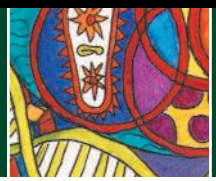

LETTERS

edited by Etta Kavanagh

The Risks and Advantages of Framing Science

THE POLICY FORUM "FRAMING SCIENCE" BY M. C. NISBET AND C. MOONEY (6 APRIL, P. 56) argues that because different audiences respond differently to certain science-based public policy issues, scientists should trade their reliance on fact-based arguments for ones more slanted toward the interests of specific groups. Their examples—climate change, evolution, and stem cells—seem all too similar to the parable of the blind men and the elephant, each man describing the beast differently based on his own limited data. In the end, although each describes a portion of the elephant accurately, none can picture the entire animal. That seems more a model for politicians than scientists, and Nisbet and Mooney's advice that "scientists should strategically avoid emphasizing the technical details of science when trying to defend it" seems somewhat dishonest. I would hope that researchers continue to rely on their data, rather than on what "spin" on an issue might prove more convincing.

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NISBET AND MOONEY'S PRESCRIPTION OF framing falls short of a comprehensive diagnosis and treatment plan for what ails science. The authors correctly argue that framing is one, albeit of many, powerful communication tools potentially useful to scientists. However, using framing for persuasion, political communication, or public relations ends does not necessarily empower people to make better decisions about complex issues (*1*, *2*).

The authors' argument may inadvertently perpetuate two commonly encountered science communication myths. The first is that complexity cannot be successfully communicated (*2*). The second is a counterproductive "two communities" notion that blames the public as eternally deficient and alienates science from society (*3*, *4*). Nisbet and Mooney can claim this misrepresents their intent, but that illustrates the inherent vulnerability of even a well-intended frame to differing interpretations (*5*). For instance, readers of *Science* may interpret the authors' advice to strategically sequester the "technical details of science" as equating framing with "dumbing down" science, even though Nisbet and Mooney certainly recognize that framing and technical complexity are distinct elements of language and communication.

Finally, what framing strategy wins the daily mass media wars may not enhance long-term relationships between science and society. Toward that end, evidence indicates that scientists should engage in more and ongoing dialogue with policymakers and the public to help build shared understanding and effective policy solutions (*1*–*4*, *6*). As Irwin wrote, "The relationship between science and society should not be about the search for universal solutions and institutional fixes, but rather the development of an open and critical discussion between researchers, policymakers and citizens" (*3*). At stake are not only relevance and increased adoption of science, but also long-term support for science, social cohesion and equity, trust, and well-being (*1*–*4*, *6*).

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IN THEIR POLICY FORUM, NISBET AND MOONEY assert that scientists need to become adept at communicating their science in public using frames "to make it relevant to different audiences." Although I agree, suggesting that scientists accept and use popular frames presents certain risks.

First, many scientists would prefer to "stick to the facts" in public for very good reasons. Frames are much more than simply "leaving out details," reducing jargon, or providing more context. When speakers frame "the problem of climate change as a matter of religious morality," for example, they are using science to support a philosophical argument. Scientists are reluctant to use frames like this one, not because of the details they have to omit, but because of the details they have to add. It's philosophy, not science.

Second, although others have used science in "foreign" frames to shape public opinion, when they dominate science media, important ideas are entirely absent. Frames work because they distill complex issues and emphasize what the audience already knows to be true. But we should be concerned if the dominant frames in the media omit the authoritative basis of science in empirical observation, experimental methods, and rational argument, for example. We're left with science "facts" in an alien frame. Without these concepts, how can society cope with scientific controversy or the implications of new and challenging discoveries?

Despite these drawbacks, "foreign" frames are important, and more scientists should

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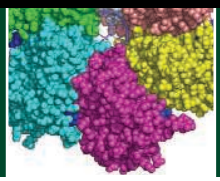

DNA, unwound

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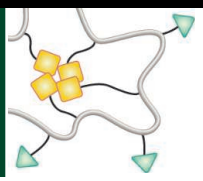

Polymer drugs

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learn to use them. It is perfectly reasonable and legitimate to use emotional, religious, political, and economic metaphors, stories, and messages to frame science. Scientists are also citizens and have a right—even a responsibility—to frame their science in their own voices. Framing science in these ways does make science more accessible. But it's important to understand the risks of saturating the media with these popular frames, as well as the potential rewards.

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NISBET AND MOONEY ARGUE THAT "WITHOUT misrepresenting scientific information on highly contested issues, scientists must learn to actively 'frame' information to make it relevant to different audiences."

I would argue that framing the debate will lead to (i) having to misrepresent scientific information or (ii) sacrificing scientific credibility, both of which will only reduce the public acceptance of what science has to say.

For example, the authors say that the United Nations Intergovernmental Panel on Climate Change (UNIPCC) has "steadily increased its confidence that human-induced greenhouse gas emissions are causing global warming. So if science alone drove public responses, we would expect increasing public confidence in the validity of the science, and decreasing political gridlock." However, this would be true only if UNIPCC is seen by the public as solely presenting technical complexities as matters of science.

UNIPCC framed itself as a political institution seeking not just scientific conclusions, but acceptable social, economic, and political solutions. Because of this, critics can easily attack UNIPCC's scientific credibility as being influenced by a political or social agenda. As a result, we have decreasing public confidence and increasing political deadlock. Had UNIPCC stuck exclusively to the science, the public would have been far more receptive to the findings of the organization and critics would be much less able to dismiss UNIPCC's science as politically or socially motivated.

Science has credibility with the public precisely because the public believes that science is neutral, that it doesn't take positions or adopt particular frames. If we are going to adopt a strategy of adopting frames when communicating to the public, we should at least consider the possibility of the unintended outcome of sacrificing scientific credibility in the process.

Another example presented is the public debate concerning evolution versus creation. According to Nisbet and Mooney, "antievolutionists promoted 'scientific uncertainty' and 'teach-the-controversy frames,' which scientists countered with science-intensive responses. However, much of the public likely tunes out these technical messages. Instead, frames of 'public accountability' that focus on the misuse of tax dollars, 'economic development' that highlight the negative repercussions for communities embroiled in evolution battles, and 'social progress' that define evolution as a building block for medical advances, are likely to engage broader support."

Although not quite a public debate, recent events in Dover, Pennsylvania, and the findings of Judge Jones came close. The antievolutionists lost.

I think one reason why is that the creationists adopted "scientific uncertainty" and "teach-the-controversy frames" while science and evolution refused to adopt any frame at all. Those representing evolution made no appeals to "public accountability" or "economic development" implications. Rather, they stuck to the science. In so doing, they built their arguments on a rich intellectual tradition that, more than any other in our society, is seen as unbiased and credible. Ask any trial lawyer: The jury buys the testimony of the most credible witness. So does the public.

In contrast, those testifying for the antievolutionary camp were tainted. They destroyed their own credibility and diminished the power of any countering arguments.

The authors observe that "many scientists not only fail to think strategically about how to communicate on evolution, but belittle and insult others' religious beliefs." I have witnessed quite the opposite. The scientific community has been much too respectful of the religious beliefs of others. When someone claims that the world is 6,000 years old, that is belittling and insulting the work of science, and just plain dumb. Scientists have to say that, and say it more often.

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Response

IN SPINNING OUR SUGGESTIONS AS "DISHonest," Holland assumes that framing is absent from traditional science communication. Yet, whether writing up a grant proposal, authoring a journal article, or providing expert testimony, scientists often emphasize certain technical details over others, with the goal of maximizing persuasion and understanding across contexts (*1*). Moreover, press officers and science reporters routinely negotiate story angles that favor particular themes and narratives (*2*) or, at the expense of context, define news narrowly around a single scientific study (*3*).

When attention to science shifts from the science pages to other media beats, new audiences are reached, new interpretations emerge, and new voices gain standing in coverage. These rival voices strategically frame issues around dimensions that feed on the biases of journalists, commentators, and their respective audiences (*4*). If scientists do not adapt to the rules of an increasingly fragmented media system, shifting from frames that only work at the science beat to those that fit at other media outlets, then they risk ceding their important role as communicators.

In response to Pleasant, we agree that a well-informed public is an empowered public. The problem, however, is that the availability of scientific information in the media does not mean people will use it. Only by framing issues in a manner that makes them personally meaningful and accessible to nontraditional audiences can scientists and their organizations boost public attention and thereby sponsor informal learning (*5*).

We also agree with Pleasant that the type of dialogue featured at deliberative forums and community meetings remains important. Unfortunately, at these forums, the citizens

Letters to the Editor

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who are most likely to attend and speak up are those who are already informed and active on an issue (*6*). In contrast, carefully framed media presentations can effectively promote dialogue and trust with a larger and more diverse audience.

Consider, for example, E. O. Wilson's *Creation: An Appeal to Save Life on Earth* (*7*). By recasting environmental stewardship as not only a scientific matter, but also one of personal and moral duty, Wilson has generated discussion among a religious readership that might not otherwise pay attention to popular science books. A second example is Karen Coshof's documentary *The Great Warming* (*8*). Narrated by Keanu Reeves and Alanis Morissette, the theatrical release combines interviews of climate change experts with testimonials from religious leaders. Endorsed by national religious organizations, forums featuring the film have also been hosted by churches and synagogues. In addition, both of these examples function as news pegs for journalists at religious media outlets to write stories about climate change, thereby facilitating exposure among nontraditional audiences.

Contrary to Quatrano's warnings, in neither the Wilson nor the Coshof examples does science appear to support a particular religious philosophy or argument. Instead, framing is used to create a narrative bond between scientists and religious citizens, communicating a shared interest in what science can tell us about the nature of environmental problems.

In response to Gerst, scientists and their institutions are motivated to discover what is true about the world and to inform the public about the implications of their research. In translating this knowledge for popular consumption, should scientists rely solely on their instincts and their personal experience, or should they rely on a systematic understanding of communication? Applying research about the public and the media will only help the scientific community tell the truth more effectively and to a wider audience.

Framing is not all-powerful, nor should it be considered a magical key to unlocking public acceptance. Research on framing suggests that establishing a connection with audiences derives from the fit between the frames embedded in a media message and the interpretative schema that a particular audience possesses. One common source of science-related schema are long-term socialized world views such as political ideology, partisanship, ethnicity, or religious belief. Other sources are the stereotypes, narratives, and images learned through popular culture and the entertainment media. As shortcuts for reducing complexity, these schema allow any individual—whether a lay citizen, journalist, or policymaker—to categorize new information quickly and efficiently, based on how that information is framed in the media (*5*). In sum, a one-size message about science will not fit all audiences.

We suggest that science organizations work with communication researchers, conducting focus groups, surveys, and experiments that explore how different audiences interpret topics such as climate change or evolution. On the basis of this research, messages can be tailored to fit with specific types of media outlets and to resonate with the background of their particular audience.

It is encouraging that the Letter writers agree on a few central principles. First, framing as a concept has strong roots in the social sciences. Second, framing is already central—intentional or not—to traditional science communication efforts. Third, when applied responsibly and ethically, framing can be a valuable tool for scientists in engaging nontraditional audiences.

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CORRECTIONS AND CLARIFICATIONS

News Focus: "Exploring the prehistory of Europe, in a few bold leaps" by J. Bohannon (13 July, p. 188). On page 189, the caption to a photograph of stone tools incorrectly calls them "Neolithic" in date. It should have read "pre-Neolithic."

TECHNICAL COMMENT ABSTRACTS

COMMENT ON "Deep Mixing of ^{3}He: Reconciling Big Bang and Stellar Nucleosynthesis"

Dana S. Balser, Robert T. Rood, T. M. Bania

Eggleton *et al.* (Reports, 8 December 2006, p. 1580) reported on a deep-mixing mechanism in low-mass stars caused by a Rayleigh-Taylor instability that destroys all of the helium isotope ^{3}He produced during the star's lifetime. Observations of ^{3}He in planetary nebulae, however, indicate that some stars produce prodigious amounts of ^{3}He. This is inconsistent with the claim that all low-mass stars should destroy ^{3}He.

Full text at www.sciencemag.org/cgi/content/full/317/5842/1170b

Undergraduate Education in Jordan

I WAS SURPRISED THAT THE MIDDLE EAST WAS not mentioned in the Special Section "The World of Undergraduate Education" (6 July, p. 63–81). The Middle East constitutes 2.9% of the world's population and plays a prominent role in international politics, and the education of its population is a relevant international issue. For details on undergraduate education in various Arab states in the Middle East, go to the UNESCO Web site (www.unesco.org).

In 2005, the gross enrollment ratio (*1*) for undergraduate universities in Jordan was about 39%, and females make up 49% of those enrolled (*2*). There are 22 (private and public) universities in Jordan, which is a high number since the population of Jordan is only 5.375 million.

We have many of the problems discussed in the Special Section, such as using English as the language for science as in the Austrian example ("'Can't have a career… without English,'" J. Bohannon, p. 73) and changing the curriculum from heavy memorization to a more hands-on approach, as has been done in South Korea ("'A strong voice' for course reform," R. Stone, p. 76). Also, our teaching load is very heavy, leaving little time for research.

We are pioneering problem-based learning (PBL, as mentioned in the UK article, "'Much of what we were doing didn't work,'" D. Clery, p. 68) in Jordan, and resistance is high. Older faculty are not interested. It would be nice to have an open dialogue to share experiences and tactics for introducing such methodology and addressing problems. I would suggest having a forum and in the future an international conference to discuss these issues.

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References and Notes

1. The number of students enrolled in a level of education as a percentage of the population in the relevant age group for that level.
2. See www.unesco.org.

Data-Driven Education Research

I APPROACHED THE RECENT SPECIAL SECTION on undergraduate science education ("The World of Undergraduate Education," 6 July, pp. 63–81) with great anticipation. Clearly, this is a vitally important topic for everyone—not just those interested in science education, since the connection between effective, inclusive undergraduate science education and national competitiveness is well documented (*1*). However, I was dismayed by the way *Science* chose to report on the worldwide state of science education. There is a growing body of data-driven research on "what works" to improve outcomes related to teaching, learning, and student retention [some of which has been published in *Science* (*2*)], yet this was ignored in favor of reports containing mainly opinion and hearsay. Private empiricism—where we believe something because of our own personal experience—is not appropriate for scientists, yet when it comes to education, personal experience seems to be an acceptable substitute for evidence. Unfortunately, most scientists' beliefs about education are rarely based on objective evidence, but rather on what they imagine to be true. Although personal experience in the classroom can give valuable insights, it is not data.

We now have many effective research-based ways to improve the outcomes for undergraduate science education and to assess student learning and achievement (*3*). There is a great deal of research on what works, so why is higher education in the sciences so resistant to change? Why does the faculty in your roundtable discussion not know about this research? Why do people who would never accept scientific information without data and theoretic underpinnings, embrace conventional wisdom and personal beliefs when it comes to education?

Could it be the perceived relative unimportance of education efficacy, compared with traditional research productivity? Or is it that faculty are simply unaware of the advances that have been made in science education? Even in departments where the primary focus is undergraduate education, often little attention is paid to research on teaching and learning. Whatever the reason, it is simply unacceptable that the flagship journal of AAAS reports opinion as fact and personal belief systems as evidence.

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2. J. Handelsman *et al.*, *Science* **304**, 521 (2004).
3. Much of this work has been funded by the National Science Foundation under a number of programs, yet I see no mention of any of this work in any of the articles.

Editor's Note: Science publishes a monthly feature, the Education Forum, which focuses on data-driven education research.