Rhetorical Principles on Uncertainty for Transdisciplinary Engagement and Improved Climate Risk Communication

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In the last few years, rhetoricians of science, technology, engineering, and medicine (RSTEM) have provided a wide range of models for how rhetoricians collaborate with scientists. These collaborations all use rhetorical perspectives to improve science and science communication at sites of transdisciplinary teaching (Goodwin *et al.*, 2014), research collaborations (Druschke, 2014; Rief, 2014), and public engagement (Walker, 2014; Parks, 2014; Vernon, 2014). Unfortunately, these avenues of collaboration—across teaching, research, and engagement—tend to be discussed as though they are separate activities with little integration or understanding of how one may inform the next. For example, research collaborations in "applied rhetoric of science" argue that rhetoricians should move from "talking about science to doing science" (Herndl and Cutlip, 2013), and thus conceive of rhetoric as "a necessary and integral part of the engaged practice of science itself" (Druschke, 2014, 2). I agree, but would suggest that the gap between talking about science and doing science isn't quite so clear.

Even applied rhetoric of science seeks inquiry into how communication and talk affects citizen participation (Herndl and Cutlip, 2013, 6). Science communication is an area that vexes this distinction: Are deliberative engagements among scientists and publics an integral part of the engaged practice of science? Is communicating science with public audiences a part of doing science or talking about science? I'm not sure there's a clear-cut answer to these questions, but my sense is that rhetoricians have an interest in the claim that science communication is an important part of doing science. After all, it is quite common for our research collaborations with scientists to include public engagement, or our transdisciplinary teaching to be part and parcel of building research collaborations. Perhaps it is time to start viewing these collaborations from a more integrated perspective.

To that end, my contribution to this symposium discusses how my collaborations with scientists in public science communication programs have informed an approach to transdisciplinary engagement that I believe can be used across sites of teaching, research, and public engagement. Mostly I will focus on how rhetorical theories of uncertainty can inform particular practices in science communication and vice versa. So while one of my goals here is to build on my previous work in science communication by offering particular ideas for effectively conveying rhetorical practices to scientists (Ceccarelli, 2013, 2014; Walker, 2014), my main purpose is to discuss how rhetoric of science can improve the doing of science communication.

These sorts of projects are important because there is simply not enough rhetorical theory and practice in typical science communication programs. Where it does exist, it is too often treated in ways that do not account for the complexity, dynamism, and practical value of the art. A theorized rhetoric of science pedagogy should be able to correct for this by showing how collaborative science communication projects—in our teaching, research, and engagement—can be improved with the participation of rhetoricians. In what follows, I describe how the "spheres model" of deliberative rhetoric can be effectively used in science communication collaborations, and climate risk communication in particular. From this model I derive three rhetorical principles on uncertainty for transdisciplinary pedagogy and improved climate risk communication. Then I demonstrate the value of these principles through a case study that can be used across collaborative sites in teaching, research, and engagement. Finally, I end with a brief reflection on how theorizing our pedagogy or building theory through pedagogy is one way to integrate various strands of rhetorical collaborations with scientists.

The Spheres Model of Uncertainty in Climate Risk Communication

Much rhetorical pedagogy is based upon defining the various parts of a rhetorical situation—rhetor/audience, exigence, and constraints—and applying them to a particular case (see Grant-Davies, 2005 for a helpful review). But as rhetorical ecology reminds us, rhetorical situations are not stable entities, but instead ongoing circulation processes and short-hands for describing a series of events (Edbauer, 2005, 8). When applied to science communication, rhetorical ecology reminds us that science

communication can never be fully controlled, that distortion will happen, and that performances are one moment in an array of broader discourses about science and scientists. This circulation is important because it constitutes publics, and thus public understandings of science. Science communicators must, and for the most part do, clearly understand these circulation processes because they underscore the importance of repeating a particular message in a clear and consistent manner by a variety of trust-worthy sources. Conversely, it is also desirable to integrate into a single rhetorical performance a variety of perspectives that circulate in a given discourse. Jean Goodwin and the group at Iowa State, for example, in their work on the *Midwest Climate Statement* have shown how a collaborative group of climate scientists who integrate various definitions of a rhetorical situation can create performances that are "resilient against a range of skeptical challenges" (Goodwin *et al.*, 2014, 4).

The art of identifying the typical lines of argument that circulate within a discourse—what rhetoricians call *topoi*, or common topics—is related to the notion of a rhetorical situation. This is because common topics often come to define an exigence—an urgent need, pressing issue, or problem that can be addressed and solved through rhetorical discourse (Grant-Davies, 2005, 265). In deliberations over climate risk, for example, uncertainties are common topics that can serve as heuristics for climate risk communication. Definitions of uncertainty are diverse, but most distinguish it from related terms like ignorance, indeterminacy, and risk (Wynne, 1992). For our purposes, uncertainty can be defined as "a situation where more than one outcome is consistent with our expectations" (Pielke, 2007, 55), or a situation in which "we know that we do not know, but that is almost all that we know" (Callon *et al.*, 2009, 20). To be sure, in order for a polysemous concept such as uncertainty to be effectively conveyed requires some productive constraints. Lynda Walsh and I have recently argued for an understanding of uncertainties based upon the "spheres of discourse" model where uncertainty arguments circulate, translate, and hybridize among technical, personal, and public spheres of argument (Goodnight, 1982/2012; Walsh and Walker, 2016). When applied to science communication, it is rhetorical practices that find and integrate uncertainties across technical, personal, and public spheres of discourse that can be most effective for climate risk communication.

Before discussing a specific example of locating and integrating uncertainties in climate risk communication, I offer a few uncertainty principles for science communication that can help put

the spheres model into practice. These principles are dynamic and can be used in any order. They are helpful mostly in pedagogical and public engagement contexts, but also have implications for cross-disciplinary research collaborations. In short, these principles are meant to be practices that help performances of climate risk communication productively mediate between scientific inquiry, affective dimensions of personal concern, and values-based decision-making. Here they are with some catchy titles:

1) **Name and Frame Uncertainties.** Name scientific uncertainties, but primarily speak to what science does know and is certain about. Then, reframe uncertainties as the domain of public deliberation about risk.

2) **Recognize Audience Uncertainties as Opportunities.** Listen to the concerns, questions, and positions of your audience by inquiring about them. Recognize that uncertainties are ideologically contested sites for audiences (i.e., some use doubt to manufacture scientific controversy; others to pursue research; others to stoke public anxiety and fear, with reason or not), and as such they represent opportunities for co-constructing knowledge about science, the scientific process, and its contribution to reasoned debate and informed decision-making.

3) **Use Uncertainties to Facilitate Personal and Public Judgments About Risk.** Negotiating uncertainty effectively means learning to facilitate a political conversation about how publics understand and evaluate risk. When done effectively, publics can use these conversations to reflect on the relationships among situated knowledge, identity, and action—among what we know, who we are, and what to do.

For scientists communicating climate risk, negotiating uncertainties is all about using technical expertise to help publics understand their own identities and values in terms of risk. In the following sections, I discuss how rhetoricians might use the three principles above as a rhetorical pedagogy in classrooms and engagement contexts with implications for research collaborations.

Negotiating Uncertainties with Skeptical Audiences in Climate Risk Communication

Setting up a debate with a skeptical audience is a fairly common practice in both rhetorical pedagogy and science communication. To demonstrate the three principles, I offer in this section an analysis of a deliberative exchange between a climate scientist and an audience of climate skeptics. The climate scientist is Dr. Stephen Schneider, who is widely regarded as one of the most effective climate science communicators of the last generation. In June of 2010, just a few weeks before his untimely death, he agreed to participate in an Australian show called *Insight*, where he and a moderator engaged in a deliberation with 52 climate skeptics in an attempt to change their minds about the reality of human-induced climate change. Though Schneider's health was deteriorating, he was in sharp form during this engagement—so much so that others have noted the exemplary nature of this particular performance (Revkin, 2011). In his attempt to mutually construct his desired exigency with the audience (i.e., the reality of human-induced climate change), Schneider expertly integrated the uncertainties circulating within this deliberative forum. I have a few problems with his performance, which I will describe later, but it does serve as a remarkable example of locating and integrating uncertainties to help audiences co-construct an understanding of the relationships among scientific processes, personal judgments, and collective actions in climate risk.

From the beginning, the forum is established as a deliberative conversation about doubt and belief on the issue of climate change. The believer, Schneider, smiling wryly as if he knows what's coming, sits on the stage next to the moderator. He listens and responds to the audience's questions. The show begins with comments from a number of skeptics who describe why they do not believe in human-induced global warming. Schneider responds by drawing a distinction between belief and evidence: "Your beliefs have to be built upon looking at the whole wide range of evidence" (Cinqmil, 2015). This distinction is used to hybridize two uncertainties: personal doubt/belief must be informed by the certainty/uncertainty of technical evidence. When the rhetorical situation is established as belief-based technical evidence, few people in the audience can match Schneider's scientific expertise. Some try. Much of the deliberative engagement follows a basic pattern: The skeptical audience defines a reason for doubt. Schneider responds by providing technical information explaining why this or that particular reason is misguided or not. Many of the audience's reasons for doubt are standard fare for climate skeptics:

climate change is hysteria for scientists to get grant money; climate change is natural and not man-made; the climate has always changed therefore there's nothing to worry about; climate change is beneficial; the temperature gauges are biased toward urban heat islands, and more. At times, it appears Schneider finds this process to be tedious. But he demonstrates good will by showing up, engaging these questions about climate science, and speaking to people's values. Schneider is clearly a believer in climate science communication.

Much of Schneider's performance is about correcting the audience's misinformation or misinterpretation of climate science. But he also consistently acknowledges where the science is uncertain. For example, in a discussion about the IPCC and acknowledgement of uncertainties by assigning confidence scales to various outcomes, Schneider says, "I have long been a believer that you must frame things in terms of the uncertainties associated with them" (Cinqmil, 2015). He readily admits there are areas where climate science is uncertain because it doesn't have the data. In a question about trust, another skeptical audience member says, "I would like to see you people admit some doubt." Schneider replies, "Go read my book, I've been doing that for 40 years." Later an audience member asks a question about how lay publics should know whom to trust when publics don't know enough and both scientists and skeptics seem to have credible points. Schneider responds that it is those who are talking not in certainties but in probabilities—ranges, bell curves, wheels of fortune—that's who you trust with complex problems: "So I think the best guide for you is, when there's a complex problem, remember you can break it down into well-established bits where *we do have some things that are very likely*; *competing explanations*—like Greenland is melting, but exactly why we don't know why; and *[the] speculative*: we really don't know what the cloud feedback amount [is] going to be. When people talk like that, they are much more likely to be credible" (Cinqmil, 2015, italics mine).

What Schneider understands is that enacting principle 1—*name and frame uncertainties and acknowledge where science is still uncertain, but primarily speak to what science knows*—facilitates trust. Schneider realizes it is important to acknowledge uncertainties because interpretations of uncertainty are a battle-ground in public discourse. They shape how publics approach science and its politics. At the same time, demonstrating expert knowledge in the relevant subject allow the speaker to become more credible to skeptical audiences. On a similar point Schneider says, "It is not a scientist's job to judge whether or not the risks are

sufficient to hedge against … [better or worse] possibilities. It is only our job to report risk." In other words, value judgments about policy are not the scientist's job; that is the job of the larger public deliberations and public policies to which scientists contribute. In his attempt to reframe uncertainties as the domain of public deliberation, Schneider often makes his own personal value judgments explicit: "I don't take 10% risks with planetary life support systems. That's my personal view. That's my personal values and I always say that" (Cinqmil, 2015). These kinds of integrated uncertainty arguments effectively transition technical uncertainties, the domain of expertise, to public uncertainties, the domain of public policy. In short, when a climate expert such as Schneider locates his personal values, and integrates them with technical un/certainties, he *reframes the discussion of climate risk as in the domain of public deliberation*. Once Schneider locates and integrates these uncertainties, he can get back to his primary mode of communication, going into nerdish detail about how scientists calibrate tree rings to temperature.

Another skeptical audience member, Dr. Ian Rivlin, asks a question about how the seemingly tiny amount of 3% of CO_2 that humans produce can have such an impact when nature produces the other 97%: "How can small changes in our production of CO_2 impact upon something as large as the earth? It seems absurd" (Cinqmil, 2015). Schneider explains the CO_2 production based on the natural cycles of the season, and uses the metaphor of a family budget. Dr. Rivlin interrupts because he thinks Schneider is not answering the question. Schneider clarifies his belief. "You believe there cannot be an accumulation of CO_2 because we only produce 3% … Oh, you're totally wrong." Then he offers this analogy:

> If you have a bathtub and you turn it on so you're getting a gallon coming in a minute, alright. And now the drain is opened up to the point where a gallon is going out in a minute. So there's a flow in and a flow out. That's an analogy to the fact that there is a very large flow of carbon dioxide naturally going into the system in the summertime and coming out in the winter. Much larger than the 3%, I agree with that. However, it's in balance. The amounts are the same. So when you add the 3% it's 3% this year, and next year, and next year, so it accumulates. … so the water in the bathtub is going to rise. That is completely well established. It's been established for a long time, and if you don't accept that, you really need to study science. You're just wrong (Cinqmil, 2015).

Metaphors about risk are one of Schneider's favorite risk communication tools. Later in the show a skeptic-turned-believer cites the metaphor of the bathtub as the moment that converted her. Both the metaphor of the family budget and the bathtub are relatable to people's lives and they communicate a threat. As such, they are good tools for enacting principle 3: *Use uncertainties to facilitate personal and public judgments about risk.* Risk metaphors serve as a relay for technical evidence, but they are communicated in a fashion that personalizes risk, such as an unbalanced family budget or a flooded house. When communicated publicly in this forum, personal risks become public value judgments about normative actions in the face of these risks. Not only does Schneider re-establish his technical expertise against the lay audience member, but through the risk metaphor he quickly and effectively personalizes risk and establishes normative value judgments about it. Presumably, few want to go bankrupt or have their house flooded. Risk metaphors like these are remarkable tools for climate risk communicators because of their ability to translate technical uncertainties into personal and public judgments about risk. Schneider uses a variety of them—loaded dice, wheels of fortune, bell curves—frequently.

Janet Thompson, a well-versed and well-prepared cattle rancher, charges Schneider for being an alarmist in his use of language like ocean acidification (the ocean is alkaline, not acidic, as she correctly points out). Furthermore, she claims CO_2 is logarithmic, and therefore cannot be accumulating... a picky point. She ends by stating, "I'm concerned about the general amount of alarmism that is out there and the terminology that is being used." Schneider responds, "I'm concerned that you're kind of repeating a mantra from discredited information." Then, after a technical explanation, he states, "When people try to say that because CO_2 is a logarithmic absorber and therefore makes no difference they either do not understand climate science or they are polemicizing because it is absolutely in every single model. It has long been accounted for and it is completely understood" (Cinqmil, 2015).

The exigence in this exchange is afforded by the word 'concern.' The exigence for the cattle rancher is Schneider's alarmism. For Schneider it is repeated polemics from discredited sources or manufactured scientific controversies (Ceccarelli, 2011). Schneider counters manufactured scientific controversy with *Principle 2: Recognize audience uncertainties as opportunities.* When confronted with what he identifies as a manufactured scientific controversy, he immediately reframes the uncertainty as an opportunity to voice concern over characters who repeat

misinformation. He then solidifies his own expert information in certain terms like "absolutely," "accounted for," and "completely understood." At the same time, when Schneider encounters audience uncertainties that he recognizes as well intentioned, he uses the opportunity to bring the audience along the scientific process with statements like, "I am actually very pleased that you're a skeptic. There's no such thing as a good scientist who is not a skeptic"; and "That very good question you asked is exactly the same question that climate scientists have been asking themselves for 30-40 years" (Cinqmil, 2015). In recognizing audience uncertainties as opportunities Schneider validates or invalidates inquiry based upon his interpretation of a worthy question—a position not unfamiliar to many teachers. After another moment of identification with the audience in which they identify perpetrators of hate mail and hate speech as a common enemy, an audience member says, "Thank you for actually engaging in dialogue sensibly. And basically not demonizing someone who dares to raise a doubt." But when the moderator asks if she is still a skeptic, she says, "I was never quite sure, to be honest. I just don't know enough" (Cinqmil, 2015). These audience remarks exemplify why uncertainty is an opportunity. Doubts and uncertainties are sources of deliberative engagement in which a great amount of mutual learning can happen. This particular audience member is uncertain, but when approached with sensible engagement, she is willing to listen.

From my rhetorical perspective, Schneider's use of a deterministic scale to quantify uncertainty and his preference for technical expertise and meta-institutions over public participation in complex issues like climate change, gives me some pause. He believes scientists should guide audiences toward the correct interpretation of facts to improve people's environmental literacy and thus public policy. So for him, technical expertise is still more important than public participation in policy making. As Chris Russill has noted, Schneider was more concerned with how scientists could contribute to the larger public discussion over climate risk than he was about understanding and situating climate science with other important voices in pluralistic democracies (Russill, 2010, 64-65).

Publicly communicating uncertainty and risk is immensely challenging work for risk communicators, particularly because scientific uncertainties do not fit with the norms of public media. The value of the spheres model of uncertainty for risk communication is that it incorporates Schneider's insights while also allowing for the potential integration of personal and public

uncertainties that may or may not value precautionary approaches as much as climate scientists do. The rhetorical practices discussed here are not necessarily attempts to derive consensus, but instead to make value judgments explicit so they can be recognized instead of masquerading as valid technical inquiry.

Conclusion

Rhetorical practices deriving from the spheres model of uncertainty stem from collaborations with scientists in public science communication programs (Walker, 2014). It is easy to see how these examples might be used in science and risk communication workshops. These principles and practices also carry implications for undergraduate program development and research collaborations. At my institution, we are using these kinds of curricular practice in professional rhetoric and writing certificates to attract a wide audience of STEM students across campus. These conversations are happening at the same time our program is developing grant projects with faculty across campus who are interested in training their advanced undergraduate and graduate students in science communication. These conversations in turn have led to discussions of current research projects in which rhetorically trained communicators might contribute. In short, deriving heuristics as principles and practices from rhetorical theory help me do double work. First, they allow me to honor the relationships that established this transdisciplinary work by serving our professional writing and rhetoric program through curricular development. Second, they provide the environmental science students access to science communication courses at fairly early stages in their academic and professional careers. Over time, our hope is if these students and faculty see value in this kind of training, we will have something to build on.

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