## Climate, Consensus, and Contrarians<sup>1</sup>

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**I. Introduction.** In debates over global climate change, much is made of the apparent consensus concerning the effects of human induced greenhouse gas emissions on surface temperatures. Contrarians correctly note that scientific methods are structured around dissent and criticism. Thus, they charge consensus-based science is orthogonal and even harmful to scientific inquiry. In this essay, I first present the contrarians' argument. Second, I argue that it is largely irrelevant to science used in the service of public policy decision-making. Third, I argue that policy-makers – and the public more generally – should form their beliefs about global climate change based on the scientific consensus; that is on the reliable testimony of climate scientists. Finally, I consider objections to my analysis.

**II. Scientific Consensus.** Many contrarians, and others of course, offer a rather obvious claim that agreement amongst scientists about some topic doesn't make the agreed upon proposition true nor even guarantees that it is true.<sup>2</sup> We can summarize this claim as follows:

(C) Scientific consensus about a proposition does not make or guarantee that it is true.

<sup>&</sup>lt;sup>1</sup> I wish to thank all those who attended my talk at the twelfth Inland Northwest Philosophy Conference and provided fruitful feedback and questions; specifically Stephen Crowley, Steve Gardiner, Bruce Glymour, Ben Hale, Kristen Intemann, Kristin Shrader-Frechette, Michael O'Rourke, Matt Slater, Mariam Thalos, Allen Thompson, Michael Trestman, and Dennis Walsh.

 $<sup>^{2}</sup>$  Non-contrarian Naomi Oreskes writes, "If the history of science teaches anything, it's humility. There are numerous historical examples where expert opinion turned out to be wrong... Moreover, in any scientific community, there are always some individuals who depart from generally accepted views, and occasionally they turn out to be right. At present, there is a scientific consensus on global warming, but how do we know it's not wrong?" (2007, 65)

Why accept (C)? We all know of episodes in the history of science in which there was (near) unanimous assent to some proposition but that proposition was latter shown to be false. For example, scientists believed that the Earth was at the center of our solar system, continents do not drift, and that species are not related by common descent. Examples such as these are sufficient to show that propositions are not made true by unanimous consent.<sup>3</sup> Thus, many contrarians assert to concern ourselves with scientific consensus is simply to let extra-scientific considerations drive science. More specifically in their view, we are allowing (left-leaning) political concerns dictate the content of scientific claims. As novelist Michael Crichton notes,

Let's be clear: the work of science has nothing whatever to do with consensus. Consensus is the business of politics. Science, on the contrary, requires only one investigator who happens to be right, which means that he or she has results that are verifiable by reference to the real world. In science consensus is irrelevant. What is relevant is reproducible results. The greatest scientists in history are great precisely because they broke with the consensus. There is no such thing as consensus science. If it's consensus, it isn't science. If it's science, it isn't consensus. Period. (Crichton, <u>http://www.crichton-official.com/speech-alienscauseglobalwarming.html</u>)<sup>4</sup>

Likewise, by focusing on consensus we are reducing dissent and that undercuts the scientific

process.<sup>5</sup> For example, MIT professor of meteorology and contrarian Richard Lindzen writes,

With respect to science, the assumption behind consensus is that science is a source of authority and that authority increases with the number of scientists. Of course, science is not primarily a source of authority. Rather, it is a particularly effective approach to

<sup>&</sup>lt;sup>3</sup> A technical aside: there are propositions which can be made true by universal assent; namely those whose truth conditions concern universal assent. However, those very propositions are not made true by universal assent *to them*. Also, on one type of pragmatist theory of truth, a proposition is true just in case it would be agreed with by fully informed and fully rational inquirers who had an indefinite amount of time to investigate them. Such theories though have serious problems. For example, pick some particular day in the Jurassic and ask whether the number of dinosaurs existing on that day is even or odd. There is no good reason to believe such a question could be answered in even in an ideal inquiry.

<sup>&</sup>lt;sup>4</sup> Crichton naively assumes a myth of the "great scientist" and likewise seems to ignore the fact that the notion of *reproducibility* is social since it concerns what a suite of scientists could or could not do.

<sup>&</sup>lt;sup>5</sup> For a popular argument for these sorts of claims, see Horner (2007) especially his chapter five and fiction writer Michael Crichton's critique of climate change science in his novel *State of Fear*.

inquiry and analysis. Skepticism is essential to science; consensus is foreign. (Horner 2007, 86)<sup>6</sup>

One can argue that by focusing on consensus we do damage to scientific inquiry. Philosophers of science have recognized that even if scientists are primarily motivated by considerations other than truth - interest in peer recognition say - this can be conducive to scientific progress (Hull 1988 and Kitcher 1993). For example, suppose a scientist A is very much wedded to a particular hypothesis. It is in his interest for it to be highly confirmed. However, scientist *B* accepts a contrary hypothesis and thus it is in her interest to challenge *A*'s claims. Finally, allies of A will use A's work in their own investigations; hence, it is in their interest to make sure that A's hypothesis is genuinely highly confirmed and likewise for B. These social processes create a climate of critical engagement and thus dissent is a crucial element in weeding out reliable from unreliable work, significant truths from falsehoods. These mechanisms at the individual level have "personal" ingredients which are harnessed socially to produce a mechanism for scientific progress. Hence, dissent is crucial for the discovery of significant truths and this may be so even if individual scientists are not particularly interested in truth per se. So, why should consensus matter with regard to anthropogenic climate change where it is often discussed?

**III. Global Climate Change Consensus.** To zero in on the debate, let's use the following claim as an example:

(GW) Average surface temperatures are increasing in part because of human greenhouse gas emissions.

<sup>&</sup>lt;sup>6</sup> Even if Lindzen was correct that science is not primarily a "source of authority", this says nothing about whether it might be secondarily so as I shall argue later.

Naomi Oreskes (2004) forcefully argues there is close to complete agreement amongst professional climate scientists on (GW)'s truth. She and her graduate students surveyed over 928 abstracts of articles published in peer-reviewed journals with the search term "global climate change" through the Institute of Scientific Information's Web of Science. Each essay was placed in one of six categories: (1) those explicitly endorsing the consensus position, (2) those explicitly refuting the consensus position, (3) those discussing methods and techniques for measuring, monitoring, or predicting climate change, (4) those discussing potential or documenting actual impacts of climate change, (5) those dealing with paleoclimatic change, and (6) those proposing mitigation strategies. Ultimately what they found was there were no papers of category (2).



**Figure 1** A Web of Science analysis of 928 abstracts using the keywords "global climate change." No papers in the sample provided scientific data to refute the consensus position on global climate change (Oreskes 2004).

That is, she found no essay which disagreed with the claim "Global climate change is occurring, and human activities are at least part of the reason why."

There are variety of criticisms leveled at Oreske's study. One criticism raised by Robert Pielke Jr. (2005) is that the Oreskes' study does not represent the "spread" consistent with those who agree with the IPCC's reports. That is, that can agree with (GW) but disagree over many

other propositions concerning global climate change. This is perfectly correct but irrelevant to the study's methods and findings which concern the focal proposition (GW). Others have suggested some duplicity on Oreskes part given that in the 2004 paper she claimed they searched with the terms "climate change" which would have turned up ten thousand papers but this a simple mistake which was later corrected in *Science*. Most importantly, one might argue that consistency with the proposition "Global climate change is occurring, and human activities are at least part of the reason why" is insufficient to demonstrate agreement with the proposition. Oreskes provides the correct response to this point. "If a conclusion is widely accepted, then it is not necessary to reiterate it within the context of expert discussion. Scientists generally focus their discussions on questions that are still disputed or unanswered rather than on matters about which everyone agrees" (2007, 72).<sup>7</sup> Similarly, one would not see common descent argued for or affirmed in an essay in *Evolution*; it is taken for granted. Hence, if one only included support by those papers which provide explicit acceptance, then it would underestimate the acceptance of evolution and by analogy global climate change as in part human-caused.

Lest one think this study is a fluke or non-representative, consider the following study done by Doran and Zimmerman (2009). They sent a survey to 10, 257 earth scientists. The individuals surveyed came from geosciences faculty, researchers at state geological facilities associated with local universities, researchers at U.S. research facilities, and U.S. Department of Energy national laboratories, etc (2009, 21). Of the questions asked, their essay discusses two:

<sup>&</sup>lt;sup>7</sup> Michael Crichton writes, "Finally, I would remind you to notice where the claim of consensus is invoked. Consensus is invoked only in situations where the science is not solid enough. Nobody says the consensus of scientists agrees that  $E = mc^2$ . Nobody says the consensus is that the sun is 93 million miles away. It would never occur to anyone to speak that way" (<u>http://www.crichton-official.com/speech-alienscauseglobalwarming.html</u>). This is false. Crichton does not deny common descent even though consensus concerning common descent is invoked. The reason for this is that those who deny common descent are not evolutionary biologists but those outside the science and it is with regard to those individuals that consensus is being invoked.

- 1. When compared with pre-1800s levels, do think that mean global temperatures have generally risen, fallen, or remained relatively constant?
- 2. Do you think human activity is a significant contributing factor in changing mean global temperatures?

Here are their results.



**Figure 2** Response distribution to survey question (2) and the general survey data come from a 2008 Gallop poll (Doran and Zimmerman 2009).

Their results showed that 90% answered "risen" to (1) and 82% answer "yes" to (2). Of those who listed "climate science" as their area of expertise and who published more than 50% of their recent peer reviewed papers in this area, 96.2% (76/79) answered "risen" to (1) and 97.4% (75/77) to (2).<sup>8</sup>

One response to such work is – So what? We know that there are dissenters with regard to (GW). Why does their opinion not receive differential weighting? One common argument given for dismissing contrarians' views has been offered in Ross Gelbspan's book *The Heat is On* (1997). Gelbspan documents how contrarian scientists have been funded by the oil and gas

 $<sup>^{8}</sup>$  It is interesting to note that amongst meteorologists, those that answered "yes" to (2) are 64% (23/36) and the general public from a Gallop poll would answer (2) as "yes" with 58%. Meterologists however study very different scales than climatologists; we generally do not cellular biologists what they epistemic status of the theory of evolution is.

industry and many in this industry have generally been skeptical of (GW).<sup>9</sup> The conclusion he draws is that these contrarians deny (GW) for financial gain. Let's consider one example. Patrick Michaels is a professor of Environmental Science at the University of Virginia. He is affiliated with the George C. Marshall Institute and the Cato Institute both of which are conservative think tanks. Gelbspan and others claim that he has received more than \$115,000 from coal and energy interests. A quarterly publication *World Climate Review* which Michaels founded was funded by the contrarian group Western Fuels. Finally, he was paid \$100,000 by the electric utility Intermountain Rural Electric Association which also is contrarian in nature. This is a suggestive argument; however, it is a circumstantial ad hominem. That is, we are conflating the truth of the denial of (GW) and Michael's associations. To correct the "Gelbspan argument" we would need to show that Michaels denies (GW) *because of* the money he has received which requires more evidence than Gelbspan has supplied.<sup>10</sup>

Having said this, one can argue indirectly that contrarian's denial of (GW) is indicative of bias. If someone trained in climate science offers arguments whose premises are poorly supported and contrary evidence is commonplace amongst said scientists, then this is evidence that they are distorting the facts. For example, it is common for contrarians to argue that since we cannot successfully predict weather more than twelve days hence, we shouldn't trust the projections of global circulation models. Likewise, many offer alternative explanations of the recent warming such as a solar variability hypothesis. However, in both cases, there are ready

<sup>&</sup>lt;sup>9</sup> Recently, due to the work of Joseph Romm, the term 'contrarian' has been sometimes replaced with the terms 'denier' and 'delayer' with regard to global climate change. A denier denies the truth or justification for (GW). A delayer accepts (GW) but claims that we are impotent to do anything about it, it would be too expensive, or there are more efficient ways of using our GNPs. Examples of these two positions would be Patrick Michaels and Bjorn Lomborg. A contrarian is typically a denier but some are delayers.

<sup>&</sup>lt;sup>10</sup> I thank Kristin Shrader-Frechette for thoughtful comments on this point.

responses to these claims with which climate scientists are familiar. It is often much easier to predict long-term global averages than particular weather patterns in localized regions. By way of analogy, it will be very difficult to ascertain whether a coin is biased from one flip but as one increases the number of tosses the potential bias will become increasingly obvious. Likewise, though the sun has been more "active" in the last sixty years than in the last 1150 years, the correlation between solar activity and temperature has disappeared since the 1970s (Usoskin et. al. (2005), Lockwood et. al. (2007)). Hence, an increase in average surface temperature cannot be accounted for by changes in solar activity.

While I wholeheartedly agree that dissent is absolutely essential to scientific advances, in other contexts, dissent of the minority stands in the way. Specifically, dissent is essential to scientific inquiry; however, when scientific hypotheses are brought to bear on policy matters, consensus is incredibly important. This is because we are now considering the beliefs of policy-makers who do not have the relevant expertise in the matters of interest. Suppose you are not a climatologist but are a policy-maker; should you believe (GW)? Well, if the majority of climatologists do believe it and you are in no position to seriously evaluate the evidence on your own, then it seems that you should. Your evidence will not directly involve tree rings, glacial retreat, ice cores, satellite measurements, etc. since you don't understand these topics. Rather, you must determine who is a reasonable authority on the issue and form your beliefs in accordance with their opinion.<sup>11</sup> As a way of conceptualizing the point, consider the following simple model. Suppose that

<sup>&</sup>lt;sup>11</sup> I should note that this point is not unique to the environmental sciences, far from it. For example, the epistemic justification for many of our beliefs depends on the reliability of authorities (Goldman1999). For example, most of us could not prove the fundamental theorem of calculus which shows how the differentiation and integration are related. However, in our mathematical work, we presuppose that it is true and can be shown so.

- the correctness of a expert's opinion is probabilistically independent of other experts, and
- and the probability that expert *i* is correct about a proposition *q* is  $p_i$ .

Hence, the probability that expert *i* is wrong about *q* is  $(1 - p_i)$ . If the number of experts that agree with the proposition is *n*, then the probability that they are all correct is  $\prod_{i=1}^{n} p_i$ . Similarly, the probability that they are all wrong is  $\prod_{i=1}^{n} (1 - p_i)$ . Hence, as *n* increases, the probability that they are all wrong gets smaller and smaller.<sup>12</sup> It is unreasonable to think that each expert *i* judgment is independent of each other statistically speaking. Hence, more realistically, we might suppose that research groups are statistically independent of one another though individuals in those groups are not (*i* now represents a token research group). It should also be noted that strict independence need not be assumed since one can show that the probability that a majority selects the correct alternative is inversely related to the average of the correlation coefficients of the expert group's opinions (Ladha 1992). Still, the points are these: first, under reasonable assumptions, if the majority of scientists or research groups accept (GW), then as that number grows the probability that they are wrong shrinks, and second, one should form their degree of belief in (GW) in accordance to this majority opinion.<sup>13</sup>

The most reasonable method for doing this in a scientific context is to determine either a) who are the relevant peer-reviewed scientists who are competent with regard to (GW) or b) who are the scientific bodies composed of such individuals that offer summary statements about (GW)'s truth. The Intergovernmental Panel on Climate Change (IPCC) is just such an

<sup>&</sup>lt;sup>12</sup> Incidentally, this is an instance of Condorcet's jury theorem provided we assume each expert *i*'s "vote" is statistically independent of the others and each  $p_i > \frac{1}{2}$ . When each  $p_i \leq \frac{1}{2}$  then a correct vote is maximized by having one and only voter. I thank Bruce Glymour for providing useful discussion on Condorcet's Jury Theorem and ways of relaxing its assumptions.

<sup>&</sup>lt;sup>13</sup> For example, one might propose the following: one's degree of belief p in a proposition q should be the average value of the majority expert's degree of belief in q.

organization. The IPCC is one of the largest science-related projects ever created. It does not conduct research of its own; rather, it evaluates the work of scientists around the world and then synthesizes this work for policymakers in a report and a summary. There are three working groups. The first works on the physical science behind climate change. The second considers the impacts, adaption, and vulnerability due to climate change. The third group concerns mitigation or how we can reduce the climate change which will occur. Each IPCC assessment involves between 100 and 200 researchers who are nominated by their own government or nongovernmental organizations. There are two scientists in charge of each working group - one from a developed and one from a developing country. These researchers produce draft reports which are then reviewed by several hundred expert reviewers. Finally, these documents are further examined by reviewers within each government and then accepted at the plenary meeting. It should also be noted that the IPCC is not the only organization who have stated that humans are having an effect on our climate through greenhouse gas emissions. The American Academy of Science, the American Meteorological Association, the American Geophysical Union, and the American Association for the Advancement of Science have issued similar statements.<sup>14</sup>

So, here is one way consensus matters – consensus among appropriately independent inquirers is indirect evidence for a proposition's truth when you lack the relevant expertise. Scientific consensus contrary to contrarians does not threaten the process of science. Dissent is crucial for as we say "normal science". Contrarians should continue their criticism and battle it out in peer reviewed journals (which they generally do not do). However, when it comes to nonexpert opinion and specifically environmental policy, consensus matters a lot. This point simply

<sup>&</sup>lt;sup>14</sup> Stephen Gardiner has argued in conversation that the opinions of the IPCC are often more conservative that basic climate science would suggest. This is due in large part to the very nature of how agreement amongst actors is produced. If this is correct, then the IPCC will often understate the seriousness of global climate change impacts.

pivots on drawing a distinction between what happens *inside* science and what happens *outside* of science as an institution. Thought they are often inextricably connected, they are conceptually distinct. When Michael Crichton writes, "When did 'skeptic' become a dirty word in science? When did a skeptic require quotation marks around it?" he clearly is confusing the two.<sup>15</sup>

**IV. Objections.** I now want to consider three objections. First, the formal model discussed above assumed probabilistic independence between the opinions of experts or research groups. However, it is extremely unlikely that such independence occurs. For example, amongst climate scientists there is common disciplinary training which leads to a common background of methods, theories, and values.<sup>16</sup> While this is certainly true, there are several responses to this objection. First, as we have seen, the formal model above can be relaxed such that correlations between experts or research groups can be present and yet as the number of experts increases the probability that they will correctly agree increases. Second, it is crucial when examining consensus opinion we compare the correct actors. Different research groups examine different elements of the evidence that anthropogenic global climate change is occurring. Physicists have successfully contended that increasing greenhouse gases will (ceteris paribus) increase temperature, earth scientists have demonstrated that CO<sub>2</sub> levels are increasing over time, conservation biologists have shown that species are moving poleward, oceanographers have collected data demonstrating that sea-levels are rising, glaciologists have argued that many glaciers are shrinking over time, etc. Each of these groups share some common elements in their scientific background; however, these meager shared elements do not uniquely determine their

<sup>&</sup>lt;sup>15</sup> http://www.crichton-official.com/speech-alienscauseglobalwarming.html.

<sup>&</sup>lt;sup>16</sup> Here I am indebted to Kristin Intemann for forcefully presenting this objection and providing very productive conversation on how one might respond to it.

views about (GW) (otherwise properly trained contrarians would believe (GW) as well). Rather, their relatively independent backgrounds coupled with the domain-specific empirical evidence results in a consensus opinion regarding (GW). More generally, what matters is not simply consensus regarding (GW) but that the consensus is *produced in the right manner*. Specifically, relatively independent experts arrive at a consensus because of the consilience of different research groups examining different bodies of evidence.

Second, one might argue that the analysis above depends on distinguishing between *pure science* and *applied science*. In the former, scientists are interested in determining answers to significant questions considering only their epistemic credentials and independent of their social or political implications. In the latter, scientists are interested in questions with regard to both their epistemic credentials but also in their social or political implications. Much research in the philosophy, history, and social studies of science suggest that such a distinction in practice is very difficult to make. For example, what makes a question "significant" often depends on a multidimensional array of factors including epistemic, social, and ethical considerations.

Fair enough. However, the point being made above is not that one can distinguish between pure and applied science but whose beliefs or degrees of beliefs are being considered. Consensus matters particularly when we are considered with laypersons – those people who are incapable of understanding and evaluating basic climate science. For them, the argument above suggests that they should calibrate their degrees of belief in light of the beliefs of climate scientists themselves – essentially they are being treated as "reliable instruments". Hence, the distinction is not between pure and applied science but between two different epistemic communities in which one is dependent on the other.

A third worry is this – why should consensus only matter with regard to how policymakers calibrate their degrees of beliefs? Couldn't scientists do the same and wouldn't that be problematic? Climate scientists themselves form their degrees of belief in light of evidence tree rings, glacial retreat, ice cores, satellite measurements, etc. That is, their degrees of belief are informed by the empirical evidence itself. However, consensus can play a role in scientists' belief formation as well. For example, the citation of other peer-reviewed papers supporting their interpretation of findings is essentially testimonial evidence for the specific significant questions they investigate. True, it is not consensus as discussed above, but they too use the work of other scientists in a similar way. The testimonial evidence scientists use in the other work is unproblematic provided that *some* are adjusting their degrees of belief in light of the empirical evidence – a paleoclimatologist, climate modeler, and environmental chemist – depend on each other's informed opinions about which they are not experts; however, on matters of global climate change they do so in a piecemeal and not in wholesale way.

**V. Conclusion.** In this essay, I have presented the contrarian's argument against consensus science. Second, I argued that we should distinguish between whose beliefs or degrees of belief are being considered – that of scientists themselves or policy-makers. Third, I argued that policy-makers should form their beliefs or degrees of belief in accordance with climate scientists themselves reflecting the consensus position that is well-documented. Finally, I considered three objections to the above analysis suggesting none of these challenges the argument above.

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