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Applying the science of communication to the communication of science

Baruch Fischhoff

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Imagine a world in which social and decision scientists control the communication of climate science. Before creating messages, they look at the sky, hold a wet finger to the wind, glance at a weather map, and listen to a bit of talk radio. Having assessed what people need to know about climate, they draft theoretically sound messages, then subject them to rigorous empirical testing.

Their theoretical analysis of what to say and how to say it draws on the vast research literatures regarding risk perception and communication, science education, judgment and decision making, literacy, numeracy, emotion, social norms, and behavior change (e.g., Fischhoff 2009, 2010; Fischhoff and Kadvany 2011; Gardner and Stern 2002; National Research Council 1989; O'Hagan et al. 2006; Plous 1993; Politi et al. 2007; Slovic 2001, 2010; vonWinterfeldt and Edwards 1986), as well as the more modest literatures focused on climate (e.g., Bostrom et al. 1994; Fischhoff 1981, 2007; Fischhoff and Furby 1983; Kempton et al. 1995; Moser 2009; Pidgeon and Fischhoff 2011; Reynolds et al. 2010; Weber and Stern 2011).

Their empirical testing begins by interviewing individuals from the target audiences asking them to review the draft communication, commenting on whatever crosses their minds. Is its wording comprehensible? Can they follow its arguments? Does it answer their questions—or raise important new ones? Do its authors seem credible? Once additional interviews yield little additional insight, the designers settle on messages that might work for their various audiences (who might differ in background knowledge, political orientation, and climate-related decisions). These drafts are then tested in conditions approximating their intended use, seeing whether people can extract the content that they need, apply that knowledge to their decisions, and appraise its limits.

Recognizing the difficulties of isolating the effects of individual messages, these social and decision scientists use surveys to track public beliefs and attitudes on climate-related issues (Leiserowitz et al. 2010; Lorenzoni and Pidgeon 2006; McCright and Dunlap 2011).

B. Fischhoff (✉)
Department of Social and Decision Sciences, Carnegie Mellon University, Pittsburgh, PA 15213-3890, USA
e-mail: baruch@cmu.edu

They perform their theoretical analyses and empirical research to the standards of scientific publication, even if the topics are too applied for submission to archival journals. The stakes riding on public understanding of climate change deserve nothing less. Besides, climate offers a worthy test of the generalizability of published research. These scientists know better than to think that the responses of complex people to complex problems are entirely predictable—hence their insistence on testing, and more testing.

However, these social and decision scientists have only incidental contact with other climate scientists. As a result, the climate science that they communicate reflects just their intuitions about that science, as gleaned from reports, meetings, and conversations. Now and again, they are upbraided for messing up some bit of climate science, when trying to make it easier to understand. They vow not to repeat that specific mistake, perhaps wondering how much it matters anyway for any practical purpose. Their communications are, therefore, as clear as is scientifically possible, but not as accurate.

Such communication would be distressing, even offensive, to climate scientists, if it neglects or misrepresents their research. It might be damaging, if it gets the science so wrong as to misdirect decisions or provide ammunition for those hoping to discredit climate science. Such communication would certainly be less effective than climate-related decisions deserve. Given the stakes riding on it, climate communication should be informed by the best available climate science, including the economic, behavioral, and political drivers of climate change; the geophysical processes shaped by those drivers; and the ecological, social, political, and economic impacts that those processes might have—as well as the expected impacts of possible mitigation and adaptation strategies.

Of course, social and decision scientists do not control climate science communication. Rather, climate scientists control communication of their own research. That is how it should be for teaching in academic settings; scientists are the appropriate arbiters of what their students need to know. If scientists have faulty intuitions about how to convey their own material, then the price is "just" poorly informed and motivated students.

The stakes are very different, though, when a science provides essential inputs to decision makers, receives public support based on its usefulness, and is subject to hostile scrutiny. In such cases, it is needlessly risky for scientists to rely on their intuitions about what to say and how to say it. They deserve the help of social and decision scientists—and criticism if they refuse it. The stakes are too high for ad hoc communication.

Thirty-some years ago, the non-economic social sciences provided one of five working groups in a DOE-AAAS project scoping a 20-year research agenda for climate science (with Elise Boulding and Steve Schneider as its chairs; Chen et al. 1983). Despite the antiquity of these connections, we still lack the sustained working relations needed for the social, decision, and other climate sciences to support one another. We have fragmentary collaborations at Yale, Cardiff, George Mason, Carnegie Mellon, East Anglia, IIASA, NCAR, and other places. However, the science of communication has vastly less organizational coherence than the science it could help to communicate. The US Food and Drug Administration (2009) has a strategic communication plan, jointly developed by social, decision, and natural scientists, and a statutory Risk Communication Advisory Committee. The climate science community deserves as much.

One institutional arrangement for meeting these needs is with science communication centers, allowing social and decision scientists to work together with other scientists. Center staff would provide the services needed for effective communication: interviewing audience members to assess their information needs so that climate-related problems are analyzed in decision-relevant terms, designing communications consistent with research into how people access and process information, evaluating their impact, tracking public opinion, and interpreting it for natural scientists. Center staff would conduct basic research into recurrent

communication challenges (e.g., conveying climate cycle feedback mechanisms, scientific disagreement, or effects distributed over time) and create communication prototypes, ready to adapt to specific messages. They would inform climate-science analyses that make assumptions about human behavior (e.g., responses to threats and disasters). They would anticipate decision makers' information needs and feed them into research plans.

As an example of a mission that such research could address, hopes are currently being placed on communicating uncertainty more effectively, as a way to help the public understand scientific controversies. Indeed, the Fifth Assessment not only directs its authors to address these issues, but provides guidance grounded in social and decision science research (InterAcademy Council 2010; Mastrandrea et al. 2010). However, without analytical research identifying decision makers' information needs (Sokolow 2011) and empirical research evaluating communications, there is no way of knowing how effective these proposals are. Budescu et al. (2009) found problems with an earlier IPCC attempt to communicate uncertainty, consistent with problems identified by decision science research stretching back 40 years (Budescu and Wallsten 1995). The intelligence community has grappled with similar problems of communicating uncertainty and produced similar guidance (Criminal Intelligence Service Canada 2007; Kent 1964; National Intelligence Council, 2007), also with uncertain results (National Research Council 2011).

Moreover, it is possible that even fully understood summaries of scientific evidence will not address decision makers' information needs. They may also need an understanding of why experts disagree. Achieving that understanding will require communications that afford them "mental models" of the relevant climate science, showing the uncertainties that are inherent to that science (Bostrom et al. 1994; Fischhoff et al. 2006; Kempton et al. 1995; Morgan et al. 2002; Reynolds et al. 2010). Knowing more about why scientists bicker may matter more than knowing more about their results (Sokolow 2011).

Indeed, focusing attention on uncertainties may encourage people to think that nothing can be done until they are resolved. Science advances by confronting uncertainties. However, uncertainties critical to science may not only matter little for decision making, but actually distract from it. Taking an example from a completely different domain of contested science, partisans have fiercely debated the number of civilian casualties in Iraq, Darfur, and Bosnia, when even the lowest estimates should be cause for alarm and action. An alternative framing of climate science is that its uncertainties show the fateful gambles that we face. From that perspective, greater uncertainty can mean greater reason to act. That framing shifts the debate from what we know to what gambles we want to take with the natural world and those who depend on it.

However, like other potential communication strategies, this one is just a speculation. It might be a better speculation for being informed by social and decision science, but it is a speculation nonetheless—until disciplined by systematic research. Connecting climate science with climate decision making will require such research, making the science of communication central to the science.

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