 12 months?

Activity	%	Effort level
Recycled more rubbish	79%	
Turned off the tap when I'm brushing my teeth	71%	
Bought energy efficient light bulbs	66%	
Switched off standby buttons	65%	
Boil the kettle for one cup of tea/coffee	54%	
Switched off mobile phones/ipod/MP3 chargers	52%	
Started walking	46%	
Reduced your thermostat by 1 degree	42%	
Bought environmentally friendly products e.g. environmentally friendly washing up liquid	40%	
Tried not to use my hose pipe	38%	
Taken shorter showers	37%	
Tried to use my car less for short journeys	32%	
Bought energy efficient products, e.g. energy efficient washing machines	30%	
Bought locally sourced food because of food miles	24%	
Started cycling	13%	
Taken the Eurostar	12%	
Donated money to environmental charities	12%	
Installed roof or cavity wall insulation	8%	
Switched to a green energy supplier	6%	
Calculated my carbon foot print	4%	
Installed an alternative energy source, e.g. solar panels/ wind turbines/ heat sumps	2%	
None of the above	2%	

Activities ranked in terms of level of engaged and effort required

1	Little effort
2	Some effort
3	A lot of effort

© HCHLV 2007   Source: Londoners Survey Jan 2007, GLA/HCHLV/Lightspeed   HenleyCentreHeadlightVision   26
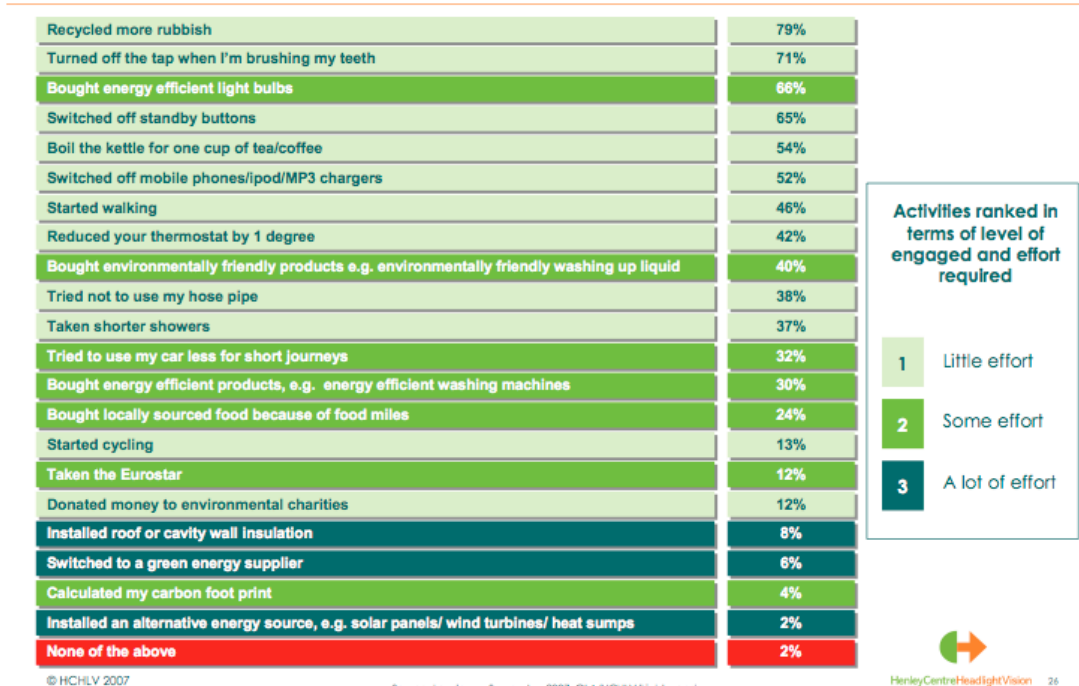
Figure 1: Market segmentation report for 'DIY Planet Repairs', an environmental awareness campaign by the Mayor of London, Henley Centre/Headlight Vision,

February 2007.

In trying to make sense of the framing of public engagement in terms of material action, it may be tempting to posit the rise of a new 'type' of citizenship. One would then argue that the 'materialisation' of participation involves the supplanting of the familiar character of the 'informational citizen' – the one in need of information in order to adequately perform his role of opinionated, decision-making subject - with another figure, which we could arguably call the 'material public' (Marres, forthcoming). There are good grounds for such a claim. Material participation has in recent years been explicitly promoted as a way of addressing the 'failure' of literacy as the foundation of an effective participatory regime. Locating participation in everyday material practices, it has been argued, solves a number of problems associated with informational citizenship – a form of public participation often criticised for making impossible demands on everyday subjects, insisting that they take an interest in complex issues with little or no relevance to their everyday lives (Macnaghten, 2003; Macnaghten & Urry, 1998; Nordhaus & Schellenberger, 2007). One could say, following this argument, that material participation is being configured today as the 'successor' to informational citizenship. However, rather than developing this kind of general claim, in this article I want to explore in more detail the role of devices in the organisation of material participation, and the wider implications this has for how we understand the relations between participation, technology and everyday practice. What emerges from this investigation, I will argue below, is a more nuanced – and ambivalent – appreciation of the role of material devices of participation vis-à-vis traditional formats of citizenship.[1]

The argument that follows focuses on 'methodological instruments' - or empirical technologies – an emphasis long customary in the social studies of science and technology, and recently extended to the analysis of public participation in studies of devices such as the opinion poll (Osborne and Rose, 1999), the home interview (Callon and Rabeharisoa, 2004), the road block (Barry, 2001), the focus group (Lezaun, 2007) and the advertising poster (Cochoy, 2007) (see also the introduction to this special section). This approach brings a broadly performatist understanding to bear on the study of participation, detailing the role of technologies, settings and objects in its enactment and organisation. It suggests that public participation cannot be adequately accounted for in terms of abstract procedures or general methods only, and that we must attend to the material

devices deployed in its performance, as well as the ways methods are embodied in them (see on this point Didier, 2009 and Lury and Wakeford, forthcoming). This approach has particular merits for the study of material participation, as it can prevent us from lapsing into a naturalistic understanding of the ability of material entities to enable public participation, as if it were somehow in the nature of things themselves to do so. But there is also a more specific, 'reflexive' reason for taking up a device-centred approach to the study of material participation. As I suggested above, empirical efforts at the 'materialisation' of participation pose a challenge to the understanding of the materiality of participation developed in the academic streams of work on this topic.

Device-centred studies of participation are distinguishable by their attention to the material dimensions of participation, but they have mostly construe this dimension as a latent one, which remains under-articulated in both theory and practice. Instruments that frame participation in terms of everyday material action, like the 'DIY Planet Repairs' figure above, disrupt this conception of 'constitutive' materiality, insofar as they present us with a *form* of participation that is distinctively material. The performance of participation by material means here involves, moreover, the deployment of particular tropes and ideals of democracy as well as technology. Thus, the 'DIY Repairs' diagram suggests that the easier it is to take a particular 'environmental action', the more people will engage in it. Or to phrase this more formally, it proposes that the scope of public engagement is inversely proportionate to the level of practical investment these activities require from citizens (in the words of the report, 'the level of engaged effort required'.) By overlaying everyday material actions with modes of public engagement, the figure makes the 'doability' of engagement a condition of its success – a proposition that echoes the liberal ideal of 'involvement made easy' (Oswell, 2008). By virtue of its mode of analysis, then, the figure grants material participation a particular logic, one that resonates with classic arguments in liberal political theory about the minimization of effort as a condition for public participation. The question is how to make sense of such idealistic resonances in accounting for the materialisation of participation.

A second reason for adopting a device-centred approach here is that it can help to make sense of an important distinguishing feature of material participation. Studies of participatory devices have directed attention to the role of these devices in the 'co-articulation' of different spheres, such as those of economy, politics and research (Callon, 2009; Cochoy, 2007). Such a conceptual focus seems especially

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useful if we are to make sense of material forms of participation: as participation is located in everyday material practice, it inevitably becomes associated with other modalities of action, such as innovation and economization. In this respect, material participation comes to challenge an assumption that has long been current in wider research and theories regarding public participation: the notion that participation can in principle be contained in a singular space of political or moral engagement (i.e., a public debate forum). This phenomenon of the co-articulation of participation is critical, I think, for understanding the normative implications of the materialisation of participation. A crucial question to ask about participation here becomes that of the logic according to which it is co-articulated. We then need to consider again the logic of 'involvement made easy', and ask about possible alternatives.

To develop these two points, I will consider a particular set of everyday technologies of material participation, namely devices of carbon accounting. A variety of agencies in the UK and elsewhere, from governmental bodies to community-level organisations, have in recent years promoted the adoption of instruments designed to take into account the environmental costs of everyday activities in the very conduct of those activities.[2] These technologies, which ideally enable the calculation of carbon emissions associated with everyday activities as part of those activities, are currently being deployed to 'materialise' participation and engagement with the environment, and present a notable instantiation of the project of locating participation in everyday practice, codifying it in the liberal terms highlighted above, those of invested effort. But everyday technologies of carbon accounting also represent an 'experimental' device of sorts – a device that is designed and taken up in many different ways. These technologies, then, can be said to materialise participation according to a number of different logics, and, as such, they offer an especially useful case for exploring what becomes of the technological politics of participation - and of the participatory politics of technology - under conditions of their materialisation. These devices allow for multiple, diverging co-articulations of economy, politics and innovation, enacting the politics of contestation in a material modality.

2. The augmented teapot: a technology of 'easy' participation

> This Green Orb constantly polls the national power grid to see how it's
> keeping up with demand from everyone watching The Apprentice, and

subsequently whether your next cuppa will be a particularly carbon intensive one.

If there's spare capacity on the grid, the tea light will glows green, it's basically saying:
'Go ahead! Make some tea! Knock yourself out!'

If there isn't, the colour shifts to red, saying:
'Now's not the best time for that cuppa, give it a little while.'

The main idea here is that you can glance at the globe from across an office or co-working space, to get an idea about whether making that cup of tea is a good idea right now, without having to think too hard about it.

Chris Adams, 'Tea, Arduino and Dynamic Demand,' April 24, 2009,
http://chrisadams.me.uk

Everyday devices of carbon accounting present a special case of what have become known in the social science literature as 'technologies of participation' Thrift, 2008; see also the introduction to this special section). These devices, like the Green Orb above, have the capacity to turn everyday material activities into forms of engagement with the environment, at least according to the promotional accounts that accompany them (Darby, 2010; Michael and Gaver, 2010; Marres, 2010). In these cases, technology is said to enable a distinctly material form of participation: adopting the form of a material object (an old-fashioned tea pot), the Green Orb foregrounds an everyday material action (tea-making), and frames it as a form of action upon the environment, which is itself given a physicalist definition (to engage with the environment here means to take into account the amount of CO_2 emissions associated with everyday activity). Insofar as this device helps to constitute public participation as everyday material action, it deviates from the technologies of participation on which the social scientific literature has tended to focus. Whereas the latter technologies have generally been characterized as only latently material, a device like the Green Orb is used to define participation in explicitly material terms.

It may be helpful here to make a distinction between the *constitutive* and *constituted* materiality of public participation (see on this point also Latour, 1993).

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Social studies of participatory devices have mostly attended to materiality in the first sense. Studies of devices like the opinion poll (Osborne and Rose, 1999), or the focus group (Lezaun, 2007), or research on modes of demonstration such as the anti-road protest (Barry, 2001), have extensively documented how material objects, technologies and settings enter into the enactment of public participation. In doing so, however, they could assume that the role of things in facilitating participation remained *under-articulated* in the staging of participation itself, which in these cases took a discursive form, patterned on the model of 'public debate', of either the consensual or the antagonistic variety (Callon and Rabeharisoa, 2004; Irwin and Michael, 2003; see on this point Marres, 2009; the introduction to this special section[3]). The materiality of public participation is then limited to its *constituent* components: to objects, technologies and settings that enter into the performance of participation, but whose contribution is not discounted in the staging of publicity. By contrast, in the case of an environmental technology like the Green Orb, a material device of participation becomes itself the object of a 'public performance': the staging of public participation focuses on the material device that facilitates it and this device is presented as enabling a distinctively material form of participation. In a careful arrangement a teapot, blog and arduino software,[4] the device comes to constitute public participation as a form of material action on the environment.

When material participation becomes the object of a public performance, the study of its material dimension requires a different analytical strategy from the one adopted in studies of 'latently' material devices. One could say that the question becomes that of the *materialisation* of participation, rather than its *materiality*. That is, we should not just consider how material entities enter into the enactment of participation – to a certain extent this question is addressed by the device itself – but how the material form of participation is actively accomplished with the aid of devices. Technology, that is, is used here to achieve the materiality of participation as a performative effect: in the small scenario outlined above, a teapot is performatively invested with the capacity to facilitate engagement by material means. The materiality of participation is then the result of an highly artefactual undertaking: to approach public engagement in its material aspect requires devices of its own, such as those that 'overlay' everyday material practice and environmental engagement.[5] Social studies of technologies have not always appreciated this artificial nature of materiality, but still they have some important concepts to offer to help clarify processes of the materialisation of

participation. It may be useful, for instance, to consider how a device like the 'carbon tea pot' enables the *de-composition and re-composition of* everyday action (Verran, forthcoming).

In presenting CO2 emissions as something to be taken into account as part of the activity of making tea, the Green Orb can be said to *de-compose* this everyday material routine into constituent elements and conditions: the supply of electricity, the fluctuating emissions associated with power generation, the time of day, and so on. However, in one and the same go, this set-up can also be said to *re-compose* the routine of tea-making as an activity in which it is possible to take these environmental, technical and social conditions into account ('Give it a little while.'). Arguably, the mundane activity of tea-making is re-constituted, in this process, as a way of engaging with and acting upon the environment.[6] Seen in this light, we can begin to appreciate how a material device of engagement like the Green Orb helps to enact a particular *form* of environmental participation. An accounting technology, the Green Orb makes it possible to take the environmental 'costs' of everyday living into consideration, while at the same time providing the means to mitigate these costs without problematising or altering the activity itself ('Go ahead. Make some tea'). This device thus enables what we can call the 'change of no change,' in a variation on Donna Haraway's (1994) phrase,[7] facilitating a mode of participation that requires only a minimum of effort.

Such an examination of how an accounting device re-constitutes everyday practice as a form of environmental action brings into view a distinctive feature of materialisation, as opposed to materiality. Materialisation entails the *codification* of participation by material means. As long as materiality could be taken to refer to an under-articulated dimension of participation, it could be approached as an un- or under-described zone – a 'great unformed' open for empirical and conceptual exploration. Technologies that materialise participation, by contrast, grant participation a particular logic – or, rather, logics, as I will describe below. I use the word codification for this process to highlight that it is not just a matter of adding an 'ideal' or 'theoretical' slogan to a material or technical practice. Rather, materialisation is the result of an operation afforded by the device, that of the de- and re-composition of everyday material action, an operation that codes this action in particular terms, namely those of the 'minimisation of effort'.

The ideal of 'involvement made easy', however, also receives an explicit formulation in Chris Adams' online presentation of the Green Orb. It comes through especially clearly in the script for environmental engagement that he

provides, as in the 'scenario of use' quoted above. Further down on the same page, Adams observes:

> Placing [the orb] in a relatively high traffic co-working space, full of people working in totally unrelated fields is a great opportunity to speak to them about the ideas inspiring this little toy, and get lots of interesting feedback, and see how best to communicate on issues related to climate change and how massively energy intensive our life styles are.[8]

The notion that participation in public affairs must somehow be made 'doable' for everyday people - who lack the time, space and shared knowledge that political engagement requires – has been an important trope in liberal theory. It played a significant role in the formulation of distinctively liberal conceptions of the public, as in the work of John Locke (Pateman, 1989). His defence of representative democracy included the argument that people are too busy to perform the duties that full-fledged participation in the political community requires. The constraints that everyday life allegedly place on participation here came to justify a conceptual distinction between two different domains of engagement with public affairs, something which Carole Pateman (1989) describes as the 'doubling' of the public: the separation between a domain of professional politics and that of a wider public engagement with politics.

Importantly, however, accounts of participation in terms of its doability do not just evoke ideals of political theory (ideals that, we could then say, are 'applied' to the world of technology, as for instance in the case of the augmented teapot above). The doability trope has been especially prominent in relation to the role of *technology* in organising political and social life.[9] It played a central role in 20th-century debates about the 'problem' of public engagement in technological societies, where both the busyness of life and the complexity of issues were said to militate against effective public participation (Lippmann, 2002 (1927); Marres, 2005; Oswell, 2008). The trope of 'making things easy' has also figured prominently in the history of *domestic* technology. As feminist studies of the 'industrial revolution in the home' have famously argued, the introduction of modern domestic appliances at the turn of the 20th century was accompanied by a distinctive ideological theme: the idea that technology 'saves labour' (Schwartz Cowan, 1983; Wajcman, 1991). The introduction of modern appliances like electric stoves, vacuum-cleaners and refrigerators into middle-class households

was legitimated in terms of the capacity of these technologies to 'make things easy' for modern housewives. It thus seems no coincidence that current attempts to 'environmentalise' households -or even society as a whole- would deploy these same domestic technologies and evoke this same capacity for saving labour and making things easy.

One of the merits of focusing on technologies of material participation, then, is that we can explore how they allow for particular connections between technology and democracy. A device like the Green Orb constitutes everyday material action in terms of the investment of effort. In it we do not just observe the application of ideas from liberal theory in technological practice: rather, the device evokes tropes that are as much associated with technology as with democracy. The question then is how exactly the 'codification' of participation in material terms produces connections between technology and democracy (and engenders more or less creative confusion between the two in the process). In taking up this question, I would like to pay special attention to the wider normative consequences of the codification of participation in terms of effort.

As the feminist scholars cited above have made clear, invocations of the idea that things must be 'made easy' for everyday subjects have particular normative implications, including the bifurcation of two domains of engagement with public affairs - one for professionals and one for laypeople, one for insiders and one for outsiders. This effect has also been foregrounded by feminist scholars of technology: the codification of domestic appliances in terms of their capacity to make things easy contributes to the framing of domestic life as a private sphere of leisure, set against the professional sphere of work. Furthermore, they have emphasised the deception involved in the codification of technological practice in the home as easy and/or fun, arguing that it involves, instead, a displacement of labour from a visible to an invisible economy. It raises the question how these well-documented effects play out when material devices of environmental participation are introduced as ways of making engagement easy. Whether, in other words, devices that are framed as turning environmental engagement into something 'easy' or 'fun' contribute to a similar bifurcation of the public, and a related displacement of labour.

3. Spaces of multi-valent action: participation, innovation, economy
The intensification of connections among domains - between politics, the economy, science, etc. – has long been recognized as an important effect of the

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proliferation of technology in society (Callon, 1983; Latour, 1986; see on this point also Barry and Slater, 2005). This effect takes on special significance in relation to devices of carbon accounting, insofar as these instruments do not just generate *relations* among different spheres, but enable the enactment of a range of organisational *forms* associated with science, politics and the economy. Technologies of carbon accounting, that is, allow for what Michel Callon (2009) has usefully called 'co-articulation.' In his account, an important distinguishing feature of the European Greenhouse Gas Emission Trading System, the EU carbon market, is that it simultaneously facilitates the implementation of new market arrangements, an experimental process of inquiry and learning about these arrangements, and the involvement of stakeholders in opinion-, decision- and policy-making about it (see also MacKenzie, 2009; Blok, 2010, Asdal, 2008). Carbon markets, then, enable action in a number of different registers all at once: business, research and participation.[10] Something similar can be said of everyday technologies of carbon accounting, but to the extent that these are everyday material devices, co-articulation here has a further implication for participation: it disrupts the assumption that public participation requires the disembedding of actors and action from everyday life.

The production of alignments between action in different registers is first of all a formal feature of technologies of carbon accounting. The paradigmatic device of carbon accounting today, the smart electricity meter, displays three measures simultaneously – kilowatts, Pounds Sterling, and CO_2 emitted. As such, it conjures up what Donald MacKenzie (2009) has called a space of equivalence, in which energy use and its financial and environmental costs are seamlessly translated into one another. Crucially, this ability to frame action in multiple registers is also often singled out as what distinguishes smart electricity meters as participatory devices. Thus, Gavin Starks, the founder of DGEN, a London-based energy profiling company, sees everyday carbon accounting as enabling 'a shift from awareness-oriented to action-based engagement with energy' (personal communication). And the notion of 'action-based engagement' usefully clarifies what enables the co-articulation of participation in this case: a key feature of everyday action is that it can be framed in multiple registers, from participation to innovation and economy.[11] As Starks put it in an interview:

> As Tim O'Reilly said, people want to work on stuff that matters. People
> want to save money and we can help with that by making consumption

more visible, and secondly we can help particularly with a reduction in footprints and consumption.[12]

Everyday devices of carbon accounting, then, are explicitly attributed the capacity to evaluate action along multiple axes, from ethics to consumption to innovation. As such, these devices facilitate a mode of co-articulation of participation that is more comprehensive than that of 'involvement made easy': they enable the organisation of spaces of multi-valent action, in which a routine act like making tea is at once a technical, economic, and ethical act. This also becomes evident in the empirical presentation of everyday carbon accounting devices. The journalist Adam Vaughan, a.k.a. the Green Guy, published on his blog a small demonstration involving a smart electricity meter hooked up to an electric kettle, showing the 'carbon costs' of making one cup of tea. Presented under the title 'Ethical stuff that anyone can do,' the entry notes that "the unique selling point of the homeCO2meter is a bargain £40 price tag."[13]

This framing of engagement as just one aspect of multi-faceted everyday actions suggests that it is a mistake to consider the facilitation of participation by devices of carbon accounting in isolation. The defining feature of these engagement devices is that they are also devices of economization, innovation, and so on. In this respect, they imply a departure from a classic condition for public participation: the assumption that public participation requires a domain of its own, a dis-investment from the material associations, habits and interests that mark everyday life. This dissolution of the requirement of disentanglement may well be a constitutive feature of attempts to locate engagement in everyday material practices, or as I describe it here, of the materialisation of participation. It raises the question of how *else* the efficacy of participation may be secured. Co-articulation, that is, has consequences for the normative analysis of participation.

No doubt the most familiar normative interpretation of attempts to locate participation in everyday material practice is the critique that they allow one register of action to dominate or subsume others. Everyday carbon accounting is said to imply the 'economization' of participation (Rutland and Aylett, 2008; Cooper and Mitropoulos, 2009). Carbon accounting, the criticism goes, reconstitutes the environmental citizen as a calculative individual, fixated on keeping a balance of the quantifiable environmental costs and benefits of individual actions. Critics have also noted how locating participation in the intimate setting of the home leads to its 'privatization' (Braun and Anderson,

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2008; Slocum, 2004; see also Hinchliffe, 1996).[14] Others have made the opposite argument: that the location of environmental engagement in the household involves the 'politicization' of everyday life. In a variation on the feminist ideal of making the personal political, intimate domestic routines like cooking and washing are here configured as sites where our political implication in matters of public concern can be rendered visible (Dobson, 2003; see also Marres, 2008).

However, from a co-articulation perspective, what stands out is the fact that these opposing interpretations are possible all at once. The device is capable of generating a multiplicity of effects: whether it codifies everyday action as primarily economic - rather than, for instance, ethical - varies from one situation to the next. Which register of co-articulation ends up being predominant then depends on how devices are deployed. And if co-articulation in this sense can be regarded as an inherent feature of material devices of participation, the fact that they allow for the codification of action in other than participatory terms is not necessarily problematic. In considering co-articulation, we may then appreciate in positive terms the multiplicity of normative effects generated by environmental accounting devices: it highlights the normative adaptability, 'instability' or ambivalence of these technologies of participation (Hobson, 2006; Murphy, 2006; Woolgar, 1999; see also Hawkins, this issue).[15] However, I want to argue here that if we are serious about understanding participatory devices in these terms, then we do well to expand the analysis of co-articulation.

The notion of co-articulation allows for a further specification of the idea of the normative adaptability of technology. Case studies of environmental technologies like recycling and ecological home improvement have noted that such initiatives may serve a variety of normative agendas. The devices have been shown to embody regimes of 'green governmentality' (Darier, 1999), as they discipline subjects into behaving according to rationales of population government, but also to facilitate creative moral practices and to enable embodied ways of attending to our entanglement with things (Hobson, 2006; Hawkins, 2006). However, normative ambivalence may not only pertain to technologies themselves, it can also be applied to the *modes of co-articulation*. I discussed earlier the focus on the 'minimization of effort' as a way of bringing the registers of participation and technology into alignment. But everyday devices of environmental accounting bring other logics of co-articulation into play as well, as I will describe next. Critical attention, then, does not have to be limited to the dominance of some registers of action over others, but may also be directed at the

different logics according to which action is co-articulated. Indeed, an appreciation of the variability of logics of co-articulation is crucial, it seems to me, for understanding why accounting devices do not necessarily enable the economic register to dominate others (and, we could perhaps add, why device-centred perspectives on participation do not necessarily have to be a subset of device-centred perspectives on the economy).

4. Another logic of co-articulation: the more invested, the more engaged
Everyday technologies of carbon accounting can be described as experimental devices in several senses of the term. For one, the device is configured differently depending on the case, and this has implications for participation. Carbon accounting can take the form of an Internet-based platform, like the Carbon Diet or Carbonrationing.org, which facilitate the management of personal energy data, from electricity bills to transport information (miles travelled; means of transport), and the monitoring of individual efforts at energy demand reduction on this basis. In other cases, carbon accounting adopts a more informal aspect, as on green blogs where individuals document their efforts to reduce their energy use in diary-style entries, for instance on the blog 'the Greening of Hedgerley Wood ('one family's attempt to save CO2') which includes reports on things like the installation of a ground heat pump, or rabbits ravaging a vegetable garden. Materially speaking, the 'device' of carbon accounting is also composed of variable elements, from an Excel spreadsheet documenting energy use and its translation into carbon emissions according to conversion factors (which is one of the things provided by company DGEN), to a blog narrating the experience of renovating a house in rural Buckinghamshire. This variability of the device is mundane on one level, it has important implications for the analysis of participation: the space of engagement can accordingly be understood as variably composed (Kelty, 2008).

To begin with, the variability of the device reminds us that it would be a mistake to assume that forms or logics of participation are somehow inherent to technologies. Thus, everyday devices of carbon accounting are sometimes attributed participatory potential of a fairly classic, representational kind, as in the case of Carbon Unlimited, an Internet-based platform for personal carbon trading hosted by the Royal Society for the Advancement of the Arts and Commerce. A report accompanying its launch sets out its rationale as follows:

There was little to no public involvement in the process leading to the

implementation of the EU ETS [the European Emission Trading Scheme], while there is actually great appetite for public engagement, which is what the Carbon Unlimited project is addressing.[16]

But in other cases, as we have seen, carbon accounting is presented as an innovation in public participation, as a way of co-articulating participation with innovation and economy. And here the variability of devices takes on special significance: co-articulation can be done according to varying logics.

One predominant mode of co-articulation we have encountered already in the form of 'the minimization of effort.' Another example of this can be found in a promotional trial organised by the RSA's Carbon Unlimited. This demonstration was conducted in partnership with British Petroleum and a data management company called Atos Origin, and invited subscribers of the online personal carbon trading platform to use loyalty cards at BP petrol stations. When subscribers used their Nectar cards at BP stations, carbon units could be automatically deducted from their personal carbon accounts. The project generated a fair amount of publicity, and the resulting accounts in the media and elsewhere emphasised the ways in which the project required minimum investment on various levels. As the Guardian put it:

> The trial is intended to show policy makers that personal carbon trading is both logistically and financially possible within the existing technological systems used by retailers and utility companies. The RSA believes that loyalty reward cards – half the population now carry a Nectar card – are the quickest and most cost effective method to record and monitor an individual's 'point-of-sale' carbon emissions.[17]

The trope of minimum investment recurred in the account of the form of participation the device of carbon accounting enabled in this particular case. The leader of the project suggested that one of its advantages was that participation here took *no effort at all*: "participants didn't even need to know that they were participating in it, as the project relied on the existing informational infrastructure of the loyalty card system." (pers. communication). The demonstration can thus be taken as instantiating a more comprehensive version of the liberal trope of 'involvement made easy' –one that revolves around the minimization of participatory, economic, and technological costs. In this case everyday carbon

accounting facilitates simultaneously a) easy participation b) minimum investment, and c) little to no disruption to existing infrastructure. The technology, here too, helps realize the 'change of no change'.

There is, however, an alternative co-articulation of participation, innovation and economy at play in carbon accounting, which we could describe as 'the more invested, the more engaged.' An example of this can be found on the 'Greening of Hedgerley Wood' blog, which also values everyday material action in multiple registers, but in a different way. The entry about the installation of a ground heat pump, for instance, can equally be said to codify action in terms of a) the investment of effort by everyday actors b) monetary cost, and c) infrastructural disruption, but according to a rather different logic. The post includes a photograph of men working in the garden, digging trenches for the pipes, under the heading 'The garden may look like a first world war zone'. The page also shows a copy of a sheet specifying how much the installation costed (£13, 071, --), and dutifully notes the amount of carbon emissions avoided.[18] This blog then measures everyday material action along the axes of the effort invested, the monetary costs borne, and the disruptions tolerated in order to take the environment into account. However, here these investments are proudly put on display: rather than their minimisation, the point seems to be the amplification of costs, efforts, disruptions, as a way of documenting the 'costs' of environmental change.

At least two different co-articulations of participation, technology, economy (and the environment) can then be discerned in demonstrations of everyday carbon accounting: some centre on the minimisation of the cost, effort and disruptions involved in taking the environment into account, while others are committed to rendering visible the amounts of work, investments and modification of habits and habitats involved in this process. The latter could be said to follow a pragmatist logic: environmental engagement must here be understood *as a consequence* of investing effort in particular practices (for suggestions for a labour theory of engagement, see Agrawal, 2005; Kelly, forthcoming).[19] No doubt further modalities of co-articulation could be discerned in the accounts generated with the aid of the device of carbon accounting. But here I would like to consider the wider implications of co-articulation for public participation. In the rest of the article I will therefore to return to the feminist analysis of the codification of technology and participation in terms of labour-saving, and discuss whether and how the normative effects these studies noted play out in the case of carbon accounting.

My argument is that the multiplicity of co-articulations on display in the field of everyday carbon accounting makes a small but important difference in this regard.

5. Consequences of co-articulation: redistributing the costs of involvement

Technologies of carbon accounting can be attributed many of the effects highlighted in feminist critiques of 'labour-saving' devices. These technologies, too, can be said to encourage the bifurcation of the public sphere into two separate domains of professional and lay participation. The Carbon Unlimited trial in petrol stations, for instance, heavily relied on the construct of the 'average Nectar card user,' while at the same time the sample of participants in the trial consisted mostly of expert users, people who found it interesting to (as the project leader put it) "be at the cutting edge of information capture." The 'lay participant' figured here as a mute template, deployed in the organisation of a technological – if not outright 'geeky' – practice.[20] A second important feminist critique of 'labour-saving' technologies is applicable here as well: while technology is promoted as a way of reducing the level of effort required, it effectively re-distributes it. Thus, Schwartz Cowan (1983)'s famous study of the domestication of technology showed how the very stoves, washing machines and thermostats that were advertised as making 'things easy' for housewives, in practice ended up producing more work for everyday actors (for example, washing machines helped to generate more laundry (see on this point also Shove, 2003)). Indeed, this is what made the trope of labour-saving so devastating: it provided a cover for a de facto redistribution of work, with modern technology enabling the displacement of labour onto individual housewives in ways that were not accounted for.

Everyday devices of carbon accounting can also be attributed the twin effects of bifurcating spheres of engagement and redistributing labour, but there is an important difference with the object of feminist critiques: in the case of carbon accounting, the critical effects of these devices are *not* altogether unaccounted for: being accounting devices, they help generate critical analyses as part of the project of environmental accounting itself. Thus, the RSA's Carbon Unlimited project commissioned various reports to evaluate its experiment in personal carbon accounting, and several of these argued that this form of environmental action brings with it certain 'hidden costs,' thereby problematising, if not undoing, the promise of easy engagement. A public consultation report documented, for instance, the various reasons why individual attempts at energy reduction are likely to be more costly in practice than anticipated: people's efforts will be

constrained in terms of their geographic location, financial situation, and access to information and services. An economists' report provided evidence that, even if personal carbon accounting is technically feasible, reductions in energy use will require significant investments that are unlikely to pay off in the short or the long term.[21] Other reports also noted distributional effects, such as the fact that some domestic subjects are more likely than others to do the nitty-gritty work of energy saving, and that only high-income groups are likely to profit financially from energy reduction (Preston and White, 2010). These kinds of analyses provide almost as effective an undoing of the trope of 'involvement made easy' as feminist studies, showing that everyday carbon accounting is likely to involve more investments, labour and disruptions than promotional narratives of the minimisation of effort assume.

However, while these critical evaluations bring into view the limits of the trope of 'the minimisation of effort,' they do not necessarily problematise this logic: evidence that interventions may be more laborious and costly than anticipated is mostly presented as a conclusive argument against everyday carbon accounting and the concentration of environmental change initiatives on households. Indeed, several of the reports cited above conclude with arguments against participatory approaches to environmental change.[22]

It is here that the alternative co-articulation of participation as work makes an important difference: projects that deploy the trope of 'the more invested, the more engaged' turn the redistribution of labour into an object of exploration. Rather than demonstrating how unobtrusively devices of environmental accounting can function, these projects document the considerable effort involved in attempts to take the environment into account as part of everyday life. Thus, a community initiative of carbon accounting in East London, the Hackney-Islington Carbon Rationing Action Group, generated innumerable reports of the work involved, the obstacles encountered, and the costs incurred as a consequence of its members' attempts at reducing energy use: 'Jax: Found it very cold on boat this winter, and hard living off-grid. Has to go to library to use internet.'[23] Others have third parties to accommodate, such as "a boyfriend who has the internet on 24/7." Another member of the group confessed: "at a personal level I find it a chore to put these numbers together."[24]

These projects, then, follow a different logic of environmental accounting, and as such they enable a different politics of participation. Carbon accounting involves in this case the specification of the consequences of letting carbon 'into

one's everyday life', along three different axes: 1) the efforts involved, 2) the monetary costs incurred, and 3) the more or less disruptive modifications of habitats and habits. And, in doing so, these projects can be said to produce inventories of the material, social, or economic effects and implications of taking the environment into account. Thus, the blog entitled 'Trying to be green in a world that is not so keen,' presents a semi-serious list of '37 consequences of going green' – from a house that smells of vinegar, to boring your colleagues with stories of a domestic life lived differently.[25] Importantly, these various 'costs' of environmental involvement do not map neatly onto a predefined grid of currencies (as the smart electricity meters that calculate CO2 emissions, Pounds Sterling and kilowatt do). There is rather a proliferation of measures, like work-related constraints: a participant in the Hackney CRAG notes that as a gardener she cannot get rid of her car, since part of her job is to 'drag bags of soil around' (the alternative would be to clean a rental car every single day). Perhaps we could say that this co-articulation of different registers, of participation, economy and innovation leaves room for a more experimental exploration of what may be relevant measures for the valuation of environmental action.

Finally, this alternative co-articulation of participation also enables a different – more constructive? - analysis of the redistribution of costs among the actors involved in environmental change. Debates among the members of the Hackney-Islington CRAG provide various examples of this. One meeting discussed whether participants who subscribed to Green Energy Tariffs - the environmentally certified energy packages offered by utility companies - deserved a 'discount'. The conversation soon turned to the fact that one particular company "did not even retire as much as 10% as ROCs [Renewable Obligation Certificates]."[26] It led to the conclusion that no more than a 10% discount was in order, since these companies were not making sufficient contributions to reductions in carbon emissions themselves. Far from a distraction, the provocation of such debates seems to be what this project sought to accomplish. Thus, the group's coordinator, John Ackers, explained to me that "yes, it is a nuisance" to keep track of your train tickets and energy bills and calculate your carbon footprint every month. But the point of doing so was to show that it is possible for the average person to live on a carbon budget: "if we can do it, without any resources, why can't government and industry?" (pers. communication). The public display of people bearing the efforts, costs and disruptions involved in taking the environment into account may then be a way of producing a particular

performative effect: that of publicly raising the question of the wider societal distribution of the 'costs' of environmental change. The device of everyday carbon accounting may thus enable participation in a politics of redistribution that goes well beyond the household.

7. Conclusion

A device-centred perspective then makes it possible to attend to the different modalities of the co-articulation of participation and its materialisation. It provides a way of attending to the *variability* of enactments of engagement afforded by everyday material devices – as something that is crucial to the politics of participation these technologies enable. The two different co-articulations of participation that I have foregrounded here can be said to materialise participation in different ways. In the first mode, that of involvement made easy, the location of environmental participation in everyday material practices aims at the minimisation of effort, costs, and disruption. It enacts the 'change of no change.' 'Materialisation' accordingly takes the form of a virtual or intangible process: the objective here is the insertion of the environment into everyday practice, without causing or requiring any significant material change of the practice itself. The 'de-composition' and 're-composition' of everyday practices, so as to include environmental issues, entails here ideally no change in the state of the things, settings, or stuff involved.

By contrast, the second way of enacting environmental participation as work actively seeks to produce material effects: the insertion of the invisible, odourless and indeed abstract 'environmental' entity of CO2 into everyday settings is shown to translate into a range of more or less surprising material effects, like a house smelling of vinegar or the garden turning into a war zone. One could say that these initiatives turn to everyday settings precisely in order to render environmental change as a material process: to demonstrate the material, social and technical transformations involved in taking the environment into account. I have suggested that this mode of materialising participation enables a wider politics of re-distribution: it provides a way of problematising the societal distribution of the work, costs and effects of environmental change. The very variability of devices here enables a particular politics of participation: precisely insofar as technology is deployed to achieve certain distributional effects, such as the displacement of the costs of environmental change onto households, it can also be used to problematise these implications. In the later case, to materialise

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environmental change is to problematise it. And this also has implications for how we understand the 'problem' of participation that its materialisation is supposed to address.

As we have seen, the location of environmental participation in everyday material practice has been promoted as a way of making it more doable. Materialisation then figures as a solution to the 'problem' of public engagement with the environment. Action-based forms of engagement are seen as an alternative to epistemic framings of it: they suggests a range of simple actions, rather than requiring citizens to grasp the complexity of environmental issues. In this respect, it seems to me, the co-articulation of participation as work has a further important contribution to make: it brings into view the innumerable ways in which environmental engagement is *not* quite doable in practice, and here this is part of the point of the exercise.

If the point of everyday carbon accounting is to render visible practical constraints on environmental change, then it can be seen to dismantle the notion that participation is predicated on doability. To engage in carbon accounting may then be a way of articulating problems of public engagement, and perhaps indeed of 'materialising' them. Attempts to take the environment into account are here *visibly* constrained by the material, social, technical, and economic relations of inter-dependence that constitute everyday life –car rental services, bags of soil, employers, Renewable Energy Obligations, the municipal council, electricity suppliers, and boyfriends. In this respect, carbon accounting in everyday life also enables a *redistribution* of the problem of environmental participation itself (on this point, see Wynne, 2008). The problem here is not just with 'people who aren't interested', or with 'issues that are too complex,' but just as much with the socio-technical-material arrangements that facilitate or rather fail to facilitate environmental action. And the question then is not whether 'materialisation' works as a solution for the problem of environmental engagement, but whether it allows for the redistribution of the problematic that participation inherently is.

Biographical note
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particularly in American pragmatism. She is now a lecturer in Sociology and co-director of the Centre for the Study of Invention and Social Process (CSISP) at Goldsmiths, University of London. She has just completed a monograph entitled *Engaging Devices: Participation after the Object Turn* (Palgrave, forthcoming.)

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[1] From a devices perspective, material forms of participation should not be understood in strict opposition to 'epistemic' framings of it, as in the classic concept of the 'scientific citizen' (Schutz, 1964). Devices like the DIY Repairs survey visualisation do not involve *stripping* participation of its informational, linguistic or discursive components. They rather provide a particular addition to, or modification of, the more usual codification of engagement in terms of levels of knowledge or awareness.

[2] This formulation draws on the vocabulary of ethnometholodology. There are some notable connections between this methodology of social science research and contemporary environmental accounting: both are concerned with deployments of everyday settings in order to produce accounts of social life as part of social life (Garfinkel, 1964). For more on this connection, see Marres, forthcoming.

[3] There we argue that materiality has often figured as an under-articulated, under-formatted under-current in the performance of public participation, participation that does not involve much *explicit* reference to its material constitution.

[4] Arduino is an open-source electronics prototyping platform that can be used to translate sensor inputs into visual outputs.

[5] Device-centred perspectives can be said to 'de-naturalize' participation: to stress the role of equipment in the enactment of citizenship is to deviate from a focus on philosophical anthropology in classic democratic theory: a focus of the nature of man and whether belief in this nature is justified, ie in human capacities to develop citizenly abilities. This question was still central to early 20th century debates about democracy in a technological society, as for instance among the American pragmatists (Stears, 2010).

[6] The Green Orb relies on information from realtimecarbon.org.uk, which provides carbon intensity data for the national UK energy supply, including whether it is above or below a given threshold. As such, this device arguably addresses a criticism that is frequently made of smart electricity meters (and carbon accounting more generally): that these devices rely on purely conventional measures of CO_2 emissions. Carbon calculations are generally based on equations to extrapolate what amount of emissions are associated with energy use, and for that reasons fail to account for empirical variation. However, to the extent that the Green Orb itself constitutes a 'thought experiment,' it too is limited by its speculative aspects.

[7] Haraway spoke of 'the culture of no culture,' in reference to scientific culture and its ability to erases its own particularity.

[8] Chris Adams, 'Tea, Arduino and Dynamic Demand,' blog post, April 24, 2009

[9] 'Doability' was introduced in the repertoire of the social studies of science and technology by Joan Fuijmara (1987), who describes knowledge production, and more specifically the organisation of cancer research, in terms of the formulation of 'do-able' research problems.

[10] Classic feminist studies of domestic technology have also documented effects of 'co-articulation'. They showed how the framing of *technology* (in terms of 'labour-saving') had implications for the place of the household, and the houswife, in the wider *political economy.* But these accounts did not really consider the performative constitution of domestic subjects or action as at once technological, political and economic in nature.

[11] The intersection of different activities has been described as a constitutive feature of mundane settings: they provide a space in which multiple, conflicting concerns, activities, and values must be juggled or somehow brought into alignment (Murphy, 2006; see also Michael, 2006).)

[12] 'Carbon-calculating data site Amee scores seven-figure investment,' *The Guardian*, December 11, 2008, http://www.guardian.co.uk/media/pda/2008/dec/11/startups-carbon-footprints.

[13] Adam Vaughan, "Why you don't want to overfill your kettle," 13 May, 2007 http://thegreenguy.typepad.com/thegreenguy/2007/05/video_why_you_r.html

[14] These two arguments can be combined in forceful ways, as in the claim that locating environmental engagement in the private sphere is a way of externalizing costs: the costs of environmental change are taken off the balance sheets of public and corporate organisations and displaced into the informal economy of the domestic sphere.

[15] This feature of normative ambiguity or ambivalence is also ascribed to discourses of 'sustainability' (Anderson and Braun, 2008),

[16] Prescott, Matthew, "Personal carbon trading: The idea its development and design", Carbon Unlimted, RSA, interim recommendations, September 2007. A project like the RSA's on-line personal carbon trading platform fits Michel Callon's (2009) definition of an "experimental market": it combines a market experiment with a stakeholder dialogue designed to enable 'learning' about the experiment. Over the 2 years that the online trading platform was active, Carbon Unlimited published a range of reports, debates and studies on the associated debate forum, identifying a range of emergent problems linked to carbon accounting. But a more general dynamic also requires consideration: accounting initiatives result in the proliferation of further accounts. This raises questions about the ways in which accounting practices (and not just market practices) may translate int the public performance of controversy.

[17] The Guardian, June 09, 2008 http://www.guardian.co.uk/environment/2008/jun/09/carbonfootprints.carbonemissions

[18] "Days 7 and 8 - Groundworks Finished," August 15th, 2005, The Greening of Hedgerley Woods, http://www.hedgerley.net/greening/index.php?paged=5

[19] The pragmatists, indeed, made an even stronger argument: Dewey claimed that the actual effort people make provides a more adequate expression of their engagement with public affairs than "what they say about it" (Dewey, 1939).

[20] Carbon rationing initiatives then blur the public and the private in another way: they can be seen to *actively confuse everyday and professional modalities of engagement*. Engagement is here not only codified *as work*, rather than leisure, it is specified in relation to work, as in the case of the gardener mentioned above. More generally speaking, indeed, exercises in carbon-based living tend to be performed by people who are also professionally active in environmental communities: many though certainly not all participants have more or less 'relevant' professional roles, as employees of environmental NGOs, building engineers, journalists, civil servants, and so on. Indeed, this confusion of roles, in which those professionally involved with the environment adopt the role of 'everyday subjects, suggests that the notion of everyday life, too, may have to be understood as a experimental construct in these cases, one that has special affordances for intervening in this issue area. The confusion of roles between 'insiders' and 'outsiders', between those that are professionally entangled, and those that may speak in the name of the public, has long been characterized as an important aspect of public controversies (Lippmann, 1927).

[21] Kerr, Andy and William Battye, "Personal Carbon Trading: Economic Efficiency in interaction with other policies, Report for the RSA Carbon Unlimited, June 2008

[22] Arguments about the 'hidden costs' of personal carbon accounting were taken up by DEFRA in support of their decision against any significant investment in it.

[23] Islington-Hackney CRAG meeting, Monday 5 January 2009.

[24] Group email, 30 June 2009.

[25] Suitable Despairing, '37 Consequences of Going Green,' Monday, November 26, 2007, http://suitablydespairing.blogspot.com/2007/11/37-consequences-of-going-green.html (accessed April 30, 2010).

[26] Islington-Hackney CRAG meeting, Monday 17 June 2009