Science, politics, and rationality in a partisan era

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Abstract
Science plays an essential role in public policy by outlining the factual foundations of policy debates. As a result, science often becomes a political football, with partisans dismissing or misrepresenting scientific findings that conflict with their political views. Here I argue that scientists can most effectively speak out, not as activists supporting particular political causes, but instead as advocates for a fundamentally rational public discourse, one that starts from the facts—not from whatever one might choose to believe—and then explores how society should respond to the challenges that they pose.

1. A Vignette of Science in Action

Some years ago, Dyan Whyte came to see me. Dyan was a graduate student in our department, and was looking for a topic for her Master’s thesis. I began the way I often do in such discussions: “So, what have you been thinking about so far?” Dyan said that in her previous work, she had been doing some site characterization on an abandoned mercury mine in the California Coast Range north of San Francisco. Cinnabar had been mined there in the 1960s and roasted to release its mercury, and the resulting mercury-laden mine waste had been simply dumped into an adjacent ravine. Shortly thereafter, the mining company went bankrupt. In the years since then, gullies had formed in the abandoned tailings pile, and the processed ore was now eroding into a nearby stream. That stream led to Tomales Bay, Dyan explained, where there was an active sport fishery, and where oysters were grown for human consumption.

My blood ran cold. Mercury is a potent neurotoxin and can lead to horrible developmental problems. This is not something you want in your fish or your oysters. And bioaccumulation magnifies its concentrations through the aquatic food chain.

Still, as with everything in ecotoxicology, dosage matters. “So, Dyan,” I said, trying to suppress a rising sense of dread, “has anyone measured how much mercury is leaving the mine site in that little stream?”

“No, not really.”

“Um, so why are you still looking for a thesis project?”

Getting good measurements ultimately took several false starts of the kind that are typical in this sort of work, but are rarely detailed in the prettified accounts that ultimately appear in academic journals. One key challenge for us was that almost all (99.97%, to be precise) of the mercury was transported along with sediment, and almost all of the sediment was transported during brief storm events. These storms came unpredictably, and often in the middle of the night when they would be missed by typical sampling schemes. So we installed sensors to continuously monitor the stream flow and sediment load, and then multiplied by the mercury concentrations in the water and sediment to calculate the total mercury load carried by the stream.

Finally Dyan had her answer: in a single 2 month period in the winter of 1998, her small stream had transported roughly 82 kg of mercury downstream toward the bay [Whyte and Kirchner, 2000]. Eighty-two kilograms of mercury is a lot, given that water quality objectives for mercury are expressed in parts per trillion.

What happened next illustrates the power of good data. Within a matter of weeks, the mine had been declared an emergency Superfund site, and state and federal officials were meeting to devise a plan, with several million dollars on the table to fund a remediation effort. Over the next few months, the waste pile was recontoured and stabilized, and its runoff rerouted [Smelser and Whyte, 2001]. And the fish and oysters...
were tested for mercury, resulting in consumption advisories being issued for all predatory fish in Tomales Bay (the oysters, which were grown suspended above the bay's sediments, checked out fine). There had been concerns about the mine for decades, and any of these actions could have been taken years earlier, but little was done until Dyans thesis project quantified the hazard.

But did the remediation effort actually reduce that hazard? Several years later, measurements by Dyans and her team showed that mercury fluxes leaving the mine site were about 99.9% lower than in her pre-remediation monitoring. But this seemingly spectacular result—a 1000-fold improvement!—was confounded by the fact that the rainstorms during the post-remediation monitoring period were much weaker and less frequent. Thus, we had to develop new methods to distinguish the effects of the site remediation from the effects of the differences in weather between the pre-remediation and post-remediation monitoring periods. Our analysis showed that the remediation itself was about 93% effective, with the rest of the reduction in mercury loads being attributable to the differences in weather conditions [Kirchner et al., 2011].

This case history shows science doing what science does best: providing the best available factual information (subject, as always, to constraints of time and money) to support decision-making in the public interest. That is not to say that the science here was perfect; indeed, in our reanalysis of the pre-remediation measurements from 1998, better streamflow calibrations led to an updated estimate that 135 kg of mercury left the mine site in 2 months [Kirchner et al., 2011] rather than our previous estimate of 82 kg [Whyte and Kirchner, 2000]. This is a substantial difference, but one with little practical consequence since either number would be grounds for serious concern. Likewise, the remediation technology was also imperfect since it still left a significant, though much reduced, mercury flux from the mine; indeed, the geological prevalence of mercury in this region means that even natural, undisturbed streams will often violate clean water standards.

2. Science in the Public Interest

Nonetheless, this case is a modest vignette illustrating how science can serve the public interest, as it does every day through the work of scientists around the world. At its best, science provides the factual basis for making decisions or taking action, but what society does with those facts will be an inherently political question. The outcome will depend not just on the facts, but also on societal values. For example, although our measurements at the mercury mine demonstrated a serious hazard, society could conceivably have decided that this hazard was not important enough to justify an expensive remediation effort. Given the societal priorities embedded in the Superfund law, however, the basis for taking action was clear.

In our case, translating science into action was straightforward. Our data were unambiguous and the hazards of mercury contamination were not politically controversial. There were no interest groups questioning our measurements, our motives, or our impartiality, or claiming that the transport and fate of mercury in the environment is not settled science, or arguing that mercury exposure is actually good for you.

Where societal values are not as widely shared, or where economic and political interests are more entrenched, science can become a political football. In a representative sample of over 2000 U.S. adults, for example, 76% of self-identified liberals, but only 29% of self-identified conservatives, agreed that government investments in basic research pay off in the long run [Kraft et al., 2011] rather than our previous estimate of 82 kg [Whyte and Kirchner, 2000]. This does not reflect a deep mistrust of science in general; in the same survey, for example, 66% of self-identified conservatives (and 83% of self-identified liberals) said that government investments in basic research pay off in the long run [Pew Research Center, 2015]. Instead, both self-identified liberals and conservatives tend to distrust scientific information that conflicts with their political views [Nisbet et al., 2015].

These are examples of confirmation bias, the widespread psychological tendency to favor evidence that confirms prior beliefs and to discount evidence that calls them into question [Nickerson, 1998]. Studies "consistently find evidence for hyperskepticism toward scientific evidence among ideologues...[and] there is mounting evidence that the most politically sophisticated and knowledgeable among us are the most prone to the strongest bias" [Kraft et al., 2015]. And scientists should not feel too smug about their supposed objectivity: studies have shown that scientific reviewers are also vulnerable to confirmation bias, tending to rate papers more highly when they confirm previously held beliefs [e.g., Mahoney, 1977; Koehler, 1993].

Still, I will argue, there is a difference. Of course science, as a human endeavor, is vulnerable to the full spectrum of human foibles, some even less appealing than mere confirmation bias: vanity, greed, envy, and so
forth. In science, as in any human undertaking, absolute objectivity is an unattainable ideal, and many of us
know colleagues (but never you or I, dear reader!) who allow their political views to color their interpreta-
tions of data, or who grasp for fame and glory by over-selling their results. But the ethos of science is based
on dispassionate objectivity as an idealized goal, and the practices of the scientific community reinforce
this value system. Getting a reputation for “torturing the data until it gives up” will hurt one’s career, and
getting caught in an outright lie is often a career-ending event.

Not so, it seems, in politics. It has long been recognized that the political process often uses science the
way a drunk uses a lampost: for support rather than illumination. Increasingly, however, we are seeing the
emergence of an attitude that factual reality is simply irrelevant. In the most recent U.S. presidential cam-
paign, for example, statements that were provably, transparently false were tweeted and retweeted by the
eventual winner, and then discussed in the media as if the mere fact of their appearance on the internet
made them worthy of serious analysis. In the months since the election, we have seen not only the Presi-
dent, but also the House Science Committee, tweeting conspiracy theories and climate change misinformation
total, Wendel, 2017]

This must not become the “new normal.” Today, three centuries after the Enlightenment, it should not be
necessary to defend the case for rationality in public life. When each side feels free to create their own
facts—to assert not just their own values but their own version of reality—common ground becomes
immeasurably harder to find, and democracy itself is at risk.

No matter what one’s political views might be, we all have to start with a clear-eyed view of the facts,
because the laws of nature fundamentally do not care whether we choose to accept them or not. Thus, we
had better know what they are, and plan accordingly. If I jump from the Golden Gate Bridge, it will make no
difference whether I believe in the law of gravity. It will make no difference whether I believe that I can fly
or believe that a divine being will rescue me. No matter what my beliefs are, or how fervently I hold them, I
will hit the water below at exactly the same speed and with exactly the same devastating impact.

In analyzing the Challenger disaster, in which facts were ignored in the name of expediency at the cost of
seven astronauts’ lives, Feynman [1986] famously said, “. . . reality must take precedence over public rela-
tions, for Nature cannot be fooled.” Scientists recognize the power of observations, of data, of facts. The
prospect of a “postfactual” society should alarm us all.

3. The Need for a Rational Public Discourse

As scientists, we should strive to make ourselves heard, not as activists supporting some political cause or
another, but as advocates for something more essential: a fundamentally rational public discourse, one that
starts from the facts—not from whatever one might choose to believe—and then confronts the messy
questions of what society should do.

The outcome of this public discourse cannot be determined by the scientific facts alone, because decisions
always involve the interplay between facts and values. Science can only outline the probable consequences
of alternative courses of action; how we feel about those consequences, and thus how strongly we prefer
one outcome over another, are fundamentally not scientific issues. Scientific information is also inherently
associated with some degree of uncertainty, and on any major issue there will always be skeptics and con-
trarians (including some with scientific qualifications) who question the scientific consensus. These facts of
life are often exploited for political ends [Oreskes and Conway, 2010] and amplified by journalists who give
equal time to consensus and contrarian views despite their unequal weight within the scientific community.

Yes, science may be uncertain, and expert opinions may differ. But the same is also true of every other fac-
tor in any decision process, and nonetheless individuals and societies make hugely consequential decisions
every day, despite considerable uncertainty about their ultimate consequences [Pollack, 2003].

Society’s interests are not served by demanding absolute proof [Oreskes, 2004], or by misrepresenting what
we know and how well we know it. These rhetorical games will lead to policy choices that are unmoored
from the reality of the world we live in. They will also obscure and distort the essential question that the
policy process should focus on: given the real-world facts of the situation (as best we know them), what are
our values and how will they be reflected in the choices that we make?
Science is just one of many voices in the policy process, one that is at increasing risk of being marginalized and distorted. Nonetheless, there are things that scientists should do. First and foremost, we should do the best possible science, and portray it as clearly and honestly as we can, striving to make our work “policy-relevant but not policy-prescriptive” [Intergovernmental Panel on Climate Change (IPCC), 2010]. We should do what we can to communicate the fascination and importance of our work to the public. We should likewise do what we can to promote science literacy, with particular emphasis on evidence-based reasoning and rational decision-making under uncertainty [e.g., Pollack, 2003]. We should work to build relationships with policymakers, show them the value of scientific research, and inform them about the science that bears on current issues. We should value and support our colleagues who do the difficult and important work of public outreach. And we should loudly object when the state of the science is misrepresented, whether by nonscientists or by scientists themselves.

But we should have no illusions that the policy process will be governed by scientific facts alone, or that the outcome of such a process, even if it respects the science, will necessarily agree with our personal politics. Thus, we must draw a clear line between a political process that distorts the facts, and one that reaches a conclusion that we dislike. Of course we are all entitled, as citizens, to our personal opinions about what society should do, and are entitled to participate in politics if we wish. But if we do, we must do so with care and humility; “global warming must be stopped” or “we need carbon taxes” are statements of values, not scientific facts. The likely consequences of climate change are a scientific matter. Whether we are concerned about those consequences, and concerned enough to bear the costs of averting them, are questions of values.

Thus, we must clearly distinguish between advocacy for science and activism for political causes. If we confuse them, we will fuel the impression that scientists are just another interest group, playing the same political game as everyone else. Even worse, we will raise suspicions that our science has been slanted to suit our personal politics. Such perceptions are political poison. If we passionately argue for our political causes, the public will not trust us to dispassionately assess the data that bear on those same political issues. To expect otherwise is unrealistic.

Science is respected in the policy process because—or, more precisely, to the extent that—it is perceived to convey unbiased factual information. In the rough-and-tumble of politics, partisans will inevitably try to portray the scientific facts that undermine their political agendas as biased “junk science.” We should not give them ammunition by conflating science and activism, however well-intentioned. Instead scientists, along with interested citizens across the political spectrum, should speak out loudly and proudly for science itself, and for a rational public discourse that respects science’s essential role in outlining the factual foundations of public policy debates (but not in dictating their outcomes). Doing so is essential for the future of science, and for the future of democratic institutions in the broadest sense.

Acknowledgments
I thank the editors for inviting this commentary. I also thank D. C. Whyte, E. P. Kirchner, G. Goldsmith, S. Wolf, T. Dawson, C. Fortunel, C. Luce, P. Troch, and eight anonymous reviewers for their comments and suggestions.

References
