Carbon Management

Prospects for radical emissions reduction through behavior and lifestyle change

Stuart Capstick[ab], Irene Lorenzoni[bc], Adam Corner[abd] & Lorraine Whitmarsh[ab]

[a] School of Psychology, Cardiff University, Tower Building, 70 Park Place, Cardiff, UK, CF10 3AT

[b] Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich Research Park, Norwich, UK, NR4 7TJ

[c] School of Environmental Sciences, University of East Anglia, Norwich Research Park, Norwich, UK, NR4 7TJ

[d] Climate Outreach Information Network, The Old Music Hall, 106-108 Cowley Road, Oxford, UK, OX4 1JE
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Prospects for radical emissions reduction through behavior and lifestyle change

Stuart Capstick*[1,2], Irene Lorenzoni[2,3], Adam Corner[1,2,4] & Lorraine Whitmarsh[1,2]
Over the past two decades, scholars and practitioners across the social sciences, policy and beyond have proposed, trialled and developed a wide range of theoretical and practical approaches designed to bring about changes in behaviors and lifestyles that contribute to climate change. With the exception of the establishment of a small number of iconic behaviors such as recycling, it has, however, proved extremely difficult to bring about meaningful transformations in personal greenhouse gas emissions at the individual or societal level, with multiple reviews now pointing to the limited efficacy of current approaches. We argue that the majority of approaches designed to achieve mitigation have been constrained by the need to operate within prevailing social scientific, economic and political orthodoxies which have precluded the possibility of non-marginal change. In this paper, we ask what a truly radical approach to reducing personal emissions would look like from social science perspectives which challenge the unstated assumptions severely limiting action to date, and which explore new alternatives for change. We emphasize the difficulties likely to impede the instituting of genuinely radical societal change with respect to climate change mitigation, while proposing ways that the ground could be prepared for such a transformation to occur.

Introduction

In its most recent assessment of the published academic literature on climate change, the Intergovernmental Panel on Climate Change (IPCC) concluded that limiting climate change "will require substantial and sustained reductions of greenhouse gas emissions" [1, p. 19], a point which has been emphasized previously by numerous other expert bodies and authors. In 2009, a joint statement by the G8+5 (group of eight highly industrialized countries, plus Brazil, China, India, Mexico and South Africa) science academies stressed that "[t]he need for urgent action to address climate change is now indisputable" [201], while in 2007 the Stern Review of the economics of climate change likewise asserted that climate change "demands an urgent global response" [2, p. i].

The case for rapid and deep cuts in emissions has thus been established across multiple scientific and socio-economic assessments – and while progress on this at an international level has stalled [3], many constituencies recognize the need for substantial emissions reduction. The UK, for instance, has set a unique and unilateral legal target of at least an 80% decrease in national greenhouse gas emissions by 2050, enshrined in the Climate Change Act of 2008 [4]. This has been applauded as a forward-looking and ambitious piece of legislation, albeit one that is precarious in the face of politically destabilizing circumstances [5].

The achievement of actual emissions[1] reduction in line with aims such as these clearly requires a wide-ranging portfolio of mitigation options. In particular, there has been growing interest within the social sciences in managing carbon reductions through techniques that influence environmentally significant behaviors and lifestyles at the individual and household level. That this

[1] School of Psychology, Cardiff University, Tower Building, 70 Park Place, Cardiff, UK, CF10 3AT

[2] Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich Research Park, Norwich, UK, NR4 7TJ

[3] School of Environmental Sciences, University of East Anglia, Norwich Research Park, Norwich, UK, NR4 7TJ

[4] Climate Outreach Information Network, The Old Music Hall, 106-108 Cowley Road, Oxford, UK, OX4 1JE

*Author for correspondence: E-mail: capsticksb@cardiff.ac.uk

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could contribute to meaningful mitigation of climate change has been asserted by numerous authors [6–12]. Given that carbon emissions can be argued to derive ultimately from attempts by individuals and households to satisfy their needs and desires [13], it has even been proposed that dangerous climate change cannot be avoided *without* behavioral change by individuals and communities [2]. As Gifford [10, p. 273] argues in this regard:

> [P]sychologists have long recognised [that] the fundamental unit of analysis for the human-caused portion of climate change is the person…. Thus, ultimately, amelioration of that part of…climate change over which we have some potential control occurs at the individual level.

While not all social scientists agree that the individual is the appropriate unit of analysis [14], a point we return to later, research studies investigating the experiences of those individuals who have pursued low-carbon lifestyles demonstrate that there does exist substantial potential for behavior change to achieve emissions reduction [15–17]. Nevertheless, we express serious concern in this article that it is difficult to point to any reliable, generalizable evidence of substantive, sustained behavioral engagement with climate change among the broader general public. For all intents and purposes, everyday life goes on in a manner largely insensible to the rhetoric of urgency and supposed centrality of lifestyle changes alluded to above.

In the present article, we consider approaches from across the social sciences designed to deliberately reduce carbon emissions at the personal and household scale through influencing environmentally significant behaviors and/or practices. We examine the extent to which the ambitions of the social sciences in this field have been realized, and ask what level of emissions reduction is realistically achievable using conventional approaches. Recognizing that attempts to change behavior – indeed, the agenda of "behavior change" itself – are situated in a particular socio-political context, we question the assumptions and conventions implicit in many approaches to date, and argue that they have precluded more radical change from being achieved. We propose some means by which social science approaches to personal emissions reduction could move in a direction more commensurate with the imperatives of genuinely radical change.

In this article we focus most closely upon approaches designed to alter individual behavior – in large part, because these have tended to dominate both the research and policy literature [14,18]. A recognition of the limitations of such strategies is nevertheless built into our critique of social science approaches to date, as well as our considerations for more radical approaches to achieving emissions reduction in the future. We define "radical" principally in respect of the scale of emissions cuts needed to effectively tackle climate change (radical *environmental* impacts), but, by implication, because of the steps required for achieving this scale of change, we imply challenging the status quo and transforming social science approaches to behavior and lifestyle change (radical *institutional* impacts). While there is substantial debate concerning the exact scale of reductions required in developed nations such as the UK, we assume that radical emissions reduction may be quantified in the region of 6–9% per annum, and/or 80% total reductions by 2050 based on 1990 levels, as articulated in research by the Tyndall Centre for Climate Change Research, the UK Government's own targets and Ekins *et al.* [4,19,20].

Emissions reduction within reach of current approaches

A variety of interventions, innovations and conceptual frameworks have been premised on the idea that meaningful emissions reduction, and pro-environmental changes more generally, can be brought about through behavior change [21–24]. In terms of the extent of emissions reduction possible through these approaches, Dietz *et al.* [25] conclude that a 20% cut in emissions could in principle be obtained at the household level in the United States – although these authors do include technical and structural measures (such as upgrading home heating systems and purchase of fuel-efficient vehicles) within their scoping study. UK analyses indicate cuts of at least 60% are possible in home energy use [26] and in national emissions [19]; however, these are foreseen through primarily technical and legislative change, accompanied by small-scale behavioral measures, such as informational feedback and product labelling.

Some characteristic approaches applied in recent years to bring about pro-environmental behavior change include informational measures such as providing feedback on energy use, motivational strategies such as goal-setting and commitment-making and a range of other individual, social and group-based approaches [23,27]. Social marketing techniques have been widely used in an attempt to persuade people to change their behaviors [28, though see 29] and, more recently, approaches from behavioral economics have been applied to "nudge" people in a particular direction on environmental issues [30,31]. As well as there being multiple approaches to effecting change, a range of environmentally significant behaviors has been targeted – including recycling, domestic heating, personal transportation and home appliance use.

Although many behavior change interventions are premised on the need to reduce personal emissions, the promotion of "pro-environmental" actions may also occur for other reasons, such as resource conservation (in the case of recycling), or reducing air pollution (in the case of transport). Nevertheless, the extent to which the behavior change envisaged by these programs of research translates into intended or actual emissions reduction is rarely apparent. One of the more recent and detailed meta-analyses in this area by Osbaldiston and Schott (2012) was able to make distinctions between the applicability of different strategies according to types of behavior, but did not present findings as to the absolute level of emissions reduction achievable using such strategies [23]. Nevertheless, a number of reviews have now attempted to quantify the amount of change that can be attained. These have focussed most often on behaviors relating to home energy use (e.g., from heating and electricity consumption), as well as transportation (e.g., car travel).

Thirty-eight studies designed to reduce household energy use, mostly through social psychological interventions, were examined by Abrahamse *et al.* [27]. The techniques applied across these studies included both "antecedent" interventions (designed to influence determinants of energy use, such as through the setting of household energy reduction targets or provision of information) and "consequent" interventions (designed to shape behavior through positive or negative consequences for actions taken, such as through provision of feedback or monetary rewards). While there was substantial variation across the studies, energy reductions averaged about 10% (ranging from null results to 21%), although many studies did not follow up on whether these effects were sustained over time.

In an examination of feedback mechanisms designed to reduce domestic electricity consumption, Fischer [32] likewise proposed typical reductions of between 5 and 12%, based on an extensive overview of five prior review studies and 21 original research projects [see also 33,34]. A further review by RAND Europe [35] examining 48 studies across a broad range of environmentally significant behaviors arrived at a similar order of magnitude for behavioral interventions. Although one study examined had achieved 17% savings in gas usage through an intensive team-based intervention, energy reductions of 10% or less were again found to be typical for behavior change interventions (where changes to physical environments such as installing insulation are excluded). This degree of change is likewise reflected in a meta-analysis by Möser and Bamberg [36] of 141 studies specifically targeting travel behavior, which concluded that an "achievable" increase in the proportion of non-car trips was around the 7% level.

Again with respect to travel behavior, a further review by Ogilvie *et al.* (2004) of 22 studies aimed at shifting people's transport from car to walking and cycling concluded that while there is some evidence that targeted campaigns can bring about change among those who are already motivated, for the most part, interventions have not been very effective [37].

These appraisals of the effectiveness of behavioral interventions, taken together, suggest that although it has been possible to bring about some reductions in personal and household emissions, this has not come close to the scale of change required under a radical emissions reduction scenario. A number of further factors also limit the extent to which current behavior change approaches are able to achieve meaningful emissions reduction, as we now discuss.

Limitations of current approaches for the achievement of radical change

Any behavioral reduction in emissions might be considered – *a priori* – to be valuable as part of a wider national effort. It is important, however, to note several general limitations of the field overall, which raise serious questions about the possibility of whether "radical" emissions reductions are within reach of the sorts of approaches currently used by the social sciences.

First, while a range of behaviors has been encompassed across the research literature, the interventions considered have almost without exception focussed upon *direct* emissions (within the home or from personal transportation) or domestic recycling, with very little attention paid to *indirect* emissions arising from consumption activities, through carbon embedded in products and services, such as food, consumer electronics, clothing and recreation. As Bailey *et al.* [38] note, however, meat and dairy products alone represent a greater share of emissions than those deriving from all worldwide road transportation, trains, shipping and air travel.

Taking into account that direct emissions account for only around 30% of households' total emissions (as illustrated in Figure 1; see also [13,39,40]; Gough *et al.* [41] suggest a figure closer to 20%) not focussing on indirect emissions therefore represents a major exclusion.[2] Given that the reviews discussed above point to a figure of around 10% reduction in *direct* emissions obtainable from behavioral interventions, this in turn therefore represents only about 3% of *total* emissions.

As well as the restricted focus on a subset of household emissions, there is also a wider sense in which the environmental behavior change agenda has confined itself to pursuing what Thøgersen and Crompton [43] refer to as "simple and painless" lifestyle change. The promotion of actions which are in themselves largely
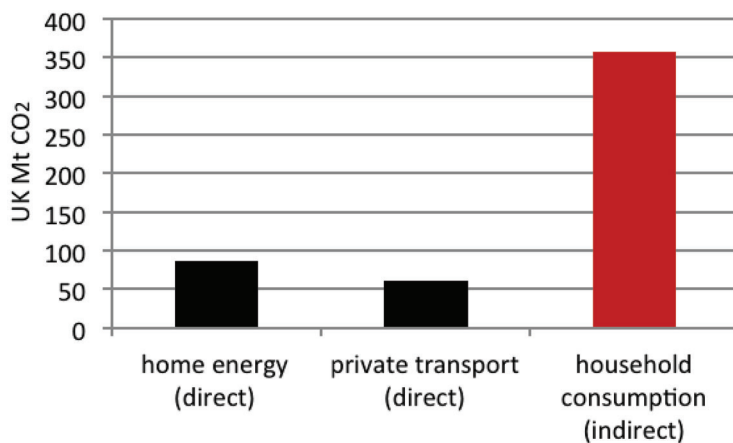
Figure 1. Proportion of UK household emissions from direct and indirect sources. Data taken from [39] and based on UK figures from 2000.

inconsequential has become widespread: examples these authors provide from real-world campaigns include turning off computer screens while at lunch, using a glass instead of a plastic cup, or printing double-sided. However, and as Thøgersen and Crompton pointedly affirm, there is a large disparity between such actions and what is actually required for effective emissions reduction:

> *The comfortable perception that global environmental challenges can be met through marginal lifestyle changes no longer bears scrutiny. The cumulative impact of large numbers of individuals making marginal improvements in their environmental impact will be a marginal collective improvement in environmental impact.* [43, p. 141]

Another author who has pointed out the limitations and dangers implicit in such a narrow framing of behavioral responses to climate change is MacKay [44, p. 114], who argues that the notion "little changes can make a big difference" is "bunkum" (i.e., nonsense) in the context of climate change. Furthermore, it has been suggested that conveying the impression that only minor changes in behavior are needed could lead a skeptical public to conclude that there is consequently little value in their being engaged [45] and that, as such, a narrow behavioral framing is incommensurate with more genuinely radical social engagement with sustainability [46,47]. Minor behavioral changes may even lead to increased emissions in other areas via rebound effects [48], as in one striking case study highlighted by Chitnis *et al.* (2013) where consumers were encouraged by a supermarket marketing campaign to "turn lights into flights" by earning "airmiles" through the purchase of

energy-efficient lightbulbs [49]. Catlin and Wang [50] outline a similar dilemma with respect to the links between resource use and recycling expectations: there may be a "moral license" to consume more if there is an expectation that products will be recycled rather than disposed of.

A focus upon low-impact behaviors is nevertheless typical in many social marketing campaigns. In attempting to encourage pro-environmental behaviors, many organizations, both governmental and nongovernmental, have emphasized short-term pragmatic actions as a response to climate change [29]. It is reasonable to ask whether the fetishization of such actions as switching televisions off standby [51] and recycling [52] is related (at least in part) to a parallel focus on such actions by the social sciences – as illustrated by the large and still-growing number of studies examining the psychological determinants of recycling behavior [53–55].

A further limitation of social science approaches to date is that even the reductions in household emissions outlined above have been achieved for the most part only in targeted experimental settings or small-scale test sites. Typically, the number of households participating in such research is in the tens or hundreds, although this does vary widely [34]. Such research is often resource-intensive, requiring substantial commitment and oversight from researchers. The interventions used vary in their approach: examples include provision to households of feedback through real-time energy displays, and personalized travel plans to reduce car use [27,36]. It is important to note, however, that such interventions are not *intended* primarily to achieve actual emissions reduction at any meaningful scale; rather, they are designed to test and develop research concepts and/or best practice. While this ensures methodological rigor, it has meant that the potential for scaling up interventions is not generally pursued, with the consequence that even well-evidenced ways of bringing about emissions reduction have rarely been implemented beyond the initial scope of a research project.

A final limitation to the pursuit of individual emissions reduction, as outlined at length within the critiques by social practice theorists such as Shove [14], is that the predominant emphases to date upon "behaviors" (which are presumed to be directed by individual attitudes and choices) has restricted the ways in which the relationship between householders' energy use and the realities of their daily lives has been conceptualized. It has been argued that the ever closer focus on the determinants of individual behavior is distracting researchers and policy-makers alike from addressing difficult and important challenges concerning the social and economic circumstances which give rise to unsustainable practices [56]. As Shove [14] has argued,

certain social and infrastructural factors lead unavoidably to certain patterns of demand. These may include the ways in which essential services such as food and water are provided, as well as a range of expectations that are placed upon people. For example, that which Shove terms the "contemporary enthusiasm" for twice-daily showering is underpinned by aspects such as the need to project social status through one's appearance, a duty to be healthy and clean, and the pleasurable and curative properties of bathing [57]. In a related way, as Hargreaves *et al.* [58] have pointed out, ethnographic research has shown huge disparities in energy consumption even across ostensibly similar households, due in large part to variability in the underlying social and cultural aspects of energy use. As Gram-Hanssen [59] argues, this may be driven by a range of contextual factors such as the different ways in which the members of a household are responsible for monitoring its heating, variability in how sections of the home are utilized and differences between households in what is considered a "comfortable" indoor temperature [59].

The wide variability in home energy use is further emphasized by Galvin [60], who presents a tripartite model of household types with respect to energy consumption, in which there is substantial disparity between "light", "medium" and "heavy" energy consumers in the area of home heating. This author argues that given a small minority of households are responsible for around half of energy consumption (while a fifth of households, by contrast, consume only 3% of energy), it therefore makes sense to target particular types of "behavers" rather than energy-use "behaviors." Other studies have also found that households' carbon emissions vary substantially according to socio-economic circumstances [e.g., 13,61], leading to the suggestion by Brand and Boardman (2008) that reducing national carbon emissions principally requires the "taming of the few" [62].

We have offered a number of critiques concerning the nature, emphases and achievements of conventional approaches toward effecting individual and household emissions reduction. We suggest that while there is an evidence base that behavioral interventions can reliably bring about change, this is limited to a small reduction in a minority subset of individual emissions, brought about principally in experimental settings, and often without consideration of the socio-cultural contexts within which behavior (change) occurs.

Undoubtedly, the design, implementation and appraisal of behavior change schemes have been important for understanding the psychological and contextual factors which influence pro-environmental behavior, and we do not seek to diminish the theoretical advances obtained to date. However, we also note that

the accumulation of ever more nuanced insights in the research literature does not in itself lead to any meaningful cuts in greenhouse gas emissions. It is, furthermore, unlikely to be a coincidence that the pursuit of behavior change and/or individual-level emissions reduction in the terms which have prevailed to date has been aligned with the current political inclination for neoliberal "soft paternalism" [63,64,65] rather than presenting genuine challenges to fundamentally unsustainable lifestyles, climate policy and governance. Some have indeed argued that such a propensity to ascribe responsibility primarily to individuals (rather than to governments or institutions) for addressing climate change is itself a manifestation of dominant political assumptions that emphasize the centrality of consumers as rational actors in effecting change [14,63,64]. According to Shove [14, p. 1274], the predominant policy focus in the UK on attitudes, behavior and individual choice "obscures the extent to which governments… have a hand in structuring [the] options and possibilities" that are realistically available to people.

At a point in time at which there is an urgent need to deliver climate change mitigation in all quarters, it thus seems legitimate to question whether conventional social science approaches have been fit for the purpose of substantive emissions reduction – and if not, to ask what might constitute a more radical set of approaches.

Radical change from a social science perspective

So what would a social science fit for the purpose of radical change look like? Here, we propose three main characteristics of a social science reoriented toward radical emissions reduction.

■ Radical social science means advocating for change

The issue of reorienting research to achieve radical change presupposes that pursuing and promoting radical change in people's lifestyles is an appropriate or desirable goal for the social sciences to seek to achieve. At this juncture, it is important to note the long-standing debate about the role of the academy in "advocating" for particular normative outcomes. At its most basic level, the widely accepted "Mertonian" norms [66] of how science should be conducted (with the most pertinent norm for the purposes of the current article being that which prescribes "disinterestedness" in scientific enquiry) may be considered to be in tension with the goal of enabling or provoking "radical change" in behavior through publicly-funded social science research. Put simply, it could be argued that radical change of any kind should not be the goal of empirically grounded disciplines. This position would indeed appear to be in line with much previous

research in this area, which has been concerned to test possibilities for marginal behavior change rather than to press for substantive changes to lifestyles and social fabrics.

It is clear nonetheless that there are many – typically non-contentious – examples of social science research adopting an explicitly normative and, at times, uncompromising stance in relation to achieving societal goals around health or public safety. For several decades, social science researchers have asked how to promote positive health behaviors such as healthy eating, and how to reduce or even eliminate entirely negative health behaviors such as smoking [67,68]. That this research explicitly contributes toward the normative goal of a more healthy society is not considered problematic – indeed, is specifically funded by the public purse. As Chapman [69, p. 1227] points out:

> When public health advocates articulate their goals, they seldom attract dissent: few decent people are willing to publicly disagree that deaths from heroin overdose are tragic, that work environments should be safer, or that it would be good if fewer people were killed on the roads.

This author goes on to note that although advocacy in public health becomes more contentious where particular strategies for achieving these ends are spelled out, nevertheless most health practitioners still feel they should be able to advocate for these.

While research on how to promote sustainable behavior is similarly funded through public money in many countries, there is, by contrast, a degree of nervousness associated with social science aimed at engaging the public around pro-environmental behavior, and debate within the social sciences about what an appropriate role for it should be [e.g., 70]. In a review of the arguments for and against advocacy in conservation science, Nelson & Vucetich [71] suggest, however, that the most important question is not whether scientists *should* advocate – indeed, they argue that advocacy is "nearly unavoidable" – but how to do so in a justified and transparent manner. These authors argue that refraining from advocacy does not constitute the "neutrality" so often invoked as a reason for scientists avoiding policy debates. Instead, they suggest, refraining from advocacy effectively constitutes implicit support for the status quo. Because climate change is among those environmental problems which are direct outcomes of dominant culture, institutions and policies, there is an argument that this places a particular obligation to speak out: "Just as being neutral toward child abuse guarantees children will be abused, neutrality about environmental abuse guarantees environmental abuse. Arguably, many current policy issues

are like this. They are clearly bad, and scientists are responsible for knowing that" [71, p. 1095].

The first challenge, therefore, in developing a social science fit for the purpose of engendering radical shifts in public responses to climate change is for the social sciences to become comfortable with the idea of promoting substantive lifestyle change as a normative aim, and to do so alongside explicit advocacy for changes to cultural and policy contexts that would make this possible.

Precedents exist for such an advocacy model in other domains. For example, the Campaign for Science and Engineering (CASE) is a British pressure group that lobbies politically to raise the profile of science and engineering, and advocates for the economic and cultural importance of science. It includes in its aims such explicitly political goals as promoting the scholarly value of immigration, and fighting for increased funding for science from the government. If a social science fit for radical decarbonization were to be developed, an analogous organization – a campaign for the value and societal worth of engaging the public in pro-environmental change – might be required.

Such advocacy of radical pro-environmental lifestyle change need not constitute a fringe activity, occurring outside of mainstream academia and undertaken only by an especially strident group of practitioners. For example, a recent *Nature Climate Change* editorial [72] approvingly cited a proposal by World Bank President Jim Kim to establish an international "movement" that includes concerned scientists, non-governmental organizations and civil society to address climate change:

> Such a lobby – "Campaign Climate," if you like – with genuine grassroots involvement would in the eyes of many be more than a match for climate change sceptics and vested interest groups, and perhaps more effective than the scientific community alone in applying pressure on national governments to act. [72, p.849]

Proponents of such a campaign might indeed be surprised to encounter a public that is more responsive than is often assumed to be the case: recent research in the US by Leiserowitz *et al.* [73] has found that three in 10 Americans either have joined or would join a campaign to convince elected officials to address climate change, and, more strikingly still, that around a quarter of Americans would, under some circumstances, support non-violent civil disobedience as part of action on climate change [73].

■ Radical social science means focussing on the sources and underlying causes of high emissions

As well as being open to a more advocative stance, the second challenge for a genuinely radical social science is

to orient research toward the topics of enquiry where the most impact in terms of carbon emissions can be made. There have been previous calls to do just this: Steg and Vlek [11] have stressed that environmental psychologists should focus their attention on behaviors that are most impactful, noting for example that lowering thermostat settings or reducing car use has greater merit than the reuse of plastic bags in stores. However, and as we outline above, there has been an implicit assumption that the scope of "behavior" within which such relative comparisons are made excludes indirect emissions (comparisons with bag reuse notwithstanding); in addition, there has been little consideration of the characteristics of individuals and households from which the majority of emissions derive.

A useful starting point in an attempt to spotlight areas of high emissions at the household level is the consistent finding that carbon emissions increase sharply with income [39,40,74,75]. With respect to personal travel, for example, the top 10% of emitters are responsible for close to half of all emissions, while the share of the bottom 10% of emitters is closer to 1%; much of this difference is in turn underpinned by household income [62].

The use of input–output models that extend carbon accounting to both indirect and direct emissions, and can attribute these to final demand categories [76], enables a more nuanced understanding of the distribution of emissions across households than has been typical in social science interventions to date. These methods are additionally valuable for their ability to attribute emissions to "functional uses" in terms of the various activities that comprise daily life, such as recreation and leisure, health and hygiene, and commuting [13]. This provides the potential to address part of the criticism levelled by social practice theorists that a focus on "behavior" neglects the everyday meanings underlying people's actions, as well as offering the opportunity to pinpoint variability in emissions by socioeconomic groupings. To give an example, Druckman and Jackson [13] observe that a quarter of all emissions derive from recreation and leisure (including personal aviation), and that people living in "prospering suburbs" have the highest per-capita emissions across a range of socioeconomic categories. Their analysis also suggests that the category of "health and hygiene" – which has obtained something of an iconic status of its own within the social practice literature in the context of changing social conventions around showering and cleanliness [77–79] – is a relatively less impactful area.

An important conclusion that can be drawn from these studies is that a more radical approach to behavior and lifestyle change would pursue change in consumption domains, and within social groups, that are of the most significance for carbon emissions. For example, rather than conducting studies on recycling behavior among the general public (as has been commonplace thus far), research might instead seek ways of addressing emissions from personal aviation by those on high incomes. It is clear that this would not be an easy task – as illustrated by the almost complete absence of previous work attempting to do so – but nevertheless, any effort to radically reduce personal emissions would need to come to terms with such challenges.

An additional conclusion that can be drawn across a range of carbon accounting studies, as we note above, is that indirect emissions in the form of consumption of products and services – including, for example, food and drink, alcohol and consumer electronics – constitute the major part of total household emissions. With this in mind, Gough (2013) demonstrates that there is a strong argument for policy and interventions to address embedded carbon in parallel with approaches for reducing direct emissions through behavior change [42].

The potential for a citizen-led response in a sustainable direction with respect to carbon embedded in everyday purchases and activities has now been acknowledged across a wider sustainable consumption literature [80,81]. While this literature is concerned with matters beyond emissions reduction, the idea that people may make a positive impact has been promoted through means such as carbon labelling of consumer durables and food [82] and through the "social marketing" of sustainability more generally [83].

This said, the sustainable consumption agenda as a whole has moved away from an earlier interest in bringing about radical transformations in lifestyles, and toward a less contentious focus on the marketing of "green" products such as biodegradable washing powder or low-energy light bulbs [84]. As Seyfang [84] notes, critics of the sustainable consumption paradigm have argued that it has neglected a fundamental point, namely that "the most sustainable product is the one you never bought in the first place" [202]. Jackson and Michaelis [85, p. 20] likewise remark that: "[m]ore radical environmentalists and social critics emphasise the importance of remaining open to the possibility that we could live better by consuming less."

The difficulty for any social science seeking to deliberately promote reduced consumption as a means of lowering people's embedded carbon emissions is that such an approach immediately collides with powerful and deep-rooted political and economic assumptions about the importance of consumer spending as a means of driving economic growth. Indeed, the paradigm of economic growth is itself used as a proxy for societal well-being [86]. Nevertheless, numerous authors and activists have now made the case for reducing absolute

consumption for the purposes of addressing climate change and other environmental problems [e.g., 87–89], as well as for wider reasons of pursuing different and better versions of prosperity and wellbeing [86,90,91].

Lifestyle change characterized by low levels of consumption is often described as "downshifting" or "voluntary simplicity" [92,93]. Under a carefully constructed reduced consumption scenario – in which people are able to have a "decent" standard of living and to participate in society, but where there is nevertheless reduced materialism and less focus on "status-driven consumerism" – Druckman and Jackson (2010) have shown there is the potential for annual household emissions to fall by 37% (though it should be noted that this figure incorporates reductions across all aspects of a household's footprint) [94].

Given the need to encourage changes to patterns of consumption, it is encouraging that members of the public themselves recognize the problems arising from excess materialism (including its association with lower well-being [95]). Research in the US has shown that a majority of research participants supported reducing total consumption, and were of the opinion that doing so would improve individual and societal well-being [96]. While more "environmentalists" and liberal voters were of the view that reducing absolute consumption was desirable, even among conservative voters this majority agreement held. Likewise, in separate studies it has been observed that the adoption of an ethic of "frugality" comprising lowered consumption is commonplace among research participants attempting to reduce their environmental impacts [15,97].

Given the critical importance of embedded emissions, we suggest that a more radical social science would be forthright about the need to achieve changes to consumption patterns to limit these, and would seek actively to promote this at the individual and household level. A more radical social science approach would comprise deliberate attempts to bring about change in areas of relatively high impact, whether corresponding to particular groups of citizens or types of consumption activity. It would, in addition, seek to promote reductions in absolute levels of consumption across society.

■ Radical social science means integrating disciplinary approaches

In addition to recognizing and targeting areas of high emissions, the third challenge for a genuinely radical social science is to develop a more integrated outlook on the opportunities for reducing carbon emissions at the individual and household level.

As we have outlined above, much of the work carried out to date which has aimed to understand and influence people's carbon emissions has adopted individuals or specific "behaviors" as units of analysis. Most psychological approaches follow a similar accepted format: an assessment of the behavior in its social and physical context, the design of an intervention (targeting the antecedents and/or consequences of the behavior), application of the intervention and assessment of the intervention's impact [98]. It has, however, been argued that such a focus on the external observable behaviors of individuals and their psychological determinants detracts from in-depth consideration and understanding of the complexity and influence of the social, economic and political contexts in which those behaviors are manifest, arise and develop [29,56,99]. Critics of individualistic approaches have argued that over-reliance on psychological and behavioral factors overlooks the important relationships between these components.

By contrast, high-carbon ways of living viewed from a different perspective will result in a different understanding of resource use and actions associated with these [100]. In particular, through the lens of social practice theory (SPT), an objective of lowered carbon emissions requires addressing the widespread but ordinary or "inconspicuous" consumption practices that make up everyday life [101]. In SPT, the unit of analysis is the practice, which can be considered the materially and socially interconnected ways of doing things by individuals within communities (e.g., cooking, bathing, commuting) [14,102]. SPT theorists have tended to describe the elements comprising practices in terms of "materials" (including infrastructure), "competences" (including knowledge and social norms) and "meanings" (including culturally shared notions).

SPT has been used to examine the constitution and dynamics of routines in everyday lives and their implications for sustainability, and has gained considerable interest in academic circles in recent years [102,103]. Jackson [24] suggests it has gained less traction among policy-makers, however, in part because it has been difficult to see how such approaches could actually be put to practical use [24]. That said, there have been attempts made by practice theorists to elucidate the means by which policy strategies could potentially be understood in these terms [101,104].

It should be noted at this juncture that SPT practitioners in the sustainability domain have in some cases gone out of their way to define these approaches in direct opposition to those deriving from behavioral science [14,105]. Indeed, Shove [14] has argued that social theories of practice are entirely incompatible with theories of behavior, due to these two approaches having different assumptions about the drivers and contexts of sustainability.

While theoretical and practical compatibilities among the various social science disciplinary perspectives do require careful consideration, nevertheless, a fragmented and fractious relationship between paradigms seems to us unlikely to advance the more important objective of emissions reduction. In line with Kurz *et al.* [106], we suggest instead that it may be at the intersections between different theoretical approaches and paradigms that novel and important policy interventions are likely to be obtained.

In a situation where an understanding of the characteristics and motivations of individuals, on the one hand, and the socially organized nature of practices, on the other, are both necessary but neither (on their own) sufficient to pursue the objective of reduced household carbon emissions, a more promising approach would be to seek out synergies between traditions. Viewed from the perspective of solving an urgent and practical problem (rather than from a particular discipline's favored ontological assumptions), it is simply not feasible to make progress on climate change in methodological silos. So while the prospect of integrating across social science disciplines may appear "radical" from an academic perspective, *not* pooling and integrating expertise may appear a perverse choice from beyond the academy.

In this vein, some have appealed for greater tolerance and integrative working across social science disciplines, and noted the potential benefits from bringing together evidence and theory from different disciplinary perspectives that nonetheless pursue the same end of understanding and promoting a low-carbon society [107]. Hardisty *et al.* [108], for example, have presented evidence through a series of case studies that an integration of disciplinary perspectives to environmental policy (in their case, from economics, psychology and anthropology) results in an approach that is more than the sum of its parts. These authors argue in particular that including insights from social science approaches that might otherwise be considered "orthogonal" to the others enables blind spots to be indentified and overcome. Rowson and Corner [109] likewise argue that any meaningful communication with the public around climate change needs to make explicit the interconnecting links between climate change and seven key "dimensions" (including science, culture, economy and democracy) – of which "behavior" is only one.

There have now been a number of conceptual models proposed within which different disciplinary insights into behavior and lifestyle change are either integrated, or addressed in a complementary manner. We give examples of four such approaches below.

In direct response to the public debate on the tensions between SPT and behavioral approaches to addressing climate change, and in keeping with a philosophical tradition of pragmatism [110], several authors have proposed ways of drawing on the insights from these two paradigms to achieve practical responses to climate change. Wilson and Chatterton [111] argue that studying behavior as an object of inquiry is not inconsistent with practice theory, in which behaviors can be seen as "physical manifestations of practices." These authors argue that emission-related behaviors vary widely in their characteristics and contexts, implying a need for diverse models and levers for change. Consequently, they propose a guide for policy-makers in selecting and using different models of behavior/practice, based on the criteria of "actors" (individuals, networks, populations), "scope" (isolated actions, catalyst behaviors, lifestyles), "durabilities" (one-off behaviors, repeated actions, habits) and domains (psychological, physical, social) of behavior. Depending on the aims of a practitioner, policy interventions could range from awareness campaigns through deliberative fora, to taxation, regulation or product labelling.

While Wilson and Chatterton advocate integrating *insights* from multiple paradigms, they stop short of advocating a more comprehensive integration across different disciplinary traditions, affirming instead the advantages of an openness to multiple (sometimes contradictory) models of behavior and lifestyles. Others have, however, gone further to argue for integrative theoretical models that combine psychological and sociological elements in order to overcome the limitations of each.

Boldero and Binder [112], for example, have proposed that the model of recursive cultural adaptation (MORCA) comprises just such an integrated approach able to accommodate insights from across disciplines [113], notably psychology, sociology and philosophy. In a similar way to that proposed by SPT, these authors see practices as constituting social structures which establish rules for behavior – as representing the non-conscious "way things are done" – which serve the purpose of defining the relationships between people and their environment. However, this model also recognizes that individuals are motivated to engage their own agency (i.e., to exercise their preferences and choices) under certain situations, such as when there are perceived to be changes to social norms, and it is at these times that practices are amenable to being changed or overridden. The authors provide empirical support for the model in the context of showering, water conservation and building firms' innovation, highlighting successful practical interventions to influence behavior (at different scales by different types of actors) and thus addressing something of a weakness in the SPT literature which has tended to adopt a more descriptive focus [106].

A third approach, which draws on multi-disciplinary insights into energy use, is the "Energy Cultures" framework, described by Stephenson *et al.* (2010) as a "culture-based approach to behavior" which is designed to help identify opportunities for behavior change [114,115]. This framework proposes that people's energy use behavior be understood in terms of interactions between cognitive norms (e.g., individual beliefs, values), material culture (including technology and structural factors) and energy practices (e.g., the typical temperature to which a home is heated). The potential for behavior change arises when there is a shift in one of these components: this may occur at the individual level, such as a change in attitudes toward energy efficiency, or at the structural level, such as the provision of government subsidies for insulation.

Fourth, the multi-level perspective (MLP) in the socio-technical transitions literature is increasingly being applied to explore the potential for radical change in numerous contexts, from resource use to water systems and mobility [116,117]. The MLP has made significant contributions to sustainability modelling and social research by providing a more integrated and systemic perspective on socio-technical change, based on detailed historical (and some contemporary) case studies and theoretical literatures. However, while the MLP has drawn heavily on economics and sociology literatures, it has not yet adequately incorporated behavioral and political science insights to fully elucidate how behavioral–institutional change might occur, nor has it considered how its core conceptual bases may relate to social practice theory [118].

While it is not our intention to recommend any of these particular approaches over others, they nevertheless serve to illustrate the potential for more comprehensive and far-reaching ways of conceptualizing the relationships between individual factors, elements of practice and wider social and structural contexts. We suggest that the prospects for a more radical social science would be greatly enhanced if future research sought to understand and influence carbon emissions in these different but interlocking ways.

Radical change in the environmental and institutional domains

We have outlined three key challenges that we consider central to the development of a more radical social science of climate change: the need for advocacy of radical change, the need for a focus on areas of high emissions and the need for more integrated social science approaches.

In conceptualizing what is represented by change in a radical direction, we have proposed that this may relate either to that which brings about radical *environmental* impacts – relating to the scale of emissions cuts needed to effectively mitigate climate change – or to radical *institutional* impacts – relating to challenging the status quo and the transformation of social science approaches to behavior and lifestyle change.

Each of the three challenges we outline emphasizes in different ways these two versions of radical change, as summarized in Table 1. In the case of our recommendation for more forthright advocacy of change, there is a stress upon a direct contestation of the status quo: rather than the maintenance of a neutral or impartial position, a more radical set of approaches would unashamedly adopt a normative stance that took serious issue with the high-carbon lifestyles that are currently the norm in many parts of the world. In the case of a re-emphasis on areas of high emissions, this would also entail confronting assumptions which sustain the status quo, but would principally entail a more strategic focus on those behaviors and practices that are, quantifiably, the most environmentally impactful. In the case of more integrative social science approaches, our focus is on institutional impacts, entailing new ways of understanding and influencing those behaviors and social contexts that give rise to persistently high levels of emissions. Nevertheless, this manner of integration would be pursued ultimately to bring about more effective approaches to climate change mitigation.

Next, we present two case studies that are designed to demonstrate the ways in which more radical emissions reduction could practically be brought about at the individual and household level. In the first case, we consider

Table 1. Characteristics of radical approaches to behavior and lifestyle change.			
	Summary description	**Principal focus of change**	**Illustrative sources**
Advocating for change	Pursuit of normative stance that challenges assumptions behind unsustainable ways of living	Institutional	[71,72]
Focus upon sources and causes of high emissions	Re-orientation of inquiry and interventions to areas of most importance to climate change	Environmental	[42,87]
Integrating disciplinary approaches	Bringing together of evidence and theory from different disciplinary approaches	Institutional and environmental	[108,114]

personal mobility, which represents a set of behaviors encompassing over a quarter of UK households' direct emissions, and yet is an area that has proved intractable to change. In the second case, we consider elements of consumer behavior and culture, aspects of which are both deeply embedded and highly impactful in terms of carbon emissions.

Case study: mobility

Travel represents 27% of UK households' direct carbon emissions (of which 67% is accounted for by owning and running a car [119]), yet it is among the least popular behavioral changes for tackling climate change due to a range of cultural, psychological and physical barriers [52,120]. Indeed, in respect of determinants of low-carbon travel behavior, location, income, demographics and (to a lesser extent) values are important [121]. Thus, as a case study, mobility is both pragmatically and scientifically significant, and demands bringing together social (and other) sciences in interdisciplinary collaborations.

Much is known about how to achieve change in mobility behavior – although less is known about how to achieve change that can be considered radical. Evidence highlights the need for a range of interventions, including both "hard" and "soft" (i.e., infrastructural and other, e.g., informational, organizational, economic) measures. While social marketing measures (e.g., personal and organizational travel planning), car sharing, teleworking and other "smarter choice" measures can encourage modal shift and reduced demand [122], such approaches must be accompanied by harder, infrastructural and fiscal measures to lock in behavior change and avoid rebound effects, undesirable modal shift or induced traffic. For example, unintended adverse consequences include information and communications technology generating transport demand through newly created relationships, new public transport services drawing demand from other public or active modes instead of from drivers and traffic reduction measures freeing up road space and attracting more drivers [123,124]. This highlights the need for integrated, long-term transport and spatial planning that addresses the multiple drivers of demand and the range of social, economic and environmental consequences of interventions. Furthermore, interventions need to be targeted appropriately to the particular context, including factors such as population density, extant transport or energy infrastructure, local policies, cultural norms and patterns of demand [125]. Adopting a participatory approach to developing transport policies is also likely to foster more acceptable, fairer and sustainable outcomes [126, though see 127].

Concrete examples of effective interventions are evident in the UK, such as the Cycling Cities and Towns initiative (increasing cycling by 27%) and London

congestion charge (reducing congestion by around 30%) [128]. Schemes to reduce road capacity have led to a mean reduction of 22% in traffic volume, while "soft measures" (e.g., teleworking) can produce a 21% cut in urban peak hour traffic [123]. More ambitious and wide-ranging improvements to transport systems have taken place within European cities, such as Stockholm, Malmö, Montpelier and Copenhagen, due to strong sustainable transport and land-use policies (including greater public transport subsidies, and transport coordination). For example, Copenhagen's walkable urban environment means car use only accounts for 27% of work trips, while cycle use accounts for 36% [122]. More sizeable reductions in driving have been recorded where interventions are focused at the organizational level: for example, up to 66% decrease in vehicle miles travelled where telecommuting schemes are introduced in workplaces [129]. A recent meta-analysis by Graham-Rowe *et al.* [130] of research into changing car use behavior found that, while the evidence base was limited, more effective interventions included those that targeted people who have just moved residence, drivers with a strong driving habit or strong moral motivation to reduce car use, and relocating employees to reduce commuting time [130].

In line with this conclusion, a particularly promising avenue for behavior change based on psychological principles, but consistent with social practices literature, is that of "habit discontinuity" [131]. Information about alternative behaviors/choices (e.g., bus travel) tends to be ignored when people have strong habits (e.g., to regularly drive [132]), but when habits are disrupted by a change in circumstances (e.g., through relocation or a new job), behavior-relevant information becomes more salient and influential, thus providing an important window of opportunity to intervene to change behavior [133]. This line of research suggests relatively low-cost or "soft" measures can have significant impact on mobility behaviors if they are timed to when there is a relevant context change [134].

In sum, there is a wealth of evidence to show that mobility behavior can be changed, ideally through a combination of measures, and where these are effectively *targeted* (e.g., to context change moments, audience values, organizations [37]). Much of this can be considered incremental change, but examples of 20, 30 or even over 60% reductions in car use have been recorded in the most effective schemes.

Regarding the arguments we make above concerning the need for integrated disciplinary approaches, the case of mobility illustrates that the more successful interventions are likely to be those which set out to change travel behavior through a comprehensive set of approaches and insights. Individualistic or psychologically informed

techniques have the potential to bring about some degree of behavior change, for example through "habit disruption" or the use of personal travel planning. However, the extent of such change is likely to be limited, and may be temporary, without adjustments to the cultural and structural factors – such as the expectations and practices of employers, and limitations of public transport – that have themselves led to the widespread reliance by many people upon cars for their mobility.

So far, less work has explored how to change flying behavior than has addressed modal shifts in more ubiquitous travel behaviors (particularly reducing car travel); yet, increasingly, this is likely to be even harder – and more important – to change than driving behavior [135]. The challenge of addressing flying is particularly pronounced because whether people travel frequently by air, or refrain from doing so, does not correlate with environmental awareness [136] and also constitutes an emotionally charged topic even for raising in discussion [137,138], as well as a "political minefield" [139]. Promotion of "slow travel" and voluntary changes to flying frequency [135,138] are two means by which the public might be engaged in reducing this component of personal emissions, although it is far from clear whether such approaches would be effective, given continually growing expectations of regular international air travel. Indeed, Higham *et al.* [139] argue that voluntary approaches alone will be insufficient to change current air travel practices in a manner commensurate with radical emissions reduction. Based on research with members of the public in four European nations and Australia, these authors conclude that altering behavior in this domain will require diverse strategies at both the individual and structural levels, but that ultimately an absence of regulatory measures constitutes the main barrier to bringing about changes in air travel behavior.

Case study: consumer culture and the pursuit of things

At least as environmentally impactful an area, and no less intractable, is the portion of carbon emissions deriving from our spending on, and acquisition of, consumer products and services. Given that consumer behavior permeates many aspects of everyday life, and is directed to end products encompassing everything from pet food to footwear to personal computers, we can only offer here an imprecise treatment of a highly complex area. Nevertheless, we briefly outline some of the means by which consumer culture has been understood and critiqued, and consider implications for more radical approaches to addressing climate change in the personal domain.

Historians have traced the origins of modern consumer society to the growth in seventeenth- and eighteenth-century Europe of rising material expectations and acquisitiveness [140]. While "consumerism" is often used as a pejorative term, it is nevertheless argued to be so pervasive as to constitute a "way of life" through which social relations are played out [141]; indeed, without consumer goods, certain acts of self- and collective definition would be impossible in contemporary society [142]. It has also been argued that conspicuous consumption has profound psychological underpinnings, based on a deeply human and cultural need to "provide meaning and value…in the face of death" [143, p. 132], and for achieving and demonstrating status, self-worth and group membership [144,145].

Despite the centrality of consumer culture to contemporary lives, it is clear that consumerism is nevertheless strongly connected to high carbon emissions. Assadourian [146] argues that it is in those countries where consumerism is the cultural norm where emissions are highest in global terms, and that as a consequence consumption patterns require urgent redirection. Jackson [86] likewise argues for the systematic "dismantling" of the culture of consumerism and its replacement with viable opportunities for less materialistic ways of life. Because of the ubiquitous functions that consumerism provides, any efforts to reduce consumption will, however, be unlikely to succeed unless the same sorts of intangible benefits and social meanings it provides can be delivered by other means [84].

Unlike the promotion of discrete pro-environmental behaviors, the establishment of an ethic of reduced – and/or radically different types of – consumption is likely to require sustained efforts at a community and societal level. From her consideration of a number of grassroots approaches to sustainable consumption, Seyfang [84] argues that community-building and shared action constitute key elements of a creative and practicable form of ecological citizenship, entailing responsibility for the environmental impacts of individual behavior, as well as for a wider political engagement (see also [147]).

The achievement of such ecological citizenship as part of wider social networks is unlikely to fit the prototypical mold of structured interventions typical across the social sciences to date [98]. Moving to low-carbon lifestyles will instead require forms of collective action that go beyond the bounds of current government policy [42] and which may typically be expected to occur at local scales and to develop in innovative, unexpected and dynamic ways [148,149].

There may, nevertheless, be a role for the social sciences in supporting radically different ways of organizing society, although it has been argued that the translation of "niche" activity into a more mainstream agenda is inherently problematic [150]. Likewise, while there is no simple formula through which to address what Miles

(1998) terms the "consuming paradox" [141] whereby consumption fulfils complex human needs while leading to ever-increasing carbon emissions, many studies have now recognized that high levels of consumption are associated with particular types of materialistic values at both the individual and community levels [151,152]. By contrast, low levels of consumption are consistently found to be associated with "other-regarding" values such as social justice [15,153]. In light of this, the opportunity exists for social scientists to find ways to promote and foster the types of values and attitudes which underpin pro-environmental lifestyles – and which are diametrically opposed to more materialistic ways of living [29,154]. One of the most effective ways for pro-environmental behavior to be promoted may indeed be through the "drawing out" of deep-seated principles and values which are already harbored by people, and which, with appropriate encouragement, are able to lead to more enduring types of environmental citizenship [155].

As with the case of mobility, considered above, any radical changes to patterns of consumer behavior will likely require efforts drawing on disparate disciplinary approaches. It is clear that individual values and attitudes are powerful determinants of consumer choices of relevance to climate change, and as such natural territory for psychologists seeking to effect change. It is also clear, however, that a person's behavior does not exist in isolation from the cultural and historical contexts that have established consumerism so pervasively in contemporary society. As such, any possibility of radical change would require the insights of sociologists and other social scientists who recognize the potential for reconfiguration of practices that underpin high emissions in this domain.

Conclusion

This article has explored the extent to which radical emissions reduction at individual and household scales may be achievable through approaches currently available within the social sciences. We conclude that implicit in these approaches are a variety of assumptions and conventions that have limited the promotion and practical implementation of significant emissions cuts. We have proceeded to consider what might constitute a more radical set of approaches, given that conventional ones – to date – have not been fit for purpose. This paper proposes that a social science reoriented toward radical change would not refrain from advocating particular strategies aimed at achieving substantive changes to lifestyles and social structures, but do so in a justified and transparent manner; focus purposefully – but not exclusively – on the sources and causes underpinning high emissions in order to orient research toward those areas where the gains are to be maximized; become

more integrative of disparate disciplinary perspectives, in order to pursue the potential for radical change using different conceptualizations of individuals in their socio-cultural contexts.

We are not naïvely anticipating that social science approaches to behavior and lifestyle change can be rapidly re-invented to become "radical", substantially reformed in contrast to how they have developed to date. We are mindful that the proposals advanced in this paper would require open and honest conversations among groups and communities that may be willing to offer their (sometimes ontologically diverse) understandings of the world. This may lead to compromise on some aspects of research in order to entertain the possibility of bringing together perspectives with a view to achieving radical change. This article has elucidated examples of where some of these conversations are already occurring, and others still where ground is fertile. It illustrates also that this extension is necessary beyond the social sciences; there are some aspects of emissions reduction that require more in-depth understanding by working with community groups and activists, as well as with natural and material scientists.

The examinations and reflections in this paper point to areas where the social sciences could demonstrate the ability to become radical: identifying opportunities for making the most impact, and developing interdisciplinary joining-up of existing frameworks such as those identified above, as well as others which may become relevant as these connections are explored. This in turn may lead to innovative combinations of approaches and methods that to date have remained siloed and distinct.

The proposals contained in this paper are geared toward rethinking the contributions that social sciences can make toward environmental sustainability, broadly speaking. We do not shy from the first element we suggest for a radical social science, namely advocacy. Our goal is to provoke our readers into reflecting in depth about what has been achieved so far and where the potential lies for advancing deeper emissions reduction, and to encourage and spur colleagues and critics to engage in conversations about which useful ways forward could be enacted and how. Climate change demands urgent alternatives – many other social and environmental problems do too.

Notes

1   In this paper, we refer interchangeably to "carbon emissions," "greenhouse gas emissions" and "emissions" to indicate emissions of greenhouse gases contributing to climate change. This convenient notation is now in use by a variety of authors and in the public domain. We acknowledge, however, that there are significant differences in the meanings of these notations.

2   As Gough [42] notes: "[t]o concentrate on the direct emissions of households is to give an impoverished and distorted picture of the carbon and environmental footprint of consumption activities in a rich country like the UK."

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