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# Seepage: Climate change denial and its effect on the scientific community

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ABSTRACT

Vested interests and political agents have long opposed political or regulatory action in response to climate change by appealing to scientific uncertainty. Here we examine the effect of such contrarian talking points on the scientific community itself. We show that although scientists are trained in dealing with uncertainty, there are several psychological reasons why scientists may nevertheless be susceptible to uncertainty-based argumentation, even when scientists recognize those arguments as false and are actively rebutting them. Specifically, we show that prolonged stereotype threat, pluralistic ignorance, and a form of projection (the third-person effect) may cause scientists to take positions that they would be less likely to take in the absence of outspoken public opposition. We illustrate the consequences of seepage from public debate into the scientific process with a case study involving the interpretation of temperature trends from the last 15 years. We offer ways in which the scientific community can detect and avoid such inadvertent seepage.


## 1. Introduction

Opponents of the scientific consensus on climate change—defined here broadly as the agreement that (a) the Earth is warming and (b) most of that warming has been due to human greenhouse gas emissions (Anderegg et al., 2010; Doran and Zimmerman, 2009; Oreskes, 2004)—have often emphasized scientific uncertainty in order to forestall mitigative action (e.g., Kim, 2011; Freudenburg et al., 2008; Nisbet, 2009). Those arguments often exaggerate, for political or ideological reasons, the actual degree of uncertainty in the scientific community or imply that uncertainty justifies inaction (e.g., Hoggan and Littlemore, 2009; Jacques et al., 2008; McCright and Dunlap, 2003, 2010; Mooney, 2007; Oreskes and Conway, 2010; Stocking and Holstein, 2009). Appeals to uncertainty are so pervasive in political and lobbying circles that they have attracted scholarly attention under the name "Scientific Certainty Argumentation Methods", or "SCAM" for short (Freudenburg et al., 2008). SCAMs are widespread and arguably have postponed regulatory action on many environmental problems, including climate change (Freudenburg et al., 2008).

In this article, we argue that the appeal to uncertainty in public discourse, together with other contrarian talking points, has "seeped" back into the relevant scientific community. We suggest that in response to constant, and sometimes toxic, public challenges, scientists have over-emphasized scientific uncertainty, and have inadvertently allowed contrarian claims to affect how they themselves speak, and perhaps even think, about their own research. We show that even when scientists are *rebutting* contrarian talking points, they often do so within a framing and within a linguistic landscape created by denial, and often in a manner that reinforces the contrarian claim. This "seepage" has arguably contributed to a widespread tendency to understate the severity of the climate problem (e.g., Brysse et al., 2013; Freudenburg and Muselli, 2010).

We first review known reasons why such seepage may occur; we then present a case study to argue that it has occurred and that

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contrarian talking points have unduly influenced scientific discourse; and we then point to ways in which such seepage may be avoided in future.

## 2. The psychological allure of uncertainty

There are several known psychological factors that can explain why SCAMs can be an effective tool in public debate to delay policy action. Perhaps the most inhibiting type of uncertainty arises from conflicts or apparent disagreements among scientists. Smithson (1999) demonstrated that conflicting estimates from experts generate more severe doubts in participants' minds than agreed but imprecise estimates. Conflicting estimates also tend to decrease trust in the experts. Cabantous (2007) replicated these findings with a sample of insurers, who assigned higher premiums to risks for which the risk information was conflicting than to risks where that information was consensual but uncertain (see also Cabantous et al., 2011). Any appearance of expert disagreement in public debate is therefore likely to undermine people's perception of the underlying science, even if an issue is considered consensual within the scientific community.

Relatedly, people prefer to bet on known rather than unknown probabilities, even if the expected outcome is mathematically identical, a preference known as ambiguity aversion (Ellsberg, 1961; Fox and Tversky, 1995). In the context of climate change, political decisions inevitably involve options with uncertain outcomes. The "doing something about climate change" options appear laden with unknown probabilities ("what will happen to the economy?"), whereas the "business as usual" (BAU) option gives the appearance of being associated with a known outcome ("won't things just stay the same?"). Ambiguity aversion leads us to avoid taking action—we prefer to take a gamble on what we "know" (i.e., "life seems fine now") rather than on what we do not know ("the Earth might warm by 5 °C or it might warm only 1 °C").

Ambiguity aversion is amplified by two further processes: first, uncertainty breeds wishful thinking (Markowitz and Shariff, 2012), reinforcing the possibility that the Earth will warm by 1 °C rather than 5 °C. Second, people generally have a strong preference for the current state of affairs over change, a tendency known as the status quo bias (e.g., Eidelman and Crandall, 2012; Gal, 2006; Roca and Maule, 2009). The status quo bias arises from a pure preference for the current state of affairs (Samuelson and Zeckhauser, 1988) as well as a preference to do nothing (i.e., an "omission bias"; Ritov and Baron, 1992). This inertia, along with the well-documented tendency to discount future losses so they seem less pertinent than immediate costs (e.g., Hardisty and Weber, 2009), further mutes people's appetite for action. At a political level, the relative difficulty of "making something happen" over "leaving things as they are" was illustrated by McKay (2012), who showed that it takes 3.5 times as many lobbyists to make something happen in the U.S. Congress (positive lobbying) than to keep it from happening (negative lobbying).

In sum, uncertainty is effective as a strategy to delay action because it resonates with human tendencies towards preference for preservation of the status quo. Uncertainty arising out of perceived expert disagreement is particularly effective at generating public doubt about an issue.

## 3. From public inertia to the scientific landscape of reticence

Scientists might think that they are not susceptible to such common errors of reasoning, especially given that the scientific community has developed various regimes of dealing with uncertainty, including quantifying it (e.g., Henrion and Fischhoff, 1986) and providing guidelines for how best to communicate it (Budescu et al., 2011; Intergovernmental Panel on Climate Change, 2005). In contrast to this belief, evidence suggests that the public's asymmetrical response to uncertainty parallels a similar asymmetry within the scientific community. Risbey (2008) identified an asymmetry with which scientific warnings about climate change are evaluated within the science community: descriptions of impacts in serious terms are often dismissed as "value laden," whereas equally subjective language describing impacts as mild is not considered value laden but is accepted without challenge. Hansen (2007) made a similar point about general scientific "reticence"; that is, the undue downplaying of dangers when the reality is (or at least may be) more alarming.

At a coarse level of analysis, the results of undue conservatism and reticence were reflected in the fourth assessment report of the Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change, 2007), which has subsequently been shown to have been unduly conservative rather than adventurous. Freudenburg and Muselli (2010) showed that the vast majority of scientific findings that were reported in the media subsequent to the IPCC's 2007 report revealed the climate to change *faster* than predicted. The *Copenhagen Diagnosis*, by a group of leading climate scientists, came to a similar conclusion (Allison et al., 2009).

These analyses have been echoed by several meta-analyses of ecological data: for example, many terrestrial organisms are moving to higher latitudes and higher elevations at greater speeds than previously assumed (Chen et al., 2011), and empirical observations of the risk of extinction are often outpacing predictions (Maclean and Wilson, 2011). Likewise, Brysse et al. (2013) provided detailed evidence of systematic under-predictions of key attributes of global warming by scientists, including Arctic ice depletion and the possible disintegration of the West Antarctic ice sheet. Brysse et al. (2013) referred to this tendency as "erring on the side of least drama." The authors attribute this tendency to the internal norms of scientific research, which, valorizing dispassion and restraint, lead scientists to tend to downplay dramatic, alarming, or upsetting results.

This broad background of reticence and under-prediction provides the departure point for our present investigation, which has two principal aims: the first aim is to survey the known psychological mechanisms by which scientists might be affected by contrarian public discourse. There is considerable scholarly agreement that any research related to climate change is subject to organized denial (e.g., Hoggan and Littlemore, 2009; Jacques et al., 2008; McCright and Dunlap, 2003, 2010; Mooney, 2007; Oreskes and Conway, 2010; Stocking and Holstein, 2009), and there is strong evidence that this denial has affected public discourse (Boykoff and Boykoff, 2004; Boykoff, 2013), with attendant distortions of the public's perception of the prevailing opinions in society (Leviston et al., 2013) and among scientists (Ding et al., 2011; Lewandowsky et al., 2013). Given that science operates in a societal context, there are strong a priori grounds to assume that relentless denial may find some degree of reflection in the scientific community. We refer to this potential phenomenon as "seepage"—defined as the infiltration and influence of what are essentially non-scientific claims into scientific work and discourse. Our second aim is to present specific instances of such seepage on scientific thinking. We focus on one suggestive case and argue that it has been to the public's detriment because of the reinforcement and amplification of the prevailing tendency of scientists towards reticence and erring on the side of least drama.

## 4. The social processes underlying seepage

In theory, scientists evaluate evidence by the internal norms of their expert communities. How citizens feel about matters such as evolution or climate change should, ideally, be irrelevant to how