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3 *Beyond counting climate consensus*

4 ABSTRACT:

5 Several studies have been using quantified consensus within climate science as an argument to  
6 foster climate policy. Recent efforts to communicate such scientific consensus attained a high  
7 public profile but it is doubtful if they can be regarded successful. We argue that repeated efforts to  
8 shore up the scientific consensus on minimalist claims such as ‘humans cause global warming’ are  
9 distractions from more urgent matters of knowledge, values, policy framing and public  
10 engagement. Such efforts to force policy progress through communicating scientific consensus  
11 misunderstand the relationship between scientific knowledge, publics and policymakers. More  
12 important is to focus on genuinely controversial issues within climate policy debates where  
13 expertise might play a facilitating role. Mobilising expertise in policy debates calls for judgment,  
14 context and attention to diversity, rather than deferring to formal quantifications of narrowly  
15 scientific claims.

16

17 INTRODUCTION

18 Quantification of consensus within climate science continues to occupy a central role in public  
19 discussions of climate change, with a particular focus on the level of agreement regarding the  
20 anthropogenic contribution to global temperature rise. Since 2004, a series of papers have addressed  
21 this issue (Oreskes, 2004; Anderegg et al., 2010; Cook et al., 2013; Verheggen et al., 2014). One of  
22 these (Cook et al., 2013) (C13) has gained particular prominence with the claim that 97.1% of those  
23 papers expressing a position on anthropogenic global warming either explicitly states or implies that  
24 humans cause warming. The claim has had significant media impact (Skeptical Science, 2014),

1 inspired a popular television comedy programme (Kelly, 2014), been adjudged Environmental  
2 Research Letters' best article for 2013 (Kammen, 2013), and even been tweeted by President  
3 Obama (Obama, 2013) (albeit embellishing C13's original claim with the word 'dangerous').  
4 Consensus quantification is justified by arguing that public ignorance of consensus amongst climate  
5 scientists provides a barrier to the implementation of climate change mitigation policy (Oreskes,  
6 2004; Anderegg et al., 2010; Cook et al., 2013; Verheggen et al., 2014). Here, we argue that  
7 focusing on consensus amongst experts as a route to policy progress misunderstands the role of  
8 scientific knowledge in public affairs and policymaking. Drawing on examples from the extensive  
9 science and technology studies (STS) literature, we show that building the basis for policy action  
10 cannot be done simply with appeals to fact. Where these facts are complex and negotiated, as in the  
11 case of climate change, experts and policymakers need to acknowledge and engage more actively  
12 with public 'matters of concern' (Latour, 2004).

### 13 SCIENCE

14 Nowhere is the social negotiation of fact clearer than in the case of C13 itself. The publication of  
15 the article prompted a long-running and robust debate on blogs (e.g. ...and Then There's Physics,  
16 2014; Pile, 2013; Nuccitelli, 2013; Hulme, 2014), within the pages of scientific journals (Tol, 2014;  
17 2016; Cook et al., 2014; Cook & Cowtan, 2015; Duarte, 2014) and even in the US Congress  
18 (Vaidyanathan, 2014). One focus of discussion has been the high proportion of abstracts in C13  
19 without a position, when compared with the previous consensus study conducted by Oreskes  
20 (2004). Both studies rate abstracts, 'but where Oreskes finds 75% agreement and 25% no position,  
21 Cook has 33% agreement, 66% no position and 1% disagreement.' (Tol, 2016). In fact, C13 re-  
22 analysed the sample used by Oreskes based on their methodology. They found a wide discrepancy:  
23 'Of the ... 894 [papers], none rejected the consensus, consistent with Oreskes' result. Oreskes  
24 determined that 75% of papers endorsed the consensus, based on the assumption that mitigation and

1 impact papers implicitly endorse the consensus. By comparison, we found that 28% of the 894  
2 abstracts endorsed AGW while 72% expressed no position.' (Cook et al., 2013).

3  
4 We do not wish to adjudicate on this disagreement here. Rather, these arguments demonstrate the  
5 pitfalls of attempting to quantify consensus in the scientific literature in the manner of C13 in order  
6 to produce 'proof' for persuading the public. Rather than securing certainty that was absent before,  
7 this exercise has invited intense scrutiny to the judgments underpinning their claim, and generated  
8 further doubt. This was a predictable outcome on the basis of STS studies which show that doing  
9 more research on politically controversial, high-stakes policy matters typically increases uncertainty  
10 (Collingridge & Reeve, 1986). This happens as different parties are motivated to undercut each  
11 other's claims, and the complexity of scientific judgment lends itself to generating endless  
12 disagreement on technical grounds (Sarewitz, 2004). Contributing to public debate and policy  
13 therefore calls for a more cosmopolitan approach to climate knowledge where the limits of  
14 scientific resolution to intractable disputes are acknowledged and efforts made to communicate and  
15 engage with the implications of different positions, not all derived from science (Beck, 2012). This  
16 brings us to the rationale for consensus quantification, not only as a means of communication  
17 within the scientific community, but also as a means of public communication and persuasion.

## 18 19 PUBLICS

20 The argument for quantifying the scientific consensus on climate change is often made in terms of  
21 better informing a misinformed public. For example, proponents use opinion poll evidence to argue  
22 that there is a "significant gap between public perceptions and reality, with 57% of the US public  
23 either disagreeing or unaware that scientists overwhelmingly agree that the earth is warming due to  
24 human activity" (Cook et al., 2013, p. 6), and that this misperception is a result of misinformation

spread by opponents of climate policies (Oreskes & Conway, 2010). Since the public seems unaware that such a science consensus exists, consensus communicators seek to publicize its existence. Following experimental evidence from psychology, this gap is believed to be associated with reduced support for a range of climate policies (Ding et al., 2011) and that this gap can be closed by providing effective information regarding the extent of consensus within climate science (Lewandowsky et al., 2013). However, these experimental findings have been challenged in two ways in the literature. First, if increasing (consensual) scientific knowledge merely accentuates the cultural “conflict of interest” within some individuals (Kahan et al., 2012), then climate science knowledge need not be the only basis upon which climate-friendly policies can be advocated. Second, if one treats the history of research and public communication of climate consensus as a natural experiment, then the persistence of the ‘consensus gap’ suggests consensus messaging has limited efficacy (Kahan, 2015). A more recent study acknowledges the influence of political ideology and cultural values in shaping attitudes about climate, but still argues that ‘the positive effect of climate information (or conversely, the negative effect of misinformation) still plays a significant role in influencing climate literacy levels’ (Cook, 2016, p. 5). Here, consensus messaging is argued to be important because even people with left-liberal views do not know the correct level of scientific consensus. It is also argued that it is important to refute misinformation, since this is the mechanism through which beneficial framings and correct information about climate are being ‘neutralized’ (2016, p. 13). The scholarly debate about consensus messaging is intense but based on a relatively small pool of researchers and published papers. Debates within psychology, and broader debates about the usefulness of laboratory studies in assessing efficacy present a picture of an emerging field of study that has yet to reach a ‘consensus on consensus’.

1 Even if one were to identify the precise effect of consensus messaging as a variable in climate  
2 communication, the fact remains that in many fields of climate change research scientific consensus  
3 is elusive. Scientific consensus exists among some relevant, small communities (for example,  
4 attribution studies leading to affirm AGW), but there are many fields relevant to climate change  
5 impacts where such a consensus does not hold. For example, the IPCC reported in its Fifth  
6 Assessment Report that “[n]o best estimate for equilibrium climate sensitivity can now be given  
7 because of a lack of agreement on values across assessed lines of evidence and studies” (IPCC,  
8 2013, p. 16). Regarding increases in North Atlantic tropical cyclone activity “[t]here remains  
9 substantial disagreement on the relative importance of internal variability, GHG forcing and  
10 aerosols for this observed trend” (IPCC, 2013, p. 914). Since the release of the Fifth Assessment  
11 Report, diverse views have been published in the academic literature regarding the existence or  
12 otherwise of a slowdown in global surface warming (Karl et al., 2015; Fyfe et al., 2016).  
13  
14 Acknowledging scientific dissensus in these matters is not the same as rejecting climate change as a  
15 global policy problem. What this does demonstrate, however, is that in the complex, multifaceted  
16 realm of climate science, relying on scientific consensus to cauterise public debate is a self-  
17 defeating strategy. Climate science is complex and findings often contradictory and, most  
18 importantly, does not tell us anything about *what to do* about climate change. Consensus-seeking is  
19 neither a social requisite nor a normative ideal for a viable democracy (Rescher, 1993);  
20 acknowledging and valuing dissensus would allow a more publicly inclusive and accessible debate  
21 over approaches to climate change that do not prematurely foreclose particular policy options  
22 (Machin, 2013). Attempts to remove political conflict from climate change have proved to be a  
23 dead end, part of a troubling wider trend towards depoliticising key policy issues (Hay, 2007) and  
24 which is now being called into question in an ongoing ‘populist’ backlash.

1

2

3 The focus on quantifying scientific consensus as a way of trying to settle controversy or persuade  
4 the public to support specific policies reveals an unquestioned faith in a particular repertoire for  
5 producing, validating and using knowledge, what scholars in science and technology studies call  
6 ‘civic epistemology’ (Jasanoff, 2011; Miller, 2005). Consensus quantification is just one way of  
7 trying to resolve epistemic conflicts into useful evidence. Traditionally favoured in US  
8 environmental risk assessment, this approach has sometimes had the opposite effect of exacerbating  
9 controversy. For example, the attempt to identify and regulate potential carcinogens such as  
10 formaldehyde has foundered in an American regulatory system that demands quantified evidence of  
11 hazard and encourages adversarial scrutiny and endless deconstruction of competing evidentiary  
12 claims (Jasanoff, 1986).

13

14 Quantification may well work in specific times and cultures as a way of making the unseen visible  
15 or of holding governments to account, or indeed, as a symbol around which a particular community  
16 coalesces. In this way, the ‘97% consensus’ may be a number around which those already  
17 committed to climate change action who are inclined to trust climate scientists can rally (Corner &  
18 Roberts, 2014), rather than one which can be persuasive for other groups in political discussion  
19 (Kahan et al., 2011). Groups who are not persuaded by appeals to scientific authority as a  
20 justification for policy might (rationally) seek to question whether such science is ‘sound’  
21 (Demeritt, 2001), placing climate science under stresses it is ill-equipped to bear (Pearce et al.,  
22 2015). Fundamentally, no set of calculations about epistemic consensus can help to tie people  
23 together in the absence of other social connections (Miller, 2005). For example, research in political  
24 psychology emphasises the importance of morality and values in binding together societal groups

(Haidt, 2012; Lakoff, 2002) and in religious studies the role of cosmology and cultural identity (Wilson & Steger, 2013)

#### POLICYMAKERS

Even if one puts to one side the non-scientific characteristics of public communication, it is unwise to assume that closing the consensus gap will influence public policy. We present two reasons here. First, the literature on science and policy shows that the level of scientific agreement about an issue often has little influence on policy action. For example, before the Montreal negotiations to regulate chlorofluorocarbons, expectations for an ambitious treaty were low despite claims of a science consensus about long-term ozone depletion (Grundmann, 2001). However, the picture changed just prior to the negotiations with the discovery of the Antarctic ‘ozone hole’, a dramatic crisis signal that was in itself completely unexpected. Thus, the subsequent political agreement of the Montreal Protocol to regulate chlorofluorocarbons was more the result of the unexplained phenomenon of the ‘ozone hole’ prompting ozone depletion to be a matter of concern than any coalescing of scientific consensus. Influential narratives about the genesis of the Montreal Protocol maintain that not only was the process science driven, but that there was a scientific consensus that led to the political agreement (see Haas, 1992; Tolba, 2008). In fact, the process was driven by changing political constellations, mainly a U-turn of big chemical companies and the European Community, accompanied by the hot crisis signal of the ‘ozone hole’ (for details, see Benedick, 1998; Grundmann, 2001). If anything moved policy towards the agreement in Montreal it was the discovery of the ozone hole, not the agreement among atmospheric scientists about future ozone losses.

1 Second, an undue focus on scientific consensus brings about missteps in policy. By narrowing the  
2 terms of political debate about the desirability of this or that (or indeed any) climate policy to the  
3 physical sciences, scientific facts are used to substitute for matters of public concern. Legitimate  
4 and necessary public argument about whether a fact matters, and why, is short-circuited. Debates  
5 about the value of carbon emissions reductions are divorced from their social and political contexts  
6 (Cohen et al., 1998). For example, Pearce (2014) demonstrates how scientific consensus constitutes  
7 poor evidence for policy in the absence of compelling ideas and arguments, while Twyman et al.  
8 (2015) contrast the universal meaning of carbon as a scientific element with its complex local  
9 meanings within communities of the global South. In short, scientific consensus does not  
10 necessarily beget policy progress. Equally, policy progress is not necessarily dependent on  
11 acceptance of scientific consensus. The US nominee for Secretary of Energy, Governor Rick Perry,  
12 does not accept the consensus enumerated in the literature, yet still made Texas into “the nation’s  
13 leading generator of wind power, a renewable technology that he promoted heavily during his 14  
14 years in office” (Mervis, 2016). Also in the U.S., the Green Tea Party, a coalition of grassroots  
15 conservatives who have allied with environmentalists, predicates support for decentralised, solar  
16 energy primarily as an expression of libertarian values rather than as a means of reducing carbon  
17 emissions, enabling it to sidestep the cultural polarisation that exists around belief in human-caused  
18 climate change (Kormann, 2015). Research in the UK also emphasises the potential for concepts of  
19 patriotism and conservation as a means of building coalitions of support for climate policy with  
20 conservatives in the UK (Whitmarsh and Corner, 2017).

21  
22 While these examples demonstrate that the relationship between science and policy is not linear, we  
23 emphasise that scientific advice to policymakers remains a crucial element of democracy  
24 (Gluckman & Wilsdon, 2016). However, important and controversial issues within climate change,

1 such as the effect of GHGs and aerosols on monsoonal weather systems and the likelihood of ice-  
2 shelf collapse may not easily lend themselves to quantifiable claims of scientific consensus. Merely  
3 emphasising the strength of a narrowly drawn epistemic consensus underestimates the challenges of  
4 many of these issues. Expertise can play a role in policy deliberation and public endorsement, but it  
5 requires attention to judgment, context and diversity. What makes knowledge useful for policy is  
6 the ability to identify levers for action and an appreciation of how scientific advice will be  
7 interpreted and used in policy processes (Grundmann & Stehr, 2012; Geden, 2016). Engaging with  
8 this question of action inevitably means acknowledging different values and pathways forward.  
9 This opens up questions about the social dimensions of successful policy-making, beyond fantasies  
10 of technocratic solutions.

11

12 For political action on climate change, the messier work of engaging diverse publics across  
13 different scales and with different interests and affiliations is urgently needed (Jasanoff, 2010),  
14 particularly as there is strong evidence that linking climate to local issues is an important factor in  
15 successful policy implementation (Ryan, 2015). Climate change is conventionally framed as a  
16 global problem, causing tension with local policy implementation (Pearce, 2014). Thus,  
17 policymakers must often focus on other drivers in order to make successful arguments for policy;  
18 for example, improving local air quality or public transport (Ryan, 2015). In the absence of such  
19 connections, efforts to quantify scientific consensus about an abstract global process come across as  
20 strategies to close down political debate rather than ‘moving it on’. Defining the central problem in  
21 terms of reducing carbon emissions has allowed technical fixes such as geo-engineering and low-  
22 carbon energy to take centre-stage at the expense of a host of wider visions for social, economic and  
23 political change. We do not want to endorse any one of these, but merely wish to call attention to  
24 the many such visions of transformative innovation being put forward (Leach et al., 2012), and that

debating these does not need to wait until a narrow scientifically-defined consensus has been achieved.

#### BEYOND COUNTING CONSENSUS

We have highlighted the limited public and policy value of enumerating consensus within climate science. A fundamental point is that, while knowledge and concerns about anthropogenic climate change have emerged mainly from scientific enquiry, responding to climate change is a deeply political process. Social media provide one means of studying the political life of climate change. For example, the publication of the 2014 IPCC report on the physical science of climate change prompted exchanges on social media that extended into political aspects of climate change such as the media's role in publicising climate change, the politics of climate change within certain nation states, and activism around fracking (Pearce et al., 2014). This attachment of new public meanings to a scientific report opens a window into the politics of dissensus, rather than of consensus, which is critical to understand and engage with if widespread support for policy measures is to be gained. Climate change is a political challenge where establishing facts such as 'humans cause climate change' is largely irrelevant to the more important task of establishing which facts matter, to whom and why (Jasanoff, 2010).

One implication for research arising from our argument is to better understand the forms and conditions of knowledge which 'open-up' spaces for constructive policy innovation and deliberation (Stirling, 2010). Centering on consensus about climate science in public debates does little to resolve the most pressing questions in climate policy design and implementation. Instead, it distracts attention away from important practical challenges that highlight the need to negotiate between different scales of concern and action rather than box them into a linear relationship

1 between scientific consensus and political action. These challenges include the need to: i) attend to,  
2 and work with, different local meanings of climate and climate change (Hulme, 2017) and their  
3 relationship to human institutions and behaviour (Jasanoff, 2010); ii) negotiate between concerns  
4 about the planet as a whole and local expressions of development rights and responsibilities  
5 (Jasanoff & Martello, 2004); and iii) find more inclusive ways of fostering innovation in cleaner  
6 energy technologies and selecting appropriate levels of investment in climate adaptation. These  
7 challenges may also represent opportunities to connect apparently disparate issues, human values  
8 and policy objectives in productive ways. But this requires developing skills in expert judgment  
9 across multiple spaces of science, political and public discussion (Hoppe, 2011; Raman, 2014)  
10 rather than a focus on scientific consensus. At some point, political questions will necessarily be  
11 closed down, at least temporarily, when policy decisions are taken. We argue that the legitimacy of  
12 such a closing down is achieved through a process of engaging with dissent on alternative policy  
13 pathways, and indeed, actively creating the conditions for a more diverse range of possibilities to be  
14 explored where these are not already apparent.

15

## 16 CONCLUSION

17 In this commentary, we have argued that repeated efforts to shore up the scientific consensus on  
18 minimalist claims such as ‘humans cause global warming’ are distractions from the more urgent  
19 matters of knowledge, values, policy framing and public engagement. We maintain that researchers  
20 concerned about the relationship of knowledge to policy would be better advised to invest their  
21 efforts in these areas rather than in exercises of quantifying consensus about tightly drawn  
22 statements of scientific fact. This lesson goes beyond climate change and should be acknowledged  
23 by those hoping that communicating scientific consensus can defuse other environmental  
24 controversies, such as around genetically modified organisms (e.g., Lynas, 2016). In short, we need

the skills for developing and deploying expert judgment in practical contexts, rather than quantitative techniques for capturing consensus in climate science and then using such metrics as a rhetorical driver of climate policy.

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