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DEMOCRACY, PUBLIC POLICY, AND LAY ASSESSMENTS
OF SCIENTIFIC TESTIMONY¹

ABSTRACT

Responsible public policy making in a technological society must rely on complex scientific reasoning. Given that ordinary citizens cannot directly assess such reasoning, does this call the democratic legitimacy of technical public policies in question? It does not, provided citizens can make reliable second-order assessments of the consensus of trustworthy scientific experts. I develop criteria for lay assessment of scientific testimony and demonstrate, in the case of claims about anthropogenic global warming, that applying such criteria is easy for anyone of ordinary education with access to the Web. However, surveys show a gap between the scientific consensus and public opinion on global warming in the U.S. I explore some causes of this gap and argue that democratic reforms of our culture of political discourse may be able to address it.

**I. DEMOCRACY AND THE NEED FOR LAY ASSESSMENT OF
SCIENTIFIC TESTIMONY**

Critics of democracy have long complained that ordinary citizens are not competent to perform the epistemic tasks that democracy requires of them. This claim is doubtful as a general matter (Anderson 2006; Estlund 2008, 261–3). Yet, as applied to public policies justified by technical scientific reasoning, it may have more force. Responsible public policy making in a technological society relies on complex research. Lay citizens—those without scientific training—lack the knowledge needed to directly assess the merits of this research. Hence, there appears to be a tension between two demands—that public policies be empirically responsible and that they be democratically legitimate.

This tension can be resolved. We pervasively rely on others' testimony (Coady 1992). Such reliance does not compromise the democratic credentials of public policy, or challenge the capacity of citizens to perform the epistemic tasks

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democracy demands of them, so long as citizens are able to judge who can be trusted. The solution to our problem is therefore to show that laypersons have the second-order capacity to judge trustworthiness and consensus, and access to the information needed to make such judgments. In part 2 of this paper, I develop criteria laypersons can use to assess the trustworthiness of those who make scientific claims, and determine whether there is a consensus of the trustworthy. In part 3, I illustrate how laypersons can readily use these criteria to assess a current controversy in the United States: the trustworthiness of scientific claims about anthropogenic climate change, and the existence of a consensus of the trustworthy on this issue.

Despite this demonstration, all is not well in American democracy. While citizens have the capacity to reliably judge trustworthiness, many Americans appear ill-disposed to do so. In part 4 of this paper, I argue that dispositions to reliable assessment depend on social conditions that are not realized in the U.S. At least three conditions undermine such dispositions: irresponsible mass media; pervasive segregation of social networks by partisan affiliation; and “cultural cognition”—a tendency of people to assess risks on the basis of cultural values, and to distrust experts who present testimony inconvenient to those values.

It follows that creating an epistemically responsible democracy may require transforming social conditions so that ordinary citizens are disposed to reliably exercise their capacities for assessing expert trustworthiness. In part 5 of this paper, I offer some modest suggestions of how public discourse in civil society should change to make this transformation more likely.

2. PRINCIPLES FOR SECOND-ORDER LAY ASSESSMENT OF SCIENTIFIC CLAIMS

Most laypersons cannot directly judge the merits of most scientific claims. Instead, they mostly judge what to believe by judging whom to believe. Such second-order judgments address whose testimony regarding scientific matters should be trusted, and whether the trustworthy agree on the issue in question.

To make these judgments, we need criteria of trustworthiness and consensus for scientific testifiers that are easily applicable by people of ordinary education, using information to which they have ready access. I shall assume “ordinary education” here to mean no more than a high school education, including basic knowledge of how to navigate the Web, and that “ready access” includes access to the Web, but not to any scholarly sources not posted on the Web.

Judgments of trustworthiness depend on three assessments. First, one must be able to judge whether testifiers are in a position to know the claims in question—whether they have access to the evidence and the skills to evaluate it. Call this an assessment of *expertise*. Second, one must be able to judge whether testifiers are disposed to honestly communicate what they believe—not only to say what they believe, but to avoid misleading by reporting only selected beliefs, or beliefs

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liable to be misinterpreted without further explanation. Call this an assessment of *honesty*. Third, one must be able to judge whether testifiers are responsive to evidence, reasoning, and arguments others raise against their beliefs. This third criterion is needed to ensure that testifiers are basing their beliefs on a responsible exercise of their skills. Since we are assuming that lay citizens cannot directly assess whether, say, a scientist has conducted an experiment properly, or drawn appropriate conclusions from it, we seek second-order criteria for this. The mark of epistemic responsibility is responsive accountability to the community of inquirers. One's claims are suspect if one fails to hold oneself accountable to the demands for justification made by the community of inquirers. To persist in making certain claims, while ignoring counterevidence and counterarguments raised by others with relevant expertise, is to be dogmatic. To advance those claims as things others should believe on one's say-so, while refusing accountability, is to be arrogant. Dogmatists are not trustworthy, because there is no reason to believe that their claims are based on a rational assessment of evidence and arguments. The arrogant are not trustworthy, because there is reason to believe they are usurping claims to epistemic authority. Call this an assessment of *epistemic responsibility*.

Criteria for Judging Scientific Expertise. With regard to many scientific issues, various kinds of *situated knowledge*, possessed by laypersons, are often relevant to the resolution of scientific questions (Anderson 2002, 2004a). In addition, value judgments may play valid roles in constructing and assessing scientific theories, especially in the applied sciences (Anderson 1995, 2004b; Lacey 1999; Longino 1990; Wylie 1992). Scientists have no special expertise on these value judgments; in a democratic society ordinary people are entitled to criticize scientific theories for failing to incorporate certain values – or for incorporating bad values (Cole and Stewart 2001).

There nevertheless remain many technical scientific questions that require specialized expertise. We may construct a hierarchy of expertise, from lowest to highest, as follows:

- (a) Laypersons.
- (b) People with a B.S. degree, a B.A. science major, or a professional degree in an applied science specialty far removed from the field of inquiry in question.
- (c) Ph.D. scientists outside the field of inquiry.
- (d) Ph.D. scientists outside the field, but with collateral expertise (for example, a statistician who is judging the use of statistics in the field).
- (e) Ph.D. scientists trained in the field.
- (f) Scientists who are research-active in the field (regularly publish in peer-reviewed scientific journals in the field).
- (g) Scientists whose current research is widely recognized by other experts in the field, and whose findings they use as the basis for their own research. This can be determined by considering such factors as citation counts, the

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impact factors of the journals in which they publish, and record in winning major grants.

- (h) Scientists who are *leaders* in the field—who have taken leading roles in advancing theories that have won scientific consensus or opened up major new lines of research, or in developing instruments and methods that have become standard practice. In addition to the factors cited in (g), leadership is indicated by election to leadership positions in the professional societies of the field, election to honorary scientific societies, such as the National Academy of Science, and receipt of major prizes in the field, such as the Nobel Prize.

In general, the weight people should accord to others' testimony about a field increases as they go down this list, increasing especially steeply for categories (f), (g), and (h). For highly technical subjects such as climate science, those who only attain levels (b) or (c) have a low level of expertise. It is easy for laypersons to rank the expertise of virtually any testifier by these criteria. Biographical and bibliographical information on individuals is readily available on the Web.

Criteria for Judging Honesty. The following factors tend to *discredit* a person's testimony by casting doubt on their honesty:

- (a) Conflicts of interest, such as receiving funds from agents who have stake in getting people to believe a particular claim.
- (b) Evidence of previous scientific dishonesty, such as plagiarism, faking experiments or data, and repeatedly citing research that does not support one's claims.
- (c) Evidence of misleading statements, such as cherry picking data or other misleading use of statistics, or taking quotations out of context.
- (d) Persistently misrepresenting the arguments and claims of scientific opponents, or making false accusations of dishonesty against them.

This list is not exhaustive. While some cases of dishonesty are difficult for laypersons to assess, others, in which the evidence is readily available through the Web and verifiable without specialized knowledge, are clearly accessible to laypersons.

Criteria for Judging Epistemic Responsibility. The following factors indicate an evasion of accountability, and hence epistemic irresponsibility:

- (a) Evasion of peer-review: refusing to share data for no good reason; refusing to reveal one's methods and procedures in enough detail to permit others' replication of one's experiments; failing to submit research to peer-reviewed journals; publicizing one's ideas in the press or in political circles before making one's case before experts.
- (b) Dialogic irrationality: continuing to repeat claims after they have been publicly refuted by others, without responding to the refutations.

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- (c) Advancing crackpot theories in domains other than the one under investigation – for example, that HIV does not cause AIDS.
- (d) Voluntarily associating with crackpots – e.g., publishing their work, or placing one's own work for publication in their venues.

Criterion (a) is plain enough. With respect to criteria (c) and (d), we should not expect that what is recognizable as a crackpot theory to scientists – for example, homeopathy – is recognizable as such by laypersons. Only theories generally known to the public as without foundation should be counted under these criteria.

With respect to criterion (b), a person exercises *dialogical* judgment by assessing whether one side of a dispute is engaged in rational discussion with the opposing side. This is possible without making first-order judgments about the soundness of responses. To illustrate, consider the following common pattern of argument among those who reject evolutionary theory:

Evolution Denialist: There are no examples of transitional fossils between one species and another.

Paleontologist: Consider the whale. We have a line of fossils starting from the 4-legged ungulate *Sinonyx*, moving to *Pakicetus*, *Ambulocetus*, *Rodbocetus*, *Basilosaurus*, and *Dorudon*, before we get to modern toothed whales. The line is impressive for showing a gradual loss of hind limbs, steady migration of nostrils from the front to the top of the head, forming a blowhole, and continuing development of other characteristics of modern whales, such as their teeth.

Evolution Denialist: There are no examples of transitional fossils between one species and another!

A layperson can observe that the evolution denialist has failed to respond in a rational way to what the paleontologist is saying, but is merely repeating the same claim as if the refutation had never happened. The denialist is exhibiting *dialogic irrationality*, and has thereby removed himself from rational discourse. His response does not even have the *form* of a rational response – a point that can be grasped without being able to directly assess the *content* of the response. Suppose, by contrast, the denialist had responded like this:

Denialist: *Ambulocetus* and *Rodbocetus* cannot be transitional fossils to modern whales, because they are reptiles.

This has the *form* of a rational response (although not the content). In this case, one cannot fault the evolution denialist for dialogic irrationality.

Must scientists be expected to respond to every alternative theory proposed by others, in order to satisfy dialogic rationality? In fact, the scientific community spends a lot of time refuting theories well outside the scientific consensus. But one cannot always be sure that any particular alternative has caught the attention of scientists. The criterion can only be applied in cases where it can be verified that a dialogue has been engaged.

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Criteria for Judging Whether There Is a Consensus of Trustworthy Experts. Major scientific theories have thousands of scientists working on them. At the cutting edge of science, disagreement within the scientific community is normal and advantageous. Science works best when communities of inquirers are epistemically diverse with respect to fields of expertise, access to different types of relevant evidence, preferred lines and methods of investigation, and cognitive styles. Science needs a balance of diverse inquirers to formulate and investigate a wide range of hypotheses, uncover a wide range of relevant evidence, and check one another's biases (Kitcher 1990; Solomon 2001). When the vast majority of diverse inquirers converge on certain conclusions, as in evolutionary theory, a robust scientific consensus obtains. Before a consensus, the best course for laypersons is to suspend judgment. Once a consensus of trustworthy experts is consolidated, laypersons are well advised to accept the consensus even in the face of a handful of dissenting scientists, or a few instances of error or dishonesty among a few of the participants in the consensus. To follow this advice, laypersons need criteria for determining whether there is a consensus of trustworthy and responsible experts around a theory. The following sources of evidence are relevant:

- (a) Surveys, reviews, or meta-analyses of the peer-reviewed literature. Is there a common opinion expressed or presupposed by the bulk of work in the field?
- (b) Surveys of the trustworthy experts in the field. Standard principles for assessing the value of surveys apply here, such as: Were the questions biased in favor of a particular answer? Were precautions taken to ensure that only trustworthy experts were included in the survey? Did the survey take a representative sample?
- (c) Consensus statements and reports of leaders in the field, for example, reports on the matter by the National Academy of Sciences.

3. CASE STUDY: IS LAY ASSESSMENT OF THE THEORY OF ANTHROPOGENIC CLIMATE CHANGE POSSIBLE?

Let us apply these standards for evaluating scientific testimony to a case study of science with policy implications in modern democracies. In the U.S. today, there is enormous political controversy over the scientific theory of global warming or anthropogenic climate change. The theory asserts (a) that global average temperatures have been rising in recent decades; (b) that the principal basic causes of this recent rise are increasing concentrations of greenhouse gases, especially CO₂ and methane, along with changes in land use; (c) that these causes are mainly due to human activity, particularly the burning of fossil fuels, but also other practices such as cutting down forests; and (d) that the earth will continue to warm in the future if concentrations of greenhouse gases are not limited, with further melting of glaciers and ice caps, increases in sea level, changes in the frequency of major

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storms, heat waves, and droughts, and so forth. Controversy over the theory of anthropogenic climate change engages not only the question of what ought to be done about climate change, but about whether the theory enjoys scientific support. This is the type of case for which our criteria are designed.

Is it possible for ordinary members of the public, equipped with a high school education, basic Web search skills, and access to the Web, to apply the criteria above to make reliable second-order assessments of whom to believe, and thereby what to believe, about climate change? I focus on the Web because this is the most comprehensive source of information available to the general public, with the important feature that much of the Web's content not only engages current controversies, but does so across ideological and partisan lines. Much of it has a dialogical character, with proponents of rival views addressing and linking to each other's arguments. By contrast, many other sources such as broadcast media, magazines, and newspapers represent only one point of view and rarely explicitly engage criticism of their own reporting.² I contend that the information needed for the public to assess the trustworthiness of those who make claims about the theory of global warming, and the existence of a consensus of the trustworthy on this subject, is readily accessible on the Web and open to lay assessment by means of the criteria listed above. "Readily accessible" can be operationalized as follows: discoverable within the first few entries of a simple Google search, or in prominent links from these entries. We can't expect the public to dig deeper than this. That would impose excessive burdens of judgment.

The first permanent entry in a Google search of the term "global warming" is the *Wikipedia* article on this subject.³ This is a reasonable place for the public to start an investigation, given that *Wikipedia* incorporates extensive self-correcting measures, strives to enforce the political neutrality of entries, and prohibits original research—which means that claims must cite research published, and usually vetted, elsewhere. For our purposes, the most relevant section of the article is the one on "Debate and Skepticism."⁴ While this is too brief to allow application of our criteria, it leads with links to articles on "Scientific Opinion on Climate Change," "Climate Change Denial," and "Global Warming Controversy." These articles do allow application of our criteria. They indicate that all three types of ground for asserting a consensus support the claim that there is a consensus of the experts in favor of the theory of global warming.

Surveys of the Peer-Reviewed Literature. "Scientific Opinion on Climate Change"⁵ leads with an account of the Intergovernmental Panel on Climate Change Fourth Assessment Report 2007—the most important and authoritative consensus report of leading climate scientists worldwide on the findings of the peer-reviewed climate change literature. It concludes that the earth has been warming and that the chance that most of this warming is caused by human activity is at least 90%. The *Wikipedia* entry also discusses and links to a survey of the peer-reviewed literature on climate science (Oreskes 2004), which found that 75% of the papers either endorsed or took for granted the truth of anthropogenic climate change, 25% of the papers

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dealt with methodology or paleoclimate, and hence took no position on recent climate change, and none rejected the theory.

These results are relevant for two of our criteria. They show that those with expertise in the field—those who publish in peer-reviewed scientific journals—overwhelmingly accept the theory of global warming. They also show that *dissenters from the theory of global warming have either been unwilling to submit their dissenting views to the judgment of their peers, or have been unable to pass peer-review—i.e., the quality of their scientific research has not met the standards of their fields.* They have been eager to talk to the press and the public, but not to hold themselves accountable to the scientific community.⁶ This impugns both their expertise and their epistemic responsibility.

Surveys of the Experts in the Field. The same *Wikipedia* entry cites several opinion surveys of climate experts documenting their support for the theory of global warming. One survey, notable for its differentiation of the sample by level of expertise, found that affirmation of the theory of global warming increased with the expertise. Among those with greatest expertise—climatologists who actively publish papers on climate change—97% agreed that human activity is a significant contributor to global warming (Doran and Zimmerman 2009). Corroborating this survey, Anderegg and colleagues (2010) compiled a database of researchers who have published at least 20 articles in climate science and found that 97–8% of them supported the theory of global warming. They also found that scientists unconvinced of the evidence for anthropogenic warming had much less expertise than those who were convinced: they published only half as many papers and were cited far less often.

Consensus Statements and Reports of Leaders in the Field. “Scientific Opinion on Climate Change” reports that 32 national science academies and dozens of professional science societies endorse the theory of global warming. It notes that “No scientific body of national or international standing rejects the findings of human-induced effects on global warming.”

Climate change deniers have circulated lists and surveys of scientists who, they claim, reject the consensus. A little digging into lists of dissenters reported by *Wikipedia* will find the “Oregon Petition,”⁷ which claimed 31,072 signers as of 2008. However, of these, only 3,697 claimed degrees in atmospheric, environmental, or earth sciences, and only 1,400 claimed to have a Ph.D. in a climate-related subject. It is unknown how many have ever published peer-reviewed research in the field. The entry reports that *Scientific American* took a random sample of 30 signers claiming Ph.D.s in climate science and found only one active researcher, six who said they would not sign the petition today, and eight who said they had signed the petition based on an “informal evaluation” that may have been influenced by a denialist report distributed with the petition, misleadingly formatted to look as if it were published by the prestigious *Proceedings of the National Academy of Sciences*, complete with a fake volume number, page numbers, and publication date.

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The *Wikipedia* entry “Global Warming Controversy”⁸ links to the Minority Staff Report of the U.S. Senate Environment and Public Works Committee (Inhofe 2008/2009), which purports to list more than 700 scientists who reject the theory of global warming. However, it also links to a *Greenfyre* web site⁹ documenting that many of those listed are not scientists, many others are scientists who accept the theory of global warming and have (to no avail) protested their inclusion on the list, some are funded by the oil industry, and others are cranks who also believe in creationism. *Wikipedia*’s own “List of Scientists Opposing the Mainstream Scientific Assessment of Global Warming,”¹⁰ includes the most prominent dissenters who are actually scientists. Its criterion for inclusion on the list incorporates a low level of expertise: publication of at least one peer-reviewed article in a science journal in any field. It notes that “the majority” of scientists on its list have not published their dissenting views in a peer-reviewed journal.

Turning to controversies over specific claims underlying the theory of global warming, we find some patterns. Faced with an accusation of error or dishonesty, scientists who endorse the theory investigate. Sometimes they find errors, other times not. Scientists drop the discredited findings and continue their research based on the new findings. Others conduct independent studies that either corroborate or revise the original report, and publish them in peer-reviewed journals. By contrast, climate change denialists don’t publish their criticisms in peer-reviewed scientific journals. They don’t revise their conclusions when independent investigations have undermined the evidence they cite in favor of them. The claims live on forever, as if no one had answered them.

This pattern is easy to verify on *Wikipedia*. For example, its article on the “Hockey-Stick Controversy”¹¹ documents this with respect to a reconstruction of Northern Hemisphere temperatures for the past 1,000 years, which found unprecedented steep increases in temperatures in recent years (Mann, Bradley, and Hughes 1998, 1999). Denialists McIntyre and McKittrick (2003) published a critique of the reconstruction. The National Academy of Sciences investigated, finding errors in the original reconstruction but confirming the substance of the results (Brumfiel 2006). One of the authors corrected the errors and published new work based on better data, reconfirming the pattern of recent temperature increases (Jones and Mann 2004). Other scientists using different methodologies corroborated the original study finding unprecedented recent warming (Committee on Surface Temperature Reconstructions for the Last 2,000 Years 2006). Yet denialists continue to claim fraud with respect to the 1998 paper, as if nothing has happened since.¹² The same pattern appears with respect to other alleged errors or biases in global warming studies—for example, with respect to the supposed discrepancy between satellite and surface temperature readings, the urban heat island effect, and the emails stolen from the Climatic Research Unit at the University of East Anglia, which were alleged to show deception in the reconstruction of the climate record.¹³

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All of this information is available directly from *Wikipedia* or from links in *Wikipedia* entries. If one ventured past the first non-news link on a Google search of “Global Warming,” most of the links would be to other scientific sources supporting the theory of anthropogenic global warming. There are some denialist sites – for example, Globalwarming.org¹⁴ is the third site listed by Google. However, the site reports that it is funded by the Competitive Enterprise Institute, a think-tank devoted to promoting business interests and limiting the power of government, and the contributors to the site do not appear to have scientific training. The site lacks expertise, and its trustworthiness is doubtful due to a conflict of interest generated by its source of funding.

Hence, the information needed for laypersons to make sound second-order judgments of the trustworthiness of testifiers about global warming is readily available. The criteria for making such judgments are evident and easy to apply to information on the Web. At least in the case of the complex issue of anthropogenic climate change, laypersons are not disabled from making the judgments about scientific testimony needed for a democratic society to support public policies based on science.¹⁵

4. THE GAP BETWEEN CAPACITY AND DISPOSITION: SOCIAL CONDITIONS UNDERMINING TRUST IN SCIENCE

Although it is not difficult for ordinary citizens to make reliable judgments of trustworthiness and consensus about climate science, it appears that many are not disposed to do so. While the scientific community has become ever more confident that human activities are causing climate change, as expressed in successive IPCC reports, American public opinion appears to be moving in the opposite direction. A recent Gallup poll (Newport 2010) finds that 48% of the public believes that claims about the seriousness of global warming are exaggerated, up from 30% in 2006. Those who believe that human activity has caused global warming have dropped from 61% in 2007 to 50% in 2010. The fraction that believes that most scientists think global warming is occurring has dropped from 65% in 2006 to 50% today. Another survey found that since 2008, the number of Americans “dismissive” of global warming has more than doubled, to 16%, while those who are “alarmed” have nearly halved, to only 10% (Leiserowitz, Maibach, and Roser-Renouf 2010, 2).¹⁶

What explains this troubling divergence between scientific and public opinion? I suggest three interacting factors: biased and misleading media reports, the segregation of people with different opinions, and “cultural cognition” – the tendency to judge the credibility of factual claims on the basis of their congruence with one’s social or political values.

A defect of my demonstration of lay capacity to make reliable judgments of trustworthiness in scientific matters is that it requires active research on the part of ordinary citizens. While the research required is easy, millions of Americans are

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passive consumers of media reports and do not independently investigate claims the media expose them to.

This is a problem because major media reports on global warming do not accurately reflect the scientific consensus. Some newspapers represent industry-funded sources as on a par with scientists and exaggerate the extent of scientific (as opposed to political) controversy on the subject (Antilla 2005). One content analysis of *The New York Times* and *The Washington Post* found that nearly 60% of their articles on climate change suggested uncertainty about its existence or causes. This contrasts with the high level of confidence of scientists on these matters, as well as with newspapers in New Zealand and Finland, which report uncertainty in only 9% of their articles (Dispensa and Brulle 2003, 96).

Some researchers believe that the mismatch between U.S. media coverage and the scientific consensus on climate change is due to a media norm favoring “balanced” reports, in which major scientific conclusions are “balanced” by contrary opinions, regardless of the weakness of the evidence for them or the untrustworthiness of the source. This balancing norm has been found prevalent in the “prestige press” (Boykoff and Boykoff 2004). Such “balanced” news reports on climate change mislead by violating the Gricean maxim of quantity: they say more than is necessary to arrive at the truth (Grice 1975, 45–6). This generates the misleading conversational implicature that what the untrustworthy source says is worth listening to—that it bears on the truth of the question. This further conveys a misleading impression that expert scientists are deeply divided on the existence and causes of climate change, when only tiny numbers of experts dissent from the consensus. Such distortions influence public opinion. People exposed to “balanced” reports are less likely to believe that global warming is happening and less concerned about it. The critical factor by which such reports influence public opinion appears to be that they make people believe that there is no scientific consensus on the subject (Malka et al. 2009).

Journalists may think they are doing their job if “balance” takes the form of a correction of an erroneous claim. In such reports, someone is first represented as asserting a factual claim, and evidence is later cited to demonstrate that that claim is mistaken. Ironically, such reports may *increase* confidence in the erroneous claim. A standard journalistic implicature is that the opening paragraphs of a story state the main point. When an article opens with a false claim without hinting that it is false, readers may stop reading before encountering the correction buried at the back, for the order of claims suggests the order of their importance. Even if readers do read the correction, this may still reinforce belief in the erroneous claim! At least three further factors appear to be at work here. One is semantic. If the original assertion associates two ideas (“Scientists are exaggerating the extent of global warming”) and the correction merely adds a negation to the original association (“Scientists are *not* exaggerating the extent of global warming”), this simply reinforces the association of the two ideas (“scientists exaggerate” and “global warming”) in people’s minds (Mayo, Schul, and Burnstein 2004). A second

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is familiarity. Mere repetition of a claim increases its availability to recollection, which in turn increases people's belief in it. People more readily recall a repeated claim while forgetting the debunking context in which they encountered it (Skurnik, Yoon, and Schwarz 2005). A third is ideological. If people have an ideological stake in some belief, and are confronted with evidence that it is false in the context of a "balanced" corrective report, this may trigger defensive reactions (construction of counterarguments against that evidence) that *increase* their certainty in the erroneous claim (Nyhan and Reifler 2010). Thus, media reports that seem to be responsible—reporting and then refuting false scientific claims—may unintentionally mislead people into believing the falsehood.

Not all media reporting on global warming is "balanced." Some influential media sources, such as Fox News, *The Wall Street Journal*, *The New York Post*, TV broadcaster Lou Dobbs, radio broadcaster Rush Limbaugh, and opinion columnist George Will, have waged campaigns against the scientific consensus, representing global warming as an exaggeration or even a hoax.

The partisan nature of much media reporting on climate change interacts with Americans' segregation by political opinion. More and more, Americans with different political opinions are living in different neighborhoods (Bishop and Cushing 2008). Americans thus have fewer opportunities to discuss these matters face-to-face with those who disagree. When people interact in groups where everyone agrees, their opinions tend to get more extreme; thus segregation leads to polarization of opinion and less tolerance of opposing views (Sunstein 2009; Bishop and Cushing 2008). While existing measures of political segregation focus on party affiliation, there is a high correlation between party identification and opinions about global warming, with growing divergence of opinion over time. In 1998, just under half of Republicans and Democrats alike believed that global warming was happening. By 2008, 76% of Democrats but only 41% of Republicans affirmed this belief. In 2008, 59% of Republicans agreed with the claim that the news exaggerates the seriousness of global warming, compared to only 18% of Democrats (Dunlap 2008). The increasing residential segregation of Democrats and Republicans may be propelling more polarized views about global warming.

Theoretically, this deficit of face-to-face communication with the opposition could be made up through the media. People could turn to the Web to learn about different sides. However, Web users tend to confine their browsing to web sites that confirm their views. These web sites rarely link to pages that advance opposing views. Hence much of the Web appears to be structured so as to encourage people who enter it on one side of a debate to confine their browsing to opinions they already accept (Sunstein 2007, 53–7). People also tend to select traditional news media that reinforce the opinions they already have (Mutz 2006, 226–30). Those who tune their TV or radio to shows that highlight partisan views in angry and insulting ways are exposed to content that makes them perceive opposing views to be illegitimate. They come to see the opposition as not merely mistaken, but deprived (Mutz 2007). The emotional denunciation of the global warming

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theory that is common on conservative broadcasts is therefore likely to close the audience's ears to the testimony of scientists who agree with the consensus.

Biased media reporting and the segregation of public discussion could explain the persistence of a gap between scientific opinion and a major section of lay opinion. But they do not explain why the gap arose in the first place. Recall that in 1998, opinion polls did not indicate a partisan divide on the subject of global warming (Dunlap 2008). Market-oriented approaches to reducing emissions, such as an emissions tax and cap and trade, were pioneered by conservative economists, implemented with respect to other pollutants by Republican President George H. W. Bush, and touted by conservative think tanks such as the American Enterprise Institute (Green, Hayward, and Hassett 2007). Since then the public reception of science became politicized.

Thomas Hobbes (1651/1994, part I, ch. XI) remarked that “if it had been a thing contrary to any man's right of dominion, or to the interest of men that have dominion, that the three angles of a triangle should be equal to two angles of a square, that doctrine should have been, if not disputed, yet by the burning of all books of geometry suppressed, as far as he whom it concerned was able.” Anthropogenic global warming has become a claim like this. Once the danger is acknowledged, so must the urgency of concerted action to limit greenhouse gas concentrations, on any credible moral principles. This threatens the power of fossil-fuel based industries, as well as those who oppose taxation and state regulation of the economy. These industries fund a great deal of climate change denial (Oreskes and Conway 2010). A substantial part of the U.S. public trusts their testimony about climate change more than that of the consensus of scientific experts. What drives them to do so?

One theory, pioneered by Dan Kahan and Donald Braman (2006), is known as “cultural cognition.” According to cultural cognition theory, people are disposed to accept or reject factual claims based on their perceived congruence with their ideals of a good society. While people are prepared to defer to what they perceive as the scientific consensus, “[s]cientific opinion fails to quiet societal dispute on... [politically controversial] issues not because members of the public are unwilling to defer to experts but because culturally diverse persons tend to form opposing perceptions of what experts believe” (Kahan, Jenkins-Smith, and Braman 2006). This is consistent with the finding that laypersons arrive at beliefs about climate change by way of judgments of where the scientific consensus lies (Malka et al. 2009). However, laypersons' judgments of who counts as an expert and what the experts say are influenced by their social value orientations. People decide whom to trust not simply on the basis of their credentials and other objective signs of expertise, but on whether what they say comports with their values (Kahan, Braman, and Grimmelmann 2005, 8–9).

With respect to global warming, Kahan and colleagues identify two dimensions of value-orientation that affect people's trust of testifiers: hierarchy vs. egalitarianism and individualism vs. communitarianism. Advocates of

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individualism and hierarchy distrust those who claim that human activity poses serious environmental risks, because controlling those risks would require state regulation of the economy, which threatens the market liberties of individuals and the power of traditional business elites.¹⁷ By contrast, egalitarians and communitarians trust those who claim that human activity poses serious environmental risks, because they welcome state action to protect the common good against powerful business interests, which are seen as imposing risks on others (Kahan, Jenkins-Smith, and Braman 2006, 2). Confirming the predictions of cultural cognition theory, Kahan and colleagues found that experimental subjects who endorsed both hierarchical and individualist value orientations were 56.9% less likely to perceive a scientific consensus that global temperatures are increasing, and 59.2% less likely to perceive a scientific consensus that humans are causing global warming, than subjects who held both an egalitarian and communitarian value orientation (15–6). Presented with photographs and strong academic credentials of purported authors on climate science, 89% of egalitarian communitarians agreed that authors quoted as saying that global warming poses a high risk to society are “trustworthy and knowledgeable experts,” compared to only 23% of hierarchical individualists. When these same highly credentialed authors were quoted as saying that global warming poses a low risk to society, 86% of hierarchical individualists but only 51% of egalitarian communitarians agreed that they were “trustworthy and knowledgeable experts” (19).

Thus, there is evidence for at least three obstacles to accurate lay assessment of scientific claims: cultural cognition, segregation, and misleading media reports. These three factors influence the public reception of science by influencing relations of trust and distrust. People trust sources that reinforce their values and distrust sources that threaten their values. They trust sources from their parochial ingroup and distrust sources distant from them in space, cyberspace, and social identity. They even trust claims debunked by the media, if the media has broadcasted these claims often enough.

5. A DEMOCRATIC RESPONSE TO IMPROVE PUBLIC ASSESSMENTS OF SCIENTIFIC CLAIMS

Each of these obstacles to accurate public assessment of science undermines the capacity of American democracy to respond effectively to urgent problems. They raise questions about the disposition of citizens to perform the epistemic tasks that democracy needs them to perform. Is this enough to indict the democratic ideal? John Dewey argued that “the cure for the ailments of democracy is more democracy” (1927/1981, 327). I think this is right. Proposals to overcome the obstacles identified above can be fruitfully viewed as attempts to improve democracy as Dewey understood it. What Dewey meant by democracy was not simply a set of legal institutions, but a way of life, a culture that consists in “free gatherings of neighbors on the street corner to discuss back and forth what is read

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in uncensored news of the day,” and “personal day-by-day working together with others.” It requires acquiring habits in which we “treat those who disagree – even profoundly – with us as those from whom we may learn” (1939/1988, 228). In doing so, we express respect for others by treating their concerns as things that merit policy accommodation. Democracy thus involves not simply negotiating interests but affirming the value of fellow citizens as persons entitled to recognition and inclusion. I suggest that the obstacles just identified may be overcome if we take steps to make our culture more democratic.

Consider cultural cognition. What can overcome distrust of scientific claims on the basis of their perceived threat to certain groups’ social values? Braman, Kahan, and Grimmermann (2005, 297) suggest that policies drawn up in response to scientific findings can be invested with multiple meanings that affirm the values of diverse ideological groups. Policies must have content that appeals to various groups. For example, with respect to reducing global warming, Kahan suggests that nuclear power be included in the mix of policy responses, to signal to individualists that their values are being affirmed, because they see nuclear power as a symbol of “human resourcefulness” (2010, 297). This is not simply an appeal to interest. It is a symbolic recognition of a value orientation, designed to lower perceptions of threat and affirm the legitimacy and inclusion of those values and hence of the people who hold them. Perceived threats to one’s value orientation raise self-defensive obstacles to the reception of evidence. Remove the threats, affirm people’s values, and they will be more receptive to an objective assessment of the evidence. The goal is “to create an environment for the public’s open-minded, unbiased consideration of the best available scientific information” (297).

Consider next the problem of partisan segregation, which generates polarized opinions and exacerbates distrust of outgroups. To remedy segregation of opinion on the Web, Cass Sunstein recommends that web sites promoting particular political perspectives should link to sites with opposing views, and that new deliberative democracy web sites host discussions where people of varying views can meet (2007, 208–9, 193–5). Face-to-face democratic discussions among diverse citizens in real life, informed by testimony from experts and regulated by norms of civility, have been pioneered by James Fishkin, who calls them Deliberative Polls (1991, 1995). Fishkin has found that people participating in deliberative polls are often moved by information and discussion with others of diverse background and opinions, and change their opinions in ways that reflect the uptake of presented information rather than their group characteristics (Fishkin and Luskin 2005, 292). One large-scale deliberative poll undertaken in the EU, known as Europolis, considered global warming. It resulted in substantial increases in support for major action to reduce greenhouse gas emissions (Cabrera and Cavatorto 2009).

Another measure to overcome partisan segregation would be to recruit spokespersons of diverse backgrounds to inform the public of the scientific consensus. People tend to accord higher credibility to the testimony of people who share their background and value orientation. President Obama’s cultivation of ties

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to leading Evangelical Christians, such as the influential preacher Rick Warren, who promote action against global warming, implements this strategy. Warren is more likely to be able to open the minds of conservative Christians to the realities of global warming than Al Gore. On a larger and more speculative scale, the epistemic powers of democracy might be enhanced by nonpartisan integrative redistricting. Representative districts today are dominated by partisan gerrymandering, which tends to create politically homogenous districts that, in turn, lead to highly polarized politics. If candidates couldn't win elections by only appealing to their own party, they would be less likely to run on dogmatic claims that have little traction outside their party. Evidence taken seriously outside the partisan ingroup would be more salient in political campaigns and less likely to be dismissed.

Finally, norms of media reporting should be revised. Those elements of the press not dedicated to misleading the public should pay attention to cognitive psychologists on how to report scientific claims and their denials. Instead of first stating and then correcting false claims, the facts should be reported first, and affirmatively. False denials of true claims, if reported at all, should be reported as negations of the facts. Media reports should refuse the balancing norm for science reporting if there is overwhelming scientific consensus, and refuse to treat unreliable sources as if they were authoritative. However, many media outlets are partisan and most are commercial enterprises that may bet they can make more money packaging the news as entertainment that highlights drama, conflict, and controversy, however dishonest or uninformed the controversialists may be. This is why Jürgen Habermas has identified the independence of media from both political powers and commercial interests as a social condition for the success of democracy (2006). While not all media outlets can be independent, there is room to hope that new nonprofit models for journalism may fill the gap left by the decline of newspapers and create a substantial segment of news reporting that fulfills the functions demanded of it by a democratic society.

Are these suggestions utopian? Michael Fuerstein has suggested that many citizens don't care about the truth; they promulgate falsehoods to advance their own interests.¹⁸ Demagogues and propagandists do exist in democratic societies. Yet I do not think that this is true of citizens in general under fully democratic conditions. The affirmation and mutual accountability produced by democratic face-to-face dialogue among those who disagree does appear to help open people's minds to the evidence.

These suggestions are speculative, given our current state of knowledge. Psychologists and communications researchers have made more progress identifying cognitive and media biases than in testing ways to block, cancel out, or overcome them. Hence, discussion of remedies is hampered by a lack of empirical data. Democracy itself is an ongoing experiment in collective practical intelligence directed at the identification of shared problems and shared solutions to those problems. For it to succeed, its institutional and cultural norms need to be responsive to feedback on how well they enable the polity to address the problems

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it faces. The challenge of global warming raises the question of whether we can learn fast enough to avert catastrophe.

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NOTES

- 1 I thank Michael Baumann, John Dupré, Michael Fuerstein, Bruno Frey, Dan Kahan, Philip Kitcher, Henry Pollack, and the participants in the conference on Collective Knowledge and Epistemic Trust, held in Greifswald, Germany, in May 2010 (hereafter called the Greifswald Conference) for helpful comments on this paper.
- 2 "Balanced" reporting, widely followed in the mainstream media, is not truly interactive.
- 3 "Global Warming," *Wikipedia*, http://en.Wikipedia.org/wiki/Global_warming. All citations to web sites in this paper refer to pages accessed in April 2010. Since the Web is dynamic, and *Wikipedia* entries are constantly updated, there are no guarantees that exactly the same content will be accessible today. My subsequent research suggests some variation in the structure of relevant web pages, but no major substantive changes in content on this subject.
- 4 http://en.Wikipedia.org/wiki/Global_warming#Debate_and_skepticism
- 5 http://en.Wikipedia.org/wiki/Scientific_opinion_on_climate_change
- 6 An alternative hypothesis would be that climate scientists who accept anthropogenic climate change are refusing to publish sound dissenting papers. If that were so, we would expect the dissenters to have documented the existence of a substantial body of original scientific papers that have been unfairly rejected by the editors of leading scientific journals, along with referees' comments and their critiques of these comments. This has not occurred.
- 7 http://en.Wikipedia.org/wiki/Oregon_Petition
- 8 http://en.Wikipedia.org/wiki/Global_warming_controversy
- 9 "NOT Sparta – Inhofe and the 400." <http://greenfyre.wordpress.com/denier-vs-skeptic/denier-myths-debunked/not-sparta-inhofe-and-the-400/>
- 10 http://en.Wikipedia.org/wiki/List_of_scientists_opposing_the_mainstream_scientific_assessment_of_global_warming
- 11 http://en.Wikipedia.org/wiki/Hockey_stick_controversy
- 12 See, for example, (Inhofe 2008/2009), a virtual archive of every criticism ever made of the theory of anthropogenic global warming, to which accusations are only added and not removed when refuted.
- 13 I shall not document this pattern with respect to these other controversies in this paper, but will provide citations upon request.
- 14 <http://www.globalwarming.org>
- 15 Michael Fuerstein, in comments on the version of this paper I gave at the Greifswald conference, has objected that not all scientific claims are as clear-cut as global warming. With respect to supply-side economics, for example, a similar investigation of Web sources yields a confusing buzz of terminology and no clear reports of consensus. I view this as evidence of a democratic deficit. Knowledgeable citizens should be providing readily accessible and intelligible sources that inform laypersons of the fact that there is

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a consensus on supply-side economics: within the current range of marginal tax rates in the U.S., tax cuts do not pay for themselves by stimulating economic growth.

- 16 Jon Krosnick (2010a) contends that poor question wording in recent surveys may have led to exaggerated reports of public skepticism of global warming. His survey (2010b) found that 74% of the public agreed that the earth has been warming. However, it also found that, prodded to assume that global warming is happening, only 30% say it is (or would be) due to human activity, 25% attribute it to natural causes, and 45% say human and natural causes are equally responsible.
- 17 Bruno Frey, in oral comments on my paper at the Greifswald conference, objects that large corporations will profit from selling the technology needed to mitigate climate change. Yet some industries, notably those engaged in extracting and burning fossil fuels, will suffer. More importantly, action to control global warming threatens corporate freedom. Businesspeople value their freedom and would rather not be held accountable to environmentalists, whom most see as embracing anti-corporate values.
- 18 Comments on a version of this paper given at the Greifswald conference.

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