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A Preliminary Report on the Cases for Teaching Responsible Communication of Science Project

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Abstract
As scientists heed the call to achieve broader impacts for their work, they will leave their labs and begin to communicate with more diverse, non-expert audiences. To accomplish this, scientists will undoubtedly need help in developing their skills of effective communication. But they also need opportunities to reflect on the roles they may appropriately play in public life, on the responsibilities they are undertaking when they address publics, and on the ideals of good communication to which they are committed. In short, they need help in developing their principles for science communication ethics. Our interdisciplinary team at Iowa State University is developing nine case studies of science communication ethics in order to promote better communication training for STEM graduate students as well as to advance scholarship in the area. In this report, we outline the first three cases, focused on a public statement regarding climate change, on the publication of preliminary but highly policy-relevant results, and on the drafting of a press release for a controversial study.

Keywords
science communication, broader impacts, science-policy interface, science communication ethics, hype, spin, advocacy

Disciplines
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Comments
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ABSTRACT: As scientists heed the call to achieve broader impacts for their work, they will leave their labs and begin to communicate with more diverse, non-expert audiences. To accomplish this, scientists will undoubtedly need help in developing their skills of effective communication. But they also need opportunities to reflect on the roles they may appropriately play in public life, on the responsibilities they are undertaking when they address publics, and on the ideals of good communication to which they are committed. In short, they need help in developing their principles for science communication ethics. Our interdisciplinary team at Iowa State University is developing nine case studies of science communication ethics in order to promote better communication training for STEM graduate students as well as to advance scholarship in the area. In this report, we outline the first three cases, focused on a public statement regarding climate change, on the publication of preliminary but highly policy-relevant results, and on the drafting of a press release for a controversial study.

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1. INTRODUCTION

Increasingly, we look to scientists to share their knowledge with broader publics. As they leave their labs, they will undoubtedly need support in developing their abilities to communicate *effectively*. But improved communication skills alone will not fully prepare scientists to meet

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the challenges of the public sphere, where plural stakeholders hold divergent values and competing messages already circulate, especially online. Scientists will need to be aware that when they share their excitement about their work, they may appear to be engaging in hype; when they contribute to policy controversies, they may be taken to be partisan advocates; and when they adapt their messages to their audiences, they may be suspected of manipulative spin. In short, to be successful, scientists also need access to training which will help them understand and conspicuously fulfill the *ethical* requirements of responsible science communication.

With support from the National Science Foundation, our interdisciplinary team at Iowa State University is developing pedagogical materials to support such communication ethics instruction for STEM graduate students. We are undertaking preliminary interviews with scientists to identify the kinds of communication issues researchers in their fields face. From these preliminary results, we are then selecting for further investigation nine cases involving significant communication challenges. Based on our interviews with participants and knowledgeable onlookers, we are drafting case-based teaching materials, piloting them in a variety of classrooms across the country, and will disseminate them widely once they are finalized. In this report, we both outline the need and opportunity for science communication ethics education and sketch the first three cases that have emerged from our project.

2. COMMUNICATION ETHICS FOR SCIENTISTS: THE NEED FOR THEORY & PRACTICAL SUPPORT

It is widely agreed that "realizing societal benefits from research requires communication of research results to potential users in society in formats beyond the scholarly journal article" (Roberts, 2009). Studies confirm that extended interactions between researchers and policy-makers are vital in ensuring that scientific knowledge is considered in the policy process (Cash et al., 2003; Landry, Lamari, & Amara, 2003). Extended interactions are also key to developing ordinary citizens' capacity to engage with controversial science topics (Powell & Colin, 2008). Alan Leshner, chief executive officer of the American Association for the Advancement of Science, therefore concludes: "there is a growing consensus that to lessen this tension [between researchers and lay audiences], scientists must engage more fully with the public about scientific issues and the concerns that society has about them.... The notion of public engagement goes beyond public education. We must have a genuine dialogue with our fellow citizens about how we can approach their concerns" (2007).

Calls for such public engagement have emerged in diverse disciplines, including engineering (National Academy of Engineering, 2004), environmental science (Lubchenco, 1998), geosciences (Oppenheimer, 2011), neurosciences (Ilies et al., 2010), physics (Safina, 2012), and plant sciences (Lally, Brooks, Tax, & Dolan, 2007). Nudged by Congress, the NSF has been equally insistent, ramping up its requirement that the scientific research it funds achieve broader impacts for society (Holbrook, 2012). The NSF encourages diverse communication activities, including:

- give science and engineering presentations to the broader community (e.g., at museums and libraries, on radio shows, and in other such venues)
- publish in diverse media (e.g., non-technical literature, and websites, CD-ROMs, press kits) to reach broad audiences

- present research and education results in formats useful to policy-makers, members of Congress, industry, and broad audiences
- analyze, interpret, and synthesize research and education results in formats understandable and useful for non-scientists
- provide information for policy formulation by Federal, State or local agencies (NSF, 2007).

An increasingly rich set of communication training resources are available to scientists who heed these calls for public engagement. The NSF's own *Science: Becoming the Messenger* program, for example, has held a series of two-day communication workshops at campuses across the U.S. to help researchers understand and adapt to the needs of the press. A cluster of recent books—including Randy Olson's provocative *Don't Be Such a Scientist* (2009)—provide tips to researchers who want to improve their communication skills (Baron, 2010; Dean, 2009; Hammack, 2010; Meredith, 2010). Universities also "are increasingly offering graduate students the opportunity to develop communication and outreach skills through courses, workshops, and certificate programs" (Dunwoody, Brossard, & Dudo, 2009). Emory, for example, is offering a full course on Communicating Science (How to talk to real people, 2011), the Center for Communicating Science at SUNY-Stony Brook is bringing in Alan Alda for workshops in improvisation (Grushkin, 2010), and the longstanding Leopold Leadership program at Stanford has incorporated communication training since its founding.

These and similar resources help scientists make the transition from expert-oriented genres like the academic article and conference presentation to public-oriented genres like the blog post and library talk. They support scientists as they develop their skills at effective communication. But they are not as of now oriented to help scientists reflect on the roles they may appropriately play in public life, on the responsibilities they are undertaking when they address publics, or on the principles and ideals of good communication they are committed to. In other words, current communication trainings do not include opportunities to deepen understanding of communication ethics.

There is broad agreement within the fields studying communication that communication ethics is vital. Even "seemingly practical communications considerations... have ethical dimensions that deserve attention" (Holmes, Henrich, Hancock, & Lestou, 2009). Responsible communicators must not only master a toolkit of techniques, they must also be able to negotiate the often-conflicting communicative ideals and obligations inherent in complex communication situations (Craig, 1999; Craig & Tracy, 1995).

We already know that the scientists encounter many communication challenges when they leave their labs. How can a scientist adapt to her audience's needs and interests without compromising accuracy and becoming a salesperson instead of a scientist? How can a she contribute to often-heated civic deliberations without creating the impression that she is politicizing her science? How can she address those who may deeply disagree, without appearing to adopt an authoritarian stance? How can she share the promise of her results, without over-promising and arousing unjustified expectations? These and other ethical challenges arise in the ordinary course of communicating science to public audiences.

Despite this, there is virtually no scholarly literature on the special challenges of science communication ethics. A recent survey of the literature concluded that even as "science communication has been made the object of increasing political and academic attention," the topic "has gone almost unnoticed as an area of serious, ethical concern" (Meyer & Sandøe,

2012). Within the research ethics community, the ethical challenges that researchers encounter in the course of public engagement have been "neglected" (Pimple, 2002). Rachelle Hollander (2011) concurs, stating that "educators in research ethics have perhaps only recently begun thinking explicitly about communication as an important aspect of this field and recognizing the need to address communication in research ethics." A parallel ethics gap is evident within the scholarship on science communication. Communication ethics has always been a vital part of communication curricula, including the education of science journalists. But with a few recent exceptions (Nisbet, 2009; Priest, 2009, 2011; Tanona et al., 2009), there has been little scholarship on the issues of communication ethics that confront scientists who communicate with broader publics.

Given this gap in the theory of science communication ethics, it is no surprise that practical resources are also lacking. While the training materials and activities outlined above provide vital introductions to effective communication techniques, none yet include ethical reflection. For example, although the AAAS has been a leader in promoting scholarly discussion of the ethics of advocacy by researchers, its own Communicating Science website remains resolutely practical, focusing on advice about word limits and nonverbal communication (2008). While such materials respond to researchers' immediate anxieties about communication, they do little to encourage them to become responsible communication practitioners in a broader sense.

The *Cases for Teaching Responsible Communication of Science* project aims to address this gap in theory and pedagogy. Our case-based research aims both to illumine the situated ideals scientists are using when confronting communication challenges and to develop teachings materials suitable for use in diverse pedagogical settings—communication courses and workshops, research ethics trainings, and even science seminars on topics of public concern. In the following section, we describe the events and issues in our first three cases.

3. THE CASES

3.1 The Iowa Climate Statement

In the summer of 2012, a group of Iowa scientists decided to use the ongoing severe drought as a “teachable moment” to discuss the impacts of climate change on Iowa communities. They spent the next three months in a series of drafting conferences involving a growing circle of participants. After soliciting signatures from over 140 faculty from colleges and universities across the state, they released the Statement at a formal press conference in mid-November. Our interviews with a cross-section of participants and non-signers have revealed that none objected to the basic message that severe weather such as the drought is going to become much more common in Iowa. Likewise, we encountered no claims that it was inappropriate for scientists to address the public in this way. Instead, this case focuses on the management of small but significant communication choices that occur in the drafting and dissemination of public statements like this one.

To start with the most basic choice, participants voiced remarkably diverse conceptions of what the Statement was intended to accomplish. A few articulated “deficit” views of science communication when they described the letter’s purpose as “education” or “information” on the purportedly misunderstood subject of climate change. More commonly, scientists said that the Statement was intended to gain attention to climate change issues by piggybacking on the

drought, which was much discussed on the news and in everyday conversation. A small group of scientists spoke in terms more closely aligned with contemporary communication research, explaining that the Statement was intended to start conversations throughout Iowa between scientists and their neighbors, especially local media and opinion leaders.

The difficulties of expressing the complexities of climate science within the bounds of a one page letter also provoked thoughtful responses from scientists. Several articulated a tension between adapting to the audience's understanding and meeting their colleague's expectations of accuracy. For example, the text of the Statement explained that the increased frequency of intense rainfall was due to increased evaporation caused by global warming. While the two halves of this assertion were each accurate (there is more intense rainfall, and there is more evaporation), the causal connection between them is not as straightforward as the sentence suggested: increased rainfall in Iowa is in fact caused by complex changes in the Gulf of Mexico (among other things). But inserting the longer, more accurate explanation would have diluted the central message that climate change was real and that it would have real impacts on Iowa communities.

A similar tension between effectiveness and accuracy arose on the question of whether to include limitations. While it as noncontroversial that climate change increases the probability of drought, no scientist was willing in our interviews to draw a causal connection between climate change and the particular extreme weather Iowa was at that time experiencing. Was it therefore necessary to explicitly *disavow* this connection, especially in light of non-scientists' known tendency to think of science as providing mechanistic explanations? (One newspaper, for example, reported the Statement under the headline "Iowa scientists: climate changed caused the drought.") Or would leading with the negative again dilute the central message?

In addition to the challenge of balancing accuracy and comprehensibility, scientists encountered problems in defining the action step at the end of the Statement. Indeed, one reason given by those who declined to sign was that the statement made assertions no climate scientist had expertise on, for example about the relationship of new "green" technologies to job creation. On the other side, some participants wanted a stronger call to action, arguing that such advocacy is appropriate if based on what was in their view sound science.

Finally, scientists faced several procedural issues during the drafting and dissemination of the Statement. For example: Who ought to be invited to sign?—just climate scientists, scientists of any specialty (who were thought to be able to assess the soundness of their colleagues general approach, even when they lacked subject matter knowledge), or any faculty member, including those in humanities disciplines? And who should be involved in the drafting process? The communication professional attached to an environmental science research institute could provide valuable advice about how to frame the message for accessibility and impact. But since he was also a citizen-legislator in the Iowa State Senate, his participation in drafting the Statement might create an appearance of politicization.

These issues presented by this case may seem mundane. But managing them well will at a minimum prevent public statements by scientists from further inflaming controversies like that over climate change. And ideally, achieving an appropriate balance between the competing values of public and scientific communication will lead to messages that are both effective and legitimately trustworthy. This case study will invite students to engage in just this management process.

4.2. Monarchs in the Corn

Scientists typically regard professional publication as a way to communicate research results to colleagues within the profession. When scientific publications are read by non-experts, or picked up in the media, however, they may generate controversies. This case examines the controversy surrounding the publication of a paper on the effects of transgenic corn on Monarch butterflies.

The United States Environmental Protection Agency approved marketing and use of genetically engineered 'Bt corn' plants in 1995. 'Bt' stands for Bacillus Thuringensis, an organism that produces a toxin that is fatal to the corn borer. Bt corn has genes spliced into the corn genome, causing the plant to express this toxin in every cell. Some people found it alarming that these plants produce their own pesticide. There was concern that what is toxic to pests might be toxic to people as well. In the case of Bt toxin, this problem does not arise. Bt toxin responds to the gut chemistry of lepidopteran species like the corn-borer with fatal response. Because mammalian gut chemistry is different, Bt toxin does not have the same effect on humans. Still, transgenic technologies were unfamiliar, and their development was initially met with skepticism and fear. People worried not only that they might have adverse health effects, but also that their introduction might have unintended environmental consequences. By 1999 there was significant public concern about Bt corn. Many scientists believed that this concern was significantly based on mistaken beliefs about the new transgenic technologies that had been used to develop this variety.

It was in this context in 1999 that a group of entomologists at Cornell University pursued a preliminary study investigating the effects of Bt pollen on monarch butterfly larvae. This research group, led by Assistant Professor John Losey, found some evidence that pollen from Bt corn was potentially toxic to Monarch butterfly larvae. Concerned about their findings, they submitted a brief account of their work as "Scientific correspondence" in the top-ranked journal *Nature*. The paper generated controversy even before it was published. Scientists asked to review the paper gave mixed reviews, some recommending publication and others vehemently arguing that it should not be published.

This case raises important issues relevant to scientists whose work touches on issues that generate public anxiety and concern. Should the researchers have published their paper before completing a full-scale study? Does the potential danger to a significant and charismatic insect species justify early publication of incomplete and potentially incendiary results? Should researchers consider public reception when pursuing, publishing, or publicizing their work? When specific terms like "hazard" and "risk" are understood differently by experts and the public, should scientists take this into account when employing such terms in professional publication? Is the answer different in the case of publications that appear in a popular journal (like *Nature*) and are likely to inspire fear and public controversy? This case study will address these and other concerns that arise when scientists publish and publicize research that is likely to generate public concern and controversy.

4.3. Case: Science Headlines

The media play a large role in disseminating science to the public as well as to policy-makers. While media bias is often thought of in political shades, i.e. liberal versus conservative, the deeper bias within media is toward news values that will interest audiences. Timely events,

prominent issues, conflict and controversy are some of the biases that select and shape what information become news.

Scientific content is subject to these same media biases as everything else. How scientists orient themselves to such media bias presents ethical challenges every time a researcher communicates about his or her research.

We are focusing on the challenges faced by Dr. Rosi-Marshall, an aquatic ecosystems ecologist, who was lead author on a 2007 article published in *PNAS* about the potential negative impact of genetically modified (GM) corn on caddisfly larva in rivers—her first article within a GM context (Rosi-Marshall et al., 2007). Scientists supportive of GM technology immediately criticized the article, in large part because of the final sentence within the abstract that the scientists feared would provide ammunition for anti-GM advocates to use toward influencing policy (Waltz, 2009). The sentence in question claimed that "widespread planting of Bt crops has unexpected ecosystem-scale consequences." The media picked up the story, amplifying the certainty of that sentence from "may affect stream ecosystems," to "may harm stream ecosystems," to "found to damage stream ecosystems" in the course of only four days. About four months later, the French government cited the Rosi-Marshall article as informing their decision to ban a specific variety of GM corn due to environmental dangers (von Mogel, 2009).

Understanding how the media select and shape news stories permits scientists to predict what aspects of their research will gain media attention and even how the interpretation of their research may shift over time. Should scientists be expected to consider this potential reaction of the media when communicating about their work? Should scientists be held responsible for public opinion or policy-decisions that result from the media influence of their communication? Some of the scientists who criticized the article claim that yes, scientists need to stop being politically naïve and shape their own communication based on its potential societal influence (Waltz, 2009). Other scientists claim that they cannot control how their communication is used, and their responsibilities do not extend beyond presenting the results of their work accurately.

The controversial sentence in question was published in an academic journal. Yet the issue becomes more complex when considering how researchers and their organizational news agencies work together to promote media attention of the research results through news releases. These news releases strategically frame the science to fit the biases to which the media are already searching. Rosi-Marshall and her co-authors edited drafts of news releases written by their university news agencies that were eventually released to the media and public. Beyond the question of whether scientists consider media biases when communicating, this case asks how far can researchers appropriately benefit from media biases before being held responsible for the impact of that benefit.

In summary, media biases will impact researchers both by influencing how their journal articles will be interpreted by the public and policy-makers and by providing guidelines that can be used to attract positive attention through the creation and dissemination of news releases. How scientists use this knowledge of media biases remains a complex question within ethical science communication.

4. CONCLUSION

One set of cases will not "solve" all the communication ethics challenges scientists are likely to encounter as they continue their efforts to communicate with more and more diverse publics. But we hope that our cases will be useful to teachers in a variety of settings and open opportunities for further research and teaching in this area. The issues at the center of our cases—appropriate advocacy, social responsibility in publishing results, and the management of relationships with journalists—are hardly unique; we look forward to exploring them and a host of similar topics with colleagues across the sciences and the communication fields.

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