Climate stories:
Why do climate scientists and sceptical voices participate in the climate debate?

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Abstract

Public perceptions of the climate debate predominantly frame the key actors as climate scientists (CSs) versus sceptical voices (SVs); however it is unclear why CSs and SVs choose to participate in this antagonistic and polarised public battle. A narrative interview approach is used to better understand the underlying rationales behind 22 CSs' and SVs' engagement in the climate debate, potential commonalities, as well as each actor's ability to be critically self-reflexive. Several overlapping rationales are identified including a sense of duty to publicly engage, agreement that complete certainty about the complex assemblage of climate change is unattainable, and that political factors are central to the climate debate. We argue that a focus on potential overlaps in perceptions and rationales as well as the ability to be critically self-reflexive may encourage constructive discussion amongst actors previously engaged in purposefully antagonistic exchange on climate change.

Keywords: climate change, debate participation, perceptions, climate scientists, sceptical voices

1. Introduction

Within the positivist scientific tradition, scepticism refers to an organised investigation of reality via empirical observation, informed questioning and doubting claims based on anecdotal evidence or belief (Gower, 1997). However, in the context of climate change, scepticism has become increasingly associated with public perception of a dualistic, antagonistic "climate debate" characterised by intense disagreement regarding the existence of a scientific consensus on the reality of anthropogenic climate change (Hobson & Niemeyer, 2012). Prevalent arguments include disputes regarding the legitimacy of scientific claims made by the Intergovernmental Panel on Climate Change (IPCC), such as the increased level of confidence between the fourth and fifth Assessment Reports that

anthropogenic greenhouse gases are the dominant cause of observed global warming since the mid-20th century, and arguments more closely linked to national circumstances such as debates over renewable energy policies in the United Kingdom (UK) (Carter, 2014). Perceptions of polarisation appear justified, as the majority of public-facing debates about climate change frame the debate as a hostile "battle" or "duel" (Hoffman, 2011; McKewon, 2012).

While climate change is a complex and multi-faceted issue with substantial policy ramifications, these public debates also frequently present the key actors as climate scientists (CSs) versus those who explicitly note their objection as stemming, either in full or in part, from disagreement over the legitimacy of scientific knowledge claims. We use the term sceptical voices (SVs) here in an attempt to move away from the problematic labelling constructs evident in the climate debate (Howarth & Sharman, 2015), but following Painter (2011) in recognising the need for a pragmatic descriptor. This public framing of the climate debate as a scientific disagreement between CSs and SVs has been recognised in the literature. Verheggen et al. (2014, p. 8964) note that contention regarding the existence of scientific consensus about climate change is at the 'center of the public debate' and Pearce et al. (2014) suggest that debate is predominantly represented in the public as focusing on the veracity of scientific evidence. This differs to academic understandings which encompass both science *and* policy (Martin & Rice, 2014) or, as Rayner (2012, p. 117) suggests, an awareness that the climate debate includes policy debate 'conducted by means of a surrogate dispute over the quality of the science'. Indeed, rhetorical devices such as the notion of "sound science" are particularly important in framing fundamentally political debates as scientific (McGarity, 2003-2004). Whilst causality between scientific evidence and policy action is complex to establish and is not the focus here, the *perception* of active scientific debate about the anthropogenic nature or severity of climate change is important because climate change is unlikely to appear on policymakers' agendas without public recognition of its legitimacy as a basis for policy action (Pralle, 2009).

Despite recognising therefore that much of what is disputed are not the explicit knowledge claims themselves, but underlying issues such as competing values (Hulme, 2009) or perceptions of societal risk (Kahan et al., 2012), why then do CSs or SVs participate in an ostensibly scientifically-focused public debate? Rooted in Converse's (1964) notion of issue publics where individuals are interested in issues of perceived personal relevance, a vast literature exists to investigate motivations behind public participation in political debates. Attention has increasingly been directed towards participation in specific topic areas, particularly those combining science and controversial policy implications. Ho et al. (2011)

find that perceptions of media bias are directly and positively associated with issue-specific participation and Becker et al. (2010) find that ideological predispositions and attention to particular media are also significant.

In the case of climate change, opinion leaders play an important role as 'connective communication tissue' (Nisbet, 2011, p. 357) within issue publics, helping to recruit previously passive members to become further involved. Individuals move up Milbrath's (1965) hierarchy of political participation, from "spectator" to "gladiator"-type activities (such as appearing in political forums) in order to influence others' opinions. However, this literature focuses predominantly on political participation by the general public and is thus inadequate to explain why actors presented as key participants in contentious public debates (in this case, CSs and SVs) either actively choose to, or are drawn into participating in, public scientific controversies. These actors are differentiated from the general public in terms of their status as holders of relevant expertise (Stehr & Grundmann, 2011). This expert status is fundamental, as those who are deemed "experts" are, within an evidence-based policy model, regarded to have a greater degree of influence and power over subsequent policy decisions (Weible, 2008). Critically, expert status may be self-designated by individuals within alternative issue publics and achieved via public profile, or may also be externally-designated via third-party accreditation (such as formal qualifications gained within academic epistemic communities). However we do not aim here to comment on the legitimacy of actors' participation in the climate debate. Whereas attention has previously been directed towards individual understanding of and personal engagement with climate change as an issue (Wolf & Moser, 2011), we do however identify a gap in terms of understanding the underlying motivations behind more active and vocal participation by both types of expert knowledge holders within public scientific controversies.

It is possible that fundamental and impenetrable differences exist between CSs and SVs, with each actor group entering and operating within the climate debate according to distinct paradigms (Kuhn, 1962). For example, scientists are understood to be particularly anxious about retaining control over knowledge claims (Poliakoff & Webb, 2007), with Young and Matthews finding that scientists become especially concerned when they perceive the public as changing the 'meanings of claims based on non-scientific values and principles' (2007, p. 141). This reflects a desire to uphold the pre-eminence of the positivist scientific tradition as a basis for evidence-based decision-making (Wesselink, Colebatch, & Pearce, 2014) as well as (perhaps unconscious) boundary-making activity (Gieryn, 1999).

In the case of climate change (albeit identified by Oreskes and Conway (2010) as also occurring in other scientific controversies), it is critical to recognise the extensive literature discussing the notion of politically-motivated dispute over climate change. Referred to by many authors as "denialism", this argument encompasses the idea that 'deliberate distortions' (2009, p. 3) are made by sceptical voices within the climate debate in order to advance particular agendas and motivations (Dunlap & McCright, 2015; Jacques, 2012; McCright & Dunlap, 2011; Oreskes & Conway, 2010). In this framing, scientific evidence is presented in order to obfuscate certain knowledge claims and to advance others to achieve specific end goals related to political ideology or financial gain. While it is entirely plausible that such motivated actions exist, and which are explicitly and rationally recognised (i.e. the actor in question is aware of making these distortions), it is however also important to recognise the vast literature on cognitive biases in the interpretation of scientific evidence. Not only do Kahan, Jenkins-Smith, and Braman (2011) show that individuals are more likely to pay attention to evidence that supports their own viewpoints (and dismiss the validity of evidence that doesn't), Kahan et al. (2012) also show that polarisation can actually become with an increase in scientific literacy.

Alternatively, it is possible that differences between conflicting parties may not be innate, but it is the public perception of a polarised, scientifically-focused debate that frames these actors as fundamentally different. In this interpretation, framing participants as duelling adversaries in the media (Zhao, Rolfe-Redding, & Kotcher, 2014) or via labelling practices (Howarth & Sharman, 2015), helps to co-construct polarisation over time, ignoring potentially important underlying similarities between actor groups such as overlaps in motivations for debate participation. Ravetz's (2011, 2012) work on "Climategate" using the framework of post-normal science gives plausibility to the latter scenario as he finds that challenges to the speaking "truth to power" model of the science-policy interface makes both CSs and SVs uneasy. However, with the turbulent nature and unpredictability of modern life, combined with complexities inherent to different cultures, existing commonalities can be challenging to recognise (Jasanoff, 2004). We are therefore particularly interested in the possibility of identifying commonalities between divergent groups engaged in conflict in order to assess where overlapping motivations for debate participation could facilitate constructive dialogue. Exposure to others' opinions is a known driver of public and individual opinion formation (Moussaid et al. , 2013), and critically, explicit recognition of opinion overlaps has been shown to increase positive attitudes across both groups engaged in dispute (Dovidio et al. 2012). Leveraging overlapping opinions, such as consensus regarding particular scientific claims, can reduce climate policy conflict (O'Sullivan & Emmelhainz, 2014) and exposure to

ideologically dissimilar viewpoints has also been found to reduce public dissemination of extreme opinions (Wojcieszak & Rojas, 2011).

An example of this occurred in 2014, when 12 CSs and SVs, all active on social media, met in the UK in an effort to 'calm the debate' (Yeo, 2014). While the specifics of the conversation are unavailable, the event was regarded by one of its participants as useful in terms of stimulating discussion and providing the possibility to 'understand each other better' (Watts, 2014). Such occasions indicate the possibility of more nuanced understanding of the different rationales contributing to others' opinions, including factors such as political rationales. It suggests that focusing on commonalities or engendering deliberative fora to avoid the more common dead-end 'dialogues of the deaf' (van Eeten, 1999, p. 185) evident in public scientific controversies may be necessary in order to inspire critical self-reflexivity to occur. Self-reflexivity is a crucial process as it, in essence, requires individuals to question their own inherent assumptions and values (Cunliffe, 2004), and it may reduce antagonism and hostility between actors involved in polarised and adversarial public debates. Moreover, examining *together* the underlying rationales behind issue publics and more formal epistemic community participation in public scientific controversies is important because it may suggest avenues for constructive dialogue, rather than dualistic debate. This is a critical methodological distinction because it innately reduces the dichotomy of the lay public versus an accredited knowledge holder(s).

2.   Method

A series of 22 semi-structured interviews were conducted with UK-based individuals identified as CSs (n=11) and SVs (n=11) (Table 1). As much of the literature on the climate debate is US-focused, this research provides an important alternative perspective. In order to delve beyond explicit statements of self-declared rationales towards more latent motivations, interviews aimed to enable participants to build their own narratives and to critically self-reflect on them throughout the interview. While research interviews engender an artificial situation (Hollway & Jefferson, 2000) where interviewees may feel the need to provide answers they think the interviewer wants to hear (Schwarz, 1999), stories told within an interview can also form part of an important 'meaning-making process' (Seidman, 2013, p. 7), interpreted by the researcher using theoretical underpinnings to form relevant conclusions. Daniels and Endfield (2009) suggest that the method in which people receive and interpret climate information, particularly of its "dangerous" nature, affects resulting actions. Thus, by producing their own stories, interviewees offer a window into personal experiences and a mechanism by which to self-reflect (Hards, 2012). Hiller and Diluzio (2004) also suggest that

interviewees participating in narrative-based interviews carry out a complex discursive activity known as reflexive progression. Through this process the interviewer can 'push further for linkages, motivations and clarifications that lead to new discoveries by the interviewee… [and create] some kind of order that was previously unclear, even to the interviewee' (Hiller & Diluzio, 2004, p. 17).

Questions covered three main themes: (i) how each actor perceives themselves, (ii) perception of a dominant "other" (commonly framed as a polarised adversary), and (iii) the perceived usefulness of participating in a vocal and public debate, including perceptions of debate framing. The first two themes were chosen in order to understand whether actors' perceptions of themselves or the "other" could be seen as contributory factors towards debate participation. The third theme covered a wider range of topics relevant to debate participation such as perceptions of debate topic (both explicit and latent), labelling practices, and why they as individual actors should be involved. Interview transcripts were analysed using a mixture of descriptive and thematic coding (Thomas, 2006). Whilst verbally narrating their thought process, interviewees were also asked to place their opinion, and that of a dominant "other" (representing the main arguments encountered that oppose their point of view) on a spectrum of opinion with two axes (science and policy), building on Capstick and Pidgeon's (2013) epistemic and response scepticism. Each of the interviewees was presented with a blank printed spectrum to complete on two occasions during their interview in the presence of the interviewer . They were first asked to use the spectrum after being asked how they had come to be interested in climate change. At this point, they were asked to place themselves on the spectrum. Later on in the interview, after they had been asked about the main arguments they encountered that opposed their views (the 'dominant other', although this terminology was not discussed in the interviews), they were asked where they would place individuals with those views on the spectrum. The semi-structured approach of the interview enabled interviewees to reflect on the markers they had placed on the spectrum representing both their own views and those of the dominant other.

Table 1: Interview sources

Category	Source	Number of interviewees
Climate scientists (CSs)	Senior, most >30 years post-PhD	6
	Mid-career, most 15-30 years post-PhD	2
	Early-career, most <15 years post-PhD	3
Sceptical voices (SVs)	Individuals from the 'list of sceptics 'mentioned' more than once in 10 UK national newspapers' (Painter, 2011)	4
	UK-based blog authors from Sharman (2014)	4
	Involved with the activities of the GWPF e.g. Academic Advisory Council or published on GWPF website	3

Participating CSs' specialisms included climate modelling and climate physics, with all participating in public engagement activities such as public speaking or blogging. CSs were selected using Kahan's (2013) list of characteristics defining a credible scientist, including professional experience in the climate science field (e.g. contributors to IPCC Reports), number of peer-reviewed publications, and seniority. SVs were identified from three sources: Painter's (2011, p. 128) 'list of sceptics 'mentioned' more than once in 10 UK national newspapers'; Sharman's (2014) climate sceptical blog authors, chosen due to online sources' increasing importance in the climate debate (Gavin & Marshall, 2011); and those associated with the Global Warming Policy Foundation (GWPF), a well-known sceptical voice about climate change in the UK.

3.   Perceptions of self

The dominant theme driving climate scientists' (CSs) self-perceptions was a youth-driven aspiration to contribute positively to the environment. Personal experiences of nature during childhood were critical, with many CSs recalling that they "*enjoyed being outdoors*" (CS5) or being in close proximity to "*the natural world which surrounded our houses*" (CS1). Other experiences built on this engagement with nature, such as CS10 recalling hearing a talk at primary school that led to him "*becoming worried about the environment*" as a result, or from family influences, such as CS1 who remarked that "*I've always had an interest in energy, right from being a child. My dad worked at a nuclear power station and we lived around the corner from it*". These early experiences were identified as important contributory factors to the subsequent aspiration to take a career path that was regarded as "*positive or useful*" (CS2) to society. Two other directly-related sub-themes were identified: an ongoing fascination with the environment, and a heroic desire to do good. CSs mentioned a sustained curiosity driven by frequent occurrences of professional amazement or awe inspiring their interest in the natural sciences. While this fascination for some was directly youth-driven, for others it emerged after a few years in the field, as the original choice to work in climate change arose from the need to be employed. CS4 identified that "*I probably stumbled into the area... [as after] finishing my PhD I needed a job*" and CS8 noted that at the start, "*I didn't believe that this was going to be my life-long career*". However, nearly all perceive themselves as having a heroic desire to "*do something that felt more tangibly useful to society*" (CS10) or to "*[work] on a problem that was an important problem for society*" (CS2). In making these statements and creating their personal narratives, the CSs emphasise the value of their work to society as well as how it fits in the growing international context of climate change as a topic

of public concern. They are also cognisant of the obligations placed on them as recipients of public funds, particularly as regards requirements to publish results truthfully, despite the possibility they may be *"politically unpalatable"* (CS9). The spectrum presented to interviewees during the interview enabled actors to further self-reflect on their views and opinions with most CSs placing themselves in the top right quadrant (Figure 1). This was predominantly based on high value being accorded to scientific knowledge claims that climate change was having serious global impact. Reflections on the certainty of this evidence were however noted, with CS6 commenting that "*nothing is certain, but it's very certain*" and CS9 narrating:

> *If you're defining anthropogenic climate change as global mean surface temperature, then I'll be right up high at the top here in terms of certain. If you're talking about anthropogenic climate change in particular regions of the globe, at particular times of the year around the place, I would be far less than certain. I have a range, depending on what your definition is.*

Indeed, two interviewees (one CS, one SV) were critical of the notion of "certain" evidence for anthropogenic climate change and chose not to place themselves on the spectrum at all.

The dominant theme underlying sceptical voices' (SVs) self-perceptions was that of being a crusader for truth. The actor disinterestedly and independently investigates scientific claims made about climate change and finds them either incorrect or, more commonly, corrupt and self-serving. There was a strong moral rationale underpinning this theme. SV3 noted that "*I have to give up a job and have no earnings in order to have someone...who can stand up and say it's not about politics; it's about whether the evidence is right!*". The SV is thus fighting to expose climate change as the "*biggest scandal in modern science*" (SV5). The ideal of disinterested investigation based on evidence, unrelated to "*motivation like a thick brown envelope from the oil industry*" (SV9) is critical to this self-perception, even when the actor acknowledges that their view on climate policies influences their view on climate science. Seven SVs disagreed that personal values influenced their opinion as they felt it was more inconvenient to take a contrary point of view to that espoused by the majority. However others were more critically self-reflective during the interview process. For example, SV6 recognised a greater personal interest in sources which suggested climate change was not a serious problem. SV8 explicitly identified the role of individual values as being an important part of opinion formation, specifically as regards "*understanding how people perceive problems and risks*". Two sub-themes support the crusader self-perception: opposition to the hype of climate science and concern for equity. The first involves the actor being triggered by a single event (e.g. Climategate) or gradually over time, to investigate scientific claims (and associated economic implications) and finding them "*over-egged... exaggerated...not*

realistic" (SV8). This exaggeration is done by scientists, the media or others, all of whom have a financial stake in maintaining the mainstream consensus. Equity captures the opinion that current climate change policy is "*hurting... the poor*" (SV1) both in the UK and internationally. Thus the SV perceives him/herself as standing up and fighting for a society which "*should be richer... more abundant, [and where] more people should have access to more energy*" (SV7).

The vast majority of SVs disagreed with government GHG emissions-reduction policies, near-exclusively on a cost basis. There was a clear message that climate change policy would "*bust the economy*" (SV11) and, building on the crusader and equity themes, that the ensuing ramifications would be felt most acutely by the poorest members of society. However, opinion as regards the certainty of scientific evidence for anthropogenic climate change was divergent. As with climate scientists, most SVs found it challenging to place themselves on the spectrum (Figure 1) because "*certain is a bad word in science*" (SV2). The spectrum also highlighted difficulties SVs felt of articulating necessary assumptions and caveats around specific knowledge claims into the debate. Many SVs railed against the public perception of the debate as "*black and white, yes/no*" arguing it should be more focused on "how *much and* which *policies*" (SV10, emphasis in the original). This tension between the latent and manifest elements of the public-facing climate debate, particularly in terms of the instrumental use of certain types of knowledge claims, was important. For example, even though SV10 frequently publicly criticises climate science he argued that "*I don't think anyone's interested in climate science per se... No-one cares. Only people care when it comes to policy*".
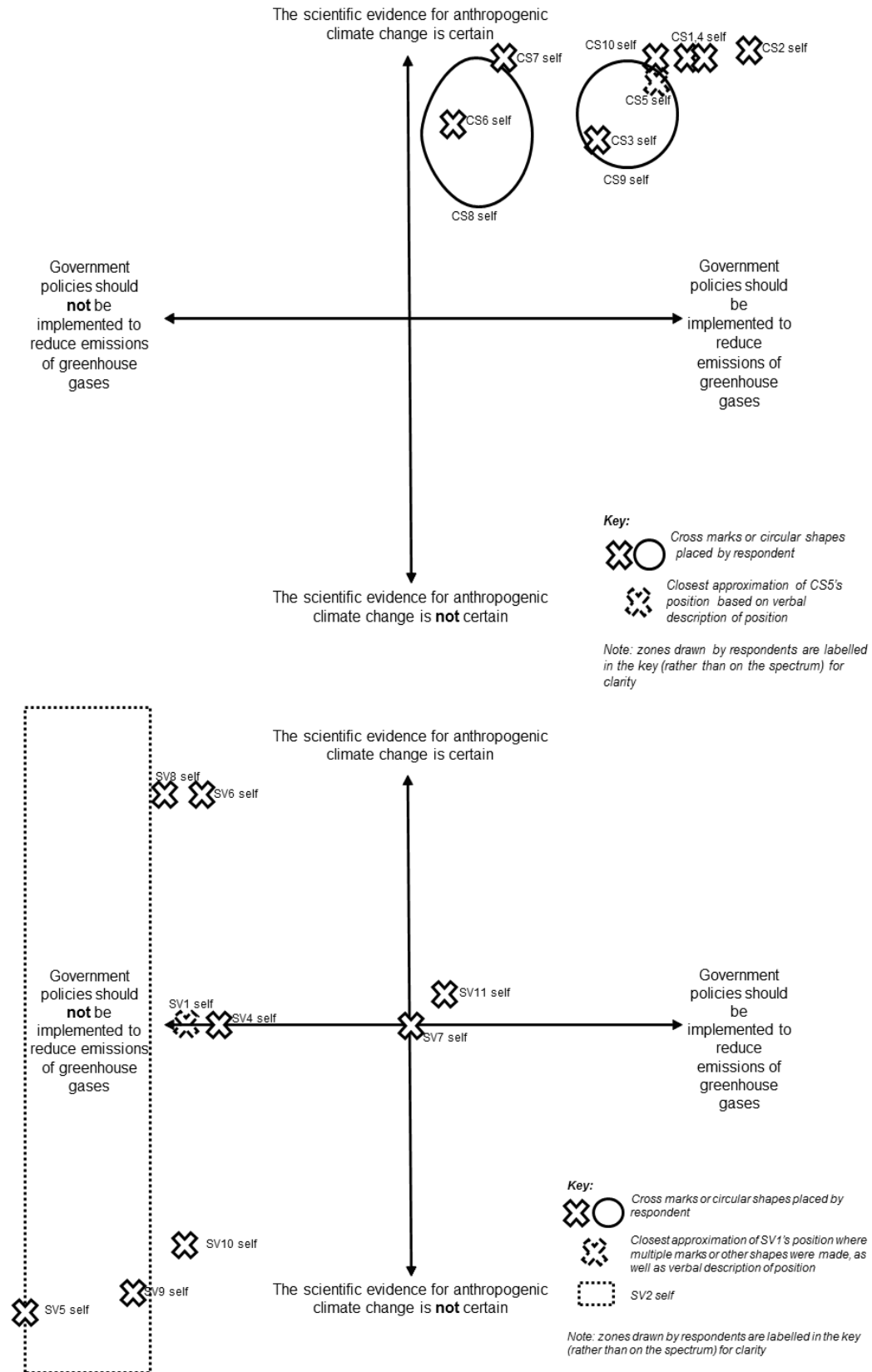
Figure 1: Climate scientists' (above) and sceptical voices' (below) opinions

4.   Perceptions of a dominant "other"

Climate scientists (CSs) found it challenging to identify a single opposing dominant voice, particularly as regards the spectrum in Figure 2. However, the most prevalent theme was that opposing opinions arise due to a lack of understanding about climate science itself, and that this misunderstanding results in people feeling threatened and needing to look for "*ways to justify not accepting it*" (CS3). A wide range of opposing arguments were encountered, including those who disputed the certainty of climate change science, through to those who "*don't deny there's some anthropogenic component of climate change*" (CS1) but who were more concerned with economic or social rationales. This perception of a lack of understanding was supported by two sub-themes. First, CSs frequently acknowledged that opposing arguments may be fundamentally driven by perspectives on government intervention in society. These opposing arguments use scientific uncertainty to suggest that "*there's not enough evidence to justify government regulating carbon emissions*" (CS11). CSs were however divided on the extent to which their role should involve engaging in manifestly political debate and making policy recommendations (see Section 5). Thus, even though CSs are key actors in public debates that explicitly focus on scientific claims, they frequently recognise that the nature of the debate itself (particularly its potential to be based on disagreement with policy choice) means that they may not always be the right debate participant. Second, most CSs acknowledged that the opinions of others were strongly linked to values, particularly in terms of how climate change challenges existing ways of life. For example CS4 explicitly referred to climate change making people "*uncomfortable*" as it challenges their "*cognitive and normative values*". This suggestion that the opinions of those who challenge mainstream climate science are largely formed by values and not by a rational assessment of evidence is important to note as it implies the possibility of normative judgement regarding the legitimacy of others' opinions. Opposing voices are perceived by CSs as being strongly emotionally influenced and experiencing "*fear, guilt, grief, loss, hopelessness*" (CS3) in response. Discomfort regarding the causes and potential solutions to climate change was mentioned, as was reference to different perceptions of human interaction with nature. For example CS3 noted encountering a "*religious belief that we have dominion over the planet rather than we have its custody and care in our gambit*". Nonetheless, a spectrum of opposing arguments is recognised. As CS6 notes,

> "*[there is a] spectrum of opinions because people have different attitudes and different weightings on how you take now, the future, yourself in the scheme of richer people, poorer people, people in different countries, whether you agree in principle with the governments controlling these things or not*".

Sceptical voices (SVs) clearly identified a dominant other fuelled by vested interests, standing in direct contrast to their role as a crusader and "*seeker after truth*" (SV2). These vested interests included scientists who are focused on "*trying to save their jobs*" (SV6), although a distrust of the civil service (including but not limited to government scientists) was also present and related to perceptions of an alleged left-wing agenda. Charges that SVs were themselves funded by interests such as fossil fuel companies were strongly refuted. There was also anger at perceptions of politicised science wherein scientists ignore the "*ugly facts*" so that they can make a "*political play*" (SV11). This may also help to explain why CSs are seen as the dominant other as opposed to political actors. For example, SV9 alleges the existence of a "*nexus of media plus politicians plus establishment plus science which is funnelling literally billions and billions and billions of pounds into academic research*" (SV9). This is particularly interesting when contrasted with perceptions of the role of evidence itself in the decision-making process. Whereas there is frustration with "*people who can't understand that if the policy isn't backed up by the evidence you shouldn't be doing the policy, especially if it's... costly*" (SV3), this does not translate into agreement that "*scientists ought to be having more impact on policies*" (SV11, emphasis added). Evidence is perceived as needing to be able to speak for itself because scientists, "*are clearly, clearly not telling the truth*" (SV1). Therefore while most of the SVs entered the climate change debate ostensibly due to disagreements over scientific elements (see the crusader theme above), they do not perceive that the other is similarly-motivated by a search for scientific truth, and is instead corrupted by political or financial incentives. The dominant other is near-unanimously perceived to be certain about the scientific evidence for anthropogenic climate change and supportive of government GHG emissions-reduction policies, reflecting the public perception of a polarised debate (Figure 2).
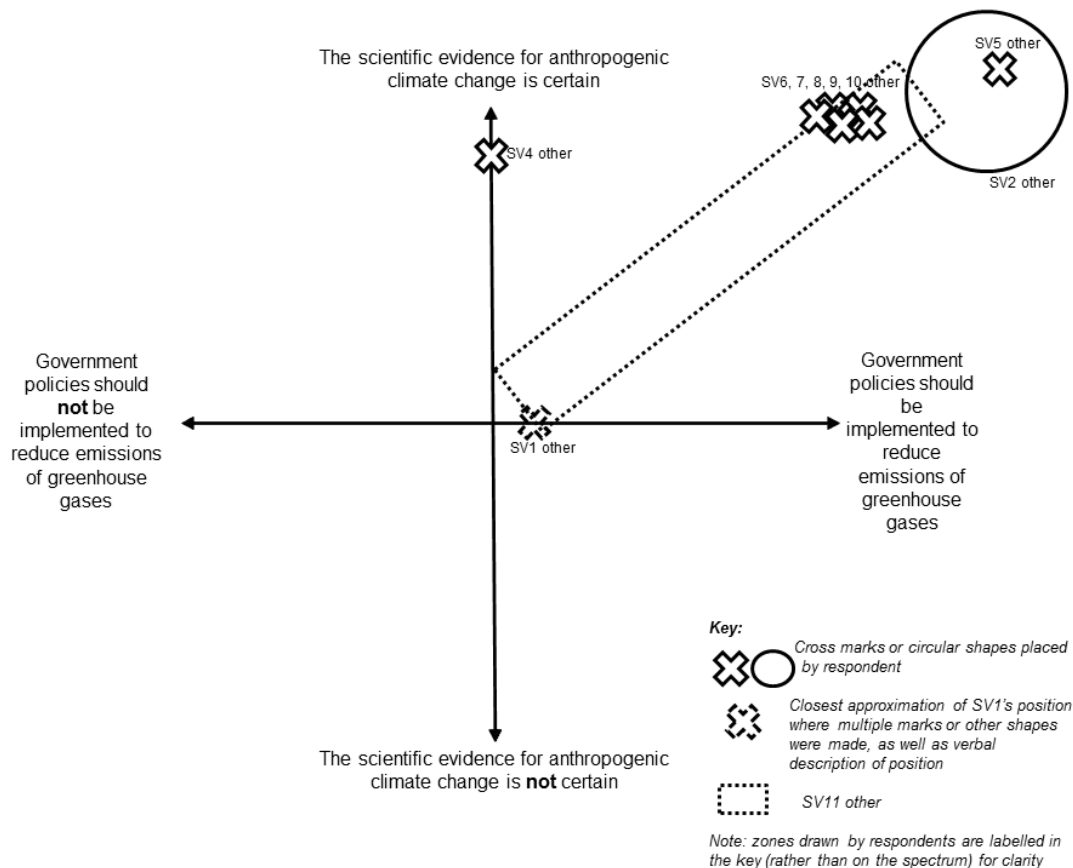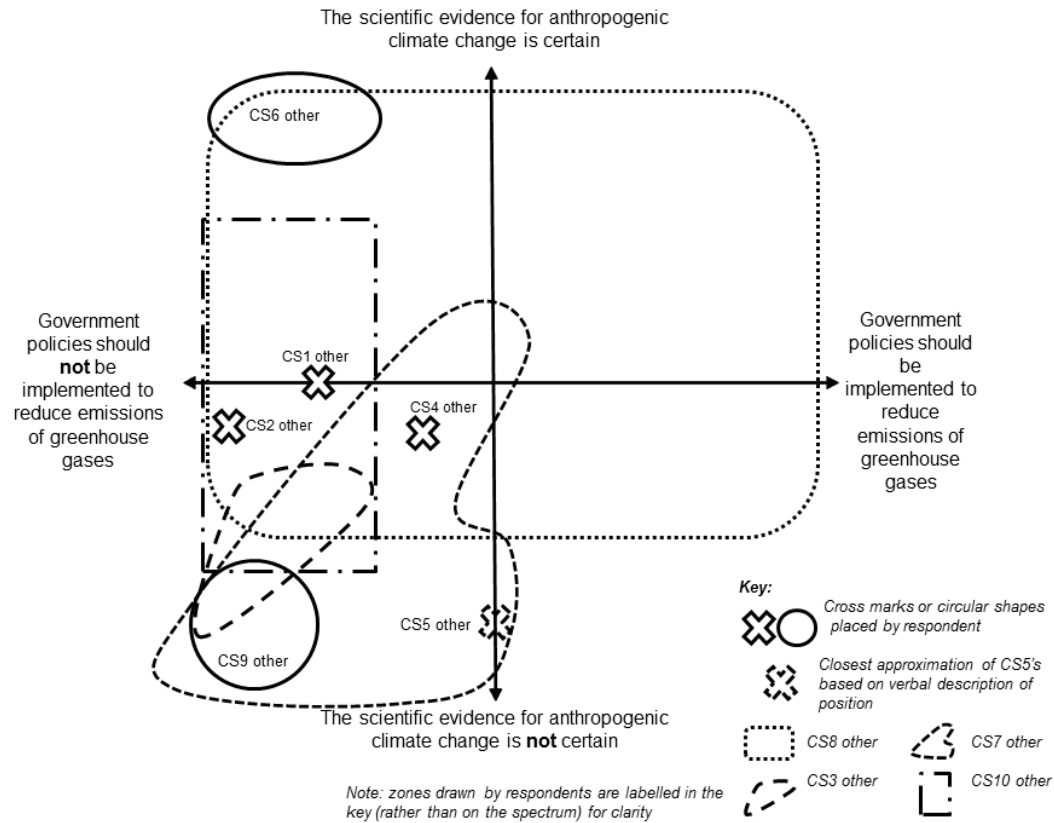
Figure 2: Climate scientists' (above) and sceptical voices' (below) perceptions of the dominant others' opinion

5.   Debate participation and framing

Despite it at times affecting relationships with their peers, the climate scientists (CSs) interviewed see it as essential to be publicly vocal about their work, particularly in terms of explaining the methods and data that have led to their conclusions. Being publicly vocal is regarded as critical as it was seen as easy for the public "*to dismiss us and dehumanise us and make assumptions about our agenda and have reservations if they don't see us out there*" (CS10). This dominant theme of a strong sense of duty to communicate research findings was related to the publicly-funded nature of their work and the significant social implications arising from certain findings. However, many acknowledged that it is "*not second nature*" (CS4) for many CSs to be good public science communicators, as "*the qualities that make you a good scientist, they're not qualities that make you good communicators, they're almost the opposite*" (CS2). Consequently it is seen as understandable that many CSs have historically been reluctant to be publicly vocal. It was also argued that public engagement is not valued by universities and that CSs may be reluctant to publicly engage as they are fearful of their statements being misinterpreted or exaggerated in the media. As a result, CS9 notes that he has been "*deafened by the roar of the silence of scientists*".

Several sub-themes were also identified. CSs have extensive experience of being labelled and attacked, using epithets such as *"corrupt"* (CS3), "*naïve, misguided, a moron*" (CS10) and "*a liar, a cheat, a fraud*" (CS7). CSs strongly believe labels, and indeed their personal experience of being labelled, leave people feeling angry and defensive, as well as deepening "*the polarisation and the entrenchment of views*" (CS10). Several CSs noted that in public discourse they attempt to avoid such labels or find words without negative connotations. Some also identified explicitly trying to directly personally engage with those who hold diametrically opposed opinions, such as via the meeting of CSs and SVs referred to in the introduction above. A general consensus emerged among interviewees that debate participation should be encouraged "*as long as it's constructive*" (CS6). This meant that participants should present "*credible arguments that they can back up with science*" (CS4), as well as bringing to the table "*their concerns, their worries, their opinion and what we should do about it, who should do it*" (CS2). There was also a commonly held perception that the current climate debate is not being held on an equal footing. For example, CS9 commented that he was is "*increasingly perturbed that people make what look to be very cogent and very eloquent conclusions but actually have completely nebulous, unframed starting points*". Therefore whereas the CSs interviewed do engage in public debate, they are often cautious about this engagement because debates are often seen as inadequately focused on scientific topics or involve other actors who are deemed to be less credible in terms of their expert status. It is thus unsurprising that most CSs believe that their engagement in the climate

debate should not be overtly political and that they as scientists should remain "*impartial and humble and open to criticism*" (CS10). The need for establishing a frame of credibility and expertise came across strongly from the CSs who believe those who participate in the debate must be accredited and where the authoritarians of climate science consist of "*people who have got first or second degrees in relevant disciplines and have spent a certain amount of professional investment of their life and study and publishing*" (CS8). CSs expressed frustration that the climate debate involves actors who mix science and policy issues when engaging with scientists thereby using the arguments interchangeably to suit their purpose: they are "*resistant against the science when really they're resistant about policy*" (CS10) and where "*they're still propagating that policy scepticism back to the science*" (CS10). There was however a certain tension between this desire to retain a separation between science and policy, with CS11 commenting that the nature of the issue means that "*some advocacy is warranted*".

The dominant driver for sceptical voices (SVs) participation in the climate debate was "*a sense of duty*" (SV3) to bring an important alternative perspective to the table. This was supported by numerous rationales. For example, SV1 identified being driven by a combination of "*a passion for science and...justice and poverty*" as what is happening (current climate policy) is "*wrong and...is hurting people*". SV2 is concerned with exposing "*scientific fraud*"; to the point that he is "*gradually encircling them [climate scientists] and it will eventually be reported to the police*". A clear tension was however identified between frustration with the "*politicised*" (SV8) and "*very unscientific*" (SV11) nature of the climate debate, and a clear and consistent message of disagreement with government climate-related policies. Several SVs emphasised the impact of climate policies on energy prices as a key motivation for debate participation. As SV11 argues, "*energy is the basis of all wealth [so]...all this green economy stuff is rubbish...We're not a post-industrial nation. We can't possibly exist on services*". The relationship between energy policy and immediate political imperatives was frequently mentioned, particularly as regards need to retain security of energy supply and the impact of green levies on energy prices. Bringing this perspective to the debate was seen as imperative to avoid "*damaging both households and industrial competitiveness*" (SV9).Notions of equity as well as opinions regarding the role of government in society were also present. For example, while SV7 acknowledged that "*there is a problem of climate change...that does require some level of intervention*", the nature of this intervention was disputed. SV7 argued that "*it doesn't have to be top-down...it should be democratic and we should be left better off*". SV2 also contended that:

"*climate science...is about pursuing a...nasty political agenda, it's a collectivist, centralising, bureaucratic political agenda which will make a few people very rich at the expense of everybody else*".

The tension between the scientific and political framings of the climate debate was also related to the notion of belief or religion, and sometimes with the idea of a scientific consensus. For example, SV11 suggests that the public climate debate is framed as a matter of "*don't argue, the science is certain. Believe!*". The notion of belief stands in contrast to the desired pre-eminence of traditional scientific enquiry where "*the arbiter of all the arguments is empirical evidence*" (SV8). For many SVs, the notion of belief was also strongly linked to the way that labels were seen to frame the debate as antagonistic between duelling sides. SV11 also noted that the use of labels "*more begs religion than it does science. When you have a religious orthodoxy, then people that disagree with it tend to be called deniers and hunted down*". Labelling was regarded as "*very unhelpful*" (SV10) as it is perceived as a mechanism to shut down debate. It was also suggested that the use of labels can further polarise individuals as those using them "*don't realise that members of the public are thinking, well, that's me as well he's talking about*" (SV10) thus "*forcing a dialogue between the middle ground...and the sceptics*" (SV7). Labelling was thus also seen to limit the possibilities for constructive dialogue. SV7 commented that:

"*Everyone walks into the room knowing that there are two sides, and there's no nuance. And so you try and express some kind of perspective. Oh right, so you're not one of us, you're one of them, and it's really powerful*".

No clear signal existed as to the importance of either themselves or others being publicly vocal (despite all being chosen due to their public profile). While half believed that it was "*absolutely*" (SV9) vital to vocally express their opinion, others were more cautious, with SV7 suggesting that it "*depends on the level of the debate*" as to whether or not participation was recommended. SV8 took recourse in the idea that evidence would be the key arbiter, only wanting to be vocal "*in a measured way [as] we're not campaigners...at the end of the day arguments will win*". And whereas SV6 considered it critical to be active in the debate as "*people have to fight their corners, so yes, the more the merrier*", he also noted that the hostile nature of the debate is both undesirable and off-putting to many. The notion of consensus was clearly seen as an attempt to close down debate, with SV5 passionately arguing "*don't* ever *tell me what I can or cannot have a debate about, don't you ever say that to me! That's fascism!*".

6.   Discussion and conclusion

This research investigated the underlying rationales behind the participation of climate scientists (CSs) and sceptical voices (SVs) in the climate debate, focusing in particular on potential overlaps between previously polarised individuals as well as each actor's ability to be critically self-reflexive about their own and others' opinions about climate change. Three themes were investigated using a narrative format: perception of self, perception of a dominant "other", and the perceived usefulness of participating in a vocal and public debate, including perceptions of debate framing. Table 2 summarises the dominant themes emerging from both CS and SV narratives. While the sample size of 22 interviewees necessitates caveats regarding the representativeness of these findings and suggests the need for further research with a larger population, a notable degree of overlap between themes expressed by both actor groups is apparent.

Table 2: Key themes

	Climate scientists	Sceptical voices
Perception of self	*Dominant theme:* Youth-driven aspiration to contribute positively to the environment *Sub-themes:* → Fascination with the environment → Heroic desire to do good	*Dominant theme:* Crusader for truth *Sub-themes:* → Opposition to the hype of climate science → Concern for equity
Perception of a dominant other	*Dominant theme:* Lack of understanding of climate science *Sub-themes:* → The role of government in society → Values-laden response	*Dominant theme:* Vested interests *Sub-theme:* → Politicisation of scientific process
Debate participation and framing	*Dominant theme:* Sense of duty *Sub-themes:* → Labelling is negative → Accreditation is vital → Credible debate needed → Debate is often actually about policy, not science	*Dominant theme:* Sense of duty *Sub-themes:* → Labelling is negative → Disagreement with government policy, especially energy policy → Climate change as a belief

Immediately apparent is the mutual sense of duty to participate in the climate debate, albeit recognising that CSs and SVs may have differing levels of inclination or access to particular venues for engagement, such as the peer-reviewed literature versus blogosphere discussion. Whereas SVs largely feel marginalised by the mainstream press, the CSs who do have a

greater level of access are cautious due to worries of misinterpretation. Nisbet and Markowitz's (2014) finding that scientists' engagement in overtly public activities such as media appearances is a function of political outlook, as well as holding the opinion that media coverage was important for career advancement, is likely applicable in this instance. We build on this finding by adding that a strongly held sense of duty (which may be unrelated to specific political outlook) is also a likely contributory factor for debate participation. Commonality in terms of self-perception regarding the moral rationale to do what was right for society (the CSs' heroic desire to do good and the SVs' crusade for truth) is also apparent. While the analysis carried out by SVs as adults was distinct from the rationales underpinning CSs more youthful motivations, both groups explicitly self-identify as moral actors acting upon deeply held convictions. Another interesting overlap identified via the opinion spectrums (Figures 1 and 2) was the recognition that certainty was a challenging concept both in terms of precise definition and as a basis for policy-making. While there were clearly differences of opinion regarding the level and/or nature of certainty required for policy implementation, possibly due to different "ways of life" as explained by cultural theory (O'Riordan & Jordan, 1999), many CSs and SVs acknowledged that the notion of a general scientific certainty about such a complex assemblage as climate change is unattainable. Recognising that certainty is multi-faceted and that particular knowledge claims may be uncertain or contested without casting doubt on other evidence has significant implications as it may engender more explicit and necessary discussions about the trade-offs between scientific evidence and political decision-making. These overlaps are important because, as noted above, recognising that one's opinion may overlap with others can not only increase positive attitudes across groups engaged in conflict (Dovidio et al. 2012), but may also reduce public dissemination of extreme opinions (Wojcieszak & Rojas, 2011). This therefore has implications for the likelihood and tenor of dialogue between disputing parties, as well as for broader public understanding of scientific controversies.

Another critical finding is that while a common public perception is that of a single debate where climate scientists are representatives of scientific truth and sceptical voices are the dominant challengers, this research contributes to understanding of a more multifaceted reality by also highlighting the potential misalignment of actors and their roles in engaging in public debate. Nearly all SVs expressed an underlying interest in the impact of climate policies on the economy despite explicit disagreement with the politicisation of the scientific debate. That SVs were preoccupied with political and economic factors is unsurprising given the extensive identification of a relationship between political viewpoint and opinion regarding climate change (Clements, 2012; McCright & Dunlap, 2010; O'Sullivan & Emmelhainz, 2014), but the fact that this viewpoint was held concurrent with a desire to

depoliticise scientific debate reinforces Ravetz's (2011, 2012) finding as discussed above that challenges to the linear, objective model of scientific enquiry are viewed as undesirable. CSs were also acutely aware, and often made uncomfortable by, recognition that much of the debate centred on disagreement about policy choice rather than the science itself. If the actor-subject interaction in public discourse were to be renegotiated (i.e. politicians debating policies rather than CSs, or CSs actively choosing to debate the policy implications of their research), it may reduce the exhaustive nature of the debate where dead-end arguments are being held precisely *because* they do not make explicit what is actually being debated, i.e. Rayner's (2012) surrogate debate. The suggestion of critical self-reflexivity evident in some interviews, such as SV6 and SV8 who presented themselves as able to acknowledge that personal values shaped their opinion, was also interesting. It was however not evident in the majority of interviews. While acknowledging the wariness of certain authors as to the intentions behind, or likelihood of such introspection taking place (Lewandowsky, Oberauer, & Gignac, 2013; Washington & Cook, 2011), we contend that critical self-reflexivity is likely to be particularly useful in debate re-framing as it helps to pare back the actual topic of disagreement (Hulme, 2009) and forces the centre of the debate to shift towards a more overtly policy or values-focused dialogue. This is particularly important for public perceptions of climate change and how debate is understood to be a useful and necessary part of the scientific process.

Nonetheless, despite uncertainty regarding the extent to which self-reflexivity did or can occur, what we consider the more important outcome of the narrative method employed for this research is its ability to uncover overlap in interviewees' perceptions and rationales. What is particularly significant is that even the way that each "side" of this polarised debate *chose* to express themselves can invite the possibility for constructive dialogue. For example, even if the opinions expressed in this research are not the "true" opinions of the parties involved, the finding that overlaps exist even within these expressed opinions, is important because it shows the possibility for conflict reduction. Critically, identifying and emphasising these commonalities can be seen as a possible mechanism to defuse the antagonism evident in the debate. For example, it may be difficult to continue a hostile argument when participants are reminded of commonalities such as a mutual love of enquiry and scientific understanding, or agreement regarding the antagonistic and potentially off-putting nature of the current climate debate. This research also indicates that whereas inevitable differences of worldview exist, such as regarding the role of government in society (explicitly identified as a topic of concern by SVs and rarely mentioned by CSs) or which types and holders of knowledge are valued in public debate (with accreditation more highly valued by CSs than SVs), greater commonalities exist than may be acknowledged in public forums. Building on cultural

interpretations of the many different understandings of climate change (Hulme, 2014; O'Riordan & Jordan, 1999), we therefore suggest that a focus on potential overlaps between underlying (and/or manifestly expressed) rationales behind climate opinions may encourage constructive discussion even with actors who had previously engaged in purposefully antagonistic exchange. Identifying even one or two such commonalities in motivations and opinions could provide a valuable source for collaborative dialogue whereby those involved utilise these commonalities to facilitate a further exchange of ideas. Based on the common themes identified above, and in order for this to progress in practice, we suggest that it is critical that the purpose or frame of the debate is made more explicit (i.e. whether scientific or political factors are the focus of contestation) so that participating parties may be nominated appropriately.

7.   References

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