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"How Can We Act?" A Praxiographical Program for The Rhetoric of Technology, Science, and Medicine

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The history of scholarship in the humanities in the twentieth century is to a considerable degree a response to changing institutional, social and intellectual conditions. The literary *new criticism* was influenced by the aversion to politics during the cold war, the need to professionalize literary studies with a unique object and disciplinary nomenclature, and the pressure to teach a huge influx of G.I.'s who lacked the careful training in Latin, Greek and the great books necessary for Germanic philology. Closer to home, *composition* developed a disciplinary apparatus and theory in response to the inauguration of open admissions that produced work like Mina Shaughnessy's (1977) *Errors and Expectations*. Closer still, the field of *technical and professional communication*, at least in English, was a response to the growing requirements for engineers to take technical writing courses, the emergence of ethnography as a research method for understanding non-academic writing, and the reemergence of classical rhetoric in English departments at places like Rensselaer Polytechnic Institute. Other than Mathes and Stevenson's (1976) *Designing Technical Reports*, there were no textbooks available for the new technical writing courses that began to appear in the late 1970s and early 1980s. To the extent that the *rhetoric of science* is a "mission-oriented" project rather than a "curiosity-oriented" project, to borrow a distinction from history of science, I think our future will similarly be a response to a finite set of intellectual and material contingencies.[1]

What Is Happening to the Rhetoric of Science?

In his wonderful introduction to *Rhetoric and Incommensurability,* Randy Harris (2005) answers the historical question of what happened in

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[1] This paper is written in the first person singular because the first half of the paper where the disciplinary position is articulated is largely Herndl's work, while the second half of the paper is largely Cutlip's work.

the mid- to late twentieth century to create the field of the rhetoric of science with a single word: Kuhn. An overstatement perhaps, but a powerful one. I'm tempted to imitate Harris and say simply: Latour. But who wants to be that derivative? And I might just as easily say "uncertainty," or "climate change," or "sustainability," or "science studies," or even "budget cuts." I want to say that, like that of any disciplinary project, the future of the rhetoric of science will be guided by an internal logic of theory and an external logic of material opportunities and demands. But I'm uncomfortable with that distinction. The field is a hybrid of these motive forces, neither of which excludes the other.

To be schematic, I think the rhetoric of science (ROS) or the rhetoric of technology, science, and medicine (RTSM) is shifting from a modern and humanist disciplinary focus to a non-modern and post-human focus. This shift includes a change in our dominant theory of realism, our understanding of agency, and the location where we do our work. To illustrate this shift, let me compare Charles Bazerman's (1988) chapter "Making Reference" from *Shaping Written Knowledge* to Bruno Latour's (1999) "Circulating Reference" from *Pandora's Hope*.

Bazerman's "Making Reference"

Bazerman examines Arthur Holly Compton's texts and focuses on the "developed system of scientific communication" (p. 191). The institutional "haggling over experience" generates arguments over the best way to represent experience and how to hold representations "accountable to the experience" (p. 190). The core resource for the scientist is the "communal structure" that constrains and enables scientific behavior and communication (p. 191). Bazerman is carefully agnostic about issues of truth and never says "true" or "truth"; his notion of "accountable" is an openly pragmatist position in which the consequences and results of the account determine its power and efficacy.

In these respects, Bazerman is very similar to Latour. Both texts avoid postmodern critiques of reference and examine scientific practice to construct a realistic, almost pragmatist account of reference. Both examine scientific process and activity. Both seek a way out of postmodern discourse critique. Both want a more practical theory of realism. But Bazerman's argument depends on metaphors of "contact," of being "accountable," of "precise exchange," "close concourse," "constant relation," and "close relation," all of these "shot through with empirical experience" (p. 192), "freighted with empirical experience" to "adjust constantly that representation to experience" (p. 195). This characterization is uncannily close to what Latour does and says, but the metaphorical system is grounded in a theory of perspective and metaphors of seeing and representation, all the core theoretical issues in the 1980s. The enabling agent here is "the communal structure" (p. 191), "the institutions of scientific communication" (p. 191), and the "developed system of scientific communication" (p. 191). The final claim is that this system "helps scientists behave like scientists and do good science" (p. 191). This carefully hedged sentence avoids truth claims and the correspondence theory of truth but also avoids overt social construction ("helps"), and it defines "good science" as "precise exchange with

phenomenon" through which "symbols of language *come into contact* with the world" (p. 188).

These analytic metaphors echo Kuhn's (1962) discussion in *Structure of Scientific Revolutions* where he talks of how scientists *"attach"* a law to nature and where he describes the experience of solving exemplar problems as allowing scientists to adopt a "group-licensed *way of seeing*" (p. 189, italics added). Both Kuhn and Bazerman warrant their realism and metaphors by referring to Ludwig Fleck's *The Genesis and Development of a Scientific Fact* (1979) in which nature "constrains" scientific statements. And all these critics depend on Kant's argument in *Critique of Pure Reason* that the forms of sensible intuition determine the shape reality takes for man. For Kant, Fleck, and Bazerman, the world is outside, separated and, to quote Latour, "contributes decisively but minimally" (p. 6). This project is fundamentally epistemological, and it is driven by questions of representation and accuracy. And it is this problematic that produces the vague and unsatisfying metaphors in Bazerman's text. Lest you hear me criticize Bazerman's text too harshly, I think his work is the very best that can be done within the modern, humanist conception of science.

Latour's "Circulating Reference"

Where Bazerman reads Compton's texts, Latour goes out into the Brazilian jungle as a member of a field expedition and meticulously records in ethnographic style the doings of the scientific team of which he is a member. For Latour and others who use ethnographic methods to study the doing of science, practice makes opaque what tradition makes transparent. Latour's goal is not critique, but understanding; he accepts the reality of science, and he produces a theory of reference that rejects the impassable gap between word and world, signifier and signified, in favor of an uninterrupted chain of tiny transformations that trace the movement from Amazonian dirt to a scientific graph in a journal article. He describes how reference brings back into discourse the material reality of the world that finally makes science legitimate.

The essence of Latour's theory is that reference is a "non-saltatory movement," to borrow William James' term (1907/1975), underwritten by an uninterrupted chain of very small transformations rather like an evidentiary chain of custody in the law. In place of metaphors of "constraint" and communal "ways of seeing," Latour adopts non-modern metaphors of translation, quasi-objects and quasi-subjects, propositions and concretization, drawn from William James, A. N. Whitehead, and Michel Serres. These metaphors allow Latour to articulate a theory in which humans and nonhumans are equally actants in the making of reality and the constitution of a realist theory of reference. Latour's post-human and distributed theory of agency is part of a renewed materialism that explores the effectivity or agency of objects, Latour's nonhumans (Bennett, 2010; Coole & Frost, 2010), and the political implications of this shift (Braun & Whatmore, 2010). Collectively, this is an ontological and essentially pragmatist project.

A Move Toward Praxiography

Annemarie Mol (2002) characterizes this as "shifting from understanding objects as the focus point of various perspectives to following them as they are enacted in a variety of practices [and] impl[ying] a shift from asking how sciences represent to asking how they intervene" (p. 152). The "praxiography" Mol describes moves us away from incommensurability and the briar patch of epistemological issues invoked by Latour's "brain-in-a-vat" or what Richard Bernstein (1983) calls our collective "Cartesian anxiety" about certainty, to questions of post-plurality and multiple ontologies. This moves us from a focus on saying and representing to a concern for doing and intervening, from "how do we know?" to "how can we act?"

Much of Latour's recent work is motivated by what he calls the impending "ecocide" and the pressing need for adequate environmental policy. Books like *Reassembling the Social* (2007) and *The Politics of Nature* (2004a) are driven by Latour's concern about the public controversy over climate change and the ineffectiveness of climate policy initiatives. And this problem will have an equally powerful influence on RTSM. To a considerable degree, however, the future of our discipline will also be a response to more mundane pressures: the increasing reconfiguration of universities in which funding is increasingly STEM; the interdisciplinary collaboration that is increasingly necessary for research funding; the influence of grant funding on tenure and promotion decisions even in the humanities. RTSM will flourish as a participant in interdisciplinary research projects in which rhetoric functions as a significant contributor to research, outreach, and policy formation.

To flourish in this new institutional environment, however, rhetoricians need to turn the kinds of non-modern ideas Latour and company articulate into practical strategies for helping manage the uncertainty of post-normal science and policy formation. This shift from analysis of science and its discourse to collaborating in the management of uncertainty is the move Latour (2004) calls for in "Why Has Critique Run Out of Steam," where he redefines the critic as one who brings things together in matters of concern. It is what Collins and Evans (2002) call for in their conception of the third wave of science studies, where humanities and science studies scholars work "upstream" of technology development, or what Herbert Simons (2005) calls "reconstructive rhetoric" (p. 239). And it addresses the problem Marlia Banning (2009) identifies so nicely when she describes how the critique of postmodern theory has been co-opted by the political right to fight climate change policy.

Four Research Foci

At the risk of considerable self-aggrandizement, I will illustrate this possibility by describing the proposal my colleagues Kalanithy Vairavamoorthy, Ali Yalcin, and I recently finished to create a new Patel College of Global Sustainability at University of South Florida (USF). This interdisciplinary college will be without departments, organized by problem-driven work teams who identify central issues in sustainability,

largely in urban areas of the developing world. We spent much of the last six months designing this new college and writing the final proposal that went to the USF faculty senate for approval on November 14, 2013. This college will include an Institute for Applied Rhetoric of Science and Sustainability that will have both its own independent research agenda and be partnered with the central research initiatives of the college. As I devote my efforts to building this new college, I realize that I am laying my academic bets on a vision of the future of our field. Guided by what I have said to this point, I will design the Institute for Applied Rhetoric of Science and Sustainability with four research foci: science policy, citizen participation, modeling, and data visualization.

Science Policy

For mission-oriented science, influencing the formation of sound public policy that brings government, citizens, and scientists together is the holy grail. Especially in sustainability studies, scientists and engineers know that good science is not enough. Addressing the challenges of the emerging ecocide requires careful policy. The research in this area reflects an understanding that bridging this gap between science and policy is a *rhetorical* issue. The question at hand is how to take the information produced by scientists and use it to get things done. How do we communicate science, and with whom should we communicate, in order to mobilize policy? The central questions of this issue include:

1. Why is there a gap between science and policy? (Cash, Borck, & Patt, 2006; Jasanoff, 1987; Lindenfeld, Hall, McGreavy, Silka, & Hart, 2012; McNie, 2007; Peterson, Peterson, & Peterson, 2005).
2. What is the role of the scientist? (Elzinga, 2012; Gibbons, 1999; Ozawa & Susskind, 1985).
3. How do organizational boundaries impact policy formation? (Guston, 1999, 2001).
4. How is science policy a specifically rhetorical issue? (Cox, 2010; Foust & Murphy, 2009; Lakoff, 2010; Nisbet, 2009; Zittoun, 2011).
5. How can we explain uncertainty to the public to influence support for policy? (Fischhoff, 2007; Weber & Stern, 2011).

Citizen Participation

As Fiorino argued in 1990, including citizens in technology development and decision-making creates better technology, increases public adoption of new technologies, and supports basic democratic principles against a technocratic model of science and technology. A widely read watershed article on citizen participation by Collins and Evans (2002) articulates a normative theory of "non-credentialed" experts and their participation in technology development. Some of the crucial questions concerning citizen participation include:

1. Is public participation useful? Why is public participation necessary? (Herian, 2011; Laird, 1993; Webler, 1995).
2. What is public participation? What does or should it look like? (Abelson, Forest, Eyles, Smith, Martin, & Gauvin, 2003; Fiorino, 1990; Lengwiler, 2008; Roberts, 2004; Rowe & Frewer, 2005).
3. How do we evaluate participation mechanisms? (Burton, 2009; Carr & Halvorsen, 2001; Rowe & Frewer, 2000; Rowe, Marsh, & Frewer, 2004; Rothstein, 2007).
4. Is public participation effective? (Bogner, 2012; Cotton & Devine-Wright, 2012; Nielsen, Lassen, & Sandøe, 2011; Wilkinson, Bultitude, & Dawson, 2011).
5. How do communication and talk affect participation? (Blythe, Grabill, & Riley, 2008; Grabill & Simmons, 1998; Veen, Molder, Gremmen, & van Woerkum, 2012).
6. How do we understand and evaluate expertise? (Allgaier, 2011; Boyd, 1998; Clark, Wegener, Habashi, & Evans, 2012; Collins & Evans, 2002; Collins & Weinel, 2011; Fischer, 1993; Goodwin, 2011; Majdik & Keith, 2011; Munnichs, 2004; Su, 2012).

Modeling

Post-normal science concerning complex, non-linear systems such as climate change, agroecosystem management, or ocean systems that cannot be controlled or easily studied in laboratories or in experimental conditions depends on models that take advantage of the enormous capacities of supercomputers. This shift represents a major change in how science operates in the twenty-first century, and it entails complex rhetorical problems and affordances. Some of the central questions regarding this issue include:

1. How and how effectively does modeling represent uncertainty? (Buede, Mahoney, Ezell, & Lathrop, 2012; Cobb & Thompson, 2012; Sriver, Urban, Roman, & Keller, 2012).
2. How can modeling bridge the science-policy divide and aid in decision-making? (Gabbert, van Ittersum, Kroeze, Stalpers, Ewert, & Olsson, 2010).
3. How do models shape research and practice? (Huber & Kutschenko, 2009).
4. How can we incorporate rhetoric/affective behavior prediction into modeling? (Lodder, 2004; Nyborg, 2003).

Data Visualization

As Ortiz (2007, p. 231) argued:

> current visualization technologies [are] especially relevant to our understanding of globalization and the global system. If by visualization we mean 'a method for seeing the unobservable,' then information visualization has yet to acquire the status of mainstream methodology within the social sciences (Orford et al.,

1999, p. 300). As yet, visualization has not enjoyed a strong, central, and coordinated research program to put forth visualization in mainstream scholarship – other than geography scholarship with a slow diffusion process often taking place from the 'harder sciences' to the 'softer sciences' (Orford et al., 1999, p. 300).

Visualization, however, is a significant strategy in connecting science, policy and citizens. Some of the emerging questions involved with this issue include:

1. What are the tools for analyzing and visualizing networks? (Shi, Zhou, Wu, & Liu, 2009).
2. What is the role of user interaction in visualization technologies? (Liang & Sedig, 2010; Simorov, Otte, Kopietz, & Oleynikov, 2012).
3. How can we teach non-experts to use visualization technologies? (Freyne & Smyth, 2010; Heer, Van Ham, Carpendale, Weaver, & Isenberg, 2008).
4. How can visualization technologies transfer knowledge across fields, to non-experts, and contribute to decision making? (Huang, Chen, Yip, Ng, Guo, Chen, & Roco, 2003; Pham, Streit, & Brown, 2009; Wuqi & Jifa, 2009; Zhu & Chen, 2008).

Conclusion

As useful as our tradition of scholarship in the rhetoric of science has been in establishing the field, it will change substantially as it responds to the demands and opportunities of this new landscape. RTSM will thrive if it builds interdisciplinary alliances, engages with our colleagues in science to help manage uncertainty and the threat of ecocide, and develops specific strategies and tools to put into practice our disciplinary intentions to make a difference. We should move from talking *about* science to *doing* science.

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