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Communicating Uncertainty

Media Coverage of New and Controversial Science

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LEA
1999
LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS
Mahwah, New Jersey
London

Chapter 5

Interpreting Uncertainty: A Panel Discussion

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Joann Ellison Rodgers *specializes in medical journalism and has written five books and numerous articles in addition to lecturing on science and the mass media at The Johns Hopkins School of Hygiene and Public Health. She is deputy director for public affairs and director of media relations at The Johns Hopkins Medical Institutions and past president of the Council for the Advancement of Science Writing and the National Association of Science Writers.*

Stephen H. Schneider *teaches at Stanford University and was a senior scientist at the National Center for Atmospheric Research in Boulder, Colorado. He was honored in 1992 with a MacArthur Fellowship for not only his research on global climate change but also for his integrated approach to communicating that information to a variety of audiences. Founder and editor of the interdisciplinary journal* ***Climatic Change,*** *he has published widely and is a frequent commentator on global climate issues.*

Question: Is uncertainty a more manageable problem for science writers than for other journalists?

Philip Boffey: Uncertainty is a smaller problem for science writers than for many other kinds of journalists. Let me give some examples of what I mean and some reasons why I think it is a smaller problem. It is not one we should

ignore, but we should see it in perspective. With the coverage of foreign affairs, for example, our editorial board has had to struggle at times to determine what is going on in China and what various power struggles there mean for military and economic affairs in the region. This is because China is a very closed society and there are enormous cultural differences between China and the United States. North Korea is even more closed. Even with a number of observers, reporters, and stringers in these countries, we have little idea of what is happening and we are trying to fashion editorial policies in almost total ignorance.

Coverage of economics is another area where there is great uncertainty. A well-known and respected economist, Paul Krugman, talks about two major problems our country faces today: slowing productivity growth and poverty that we cannot seem to eradicate. But the economics profession does not have a clue about what should be done. Krugman describes the profession as being similar to the medical profession at the turn of the century. Economists know a few things that they should not do at the margins, some things that will make matters worse, like bloodletting. Meanwhile, they are trying desperately to find out what has happened to the economy in the last 20 years and are uncertain about what to suggest for the future.

With social issues, there is the same uncertainty. What brought New York City's crime rate down in 1996? Is it that the drug gangs are not shooting each other up anymore or that the bad guys are in jail? Is it because the New York cops put more officers on the street or is it because the cops have a computer system that analyzes where crimes are breaking out and lets them plan better crime prevention? Who knows, but we have a big drop in crime and great uncertainty as to what brought it about.

With science writing, the subjects are better defined. One of the reasons why uncertainty is less of a problem for a science journalist is because the scientific material we cover is mostly issued and argued publicly. This is not North Korea or China. While it is true that journalists cannot view a scientist's lab notes or sit on a peer review committee, the final product is out there in public. There can be a vigorous public debate about it and reporters and others can see what is happening.

The uncertainty in science also is easier to identify because of the scientific tradition of replicating or refuting studies and findings. It is a professional obligation for researchers to discuss the uncertainty of their findings. And finally, many types of science do not deal with the messiest parts of the human equation where there is choice and response that cannot be predicted.

Joann Rodgers: Science writers may have an easier time in dealing with uncertainty issues in the conventional sense if they just seek comments from a number of sources—the he said/she said approach. However, there is the more difficult aspect of trying to understand influences on scientists and studies that are not so visible and not very accessible. When I was a reporter outside of an institution looking in, I had no idea of what went on inside. It is very difficult until you work in an institutional culture to understand some of the barriers to getting science-based information to the public. It also is difficult to understand how science is manipulated, and I do not mean that necessarily negatively, but how the uncertainty around it is manipulated by the dynamics of an institution and the people who have power there. I think these factors make scientific uncertainty a hard issue to cover.

Stephen Schneider: In my experience, science journalists do a better job of handling uncertainty than most other reporters because, as beat reporters, they get to know both people and the subject over time. This makes it somewhat easier for them not to be fooled by the quick press releases and fast-breaking stories that claim too much. But there is a fundamental problem in journalism that works against having knowledgeable reporters on a beat. Some top editors, including Ben Bradlee, the former editor of *The Washington Post*, have said that once a reporter gets to know nearly everybody on a particular beat, he or she is now too biased and should be transferred to some other beat. To me, that sounds like someone who does not understand the scientific process will then be assigned to cover the science beat. It will be difficult for this new-to-science reporter to know the good from bad players and he or she will probably give disproportionate attention to those with much to claim, but little credible to say. The reporter will not handle uncertainty well because she or he possibly will not know the difference between objective and subjective probabilities [see the following]. Unlike these editors, I believe reporters can be both knowledgeable and unbiased if they are conscious of the bias problem. When reporters do not know people or concepts from the field they are covering, many things are hidden. Then they are more likely to be fooled into producing an unbalanced or inaccurate story.

Question: What factors influence how scientists discuss uncertainty and does this change with the audience?

Joann Rodgers: When we talk about strategies to deal with communicating uncertainty in the process of science, I think reporters and many others make

an assumption that the people most intimately involved in generating science buy into the ideal view of how science operates—with peer review, publication, critique, replication, and validation. But, I want to argue that there are often conflicting and hidden agendas inside scientific institutions and universities that work against this ideal view. These include commercial factors, licensing agreements, personality conflicts, multidisciplinary turf battles, and marketplace forces that are manipulated and factored into all the decisions built around how we communicate about science and all the uncertainties that go with it.

While most people generally believe that corporations often smooth over uncertainties involved in their research, they do not believe this of universities and other scientific institutions. However, universities are not just generators, users, and conduits of information. They also are major players in manipulating uncertainty and how it operates. Corporate, commercial, and technology transfer issues are beginning to outstrip the capacity of science-generating institutions to communicate about or even deal with uncertainty.

The press does not know about this. I rarely get a reporter on the other end of my telephone, even a science journalist, who knows that conflicts of interest exist much of the time. There are investigative reporters who do. They are, however, few and far between, and they do not pay much attention to science. The way scientists express uncertainty certainly depends on whether they are talking to their corporate board, their dean, the press, their peers, or a journal editor. They may tell very different stories and whisper in many ears.

Stephen Schneider: Scientists deal with different types of uncertainty and respond to them differently, and we must keep that in mind. One form involves objective probability. Take the case of a coin or die: We do not know which face will turn up when it is tossed, but we have objective probabilities as to what it will likely be. Here and in other similar areas where we have considerable knowledge of outcomes, we have an objective probability for a given outcome.

However, there is a second kind of probability that involves judgments: subjective probability. This occurs when scientists deal with complex systems, as I do in studying a climate-environmental system or with those who study health systems. In these complex systems, where there are many interconnected subcomponents, scientists often are uncertain about the extent and magnitude of these interconnections. As a result, they have to make judgments about these interconnections and, consequently, underlying assumptions are subjective. This leads to subjective rather than objective probabilities about how these systems behave, despite the myth that there can be objective probability when dealing with complex systems.

Because of the many judgments that have to be made, evaluating or assessing the state of science is important. Science and science assessment are not the same thing. *Science* strives to explain how natural or social systems work. The motivations vary, but the simple curiosity-driven search for explaining nature is the archetype. *Science assessment*, on the other hand, is the evaluation of the likelihood of various possibilities needed by decisionmakers—personal, corporate, or governmental—to address real world problems. Truth is not the objective—only best guesses of the state-of-the-art science. When one is in the policy arena, one is dealing with science assessment and this factor influences how scientists behave. Science assessment is a social process, but it is usually done with a large degree of openness. In explaining judgments made in a study, it would be very difficult at an assessment meeting for a scientist to consciously stand up in front of his or her colleagues and knowingly distort what he or she believes to be the subjective probabilities of any specific event. This does not mean that scientists lack biases, but to allow these biases to knowingly alter one's judgment about the likelihood of an outcome is a good ticket to a reputation problem. However, fighting biases in one's subjective judgment does not mean there is no controversy. Scientists may still advocate policy positions, but they then have to acknowledge other points of view in their presentations or they do not look very good to their colleagues.

One problem in some assessments is that scientists often do not separate what they know to be likely from what is only possible—and this leads to much confusion. Journalists cannot be expected to do this separation for themselves. The frequent lack in media accounts of differentiation of what is reasonably well-known from what is speculative leads many laypeople to believe that scientists do not know very much. This simply may not be true. There often are aspects of knowledge that are known—for which there is established experimental, empirical, and other evidence. Also, there are aspects in which scientists have considerable confidence, but still moderate degrees of uncertainty remain. And there are aspects that are completely speculative. These different degrees of uncertainty get jumbled up in both assessments and media coverage, and when this happens, a false impression is conveyed that nothing solid is known.

It takes some depth of understanding of scientific issues to be able to sort out what is known well from what is highly speculative and that sorting is necessary when both scientists and journalists discuss science assessment and uncertainty among themselves and with the public. I do not think the science assessment process is well-understood outside of the scientific community and in fact, many scientists do not communicate degrees of uncertainty very well at all.

Even good science journalists do not convey much information about science assessment. *NOVA*, the weekly science program on the Public Broadcasting System, for example, highlights science at its exciting edges and often misses the deliberative, argumentative process out of which scientific truth, even if it is tentative, is likely to emerge. Because of television production values, even this kind of show must focus on exciting, visual science. But where scientists determine their truths is not just out in the field—that is where the information underlying the assessment comes from, of course—but in the community process of getting together with colleagues for discussions. Science assessment occurs in academic offices and hotel lobbies and often appears dull on camera. It is not the stuff of television or other media coverage.

Question: Do the tactics that journalists and scientists use to convey uncertainties get the message across to the audience?

Joann Rodgers: Even when reporters do what scientists and I think is an excellent job of qualifying the results of a study, the reality is that if the study relates to a prevalent human disease, readers and viewers interpret the stories through a filter of their own. The next day the phones ring off the hook from people who have read the story or heard about it on television or radio and these people are demanding the cure. Or, they are angry and fearful about reports that a drug or treatment has side effects. This happens despite carefully crafted language, carefully spelled out qualification, even a broad statement that says that treatment is 10 years away and much more experimentation is needed. People do hear what they need to hear and read what they want to read. They think that perhaps the institution and the investigator are not telling them everything and they want to check it out despite what the scientist or journalist has said.

Philip Boffey: In some ways, reporters can go too far. If they are going to write a story, they probably think the subject is somewhat important. So they will try to show that here is something that may affect people's health or their understanding of the universe, and only acknowledge dutifully that there are some uncertainties involved. But they are writing to convey, "Wow! Look here is a new surge in some new direction." They are not going to say that this study, which came out yesterday, may or may not mean anything. So while they need caveats in the story, those are more like "weasel" words stuck in somewhere in the flow of the article where they are hardly noticed. The only people who pay attention to them are the writer, or the editor who made the reporter put them in, or the scientist who says that he or she did not say the finding was definite, or the lawyer who wants to protect the media organization from litigation. What I am saying here is true for all journalism, not just science writing. Reporters are always faced with deciding on the truest interpretation they can put on what they are describing, and on how to achieve balance and tentativeness when that is needed.

Joann Rodgers: Scientists act as qualifiers. Often in our institution, for example, a scientist will want to bury the lead of a news release in the fifth paragraph or the third page. They do this, I believe, so people will not think they are going too far in what they say about their work. Of course, this tactic does not work because journalists are smart enough to figure out where the lead is in the story, and so is the public. The public assumes that all of the qualifiers are background noise after a while and they interpret the research from their own needs and perspectives.

Stephen Schneider: Scientists have a serious problem in communicating about science that I call the *double ethical bind*. On the one hand, your scientific ethics require the truth—the whole truth—which means lots of caveats that cannot be included in a two-page article, let alone a short sound bite for broadcast. On the other hand, you also want laypeople to know about and understand your research, particularly if you are working in a controversial area such as climate change. To work with the media effectively, particularly television, requires dramatic stuff and catchy phrases. What I advocate to handle this tricky situation is to use metaphors that convey the newness, the potential seriousness, and the uncertainty of what scientists are presenting. One involving the climate that I use all the time is that the climate is like dice and what humans may be doing is slowly loading them. This metaphor means that although weather is going to bounce around, there is an increasing probability that underlying climatic change also will emerge as the dice are loaded.

Scientists who do public outreach have an obligation to prepare a series of products of varying lengths about their research to provide to their colleagues, the media, and the public. For example, I have produced, in addition to my repertoire of sound bites, longer explanations for use in the more in-depth media, as well as written articles in *Scientific American* and books that are readable by laypeople. And, of course, I also have written scientific papers for my peers. For the small fraction of people who really care about what I think in depth, they can find the necessary caveats spelled out in the longer works.

But for the majority of people, simple phrases and metaphors that convey both urgency and uncertainty get the main idea across. While an individual journalist often does not write in all of these various lengths about some specific scientific subject, the collective of journalistic work done by the profession produces a similar variety of materials so that a layperson has many choices in seeking more scientific depth on a subject. People who get their information by reading only a general magazine or a business-oriented newspaper or by viewing the evening television news get very limited information about the environmental debate. They have to go to multiple sources that provide many viewpoints and greater depth to be well-informed.

Question: Differences and disagreements about what is professed as true in science frequently are linked to scientists' values. Are those values a part of what needs to show up in stories so that readers and viewers can become aware of them?

Philip Boffey: Values belong in stories, but they are extraordinarily hard to get a handle on journalistically in the space and timeframe of what reporters are usually doing. Values enter into the favorite example everyone always gives of the business person versus the environmentalist. These two are going to interpret differently the degree of health risk represented by a toxic waste disposal site or a product of some kind. Their backgrounds should be mentioned to make their biases clear. The same goes for the head of any organization that is pushing for something. But usually, science writers are faced with academic scientists, whose values are not readily identifiable. Some people will say a journalist can see a scientist's values based on where his or her funding is coming from or whether that person has ever taken money from a company or a labor union, or what she or he has testified about. But this is dangerous unless the reporter has the time to pursue the circumstances of how these different things occurred. They do not necessarily mean anything other than that the scientist was the best available expert on that particular issue. Just because the scientist was once associated with a value-laden organization does not mean that he or she is necessarily in the same camp.

Joann Rodgers: How universities and scientists deal with disclosures over conflicts of interest is definitely a value-laden area that needs more attention from the social science community as well as from journalists and scientists themselves. While it is simple to sign a form that discloses any conflicts of interest about funding, for example, it is anything but simple to get agreed-upon, meaningful disclosure language into news releases or presentations of science at meetings. There are legal, political, and financial complexities as well as the personal issue.

Stephen Schneider: Values creep into virtually everything and it is important that they be discussed in articles. As I said, even when we have objective probabilities, usually in any complex problem of interest, they get combined with aspects that include subjectivity. For a scientist, the best way to deal with a value question is to do it explicitly. Try to know what your biases are and put them in the open. Since no one can be, consciously or unconsciously, entirely value neutral, it is important to represent a distribution of opinions across a broad knowledge-based community. The problem then becomes who should be in the community whose opinions are tapped? Rarely can we rely solely on one or two sources for a balanced judgment of scientifically complex issues in which both values and uncertainty are endemic. Yet, this is typical in many media accounts.

This gets to the question of balance in reporting. Journalists are supposed to provide balance, of course, but does this mean countering the opinion of a major intergovernmental panel of hundreds of scientists with those of a few contrarian scientists, giving each equal weight in the story? In this example, a hundred-scientist, thousand-reviewer assessment of climatic change by the United Nations was often balanced in news reports by dissenting views of a handful of opponents with little guidance to the public about which group more closely represented the mainstream scientific community. There is a real question as to whether it is appropriate to balance a broad community with a few extreme dissenters unless journalists also include that the nonmainstream opinions are likely to represent a low probability case. It should not be a statement that these few dissenters are necessarily wrong, but that the bulk of knowledgeable scientists support the opposite point of view. To do that, reporters need to know a fair amount about the issue and the actors. Journalists need to find out which arguments are mainstream and which are outliers.

Getting back to values, it is very easy to dismiss people based upon the fact that they have a business or environmental perspective, or that they have been funded by the Department of Defense. Such circumstantial evidence of bias is not enough. Reporters, especially science writers, really have to do an assessment of the issues so they can get a better sense of the credibility of the arguments. Average citizens certainly cannot do it for themselves, unless they do a lot of digging.

Question: How do you cover the nature and limits of uncertainty in scientific issues where there appears to be a majority, mainstream viewpoint, but also vocal, established scientific sources whose views make them outliers on these issues?

Philip Boffey: One of the problems in journalism is to try to find what is really going on, what is accurate and which sources to trust. What makes it slightly easier in the science arena than in others is the mechanisms that are designed to both produce consensus and reduce uncertainty in science. A peer-reviewed journal gives reporters more confidence than an unreviewed source because at least someone who knew something about the subject looked at the paper. This is in contrast to material that comes in over the transom to me occasionally from individuals who have been spurned by journals, the patent office, and everybody else and want me to bring their issue to people's attention. In the scientific community, there is also the consensus panel mechanism for government agencies, which have internal staffs and processes all designed to search out what they think the truth of something is. The National Academy of Sciences does this, too, with its studies and panels. There are huge consensus mainstream organizations that are trying to define what they think the truth is. Of course, there is a second level problem in deciding whether these consensus mechanisms are operating properly. Have they gone astray somehow, have they distorted something deliberately, were the panels loaded or incompetent? Often, the journalist does not have time to investigate these questions given the constraints of daily journalism. However, these consensus mechanisms do help the journalist decide where the mainstream opinion is and how and whether to deal with outliers. Should they be part of the debate? In some issues, such as climate change, I do not feel they should be ignored because in this subject, the last major consensus report still showed there were a number of unknowns, so the situation is still fluid. However, in the debate where only a handful of people claim that the HIV virus is not causing AIDS, I feel there is enough evidence to ignore their viewpoint. Years from now, I may regret this if the outliers turn out to be right, but there comes a practical point where you say, the consensus is here and I am going to ignore the outliers.

Joann Rodgers: Sometimes deadlines and other journalistic pressures make it difficult to handle these situations. Any public information officer will tell you that reliability is often defined by journalists as some combination of accessibility and familiarity. It is a very practical consideration. In the daily fray of having to cover stories quickly, success may be defined by whom

reporters can get to fastest, who is familiar, who has not lied to them in the past, or who at least will quickly tell them three other people in the field to contact. Often, there is no time to look at consensus organizations or get to a database. Journalists often say that they make five phone calls and whoever gets back to them first gets their attention. This is just a recognizable fact of life.

Stephen Schneider: Scientists worry about outliers too. Students, in particular, worry that their positions might be wrong because, with highly uncertain science and a wide range of subjective probability, the outliers could be right, even though there is little chance of this in each specific case. Scientists are often nervous about dealing with the media, particularly concerning the reputation issue.

But, in science, rewards do not come from predicting what turns out by luck to be the right answer. Credibility comes from whether you have dealt with the scientific process as best you could given the empirical and theoretical information at the time. I would much rather be wrong for the right reasons then right for the wrong reasons. One columnist writes about how I talked about global cooling rather than global warming in the early 1970s. But this was when we had no idea about how widespread the distribution of aerosol particles was around the globe. These particles reflect sunlight and cool the earth. We admitted our lack of information at the time, of course. Now, we know suspended particle hazes are regional and our old global-scale calculations were not realistic. However, the columnist and others say that I am not very credible talking about warming today because I was discussing cooling back then. But what I and others said then was the right thing given the information at the time.

It takes careful reporting to find out whether the discussions at the time were based on what scientists could know and whether caveats were applied to their findings. It is a high risk for scientists to get in the media game and it is a gamble that most do not choose to take. When students ask me how to deal with the media, I always say there are two choices: Do it a lot or not at all. If scientists work with the media a lot, what they say and how it gets reported average out. Some stories will make you look foolish to your colleagues while others will make you look better than you deserve. Occasional service as a media source is a lottery with your reputation, a gamble that many scientists, especially young ones, are unwilling to take. And in science, your reputation governs grants, promotions, and prizes.