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What is climate change scepticism? Examination of the concept using a mixed methods study of the UK public[☆]

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ABSTRACT

The holding of doubts about climate change is often referred to as 'scepticism'. However, there has been a lack of clarity in previous work as to what exactly this scepticism comprises. We integrate data obtained from discussion groups and a nationally representative survey, to interrogate and refine the concept of climate change scepticism with respect to the views of members of the public. We argue that two main types should be distinguished: epistemic scepticism, relating to doubts about the status of climate change as a scientific and physical phenomenon; and response scepticism, relating to doubts about the efficacy of action taken to address climate change. Whilst each type is independently associated by people themselves with climate change scepticism, we find that the latter is more strongly associated with a lack of concern about climate change. As such, additional effort should be directed towards addressing and engaging with people's doubts concerning attempts to address climate change.

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1. Introduction

1.1. Background

In developed nations, almost half of all greenhouse gas emissions are tied to individual and household energy use, such as space heating and private transportation (IEA, 2007). The fostering of more sustainable lifestyles has therefore been a focus of numerous initiatives and interventions (Abrahamse et al., 2005; Bamberg and Möser, 2007). Another facet of public engagement is political: citizens' support is essential for bringing about progressive energy and other climate policies (Lorenzoni et al., 2008; Höppner and Whitmarsh, 2011), prompting research interest regarding public participation in decision-making about climate change (Backstrand et al., 2010).

Public concern about climate change has risen in many nations for much of the past 20 years, and there has been cross-national, general support for policy responses in this area (Brechin, 2010).

Personal action on climate change is also important to a subsection of society (Wolf, 2011) and there is evidence that some pro-environmental behaviours have become increasingly normalised in recent years (Barr et al., 2011). Nevertheless, research has also shown that numerous barriers operate at both the individual and social levels that impede wider engagement (Lorenzoni et al., 2007; Gifford, 2011; Markowitz and Shariff, 2012). Climate change is often seen by people as a temporally distant phenomenon primarily affecting other places, times or peoples (Gifford et al., 2009; Lorenzoni and Pidgeon, 2006). It may have limited salience, being considered a lower priority than other social and even environmental issues (Nisbet and Myers, 2007), failing to evoke strong emotional reactions (Weber, 2010) or even leading to a sense of futility given its apparent immensity (Wolf and Moser, 2011).

The perceived absence of a popular mandate for political action may also have undermined the pursuit of more ambitious climate policies by governments (Compston and Bailey, 2008). Furthermore, recent studies have noted declines in the public's acceptance even of the central tenets of climate science (Spence et al., 2010; Leiserowitz et al., 2010; Pidgeon, 2012). Given the timing of these trends, they have been attributed variously to the global economic downturn (Scruggs and Benegal, 2012), public attention cycles (Ratter et al., 2012), the controversy surrounding hacked emails from the University of East Anglia (Leiserowitz et al., 2010), the influence of partisan advocacy groups (Brulle et al., 2012), and cold weather events (Krosnick, 2010).

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1.2. Conceptualisations and studies of climate change scepticism

The problematic nature of public perceptions has tended increasingly to be talked of in terms of climate change ‘scepticism’ though it is often unclear exactly what this may comprise, beyond a shorthand for disengagement or disbelief. The idea of scepticism has been used, firstly, to refer to doubts and uncertainty about the physical and scientific aspects of climate change. For example, [Poortinga et al. \(2011\)](#) constrained their use of the construct to the framework of [Rahmstorf \(2004\)](#) who characterised doubts about climate change into *trend*, *attribution* and *impact* scepticism – concerning doubts that warming is taking place at all, doubts about an anthropogenic component, and regarding the harmfulness of the impacts of climate change. However, applications of the notion of scepticism in the literature are for the most part not limited to this narrow framing – more commonly being extended to conceptualise doubts about a wider range of societal, political and personal responses to climate change.

[Lorenzoni et al. \(2007\)](#) for example apply the notion of ‘scepticism’ together with ‘uncertainty’ to refer to doubts among the UK public with respect to scientific controversy – but also concerning the perceived necessity and effectiveness of acting on climate change. [Smith and Leiserowitz \(2012\)](#) categorised scepticism according to the affective imagery associated by survey respondents with climate change, identifying elements of scepticism corresponding to doubts about the reliability of climate science and an anthropogenic component – but also in terms of ‘associations with conspiracy theories’, ‘flat denials’, and references to ‘media hype’. Similarly, in a study of the determinants of scepticism in the UK, [Whitmarsh \(2011\)](#) used a 12-item scale containing items corresponding broadly to trend, attribution, and impact scepticism – but in this same scale also incorporated measures intended to gauge respondents’ positions concerning alarmism in media reporting and the view that too much fuss is made about climate change (i.e. that its importance is overstated). [Malpass et al. \(2007\)](#) too refer to ‘sceptical citizens’ as being those who harbour doubts about the placing of responsibility for action at an individual level; and [Tobler et al. \(2012\)](#) have treated scepticism as a construct encompassing doubts about information sources and media exaggeration, relating to general ‘distrust’, concerning a lack of perceived personal threat, and concerning the relative importance of climate change compared to other issues.

This lack of clarity about what climate change scepticism actually is has important implications. This is not least because the concept is often used synonymously (and pejoratively) with ideas such as contrarianism and denial, as where [Nerlich \(2010, p. 419\)](#) refers to climate scepticism “in the sense of climate denialism or contrarianism”. With particular reference to [Anderegg et al.’s \(2010\)](#) study of expert credibility in climate science in which these labels are also used interchangeably, [O’Neill and Boykoff \(2010, p. E151\)](#) caution against the imprecise use of such terminology, arguing that:

Blanket labelling of heterogeneous views under... these headings has been shown to do little to further considerations of climate science and policy... Continued indiscriminate use of the terms will further polarize views on climate change, reduce media coverage to tit-for-tat finger-pointing, and do little to advance the unsteady relationship among climate science, society, and policy.

We argue in this paper, therefore, for a more rigorous treatment of the construct of scepticism itself, as it pertains to public understanding of climate change.

We contend that, to date, applications of the notion of scepticism have been inconsistent and have often mixed disparate types of perceptions – but that nevertheless their usage has

corresponded thematically to two broad treatments. The first of these concerns perceptions about scientific and physical matters, such as regarding scientific consensus and an anthropogenic component to climate change. The second concerns perceptions about social and behavioural matters, including doubts about responding to climate change at the individual and collective scales, and concerning the communication and portrayal of climate change.

Missing from the literature is an attempt to clarify and distinguish between these two main strands of scepticism, both conceptually and in terms of appraising whether these constitute meaningful categories within the public’s own perspectives.

1.3. Roots of scepticism

Whilst the meaning of climate scepticism has varied across studies, largely consistent findings have nevertheless been obtained with respect to the socio-cultural and psychological determinants of climate change perceptions. Both [Poortinga et al. \(2011\)](#) and [Whitmarsh \(2011\)](#) found that older, more conservative respondents were more likely to express climate scepticism, and that people’s values were also important determinants. In the USA, [Smith and Leiserowitz \(2012\)](#) obtained comparable effects, finding that political and cultural worldviews predict risk perceptions about climate change. Studies by [Kahan et al. \(2011\)](#) and [Kahan et al. \(2012\)](#) have also observed that cultural worldviews are important determinants of climate change perceptions (including doubts about scientific consensus), arguing that this is due to people’s tendency to form perceptions of societal risks in line with the values of groups with which they identify. There has however been no previous work that has attempted to ascertain whether different scepticism types have common or divergent underpinnings. As well as developing a conceptual distinction between scepticism types, we therefore seek to examine whether variants of scepticism have common or dissimilar foundations in public perceptions.

1.4. Aims of the study

We seek to understand in detail the nature of scepticism within public understanding of climate change. Our approach is informed by the use of both qualitative data (discussion group transcripts) and quantitative data (survey findings). The study aims to obtain insights about public scepticism through separate analyses of these datasets, and subsequently to integrate the findings from both phases in drawing overall conclusions.

2. Methodology and findings

2.1. Use of mixed methodology to understand public scepticism

The present study employs a mixed methods design utilising two datasets obtained in the UK during 2010 and 2011. We first analyse participant talk ($n = 47$) arising from a series of guided discussions around climate change, to explore the different ways in which scepticism about climate change is expressed by people. The framework developed in the qualitative phase is then extended and refined in a second, quantitative research phase through the analysis of survey data ($n = 500$). In addition, we consider the sociodemographic determinants of scepticism types, and their relationship with levels of concern about climate change.

Finally, we synthesise the findings from the qualitative and quantitative research phases to draw conclusions about the principal characteristics of scepticism within public perspectives. The general procedure used in the present study is illustrated in [Fig. 1](#).

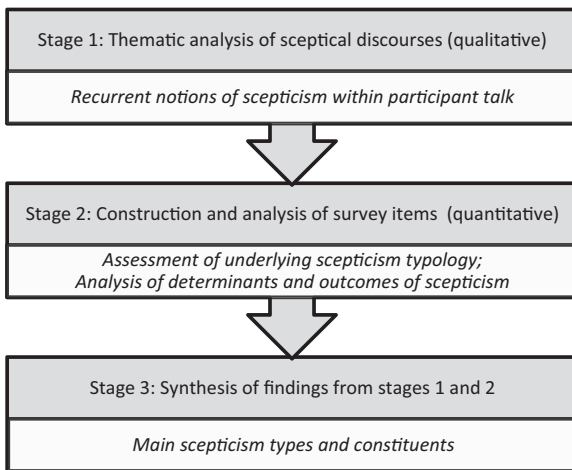


Fig. 1. Mixed methods approach to understanding public scepticism.

2.2. Qualitative phase: procedure and data treatment

Qualitative studies have proven valuable in providing in-depth insights into public understanding of climate change (Wolf and Moser, 2011). The consideration of qualitative data in the present study likewise enables us to explore nuances in people's doubts about climate change. It is our intention through the analysis to reveal how scepticism manifests in participants' own talk in a relatively spontaneous manner, and with respect to a number of different conceptual domains.

2.2.1. Study participants and data gathering

The qualitative data derives from a series of focus group discussions undertaken during March and April 2010 in Bristol, UK. Forty-seven members of the general public took part (anonymised here using numerical codes), recruited to be representative in terms of age, gender, and socio-economic grade. Each of five groups of individuals met on two occasions, separated by several days, resulting in ten focus group transcripts. Each group's discussions lasted around 3 h in total.

At the first meeting, views were explored with respect to climate science, responsibility for addressing climate change, and the role of individual behaviour in mitigating climate change. During the second meeting, more structured themes were explored, especially concerning perspectives on the recent COP15 Copenhagen conference, views on media reporting, and responses to policy options. Further detail concerning the materials and procedures used can be found in Capstick (2012).

2.2.2. Data analysis

The analysis of discussion group transcripts for the present study was carried out in parallel with a wider discourse analysis in which a series of distinct, commonplace and recurrent ways of understanding climate change was identified across several samples of UK participants (Capstick, 2012). This wider analysis integrated the approach of Dryzek (1997) in which discourses are viewed as shared ways of apprehending the world that are embedded in particular language constructions; together with the discursive psychological approach of Potter and Wetherell (1987) through which discourses are seen both as sense-making devices and as possessing interactional functions. Using this approach, Capstick (2012) argued for the presence of a series of coherent discourses which encompassed scientific, social and personal dimensions of climate change (see Table S1, supplemental information).

The present study focuses upon the presence of sceptical perspectives towards climate change which span these different

conceptual domains. The scepticism themes are developed using an iterative procedure which both recognises prior categories/themes, and also draws on analysis grounded in the transcript data (Henwood and Pidgeon, 1992, 2006) thus combining elements of both inductive and theoretical thematic analysis (Braun and Clark, 2006). For example, we apply the term 'attribution scepticism' in a similar manner to its use within published studies of scepticism (e.g. Poortinga et al., 2011) but elsewhere derive concepts in a more grounded manner: for example we discuss the idea of 'response scepticism' in the context of doubts commonly expressed by participants around the value of action taken to address climate change; consider articulations of doubts around human nature and the human condition; and identify participants' scepticism in the context of views towards academic impropriety (issues which were salient at the time in light of so-called 'Climategate').

Two broad categories of meaning derived and simplified from Capstick (2012) are used as an organising ('top-down') framework within which we seek to identify commonplace expressions of scepticism. These overarching categories we refer to as 'scientific/physical' scepticism and 'social/behavioural' scepticism. The former category incorporates doubts towards the scientific and physical aspects of climate change – such as regarding the evidence base, physical reality and human component to climate change. The latter category is used to group doubts about responses to climate change at the personal and collective level, and concerning the communication and portrayal of climate change. Both of these are treated as prior but provisional categories, used to organise the scepticism themes within participant talk, and subsequently to construct a set of survey items. Their utility as conceptual categories is then revisited where drawing our overall conclusions about public climate change scepticism.

As well as characterising these themes thematically we consider their function both in sense-making and as linguistic devices which are able to be used by people in interaction to legitimate and justify behaviour, or lack thereof (Kurz et al., 2005; MacLennan, 2010; Potter and Wetherell, 1987). This attention to the purposes to which different types of scepticism are put enables additional insights into their significance within people's overall understanding of climate change.

2.3. Qualitative phase results

Within the 'scientific/physical' framework we identify six scepticism themes; within the 'social/behavioural' framework we identify five scepticism themes. These are outlined in summary in Table 1.

2.3.1. Scientific/physical scepticism themes

Doubts were commonly expressed across the 2010 data concerning the **evidence base** for climate science, portrayed as

Table 1
Scepticism themes identified through qualitative thematic analysis.

Category of scepticism	Themes encompassed/subject of scepticism
Scientific/physical scepticism	<ul style="list-style-type: none"> - Evidence base - Scientific consensus - Scientific expertise - Conduct of science/(im)propriety - Attribution (human causation) - Impact (severity of climate change)
Social/behavioural scepticism	<ul style="list-style-type: none"> - Responses at individual, societal level - Responses at a political level - Folk psychology (motivations of others) - Portrayal and communication - Climate change fatigue

being contradictory and contested by some participants. For example, it was asserted that climate science was characterised by “a lot of conflicting information” (P1), “conflicting stats” (P2), and that there were “a lot of very very different theories out there” (P3).

Participants elsewhere questioned the reliability of evidence in climate science, for example where P4 argues that reliable data does not exist for past climatic conditions: “I know the ice cores give us a lot more information, but it’s not real in the sense that you haven’t got any written down experience of what the climate was in those days”. This assertion was made in the context of a wider discussion around the strength of the case for climate change – in which other participants also advanced arguments regarding the incompleteness of the scientific evidence base. As P1 succinctly remarks during this discussion: “if it’s unproven everybody just say OK, no idea, and just back off.”

In a related way, a sense was also given of a **lack of consensus** in climate science, for example as where P5 suggests “the scientific people aren’t exactly a hundred percent on this, there’s a big minority which is pretty sceptical as well” and P6’s suggestion that “it’s often the case with this subject, that there just doesn’t seem to be a straight line on it”. In general terms, climate scientific **expertise** was also able to be questioned, such that “there’s the fear – there’s the experts, do they really know what they’re on about? Which is justifiable scepticism I think.” (P7). P8 similarly questions reliance on expertise in climate science, by way of analogy with the 2008 financial crisis, arguing:

These people [climate scientists] are experts, but we have expert economists that screwed up the economy, so why is a scientist going to be any more of an expert than someone else that predicts the future?

In terms of the function of these expressions of scepticism, in the main these arguments tend to be put forward by participants to directly challenge the veracity of climate change or an anthropogenic component, and/or to portray uncertainty within climate science. Typically such arguments arose within discussion either where participants jointly affirmed their doubts about the science and/or physical realities of climate change, or were used by participants to question the knowledge claims of others. For example, the assertion above by P8 linking climate science expertise to the ineptitude of ‘expert’ economists was made in direct response to another participant’s explicit endorsement of climate scientists.

Scepticism concerning the capacities of (climate) science may also be employed to support a self-declared sceptical stance. For example, the above comment from P5 regarding lack of scientific consensus occurred subsequent to his having first stated that “I am a sceptic” and been asked to expand further on this. Later in this same group’s discussion, P5 again supports his sceptical stance by referring to a perceived inconsistency in scientific predictions:

One of the reasons I am sceptical is because in the 1970’s it was going to be the start of a new ice age. So in thirty years we’ve gone from the start of a new ice age to global warming.

Attribution scepticism was also commonplace across the discussions, and commonly contextualised to very long timeframe (including cyclical) climatic change, for example through the assertion that climate change “has been happening since the last ice age, it’s the planet’s response to what’s gone before” (P9). Attribution scepticism was not generally employed by participants to argue against *any* anthropogenic component to climate change, rather was seen to diminish the relevance of human activity. Thus for example P10 argues that “I think man does contribute to [climate change] but to the degree, I think it’s very slight”.

Arguments characteristic of attribution scepticism were used as rejoinders to assertions about the importance of climate change.

For example, P11 responds to another participant’s contention that “all the reputable science on the matter is that global warming is happening and it’s as a result of human actions” by suggesting that whilst “we’ve got something to do with it” nevertheless “I also think that global warming is natural, and [that] climate changes. . . since the planet began”. This provides an alternative, plausible explanation for climate change, without suggesting that the phenomenon is entirely false. Following this remark, a third participant (P12) also responds in line with this argument, stating: “I think the same, sort of idea that obviously we are part of it but there’s a natural cycle as well”.

Such arguments are important for their tendency to characterise climate change as something which is not unprecedented or unexpected – and as such not justifying particular concern. This is also illustrated by the argument of P13 who uses the analogy of human ageing to play down the importance of climate change:

[I]t’s just natural and it just happens, because I suppose it’s like us as a person, we change as we get older, so I guess the Earth is changing as it gets older.

The use (twice) of the term ‘just’ in this context acts discursively to diminish the cause for concern of such a ‘natural’ process. Arguments characteristic of **impact scepticism** were also used by participants to suggest that climate change was less of a problem than was often assumed to be the case. This could be maintained even where explicitly accepting the veracity of climate change: as P5 suggests, “I’m not saying it’s not happening, but. . . I wouldn’t have thought it was quite as disastrous as some people perhaps make us think it will be”. Similarly, P14 suggests that “I don’t think there’s many people in society who don’t believe there is a problem. I think what they all struggle to believe is the extent of the problem”.

In the context of a question about whether they were of the view that climate change would have consequences for them personally, P12 likewise argues that “you’re talking about a couple of degrees in the next fifty years or something. . . I don’t think it’ll have a huge effect”. Again, this participant did not seek here to argue that climate change was not ‘real’ however does state that its impact (for him at least) is seen as minimal.

Allegations of **academic impropriety** salient in the media at the time (so-called ‘Climategate’), were referred to only in three of the five focus groups, with the associated stories described as having “added to the confusion” (P15); and that it “didn’t help, whether the case is true or not [it] adds an element of doubt” (P1).

The controversy was however reported as having damaged trust, such that these events had “chip[ped] away at the very bedrock of the arguments of global warming” (P16). P17 relates the story to diminishing trust in climate science, and also refers to the implications of this for his own behavioural responses to climate change:

I think that at the end of the day we’re trusting. . . the people who are giving us all these ideas. . . we trust that those facts are correct. So I suppose if you’re told that they’re not correct or if for some reason that trust is mislaid, where do you go from there? Do you think. . . ‘well, what am I actually contributing? I can’t trust them, whatever they say, it could be right it could be wrong’. So it’s difficult, it’s difficult.

2.3.2. *Social/behavioural scepticism themes*

Themes encompassed within the social/behavioural scepticism framework relate to doubts about the significance of responses taken to address climate change, doubts concerning human nature and motivations, as well as scepticism directed towards the communication and portrayal of climate change and in the context of people’s own climate change ‘fatigue’.

Much of the scepticism expressed across participant groups concerned responses to climate change. This theme we term **response scepticism** – encompassing doubts about the effectiveness of responding to climate change, and concerning the ability and willingness of social actors to respond to it. It is applied at every level from the individual, to a general social collective level, to national and international responses to climate change.

At the individual level, participants often expressed doubts which were contextualised to the lack of efficacy of one's own behavioural responses to climate change. For example, P18 remarks:

I can't help thinking whether I sort my glass from my cardboard doesn't really have very much effect on the melting of the ice caps. I know if everyone did it it would, but it is tokenism at the moment. It's more about making us feel better than actually doing anything about the problem.

Similarly, P13 expresses response scepticism about household recycling and uses the term 'cynical' with respect to this:

Me recycling one wine bottle am I really going to save the world? I'm not. If I don't put my photocopying paper in the recycling is it going to make a huge amount of difference?... I'm cynical about the whole thing.

As well as characterising a general scepticism towards the framing of climate change in terms of individual responsibility, assertions such as P13's may be used to account for a lack of personal engagement with climate change. Likewise, in the following exchange two participants provide a context in which individual inaction is portrayed as entirely justifiable:

P19: If you and I change what we do... it doesn't really make any difference whatsoever.

P5: If I don't eat cows [reference to sustainability of meat-eating], it doesn't make a big difference.

Such remarks affirm participants' doubts around behavioural responses, and these types of argument also extend to misgivings about the wider social context in which such behaviour occurs. For example, the following exchange points to a scepticism around individual responses both in terms of their efficacy and their meaning:

P12: You just feel – although I would like to do something about it – helpless almost. You do a bit of paper recycling, and whatever, and how much difference is it going to make?

P18: It's becoming like a religion... it's like: 'how can I show how holy I am? I know what I'll do, I'll put the recycling bin out, that'll show what a good person I am!'

P20: There is a certain holier than thou element to some people around it.

Unlike in many of the instances of scientific/physical scepticism, it is important to note that these arguments are not being used to suggest climate change is not a legitimate concern (indeed as P12 notes, "I would like to do something about it"), but rather to cast doubt on both the value and purpose of people's responses to it.

As well as doubts about the efficacy of personal responses, scepticism was expressed concerning people's motivations and in more general ways about the human condition – what has been termed a **folk psychology** of climate change (cf. Fischer et al., 2011). Folk-psychological explanations were commonly employed to explain people's resistance to change, for example that "we live in the moment too much" (P21), or that achieving behavioural change entails "changing habits... which is the most difficult thing of all" (P11); that "we're a bit lucky and a bit lazy" (P22); and that "people are basically selfish, and lazy... and it's very difficult to change that" (P20).

Participants often referred to human nature in a negative manner, for example "I don't think the human race can control themselves" (P23), or that "the capacity of the human race to just block stuff out... is very very terrifying" (P14). Lack of action was attributed to this innate 'human' problem, whereby "deep within us as human beings, it's very difficult to say: right I have to take an action on something that's not affecting me... at this point in time" (P16).

Such doubts were also situated in the context of cultural expectations; as P24 explains:

Over time humans have... got used to a way of life, and we pretty much do what we want, when we want. And even though we probably know that it's having some effect, you particularly probably don't really care. Or at least not care enough to actually physically change our behaviour.

P24 uses a similar line of argument at a later stage of discussion, in direct response to another participant's contention that action on climate change is both justified and a matter of personal responsibility. This individual having argued that "even if there was only a ten percent chance of the world becoming uninhabitable, then I think it's up to us to do something about it", P24 responds:

I just want to say to [participant], is your point by saying that, that we should all be more concerned than we actually are? Because... if we have a hundred years to save the planet, no one seems too bothered really... the world has just sort of accepted it... and as long as my four by four still goes up my highways...

This argument is revealing for its characterisation of people-in-general as unconcerned even under conditions where major risks from climate change may be recognised.

With the COP15 conference having occurred just prior to the group discussions, substantial scepticism was also expressed regarding the **political response** to climate change. For example, one participant offered the perspective that "all the world's governments can't manage to cobble together anything between them, despite all saying that they need to" (P19); another that "unfortunately we're in the hands of the world leaders. That is the bottom line, we can do what we can do, but as we've found out they all fly from all directions [to COP15] and come up with no answers" (P25). Scepticism was also expressed more generally regarding short-termism inherent to politics and its implications for addressing climate change, such that "they [politicians] are only in power for so long... they will always look for short-term solutions to make sure people are happy with the decisions they make, therefore they're unable to make a long-term solution" (P17). Similarly, it was argued that political action would be stymied by the long-term nature of climate change: "targets are being set... so far in the future that is there any point?... if someone held a gun to someone's head they could pretty much change everything pretty quickly, but they don't" (P3).

These types of argument were often put forward by participants to affirm that political action is necessary but unlikely actually to occur. In addition to the sense that political will and capacity is lacking, participants expressed the view that climate change has become a political contrivance – i.e. treated as an issue of expedience. This is revealed by remarks such as "it's [climate change] just another big political buzz-word at the moment towards the election" (P26), or "I think it's a bit of a bandwagon" (P27). Such remarks convey a certain cynicism towards climate change and terms such as 'buzz-word' and 'bandwagon' situate the issue as one associated with hype rather than being of genuine concern.

Participants also expressed scepticism about the **portrayal and communication** of information about climate change. Media

outlets in particular were characterised as exaggerating and of sensationalism, for example where P10 argues “I don’t think it’s the scientists so much [mis-representing]. It’s a lot run by the media. . . the media gets hold of things, and spin things out of control”.

Newspapers were elsewhere characterised as unreliable sources of news about climate change, as “wanting to give people what they think they want” (P16) and as emphasising ‘bad’ news for financial gain. Elsewhere, doubts were expressed regarding the portrayal of climate change by environmentalists who were seen as being “prepared to go for the headline information and therefore look at the doomsday scenario” (P28).

These arguments tend to characterise the risks from climate change as having been overstated by different social actors, or as otherwise promoting particular agendas or vested interests. One participant (P16) expresses their view in this area in the specific context of a wider discussion around people’s being ‘weary’ or ‘tired’ of climate change:

I get weary of the constant message that comes through about global warming, that it’s coming at us through the airwaves and through the television. And newspapers and television have to sell their stories and everything else, but I get weary of the drum that’s constantly banged.

Elsewhere too, participants’ doubts about climate change were characterised by what we term **climate change fatigue**. P29 for example remarks that “you get disaster fatigue as well I think, you know: ‘oh god, not another polar bear,’ whatever it is”. Elsewhere, a participant directly relates her own scepticism to doubts of this nature:

I have put scepticism [during written exercise]. It’s not that I don’t agree with it. . . [but] look, we’ll handle it, it’ll be fine, humans have been around for however many years and we’ve all adapted to be where we are today so I’m sure we can cope with it again, it’s just made into this massive issue that it’s not. . . I just can’t be bothered with it. (P30)

Whilst affirming that she accepts – in some sense – the veracity of climate change, this remark is revealing for portraying a particular type of reaction which by the participant’s own terms is associated with scepticism.

2.3.3. Differences in content and function between scientific/physical and social/behavioural scepticism

There are important distinctions between the arguments and explanations advanced as part of scientific/physical scepticism as compared to social/behavioural scepticism.

In the former case, the focus of participants’ scepticism is the veracity or certainty of some aspect of climate change. It may be asserted that it is unclear whether climate change exists – more usually, however, uncertainty is associated with the knowledge basis and claims made around climate change. Participants employ this type of scepticism primarily to argue against or downplay the legitimacy of climate science or the significance of climate change as a physical phenomenon – and in doing so often imply a resultant lack of concern.

In the case of social/behavioural scepticism, by contrast, the truth status of climate change is not generally disputed – indeed is in places explicitly acknowledged. Instead, participant doubts relate to judgements about the value, efficacy and likelihood of responding to climate change at the personal and collective levels; as well as doubts about the portrayal of climate change and the relevance of climate change as a contemporary concern. Participants may employ this type of scepticism to justify or explain lack of personal action on climate change, or as a way of distancing themselves from the need or requirement to do so.

2.4. Quantitative phase: survey instrument design and procedure

2.4.1. Respondent sample and survey administration

A nationally representative (by age, gender, socio-economic grade) quota sample of the British population aged 18 years and over ($n = 500$) was recruited during February 2011 to complete the online survey instrument. The items used in the present study formed part of a larger survey measuring perspectives on climate change (including in comparison to other risk issues and concerning climate policy). Items were randomised within the wider survey using the survey software package, to preclude ordering effects.

2.4.2. Measures of climate change scepticism

Twenty items were used to measure climate change scepticism utilising the dual framework developed in the qualitative phase. Ten items measured components of scientific/physical scepticism and ten items measured components of social/behavioural scepticism.

Table 2 provides an overview of item wording, constructs these items are intended to measure, and their derivation. Each was measured on a 5-point bi-polar scale asking respondents to indicate level of agreement (ranging from ‘strongly disagree’ to ‘strongly agree’).

The items used in this research phase were selected or devised specifically for their correspondence with the salient themes arising from the qualitative thematic analysis. Several of the items used are replications or modifications of measures used by Whitmarsh (2009, 2011) and we also include an item modified from Tobler et al. (2012). A number of items also reflect key themes from the literature with respect to climate change scepticism, for example corresponding to trend, attribution and impact scepticism (Rahmstorf, 2004; Poortinga et al., 2011).

2.4.3. Measures of cultural worldviews

Worldviews were measured using items derived from Leiserowitz et al. (2010) and Rippl (2002) in line with the cultural theory of risk perception (Douglas and Wildavsky, 1982; Thompson, 2003). Previous studies have found that worldviews measured according to this framework are important predictors of climate change perceptions (Leiserowitz et al., 2010; Kahan et al., 2012). The present study applies measures of Egalitarianism and Individualism as these have been found to be particularly salient (Leiserowitz et al., 2010). Three items were used to measure each of the two types of worldview; see Table 3. As with the scepticism items, respondents were asked to indicate the extent to which they agreed or disagreed with each of these statements.

The two cultural worldviews are assumed to be orthogonal constructs; a principal components analysis using Varimax rotation of the six items confirms this (two clear factors were obtained together explaining 53% of total variance). The resulting components obtained are used in the regressions reported in Section 2.5.4.

2.4.4. Socio-demographics, pro-environmental identity, self-reported knowledge, self-identifying scepticism and climate change concern

Data was obtained for survey respondents’ age, gender, voting intention, and level of education.

Pro-environmental identity was measured through (dis)agreement with the statement ‘Being environmentally friendly is an important part of who I am’. This measure has been used previously by Spence et al. (2010).

Self-reported knowledge was assessed through (dis)agreement with the statement ‘I am well-informed about climate change’. Self-identifying climate scepticism was measured through (dis)agreement with the statement ‘I consider myself to be a climate change sceptic’.

Table 2
Scepticism survey items with corresponding constructs and derivation.

Item wording	Construct	Previous use/novel item
<i>Scientific/physical scepticism measures</i>		
There is too much conflicting evidence about climate change to know whether it is actually happening	Trend scepticism ('actually happening'); scepticism about evidence base (‘conflicting evidence’)	Whitmarsh (2011)
Current climate change is part of a pattern that has been going on for millions of years	Attribution scepticism	Novel item
Climate change is just a natural fluctuation in Earth’s temperatures	Attribution scepticism	Whitmarsh (2011)
Even if we do experience some consequences from climate change, we will be able to cope with them	Impact scepticism	Novel item
The effects of climate change are likely to be catastrophic (reverse coded)	Impact scepticism	Whitmarsh (2011)
The evidence for climate change is unreliable	Scepticism about evidence base	Whitmarsh (2011)
There are a lot of very different theories about climate change, and little agreement about which is right	Scepticism about scientific consensus and expertise	Novel item
Scientists have in the past changed their results to make climate change appear worse than it is	Scepticism about climate science conduct	Novel item
Scientists have hidden research that shows climate change is not serious	Scepticism about climate science conduct	Novel item
Climate change is a scam	Scepticism about climate science conduct	Modification of item used in Tobler et al. (2012)
<i>Social/behavioural scepticism measures</i>		
Climate change is so complicated, that there is very little politicians can do about it	Response scepticism (political)	Novel item
There is no point in me doing anything about climate change because no-one else is	Response scepticism (personal)	Whitmarsh (2009)
The actions of a single person don't make any difference in tackling climate change	Response scepticism (individual level)	Whitmarsh (2009)
People are too selfish to do anything about climate change	Response scepticism ('folk psychology')	Whitmarsh (2009)
Not much will be done about climate change, because it is not in human nature to respond to problems that won't happen for many years	Response scepticism ('folk psychology')	Novel item
It is already too late to do anything about climate change	Response scepticism (fatalism)	Whitmarsh (2009)
The media is often too alarmist about climate change	Scepticism about portrayal/communication	Modification of item used in Whitmarsh (2011)
Environmentalists do their best to emphasise the worst possible effects of climate change	Scepticism about portrayal/communication	Novel item
Climate change has now become a bit of an outdated issue	Climate 'fatigue'	Novel item
Whether it is important or not, on a day-to-day basis I am bored of hearing about climate change	Climate 'fatigue'	Novel item

Level of concern about climate change was measured on a 5-point scale from 1 (not at all concerned) to 5 (very concerned).

2.5. Survey analysis

2.5.1. Principal components analysis of scepticism items

To ascertain whether the scepticism sub-types developed in Section 2.3 comprised separate constructs within the survey data, a principal components analysis (PCA) was carried out on the 20 scepticism items as detailed in Table 2. Principal components analysis is a technique for determining the latent structure of a set of variables, which operates by identifying groups of variables which inter-correlate (the components). Each component obtained through a PCA represents an underlying dimension (termed a ‘factor’ within this procedure having been interpreted and named). PCA is used in the present study to examine whether the range of

measures corresponding to different scepticism constructs can be explained by a smaller number of coherent factors.

Table 4 shows the item loadings (strength of association of each item with the corresponding component) within the pattern matrix obtained from the PCA.

A distinction between scepticism types as considered in the present study has not previously been tested or predicted on the basis of theory; we thus utilised an exploratory factor analysis to examine associations between item scores. We did not expect that factors obtained would be orthogonal constructs (i.e. completely unrelated), given that the literature has pointed to an association between different measures of scepticism (e.g. Poortinga et al., 2011). Therefore, an oblique (oblimin) rotation was carried out, permitting the components derived to correlate. Missing values were excluded in a pairwise manner (statistical procedures omit missing cells rather than complete cases with any missing cells); 348 respondent cases were retained for the full PCA. Further checks were carried out to ensure that the sample size was adequate for the PCA performed, and that the variables used were correlated at an appropriate level for this type of analysis. There were no problems identified concerning sampling adequacy or sphericity (inter-variable correlation) based on the KMO statistic (.95) and Bartlett’s test ($p < .001$); no variables were found to inter-correlate at a level higher than .8 (multicollinearity is not a problem).

Three factors are obtained from the principal components analysis (based on a criterion of eigenvalues > 1, an accepted indicator of a reasonable minimum variance to be explained by components from a PCA). The majority of items loaded on the first and third of these factors. The components together accounted for 62% of variance. Means and standard deviations shown in Table 4 correspond to a score of 5 as a ‘strongly agree’ response and a score

Table 3
Cultural worldview items.

Item wording	Construct
The world would be a better place if its wealth were divided equally among nations	Egalitarianism
Discrimination against minorities is still a very serious problem in our society	Egalitarianism
In my ideal society, all basic needs (food, housing, education, health care) would be guaranteed by the government for everyone	Egalitarianism
When I have problems, I try to solve them on my own	Individualism
People should be allowed to make as much money as they can for themselves, even if others are not able to	Individualism
If the government spent less time trying to fix everybody's problems, we'd all be a lot better off	Individualism

Table 4
Principal components analysis of scepticism items.

Item wording	Component loadings			Item scores	
	1	2	3	Mean (SD)	Agree (%)
There is no point in me doing anything about climate change because no-one else is	.839	.011	-.005	2.39 (1.05)	13.0
It is already too late to do anything about climate change	.775	.127	-.099	2.65 (1.07)	19.5
The actions of a single person don't make any difference in tackling climate change	.715	-.051	-.028	2.87 (1.17)	30.2
Climate change is so complicated, that there is very little politicians can do about it	.650	.066	.161	2.95 (1.16)	34.9
Climate change has now become a bit of an outdated issue	.598	-.175	.280	2.57 (1.12)	20.3
Climate change is a scam	.576	-.232	.322	2.37 (1.20)	17.7
Whether it is important or not, on a day-to-day basis I am bored of hearing about climate change	.550	-.140	.357	2.93 (1.17)	29.9
People are too selfish to do anything about climate change	-.048	.817	.147	3.70 (0.87)	65.1
Not much will be done about climate change, because it is not in human nature to respond to problems that won't happen for many years	.467	.660	.037	3.49 (0.94)	53.2
The effects of climate change are likely to be catastrophic (reverse coded)	.293	-.480	.207	3.44 (1.02)	50.3
There are a lot of very different theories about climate change, and little agreement about which is right	-.209	.060	.850	3.76 (0.88)	69.2
Environmentalists do their best to emphasise the worst possible effects of climate change	-.103	.138	.759	3.81 (0.86)	68.2
Current climate change is part of a pattern that has been going on for millions of years	.044	-.001	.747	3.66 (0.98)	58.2
The media is often too alarmist about climate change	.184	-.066	.649	3.56 (1.12)	54.3
There is too much conflicting evidence about climate change to know whether it is actually happening	.267	-.079	.621	3.29 (1.13)	45.9
Climate change is just a natural fluctuation in Earth's temperatures	.306	-.077	.615	3.30 (1.08)	43.1
Scientists have in the past changed their results to make climate change appear worse than it is	.279	-.097	.603	3.24 (1.08)	40.8
The evidence for climate change is unreliable	.403	-.148	.534	3.06 (1.17)	35.6
Scientists have hidden research that shows climate change is not serious	.399	-.135	.453	2.78 (1.02)	20.3
Even if we do experience some consequences from climate change, we will be able to cope with them	.303	-.288	.339	3.11 (0.91)	31.1

Components within the table correspond to groupings that reflect the underlying structure across the set of items as a whole. Where items have high (positive) loadings these are strongly associated with a component, compared to those with lower loadings. Negative loadings reflect a negative association. Loadings over .4 are shown in bold; proposed component structure is highlighted. Means and standard deviations correspond to a score of 5 as a 'strongly agree' response and a score of 1 a 'strongly disagree' response. Levels of overall agreement ('agree' or 'strongly agree' responses) across the sample are also given.

of 1 a 'strongly disagree' response. Levels of overall agreement (percentage of respondents answering either 'agree' or 'strongly agree') are also given. For the item 'The effects of climate change are likely to be catastrophic', mean scores and level of agreement are given in Table 4 prior to the reverse coding of the item for the principal components analysis.

2.5.2. Interpretation of the principal components analysis

The structure from the principal components analysis is interpreted below. The components derived correspond in some respects to the dual framework developed in the qualitative phase – however there are a number of distinctions arising between the two research phases, which are reflected in the nomenclature used to characterise the underlying factors obtained.

2.5.2.1. Factor 1: Response scepticism. The first component from the PCA corresponds most closely to those constructs from the qualitative thematic analysis comprising what we have termed 'response scepticism'. The highest-loading items convey response scepticism at the personal, political and general level. We argue therefore that this label offers the most suitable characterisation of this factor – although further items which clearly and uniquely load on this component correspond to those representing climate fatigue, as well as the view that climate change is a 'scam'.

2.5.2.2. Factor 2: Folk psychology scepticism. The second component from the PCA has a less clear and comprehensive conceptual structure, however most prominent are the two 'folk psychology' items.

2.5.2.3. Factor 3: Epistemic scepticism. The third component incorporates seven of ten of those items corresponding to scientific/physical scepticism, and additionally two items corresponding to the portrayal of climate change. We argue that each of the items loading highly on component 3 relate primarily to what we term 'epistemic scepticism' – that is, they relate to the (lack of) acceptance of the physical or scientific basis of climate change and the way this is represented.

2.5.3. Relationships between scepticism types, self-identifying scepticism and level of concern

We now present further analyses utilising the two factors incorporating the majority of items from the PCA, corresponding to 'response scepticism' and 'epistemic scepticism' (components 1 and 3 respectively as shown in Table 4).

In order to provide an indication of the extent to which each is aligned with a lack of engagement, we examined the association between the scepticism factors and the measure of concern. We calculated the partial correlation between response scepticism and level of concern (controlling for the remaining two components); likewise the partial correlation between level of concern and epistemic scepticism (again controlling for the other two components).

It is a key finding of the study that a negative association with concern about climate change is significantly more pronounced for the response scepticism factor ($r = -.40, p < .001$) than it is for the epistemic scepticism factor ($r = -.25, p < .001$); Fisher's z test (a test of whether there is a significant difference between two correlations), $z = 2.21, p < .05$ (using one-tailed test).

In order to provide an indication of whether the two scepticism types are associated with people's perception of the extent to which they see themselves as climate sceptical, we examine in a similar manner the partial correlations between scepticism types and the measure of self-identifying scepticism. Partial correlations reveal that self-identifying scepticism shows a similar strength of association with epistemic scepticism ($r = .60, p < .001$) as with response scepticism ($r = .58, p < .001$).

2.5.4. Determinants of scepticism types

Two separate linear regression analyses were conducted upon the two scepticism factors. For the first models in each regression, cultural worldview measures were included as predictors; in the second models, pro-environmental identity and voting intention were also included (the latter was treated as a binary variable with Conservative voters assigned a score of 1 and all other voters a score of 0); the third models added level of education and self-reported level of knowledge; the fourth models included age and gender variables.

As shown in Tables S2 and S3 (supplemental information), the cultural theory measure of Individualism was a significant and powerful predictor of both epistemic and response scepticism. Environmental identity was also highly predictive of both scepticism types. Where age was included, this was found to be a significant predictor for the epistemic scepticism factor.

2.6. Summary and synthesis of findings from the qualitative and quantitative phases

The qualitative thematic phase of the research outlined in Section 2 utilised a framework derived from Capstick (2012) which was used to identify themes grouped under the broad headings of ‘scientific/physical scepticism’ and ‘social/behavioural scepticism’. Scepticism themes derived from the consideration of participant talk related to such aspects as the evidence base and conduct of climate science, and towards the efficacy and value of responding to climate change at the individual and societal level. We suggested that the discursive function of these two types of scepticism was distinct: the former serving to construct climate change as an objectively uncertain phenomenon, the latter serving to explain or justify lack of action on climate change.

The quantitative phase of the research utilised a twenty-item survey instrument, constructed to reflect the key themes arising from the qualitative phase. Principal components analysis found that the broad prior framework from the qualitative phase did not translate straightforwardly into latent factors. However, two underlying factors were identified which included the majority of survey items, and which incorporated common constructs from the qualitative thematic phase. The first of these factors we termed ‘response scepticism’ as this incorporated doubts about responding to climate change at the individual and societal level, as well as items corresponding to climate change fatigue. The second of these factors we termed ‘epistemic scepticism’ as this incorporated doubts about the physical and scientific basis of climate change and the way this is represented.

In synthesising these two sets of findings we suggest there are two emergent types of scepticism which, we argue, integrate characteristics common to both the qualitative and quantitative research phases. Fig. 2 provides a summary illustration of the process by which these types are derived.

The first scepticism type we propose incorporates concepts derived from the notions of scientific/physical and epistemic scepticism as used in the two research phases. The defining feature

of this type of scepticism, common to conceptualisations used in both research phases, is doubt or uncertainty about the status and generation of knowledge around climate change as a physical phenomenon. We retain the term ‘epistemic scepticism’ to reflect that this type of scepticism is concerned fundamentally with the factual basis and objective realities of climate change.

The second scepticism type we propose incorporates concepts spanning the notions of social/behavioural and response scepticism as used in the two research phases. This type of scepticism is characterised by doubts about the efficacy of action on climate change, and regarding the personal and societal relevance of climate change as an issue. We retain the term ‘response scepticism’ to reflect that this type of scepticism is concerned primarily with action taken to respond to climate change (rather than to do with its objective reality).

Whilst people’s perspectives concerning folk psychology and impact scepticism are of interest in how people understand and respond to climate change, neither clearly emerge from the quantitative PCA as being related to the central concepts of the two main scepticism types. We thus do not argue that they be incorporated into the dual typology we propose here. This is considered further within the Discussion.

3. Discussion

The present study has used a sequential, mixed methodology to develop and distinguish between two main scepticism types, which we term *epistemic scepticism* and *response scepticism*. Analysis of discussion group transcripts has shown that both these type of scepticism are expressed in participants’ talk about climate change. Analysis of survey data finds that constructs central to these two types emerge as latent factors within a principal components analysis.

3.1. Epistemic scepticism – characteristics and consequences

Previous research has considered climate change scepticism in terms of the public’s doubts about the physical existence, human component and severity of climate change (Poortinga et al., 2011). The present study extends this work empirically by obtaining evidence for the coherence of doubts around the reality and human contribution to climate change within a broad scepticism type, and conceptually by showing that these sorts of doubts tend also to be associated with scepticism concerning the evidence base, level of consensus and practice of climate science.

The present study is not the first to have applied the idea of epistemic scepticism in the area of climate change. In recent work which examined the beliefs of individuals who self-identified as being sceptical or disbelieving about climate change, Hobson and Niemeyer (2013) also refer to epistemic scepticism in the context of doubts about the reality, causality and impacts of climate change – reflecting the typology originally advanced by Rahmstorf (2004) and tested empirically by Poortinga et al. (2011). The present study differs from the approach taken by these previous studies, however, by arguing that epistemic scepticism also incorporates doubts which centre on climate science and scientists.

Our qualitative analysis of research participants’ talk shows that such scepticism relates to perceptions of the legitimacy of climate science claims; this is consistent with studies dating back to the mid-1990s (Darier et al., 1999). In addition, some participants contextualised their doubts to allegations about academic impropriety pertinent to the time this research was conducted (the so-called ‘Climategate’ controversy; cf. Shuckburgh et al., 2012). Whilst a number of commentators have suggested that this may have impacted public perspectives (e.g. Leiserowitz et al., 2010; Gavin and Marshall, 2011; Maibach et al., 2012;

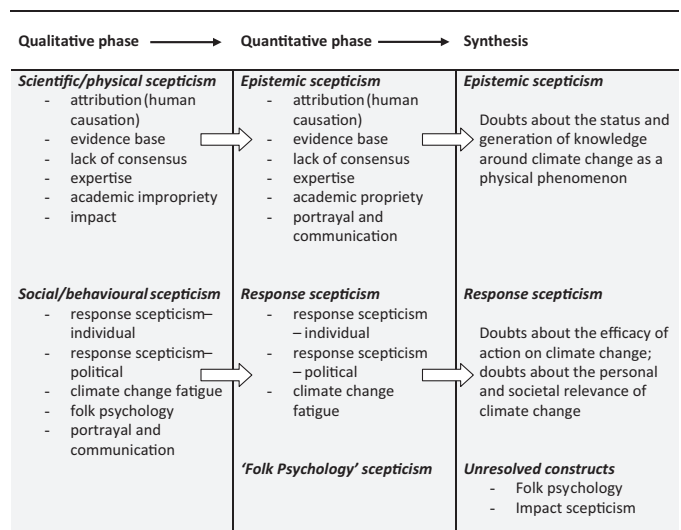


Fig. 2. Synthesis of findings from qualitative and quantitative phases.

Pidgeon, 2012) the present study is unusual for having directly identified this in people's spontaneous expressions of doubt.

We argue that the consequences of epistemic scepticism are important, as in their essence they disclaim the basic tenets of climate science as assembled through bodies such as the IPCC and represented by the broad tenor of the academic literature (e.g. Anderegg et al., 2010; Doran and Zimmerman, 2009). What might explain the presence of this type of scepticism? It seems likely first of all that people's doubts around climate science and its knowledge claims are aligned with a particular idea of what 'science' is – participants speak for example of a lack of 'proof' or refer to uncertainty in pejorative terms. In this, participants appear to be drawing on a view of (climate) science as a process which produces certainty (Collins, 1987) and that science aims and is able to determine a 'true' picture of the world (Bauer et al., 2000). Doubts about climate science in particular may also be reflections of a more universal belief among the public that there are clear limits to the levels of knowledge that scientists actually possess in the domain of socio-technical risks (Sjöberg, 2001; Sjöberg and Herber, 2008). In addition, inaccurate media portrayals of uncertainty (e.g. Boykoff and Mansfield, 2008) have likely underpinned the persistence of epistemic scepticism in the case of climate change.

Participants' scepticism about an anthropogenic component to climate change may similarly be connected to doubts towards climate science – however likely also reflects the influence of deeply ingrained views about how natural systems operate, whereby climate may be understood as part of a natural world which is in essence ever-changing, self-regulating and cyclical (cf. West et al., 2010; Ladle and Gillson, 2009). The notion of 'natural' climate change thus represents a plausible alternative explanation for material which might otherwise be difficult to ignore (e.g. global temperature increase).

3.2. Response scepticism – characteristics and consequences

The second scepticism type which we identify, which we term 'response scepticism', concerns doubts about the effectiveness of responding, and willingness and capacity to respond to climate change at the personal, political and societal levels. As we noted in Sections 1.2 and 1.3, previous studies have (explicitly or implicitly) tended also to talk of scepticism in similar ways; as importantly, we find that survey respondents' own conception of what constitutes climate scepticism is related to these ideas: the degree to which people self-identify as being a climate sceptic is strongly and independently associated with response scepticism measures.

Previous studies have noted both that climate change constitutes a large-scale social dilemma (Irwin, 2009; Turnpenny et al., 2009) and that the public themselves recognise this inherent characteristic and its implications. Lorenzoni and Pidgeon (2006) have, for example, suggested that people perceive low personal efficacy for action on climate change due to its being considered too large and complex a problem for individuals alone to address. It has been argued that a social dilemma perspective leads to people's direction of responsibility to institutional actors such as (inter)national government (Bickerstaff et al., 2008); the present study finds that doubts about the capacity of these actors to act on climate change is also incorporated into people's scepticism. This was both in terms of people's reflections on the COP15 process and more generally: over a third of survey respondents agreed there is 'very little' politicians can do about climate change. Such scepticism about the political response to climate change may reflect wider disconnection with politics in recent years (Hay, 2007) and is likely also to be a result of the increasing politicisation of climate change over time (Jordan and Lorenzoni, 2007; McCright and Dunlap,

2011). It may also characterise a generally fatalistic perspective – doubts about personal, collective and political responses to climate change were incorporated into the response scepticism factor together with the notion that it is 'too late' to act on climate change.

Such perspectives constitute a coherent and particularly disengaged cluster of viewpoints: as well as factoring together, they are strongly associated with a lack of concern about climate change. The finding that response scepticism is more strongly associated with a lack of concern (than is epistemic scepticism) may also be explained in part due to a relationship between the constituent constructs and a wider sense of fatalism or resignation. In according with the view that there is 'no point' in acting on climate change and that it is 'too late' to act, participants express the idea that there is little prospect of climate change being effectively addressed. Such a sense of fatalism around climate change has been previously shown to be linked to a lack of engagement (O'Neill and Nicholson-Cole, 2009). Such perspectives as expressed within participant talk also encompass this manner of fatalism – for example people express feeling 'helpless' and that there are 'no answers' – which again may be expected to correspond to lack of engagement and concern. The lack of efficacy conveyed by the sense that there is 'no point' in acting also relates to research which has affirmed a connection between perceived personal efficacy and climate change concern (Milfont, 2012) and which has pointed to the importance of efficacy constructs for determining personal responses to climate change (Gifford, 2011; Kellstedt et al., 2008).

3.3. Underpinnings of climate scepticism

That people's cultural worldviews are powerful predictors of scepticism about the physical and scientific aspects of climate change is in line with previous research by Kahan et al. (2011) and Leiserowitz et al. (2010). In the present study, moreover, we have demonstrated that cultural worldviews are separately predictive of scepticism about the social and behavioural aspects of climate change. Cultural worldviews are thought to exert influence upon climate change perceptions through leading people to selectively interpret evidence about risks in line with their pre-existing outlooks. According to two of the early originators of cultural theory, this takes place because individuals 'choose' what to believe in line with preferences for particular types of social relations (Wildavsky and Dake, 1990). The present study suggests that this 'choice' extends not just to perceptions of the scientific basis and physical aspects of climate change, but also into the social and behavioural domain. This is important because these latter types of doubts need not be premised on the former: indeed, to be of the view that it is 'too late' to act on climate change or that the problem is 'too complicated' (as in the response scepticism factor) presumes there is a problem in the first place. Discussion participants' remarks also reflect in many places an acceptance of the reality of anthropogenic climate change, in concert with doubts about the effectiveness of mitigation responses. From a cultural theoretical perspective, such response scepticism is arguably underpinned by an individualistic worldview in which one's preferred social relations (atomistic and characterised by personal autonomy) are anathema to the idea that collective effort is required to address a social dilemma such as climate change (cf. Pendergraft, 1998): this is indeed supported by the results of the regression analysis of the present study which finds Individualism to be a powerful predictor of response scepticism.

3.4. Limitations of the study and further research

Whilst we find evidence for distinct scepticism types through the use of principal components analysis, nevertheless the

correspondence between the qualitative and quantitative phase distinctions is partial. Whilst doubts about responses to climate change cohered together within the principal components analysis, the items designed to test a 'folk psychology' scepticism – that people are in general 'selfish' or that 'human nature' itself precludes action on climate change – did not factor within the response scepticism construct. These folk psychology scepticism items nevertheless received high levels of agreement, with almost two-thirds of respondents of the view that people are 'too selfish' to act on climate change. That these types of perspective are widespread – including across Europe (Fischer et al., 2011) – points to an important and under-explored role for the ways in which people's views about humanity in general may affect their understanding of climate change. As Fischer et al. (2011) argue, such attitudes could be expected to hinder rather than foster action on climate change. Further research is required to ascertain whether these types of views do constitute an impediment to engagement, and whether they are consistent with more general sceptical views or are a distinctive way of understanding the place of humanity in causing and responding to climate change.

The survey items used reflect a range of sceptical perspectives, however given the extensive array of climate change perception measures now available (Roser-Renouf and Nisbet, 2008) alternative means of gauging perceptions may have been incorporated. In the present study we have used some novel items, such as to gauge climate 'fatigue', which require further attention as to their association with scepticism. In light of these limitations, additional research would be useful to carefully consolidate the distinction between scepticism types and to clarify the more salient components of each. That the present findings are obtained in a UK context is an additional limitation – the characteristics of public debate around climate change in the USA (McCright and Dunlap, 2011) might suggest different characteristics of scepticism there.

The focus of the present study has been exclusively upon scepticism – as such we have been concerned with one part of the broader ways in which climate change is understood. Despite many reasons to expect people's doubts about climate change to have grown, recent studies do point to newly increased concern about climate change in Europe and the USA (Eurobarometer, 2011; Gallup, 2013). That we argue that public scepticism in the UK context is coherent and complex should not therefore be taken to automatically suggest this reflects the prevailing public mood around climate change.

3.5. Implications for public engagement with climate change

The present study finds that of the two scepticism types that we focus upon, scepticism about responding to climate change is more strongly associated with a lack of concern. This is important because, whilst there are clear arguments which can be made concerning the level of scientific consensus and degree of confidence in an anthropogenic component to climate change, doubts concerning personal and societal responses to climate change are in essence more disputable.

To date, the majority of work focussing on communicating climate change has tended to be concerned with aspects of climate science. We suggest, however, that additional efforts are required to identify and engage with the doubts held by people concerning the relevance and effectiveness of measures taken to address climate change. Whilst a substantial literature has now developed around strategies for promoting behavioural responses to climate change (e.g. Swim et al., 2010; Whitmarsh et al., 2011) nevertheless this has tended not to directly address people's fundamental misgivings about the value of such responses in themselves. To do so is complicated by the fact that a person cannot be said to be 'wrong' should they be sceptical in this way. Perhaps then, the

most appropriate strategy may be to acknowledge the validity of such doubts, but in such a way that nevertheless permits the value of personal and societal action on climate change to be emphasised. This may be most likely to work where individual action is contextualised to common efforts (notwithstanding that this may be particularly challenging for those of an individualistic disposition). Connections made with the effectiveness of collective action (Koletsou and Mancy, 2012), including promotion of environmental citizenship (Wolf, 2011), participatory democracy (van den Hove, 2000) and decision-making at local scales (Rayner, 2010) may be some ways in which this could be achieved. Likewise, Van Zomeren et al. (2010) have shown that communicating strong group efficacy beliefs (conveying the message that people are able to collectively address climate change) can increase individuals' pro-environmental behaviour intentions.

We suggest finally that in future research and where using the term 'scepticism' to refer to people's doubts about climate change, a more fine-grained distinction is made between whether reference is being made to doubts about the physical properties of climate and the status of climate science, or whether about the human dimensions of climate change. The present study has provided one such framework by which this could be achieved.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.gloenvcha.2013.08.012.

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