

The Productivity of Scientific Rhetoric

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1. Rhetoric and Contemporary Studies of Science

Rhetoric of science is a so far a small but proud scholarly field that seeks simultaneously to contribute to rhetorical studies and to secure a place in the conversation of (to use a broad and not exclusively owned term) science studies. We want to be mindful of both of those fronts. Its approach to argumentation, including scientific argumentation, recognizes that, no matter how valid their reasoning or how strong their evidence, speakers must command authority with audiences, and that audiences bring a lot of baggage with them to the context-dependent rhetorical situations in which they encounter rhetorical activity. Accordingly, rhetoricians of science take seriously the role of rhetorical choices, including the use of tropes and figures, narrative accounts, genre expectations, and terministic framing to shape conversations about science.

Allow us to express our gratitude to pioneers such as John Angus Campbell, Lawrence Prelli, Alan Gross, Jeanne Fahnestock, Carolyn Miller, and others who made this or a related point at a time when the reflective study of science was still dominated by history and philosophy of science. Within the narratives of these more prestigious disciplines, the scope of rhetoric was pretty much confined to public communication of scientific results. The epistemic grounds of scientific claims were located elsewhere. Since then studies of science have taken so decidedly a discursive and social turn that logical-formalist philosophies and internalist histories of science are no longer taken seriously by nearly anybody (with certain exceptions that both these authors know all too well). This raises two interlinked questions. One is whether the social-discursive turn in the study of science has taken full advantage of rhetorical theory and criticism in articulating its alternative to philosophy of science. The other is whether we rhetoricians of science have taken full advantage of the opening created by the broader discursive-social turn to articulate, deploy, and advertise our distinctive yet varied approach.

If one were to cast a net in the waters of rhetorical studies of science and technology, one would see quite a range of projects over the last few decades. These include, but are not

limited to: (1) rhetorical analysis of major scientists; (2) the rhetoric of scientific genres; (3) rhetoric within specific scientific fields; (4) the rhetoric of science-related controversies; (5) inventional practices in science; (6) episodes in the history of science; (7) public appropriations of scientific terms; (8) language and figures within science; (9) incommensurability and the relationships among disciplines; (10) rhetoric and philosophical rationality; (11) the uses of scientific expertise; (12) the rhetoric of medicine, (13) rhetoric and materiality; (14) the rhetoric of risk; (15) visual rhetorics of science; and (16) the mythic rhetorics of science and religion.¹

Collectively, these represent contributions to the theory, criticism, and history of rhetoric. And we can be proud of the many variations on a theme. But the studies do not follow a single program or share a specific agenda. Rhetoric is opportunistic and unruly, and we cast our nets where we think the fishing is good. Is this a problem? This is a fair and timely question. What would it mean to be part of a unified agenda, and what principles might provide that unity? Or, by contrast, might we embrace the concept of *repertoire* and still remain aspirational? And is that enough?

Perhaps it is an aspiration to find a common framework that leads us to draw upon other fields. Many among us want to make common cause with Bruno Latour, for example, and it is encouraging that this most prominent proponent of social studies of science makes use of the term ‘rhetoric’ to describe the transactions that resulted in, for example, the pasteurization of France or the exportable, packaged bits of sellable knowledge generated by words as much as by deeds at places like Salk Laboratories. Let us quote Bruno in reference to the “R-word.” “Rhetoric,” he observed, “is a fascinating albeit despised discipline, but it becomes still more important when debates are so exacerbated that they become scientific and technical.”² We would also like to note that Latour’s own rhetoric is fascinating to us. For instance, his thought experiment of ontological egalitarianism in which things as well as persons take part in the wrangling of a great parliament, may have helpfully challenged the assumption that persons alone are articulate and things just get pushed around—even as the exercise strains credulity. But perhaps his inventional boldness has caused Latour to encounter difficulties in convincing people that his case studies support local, context-dependent forms of scientific empiricism, not the wholesale social constructionism most of his readers expect to hear.

We largely agree with Latour about going local, to robust context, and that science does not reduce to textualism. Yet here is a point at which the rhetorical perspective leads us to the contentious claim that rhetoric of science contextualizes science better than does sociology of science, because the former tends to reduce arguments to context rather than defining context by argument. This, for us, means that context is a very flexible concept. In this and other matters, perhaps as rhetoricians of science we can engage the social studies of science to mutual benefit, and in the process fulfill the expectations that led our divinely inspired founders to form this exceptional society.

Perhaps Burke’s pentadic devices for distributing agency would add something of value to Latour’s argument. One of those five terms is “scene.” Tom Goodnight’s threefold distinction between personal, technical, and public spheres of discourse—itsself a

rhetorical reconstruction of Habermas's theory of communicative action—can help frame the scene in which the kinds of transactions Latour posits take place. If you see it this way you will observe that only under very particular, very contingent, and very hard to sustain conditions, such as those that obtained in post-War America, can modern societies support the degree of phase separation among these discursive spheres that grants serene autonomy to the technical sphere in ways philosophers and historians of science tend to take for granted. Why otherwise would the intrusions of creationists and climate science deniers seem like, well, intrusions? Rhetoricians know better. The boundaries between discursive spheres are not god-given, but are constructed and maintained by ongoing rhetorical activity, and even at their best they leak at the seams.

If there is one theorem that we rhetoricians of science have sustained in ways that have suffered little back talk it is that demarcation or boundary-work between science and society, between science, non-science, junk science, and pseudo-science, and between various scientific fields themselves is irreducibly rhetorical. We are thinking of the work of Charles A. Taylor and of Thomas Gieryn.⁴ Efforts of philosophers to try to find purely logical, Bayesian probabilistic, and other methodological ways of demarcating have been in vain. Still, the main implication of recognizing that demarcation is essentially rhetorical is both inescapable and hard to hear even for some of its supporters. Unless you define the technical sphere in a way that is both question-begging and hopelessly unreal, it must be admitted that there is nothing in principle that prevents junk science and pseudo-science from being hatched up in and passed out by technical sphere venues. Nor is there anything in principle that prevents public sphere discourse from putting the *burden of proof* on what comes out of the mouths of scientists.

Both of these things in fact happen. It was not scientifically scrupulous progressives or scientists, for example, but benighted big city Catholic politicians who put the brakes on the eugenic laws in this country. The laws had not only been supported by scientists and political progressives; they had been proposed by them in the first place. It is cases like these that rhetoricians are well-equipped to study, because there is a strong sense of how contexts, events, politics, and traumas are integral in the trajectories of scientific research programs. At present, many in our field are worried, with good reason, about how good science is being blocked by political opposition; but we do not want to forget that it has sometimes been the scientists who have blocked good sense. One sometimes hears that we needn't worry about such misadventures as eugenic laws anymore because that was the result of bad science, while we, unlike the people of a century ago, practice *good* science and would never make such mistakes. (Well, at least we wouldn't use "eugenics" as an authorizing term if we did.) Such complacency does not seem to be justified by history. Nor is that view that deviations like that can go on only for a while, since there is a built-in mechanism in scientific rationality that inevitably corrects for ideologically-inspired errors like eugenics laws or Lysenkoism in Stalin's Russia. That isn't quite how it happened in either case.

2. Optimism About Science—and About Democratic Discourse

Reflecting on histories like these, some science studies folks (largely constructionists) have drawn what they call the “pessimistic induction,” according to which science never gets good enough to rise above the weak forms and norms of evidence that presumably haunt public and personal spheres of discourse. If this is so, then, the hopes of the middle class regimes that first took power in America and Europe in the 1830s that science would serve as a corrective for the democratic institutions they were promising to erect would indeed be in vain. Irrationality would reign—and indeed historically we find just such bursts of irrationality accompanied by pessimism, even nihilism, and by pseudo-science where democracy collapses, as it did in Germany in the 1930s.

But what if rhetoricians of science made it a special charge to point out that this may be a false dichotomy? And conversely, what if public discourse is not antecedently dismissed as deficient in rationality? What if scientists, in order to live up to their loudly proclaimed devotion to rational inquiry, were asked reflectively to confront and reject their own prejudices, as feminist philosophers of science have, for example, been asking them to do with some success in recent years? In that case might one draw a different, more optimistic conclusion from the very histories that on scientific assumptions stimulate pessimism? Consider the case of eugenics. If in the end things did go well we think it was because criticism in democratically structured public venues inspired criticism in technical ones that eventually destroyed the genetics arguments on which eugenics was predicated. It was because scientists shared the intuitions of untutored publics that they looked for and found these arguments. This critique, first inspired by advocates of religion, turned into a tidal wave in the wake of revelations about Nazi science. Celeste Condit has shown that, aside from serving as a stigmatizing term, use of the term “eugenics” virtually ended—but, we add, it did so completely only when the story of its rise and fall was told in public venues by people like Daniel Kevles in the 1980s.

In sum, because we rhetorical scholars are not contemptuous of public sphere and personal sphere forms of discourse we are more upbeat about truth-finding, or at least falsehood-extinguishing. Maybe our civic instincts make us comfortable with the idea that science is too important to be left to the scientists. While there is no magic guarantee that errors will be flushed out of science, we believe that the arc of a vigorous cross-sphere practice of rhetorical criticism of scientific claims, evidence, assumptions, and implications can bend toward truth, albeit situated and localized truth—just as Martin Luther King reminded us that the arc of democracy bends toward justice. To those skeptical of appeals to truth and justice on such a large scale, let us at least offer this alternative: Good rhetoric, like good science, helps in rooting out falsity and injustice, which are far more plentiful.

3. Discovery and Proof: An Inventional Continuum.

What justifies our optimism that rhetoric can be as good for science as it can be for justice? It is partly because we, along with Fahnestock, Prelli, and some others, think that rhetoric, both as advocacy and as criticism, is, as an organon, *productive of knowledge*. It extends the tentacles of conceptual grasp. It is as epistemic in its force as the rhetoric-baiting Plato, and anti-rhetoric Platonists after him, took logic and mathematics alone to be. Here we give a tip of the hat to Richard McKeon, and his call for an “architectonic

productive art,” even if we cannot share the grandeur of his ambition. During the post-War heyday of philosophy of science it was big news to assign to rhetoric a role not just in marketing scientific discoveries to non-expert audiences, but more deeply in inventing ideas that could subsequently be subjected to confirmation or falsification. McKeon made that case, pointing out that the logical empiricists’ and the Popperians’ distinction between the context of discovery and the context of justification is a riff on the ancient rhetorical distinction between invention and arrangement. And, as Jeanne Fahnestock pointed out in an excellent earlier review of rhetoric of science, Iowa’s Project on the Rhetoric of Inquiry, with which both of us have been associated, was and is more or less dedicated to reviving rhetorical invention in and especially across fields of inquiry, including science.

Invention is a shared social practice, not the private, purely psychological process to which philosophers confined it in order to put the accent instead on logical justification. Considered rhetorically, however, invention in science as in other forms of inquiry can’t be thought of in isolation from justification at all; rather, the two comprise at most dialectical poles in the dynamics of inquiry. When one invents, it is with an eye toward how the invented argument, framing, or interpretation might hold up under the scrutiny of an audience. And sometimes that audience, including the internalized audience that any well-socialized inquiry leans upon, sends the inquirer back to the drawing board. Indeed, the critical audience (e.g. another scientist or an external critic) might not just challenge an explicit argument but also, for example, challenge the use of a dominant metaphor, which then puts it within the space of investigation and productive inquiry. While we understand that a metaphor is never precisely true or false, a metaphor that is apt can open whole new vistas, while a bad one can really gum up the works. So metaphors too can be and often are challenged and tested.

All of this makes the activity less like a monologue than like a dialogue. The scientist is, so to speak, putting down steppingstones as he/she goes, with each step testing them with one foot. Those scientific ideas that make themselves clear enough to count as testable hypotheses do so in and through debates about their merits. The process of stating a claim is inseparable from justifying it. What philosophers like to call justification, as opposed to discovery, is just perspicuous deductive display after the fact, and rather like what rhetoricians once called arrangement. It may seem otherwise, as when we hear about crucial experiments like Michelson-Morley that dispose of an issue once and for all. But closer inspection shows that in such cases what has happened is that critical discussion has reached a point of stasiation. The crucial experiment is both invented and tested within a field of argument, in this case whether a light-carrying medium, the ether, exists or does not. The same experiment in a different rhetorical situation would mean very little.

The rhetorical productivity that we have inadequately described comes into focus as soon as we recognize, with Goodnight, that knowledge production necessarily takes place in the space of implicit or explicit controversies. All controversies, whether they are scientific, political, religious, find their natural medium in rhetorical argumentation, both on the side of advocating claims and on the side criticizing them. This turns out not to be trivial. It implies, for one thing, that the meaning of claims and the persuasiveness of

evidence for and against them is essentially entangled with the claims they contest and the evidence for and against them. This is primarily what we mean by the localness of inquiry. Controversies are rhetorically situated.

What do we see when we look closely such scenes of contestation? We see the productive interplay of competing accounts, models, configurations, narratives, metaphors, emphases, and authorizing terms. Let us look a bit more closely at a few of these.

4. Embedded Rhetoricity

Working as both of us do in the rhetoric of evolutionary biology, along with our esteemed colleagues John Angus Campbell and Leah Ceccarelli we see the rhetoricity of ostensibly demonstrative scientific prose everywhere. Let's look a bit more closely at a couple of the ways this happens in evolutionary biology. We can discuss more in conversation.

Selective examples as good evidence.

The selection of examples in support of an argument—ever since Aristotle, let us recall, we have known that examples play a key evidential role in rhetorical argumentation—is very prominent in evolutionary biology. Evolutionary arguments rest, in fact, on persuasive examples: archeopteryx, black and grey pepper moths, the heterozygotic superiority of blood cells that confer some immunity to malaria. We are aware that these examples, which appear over and over again in textbooks, stand in for, and are promissory notes on behalf of, many other similar cases that, authors assure us, will eventually turn up to confer general significance on the examples. We are aware that, while similar cases often do show up, they are seldom enough to turn a case study into a general model or even less often to turn a good model into a law-governed theory. Philosophers of science like Alex Rosenberg worry about this enough to conclude that evolutionary biology, let alone the social sciences, is not and never can be law-like enough to be a real science. As rhetoricians of science, however, we have a more equable attitude. We are not in the least scandalized by the fact that examples are perspicuous and paradigmatic because they are described in terms of images, analogies, metaphors, and other tropes. Why, in a specific context of inquiry, did Dawkins have to say that DNA is “selfish” if he wanted to make the point stick with those he was addressing that it is more explanatory and more parsimonious to look at natural selection as operating on behalf of genes than of the organisms that contain them? There are, or at least were in the 1970s, good reasons for saying this. But selfishness and Darwinism when combined always bring a lot of baggage with them too. Examples are perspicuous only when criticism blunts their tendency to become excessively persuasive.

Authorizing terms

Persuasive examples, we think, are closely tied, when their force is spelled out, to authorizing terms. Here we encounter an issue about which the two of us talk a lot. The connection between local cases and high-level theories is so open that authorizing terms like ‘Darwinism’ are not forced conclusions, but independent variables. Why do evolutionary scientists think they have to call what they are doing Darwinism, especially

since that term packs so much baggage that the insistence of scientists on it does more than anything else to keep creation or intelligent design alive in the space of controversy, as alternative authorizing terms? One of us tends to think that the ideograph Darwinism has been so poisoned by its history that it might be better to give it up altogether. What would be lost, he asks, if the scientific community took, say, a Lamarckian turn? Would this not let us see what experimental biologists are showing all the time these days as more than anomalies or counter-examples, namely that genomes are remarkably sensitive to environmental changes, and can hatch up regulatory sequences, micro-rnas, epigenetic markers, and other bits of ontogenetic machinery to respond to those changes with much far more ease than would have been thought possible, or at least likely, in the heyday of Crick's Central Dogma—right: Dogma—of Molecular Biology? Still, we have to admit that Lamarckism lugs along some baggage too, such as Lysenkoism. So the other of us is inclined to follow the lead of Theodosius Dobzhansky, whose genial and inviting rhetoric has been studied by Leah Cecarrelli, in hoping to show the public, through biology education, that for well over half a century natural selection has been articulated as so benign a process that it does not carry any of the negative connotations that are so deeply embedded in public memory. Which of us is right? We are not sure. What we are sure of is that the discussion of this point puts the phenomena we are studying in the right, that is, the rhetorical, light.

Presumption and burden of proof

No one, we hope, will construe our remarks as anti-science. So we take the opportunity to express our agreement with Celeste Condit that rhetorical scholars, in opposing scientism and its philosophical defenders, are ill advised to buy into an anti-science stance. Just as we do not think creationists should colonize evolutionary biology by making it conform to their worldview, neither do we think that literary humanists should be allowed to do something similar. We are afraid that social constructionism has fallen into that trap, and that it has been encouraged by certain trends in rhetorical theory. We hope we have given you reasons to see why we think we have evaded it.

We may put our point differently by noting something else about the rhetorical character of scientific argumentation. Since it is embedded into rhetorical occasions, scientific criticism, whether by scientists or informed others, is permeated by judgments about where presumptions and burdens of proof lie at any given time. These favor a certain judicious balance between innovation and tradition. Accordingly, being a rhetorician who is pro-science does not require granting presumption to the latest thing to come out of scientific fields, especially fields that are clearly in a more inventive stage. Among these are behavioral and cognitive genetics. The impulse to extend evolutionary biology to these topics runs very deep. But the track record of earlier attempts to bring these topics under scientific, even techno-scientific, control is very poor, and the burden of proof remains on them.

The assumption that this burden is shifting is based on the idea that we now know enough about genetics to do the job. This assumption is probably wrong; or, even if it is right, it shows that we also need to know a lot about other things as well, such as development and its intersection with culture. So caution is advisable. It is particularly advisable because public sphere books and articles tend to place too great a value on particular

discoveries that might have, we are told, revolutionary implications. The language of gene for this or gene for that falls into this class of journalistic effects. In the technical sphere, however, things seldom if ever work that way. The latest and biggest thing soon turns into a single data point in an array that continues to change. The lesson is that rhetoricians of science must know enough about what is going on in the technical sphere to be able to address, and judge properly, its relevance to the public sphere. Rhetoric is about judgment—in science as in other dimensions of discourse.

5. Inventing on All Cylinders

Our emphasis on the productive role of rhetoric in the sciences has so far focused on how criticism fosters the growth of knowledge. But the productivity of rhetoric so considered also affects how we should think of invention. That is, it makes us look to the question of how invention is *doing work* within science in ways that support many of the traditional aspirations of science in modernizing societies.

Ever since the early days of rhetorical theory topical and stasis theory has proven to be one useful way of thinking about invention. It has proven no less fertile in the sciences. Francis Bacon's view of scientific method was in fact an extension of the atechanical rhetorical proofs to scientific inquiry in a context of political improvement. Baconians could have been, from the start, more attuned to technical proof as well, and hence to the role of discourse that we have advocated. The motto of the Royal Society, *nullius in verba*, may be well taken as dissociating science from the decorative rhetoric of the day. But it is not in the least true about the role of rhetorical argumentation in science as it has developed in modern societies. Thankfully, the palette is slowly expanding in rhetoric of science work today and more generally in the work of contemporary science studies.

In the view we are advocating, invention is not sudden inspiration. It is a process in which leads and topics are explored in as creative and systematic a way as Edison,⁸ for example, explored them. Because the inventional process is a critical, context-dependent practice it does not stand in contrast to discovery. It *is* a process of discovery. Since on this point we want once again not to play into the hands of those who might dismiss us as advocating some kind of effete textualism, however, we might picture a kind of spectrum on which discovery lies at one end and invention at the other, with most cases closer to one end than the other. In saying that a previously unknown species has been 'discovered' we register that something ontological does indeed seem to be at stake, pulling us back from going as far as Latour when he maintains that microbes did not exist until Pasteur discovered them. Invention in our usage does not carry that force or implication. What it does carry is the implication that when something gets called a discovery a process of discourse has been found so persuasive that talk moves on to other things in which the discovery is taken for granted, although in principle it is re-visitabile.

Here are a few dimensions of the inventive process as productive work in evolutionary biology, and *mutatis mutandis*, in science generally:

Inventing counter-examples

In debates over biological evolution, the use of carefully selected examples has often done extensive rhetorical work in the advocacy of different explanatory models, as we have noted. As we say, too, the textbooks provide ample testimony of examples that have become so obligatory that their exemplary status as standing for other, similar thing—their metonyms or synecdoches, stand-ins for a whole underspecified class of other such things. One might think of this process as inventional and the corresponding practice of offering counter-examples as critical. But our way of thinking about invention suggests that there are just as many productive possibilities in scouting out counter-examples as well.

Inventing (and expanding) the scope and texture of context

Not all rhetorical criticism should be tied to current circumstances. This is why Isocrates is probably not enough, or the kind of political reductionism we find in Shapin and Shaffer's *Leviathan and the Air Pump*.⁹ In the context of the sciences, the pertinent circumstances are not just today and tomorrow. Rather they pertain to a long-range trajectory in the pursuit of inquiry, and should not be tied too closely to political life. And not all science should be measured by how fast it produces technologies either, as seems to be the current *Zeitgeist*. What used to be called basic research, for instance, is now often called “curiosity science.” Yikes! This is a very powerful act of renaming, because it makes concern for the longterm future seem like a kind of diversion, and thereby recontextualizes those concerns. This points to our next type of invention.

Inventing names

Kenneth Burke was right about this. Name, mis-naming, re-naming can be very powerful indeed—and as KB put it, “a way of seeing is a way of not seeing.” Did you notice how fast some of the fast food chains capitulated when a particular substance in their hamburger patties was re-named “pink slime”? That was a brilliant rhetorical move—and a good counter-example to deterministic ways of thinking. Did you notice how support for the inheritance tax went way down once it was re-named a “death tax”? And so on. Are these not in some ways similar (and in some ways different) from certain rhetorical moves emanating from the sciences--we're looking at you, “selfish gene” and “the Modern Synthesis”--even if there are generally more stringent checks on unfettered invention and more specificity to the available means of persuasion” in those provinces? Names can be, as Fahnestock says of rhetorical figures in science, “figures of thought.”ⁱ

Here is a case very much to KB's point. Public attention has recently been called in a most dramatic way to that part of the genetic material that does not code for DNA, which is to say, most of it. The term “junk DNA” was coined in 1972 and has fanned out, first among prominent biologists, and then widely across the general culture. Yes, this name was chosen to reflect a view, widely adopted at the time, that non-coding parts were also nonfunctional parts. In that sense and context, the term arguably did productive work in crystallizing the theoretical outlook that led to full understanding of the so-called genetic code, coding and programming being metaphor that advanced the research program. But as that view gradually lost scientific credibility by its very success, leading to the epigenetic revolution that is upon us now, whole segments of the evolutionary biology community, in thrall to a set of terms, remained largely blind to a revolution being

brought within the most respected precincts of molecular biology itself that has pointed to the importance of (noncoding) regulatory genes. The term “junk” continued to sustain a blinkered view of what genes are all about. And this orthodoxy bore down on many scientists as well as that part of the public who read about such things. Change the names and you invent a better, truer future. (The more agnostic term, “dark matter” has been used in reference to the noncoding genetic material, and we are intrigued by the overtones and possible rhetorical destiny of that term.)

But naming has more systemic uses as well. One of these is in the maintenance of authorizing terms, the terms under which research programs are legitimated. And on the matter of supporting a program by advocating for a term, Richard Dawkins could not have said it better: “My contribution to the idea of the selfish gene,” he wrote, “was to put rhetoric into it and spell out its implications.”¹⁰ This is a stunningly direct acknowledgement of—indeed, embrace of-- the rhetoricity of his project. And this process of embracing term, and then justifying it occurs right in the thick of scientific theorizing which Dawkins’s invention did too, in additional reaching a broader public. These processes are going on all the time. So, for instance, as “autopoietic” theory bids for respectability in evolutionary theory, it relies on the name to do a lot of the work of coalition-making, opponent-defining, and conceptual-aligning, even as its arguments are not static. In that sense it is a call to “think this way,” and advocates will search for reasons to support that way of thinking, and opponents will put forth reasons for not thinking that way.

Inventing within a dialogical frame

Let us bring to bear on the topic of invention our earlier insistence that science takes place within the space of controversies. This being so, we should resist the tendency to think of scientific rhetoric as something that is monological, or something just to be mapped, or just apprehended as text. Scientific arguments move forward by encounters with professional resistance, alternatives, counter-interpretations, reproducibility arguments, theoretical adjustments, biases, cultural and ideological resistance, and funding issues. They also move on the harnessed energy of theories, programs, technological promise, reputations, funding, and aspirations. These things constitute the rough ground that is presupposed in the discourse of science. And we should be alert to the events and traumas that affect the movement of science as it responds to them. One of the challenges for competing accounts, in evolutionary biology and elsewhere, is to find ways of putting the dominant metaphors into some kind of dialogical relationship. This represents an inventional challenge for evolutionary biology particularly, and other fields generally.

7. Need We Be Unified?

In Condit’s position paper, she has once again acted to stimulate democratic debate. In her survey, it is the *purpose* of studying the rhetoric of science and technology that is given primacy, explicitly so in two of the categories of work covered in her overview-- the purpose of building theory and the purpose of improving scientific rhetoric. These are purposes that we both could sign on to, and in our way do, as we have been trying to suggest. The other two categories identified, and summarized with Tarzanic directness as

“science bad” and “science too powerful,” might better be described as matters of “attitude” rather than purpose, and the point is well taken. Implicit in these two attitudes is oppositional motivation, and so it seems to beg the question, “to what end?” or perhaps “in the service of what?” is this work undertaken? Here it seems, we may have differences among us that have not been very well thematized and debated in our field, a situation that we might rectify. As nothing unifies like an attack from the outside, Condit points to a looming threat from the outside as a motivation to pull us together—and we believe her concerns are well justified. If the very conditions under which we work are endangered, then rallying to preserve and protect values even more basic than the value of rhetoric of science is—as the physician might say—indicated. But there also some risk in defining our purpose in political terms. Here is where we need to tread carefully. Nothing undercuts the credibility of scientific claims faster than when the messenger is seen as acting with political intent. Witness that extraordinary hit that belief in global warming took in public opinion after the “climategate” emails were politically exploited. And there are similar risks within academic institutions. We believe, for example, that the normative meta-theory adopted by advocates of STS has come at some cost to their credibility in some quarters.¹¹ If we sign on to a set of political objectives in studying the rhetoric of science, do we risk activating ethos-damaging blowback? And, if so, is that a risk worth taking?

As diversity seems to be a good thing in both ecology and evolution, it might have some advantages for those who have been constructing an environmental niche for rhetoric of science. Work thus far has been highly varied in character, and maybe that pluralism should be embraced rather than taken as a sign of weakness. Steve Fuller’s view that we need a “strong program” in rhetoric of science, analogous to the “strong program” of social studies of science and technology has some appeal, and we have done little to relieve his exasperation over the fact that we haven’t. As a rhetorical framing, a “strong program” should beat out a “weak program” every time. But if we take the metaphor of niche construction as a heuristic, diversity need not equate to weakness. Fuller, after all, would have us follow him into places we might not want to go.

8. Parting Thoughts

Michael Pollan wrote a well-regarded book, titled *The Omnivore’s Dilemma*, for which the title sets up his central question: since humans can eat just about anything, how do we, meaning those of us who have the option of choosing, decide what to eat? How we answer that question has implications not just for our health, but for our environment, our ethics and for our politics as well. The contemporary rhetorician has a similar dilemma. When the world is your field, it’s hard to know what to feast upon. We exaggerate slightly, if at all, in suggesting that rhetoric has taken the world and all that’s in it—and potentially in it—as our field of concern. Rhetoric of science has always lent itself to interdisciplinarity, but at times it seems to have its sites set on omni-disciplinarity. If other fields offer powerful explanations for the way things work—sociology, psychoanalysis, philosophy, neuroscience—many of us want to harness their power. And from a historical viewpoint this is to be expected, as conceptions and practices of rhetoric have over the centuries been shaped by the social, political, and epistemic biases of their times. Moreover, rhetoric tends to gravitate to the centers of power, and to adapt

according to what that power is—the church, the king, the assembly, public opinion, funding agencies, and so on—for that is where it can matter most. And we should therefore expect that the very powerful forces of science are magnets for rhetoric. But as rhetoricians we should want to be careful not to give up on the idea that there is power in rhetorical invention, for good or for ill, and that it should be studied and engaged and need not be outsourced. If we succumb to determinisms that relegate discourse to the level of epiphenomena, we would do well to get on the wagon of some other field, such as sociology, economics, psychoanalysis, or neuroscience.

Now rhetoric invites those fields, and practically all others, to help it see the terrain on which discursive interventions occur; but it need not fade into the woodwork as it draws on the expertise of other fields. POROI was more or less founded on that understanding. It was an assumption of those who founded ARST, too, and we believe it is a shared assumption of most of those interested in the rhetoric of science, including authors who, like ourselves, have worked collaboratively with folks from other disciplines. We have advocated for more attention to how rhetoric can be productive within science. Our perspective is that this doesn't happen in a hermetically sealed technical sphere just as its consequences certainly do not confine themselves there. And that means that our perspective is very much pro-science—and very much pro-rhetoric.

ENDNOTES

The following are examples from each of the variations on rhetoric of science studies that we have enumerated. Neither the categories of variation nor the exemplars are fully represented here.

1. Studies of major scientists include: John Campbell, “The Polemical Mr. Darwin,” *Quarterly Journal of Speech* 60 (1975): 442-49; John Campbell, “Scientific Revolution and the Grammar of Culture: The Case of Darwin’s *Origin*,” *Quarterly Journal of Speech* (1986): 351-76; Leah Ceccarelli, *Shaping Science with Rhetoric: The Cases of Dobzhansky, Schroedinger, and Wilson* (Chicago: University of Chicago Press, 2001); G. Mitchell Reyes, “The Rhetoric in Mathematics: Newton, Leibniz, Their Calculus, and the Rhetoric of the Infinitesimal,” *Quarterly Journal of Speech* 90 (2004): 163–88; J. Zappen, “Francis Bacon and the Historiography of Scientific Rhetoric,” *Rhetoric Review* 8 (1989): 74–90.

2. Studies of the rhetoric of scientific genres include: Charles Bazerman, *Shaping Written Knowledge* (Madison: University of Wisconsin Press, 1988); Carol Berkenkotter & Thomas N. Huckin, *Genre Knowledge in Disciplinary Communication* (Routledge, 1994); Alan Gross, *The Rhetoric of Science* (Cambridge, MA: Harvard University Press, 1990); Alan Gross, J. E. Harmon, and M. Reidy, *Communicating Science: The Scientific Article From the 17th Century to the Present* (New York: Oxford University Press, 2002); Greg Meyers, *Writing Biology: Texts in the Social Construction of Scientific Knowledge* (Madison: UW Press, 1990); Jack Selzer, ed., *Understanding Scientific Prose* (Madison: University of Wisconsin Press, 1993)

3. Studies of rhetoric within particular scientific fields include: David Depew, “The Rhetoric of Evolutionary Theory,” *Biological Theory*, Vol. 6, no. 1 (2011); Henry Howe and John Lyne, “Gene Talk in Sociobiology,” *Social Epistemology* 6 (1992), 1-54; Jordynn Jack & L. Gregory Appelbaum, “‘This is Your Brain on Rhetoric’: Research Directions for Neurorhetorics,” *Rhetoric Society Quarterly*, Vol. 40, No. 5, 411-437; Zoltan P. Majdik, Carrie Anne Platt & Mark Meister, *Quarterly Journal of Speech*, Vol 97, No. 1 (2011) 74-99; Carolyn Miller, “The Rhetoric of Decision Science, Herbert A. Simon Says,” in Herbert W. Simons, ed., *The Rhetorical Turn: Invention and Persuasion in the Conduct of Inquiry* (Chicago: Univ. of Chicago Press, 1990), 162-186; James Wynn, *Evolution by the Numbers: The Origins of Mathematical Argument in Biology* (Parlor Press, 2012)

4. Studies of the rhetoric of scientific and technological controversies include: Leah Ceccarelli, “Manufactured Scientific Controversy: Science, Rhetoric, and Public Debate,” *Rhetoric & Public Affairs*, Vol. 14, no. 2 (2001): 195-228; Nathan Crick and Joseph Gabriel, “The Conduit Between Lifeworld and System: Habermas and the Rhetoric of Public Scientific Controversies,” *Rhetoric Society Quarterly*, Vol. 3, No. 3: 201-223; Thomas Lessl, “Heresy, Orthodoxy, and the Politics of Science,” *Quarterly Journal of Speech* 74 (1985): 18–34; John Lyne and Henry F. Howe, “Punctuated Equilibria: Rhetorical Dynamics of a Scientific Controversy,” *Quarterly Journal of Speech* 74 (1985): 18–34; Gordon R. Mitchell and Marcus Paroske, “Fact, Fiction and Political Conviction in Science Policy Controversies,” *Social Epistemology*, Vol. 2-3 (2000): 89-107; Gordon Mitchell, *Strategic Deception: Rhetoric, Science, and Policy in Defense Advocacy* (East Lansing: Michigan State University Press, 2000); Marcus Paroske, “Deliberating International Science Controversies, Uncertainty and AIDS in South Africa,” *Quarterly Journal of Speech*, Vol 95, No 2 (2009): 148-170.

5. Studies of rhetorical invention in science include. John Campbell, “Scientific Discovery and Rhetorical Invention: The Path to Darwin’s Origin, in Herbert. Simons, ed. *The Rhetorical Turn: Invention and Persuasion in the Conduct of Inquiry* (1990); Alan Gross & William Keith, *Rhetorical Hermeneutics: Invention and Interpretation in the Age of Science* (Albany: SUNY, 1997); Lawrence Prelli, *A Rhetoric of Science: Inventing Scientific Discourse* (Columbia: University of South Carolina Press, 1989); Herbert Simons, *The Rhetorical Turn: Invention and Discovery in Conduct of Inquiry* (Chicago: Univ. of Chicago Press, 1990).

6. Studies of episodes in the history of science include: Lisa Keranen, *Scientific Characters: Rhetoric, Politics, and Trust in Breast Cancer Research* (University of Alabama Press, 2010); Jean D. Moss, *Novelties in the Heavens: Rhetoric and Science in the Copernican Controversy* (Chicago: University of Chicago Press, 1993); Dale Sullivan, “Galileo’s Apparent Orthodoxy in The Letter to the Grand Duchess Christina,” *Rhetorica* 12 (1994): 237-264

7. Studies of public appropriations of scientific terms include: Celeste Condit, *The*

Meanings of the Gene: Public Debates about Human Heredity (Madison: University of Wisconsin Press, 1999); Marita Gronnvoll & Jamie Landau, "From Viruses to Russian Roulette to Dance: A Rhetorical Critique and Creation of Genetic Metaphors," *Rhetoric Society Quarterly*, Vol. 40, No. 1 (2010), 46-70.

8. Studies of language and figures within science include Jeanne Fahnestock, *Rhetorical Figures in Science* (New York: Oxford University Press, 1999); Thomas Frentz, "Creative Metaphors, Synchronicity, and Quantum Mechanics," *Philosophy and Rhetoric*, vol 12, no 44 (2011): 101- 128; E. F. Keller, *Refiguring Life: Metaphors of Twentieth-Century Biology* (New York: Columbia University Press, 1995); Scott Montgomery, *The Scientific Voice* (New York: Guilford Press, 1996); Carol Reeves, *The Language of Science* (London: Routledge, 2005).

9. Studies on incommensurability and the relationships among disciplines include: Randy Allen Harris, *The Rhetoric of Incommensurability* (West Lafayette, IN: Parlor Press, 1997).

10. Studies of rhetoric and philosophical rationality include: M. A. Finocchiaro, *Galileo and the Art of Reasoning: Rhetorical Foundations of Logic and Scientific Method* (Dordrecht, Netherlands: Reidel, 1980); Henry Krips, J. E. McGuire, and Trevor Melia, eds., *Science, Reason, and Rhetoric* (Pittsburgh: University of Pittsburgh Press, 1995); Steven Fuller and James Collier, *Philosophy, Rhetoric, and the End of Knowledge*, 2nd ed. (Mahwah, NJ: Lawrence Erlbaum, 2003); Jean D. Moss and W. A. Wallace, *Rhetoric and Dialectic in the Time of Galileo* (Washington, DC: Catholic University of America Press, 2003); M. Pera and W. R. Shea, *Persuading Science: The Art of Scientific Rhetoric* (Canton, MA: Science History, 1991).

11. Studies of the rhetorical uses of expertise include: Thomas B. Farrell and G. Thomas Goodnight, "Accidental Rhetoric: The Root Metaphors of Three Mile Island," *Communication Monographs* 48 (1981): 270–300; Johanna E. Hartelius, *The Rhetoric of Expertise* (Lanham, Md: Lexington Books, 2011); James Hixson & Richard Cherwitz, "On the Ontological and Epistemological Dimensions of Expertise: Why 'Reality' and 'Truth' Matter and How We Might Find Them," *Social Epistemology*, Vol. 24, No. 3 (2011): 291-308; John Lyne and Henry F. Howe, "Rhetorics of Expertise: E. O. Wilson and Sociobiology," *Quarterly Journal of Speech* 76 (1990): 134–51; Damie Pfister, "Networked Expertise in the Era of Many-to-many Communication," *Social Epistemology*, Vol. 25, No. 3: 217-231; Zoltan Majdik, "Judging Direct-To-Consumer Genetics: Negotiating Expertise and Agency in Public Biotechnological Practice," *Rhetoric & Public Affairs*, Vo. 12, No. 4 (2009): 571-606.

12. Studies of the rhetoric of medicine include: Michael Hyde and J. McSpirtt, "Coming to Terms With Perfection: The Case of Terri Schiavo," *Quarterly Journal of Speech* 93 (2007): 150–78; Lisa Keranen, "'Cause Some Day We All Die': And the Case of the 'Patient' Preferences Worksheet," *Quarterly Journal of Speech* 93 (2007): 179–210; John Leach & Deborah Dysart Gale, *Rhetorical Questions of Health and*

Medicine (Lexington Books, 2010); Judy Z. Segal, *Health and the Rhetoric of Medicine* (Carbondale: University of Southern Illinois Press, 2005); Celeste Condit, "Women's Reproductive Choices and the Genetic Model of Medicine," in M. M. Lay, L. J. Gurak, C. Gravon, and C. Myntti, eds., *Body Talk: Rhetoric, Technology, Reproduction* (Madison: University of Wisconsin Press, 2000), 125–41.

13. Studies of Rhetoric and Materiality: Celeste M. Condit, "Race and Genetics From a Modal Materialist Perspective," *Quarterly Journal of Speech*, Vol. 94, No.4: 383-406; John Lynch, "Articulating Scientific Practice, Understanding Dean Hamer's 'Gay Gene' Study as Overlapping Social, Rhetoric, and Material Registers," *Quarterly Journal of Speech*, Vol. 95, No. 4 (2009): 435-456

14. Studies in the rhetoric of risk: G. Thomas Goodnight and Sandy Green, Rhetoric, Risk, and Markets: The Dot-Com Bubble, *Quarterly Journal of Speech*, Vol. 96, no. 2 (2010): 115-140

15. Studies in the visual rhetoric of science include: Michelle Gibbons, "Seeing the Mind in the Matter: Functional Brain Imagine as Framed Visual Argument," *Argumentation & Advocacy*, Vol 43 (2007): 175-188; Alan Gross, "Toward a Theory of Verbal-Visual Interaction: The Example of Lavoisier," *Rhetoric Society Quarterly*, Vol. 39, No. 2 (2009): 147-169; Jordynn Jack, "A Pedagogy of Sight, Microscopic Vision in Robert Hooke's *Micrographia*," *Quarterly Journal of Speech*, Vol. 95, No. 2 (2009), 192-209; Lawrence Prelli, ed., *Rhetorics of Display* (Columbia, SC: USC Press, 2006); Lynda Walsh, "Before Climategate," *Poroi*, 6, No. 2 (2010): 3-33.

16. Studies of mythic rhetorics of science and religion include: James Herrick, *Scientific Mythologies: How Science and Science Fiction Forge New Religious Beliefs* (IVP Academic, 2008), Thomas Lessl, *Rhetorical Darwinism: Religion, Evolution, and the Scientific Identity* (Baylor University Press, 2012)

² Bruno Latour, *Science in Action* (Harvard University Press, 1988), p. 30.

³ See Bruno Latour and Catherine Porter, *We Have Never Been Modern* (Harvard UP, 1993); and Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network Theory* (Oxford UP, 2007).

⁴ Charles Alan Taylor, *Defining Science: A Rhetoric of Demarcation*, (Madison: UW Press, 1997); Thomas Gieryn, *Cultural Boundaries of Science: Credibility on the Line* (Univ. of Chicago Press, 1999).

⁵ Richard McKeon, "The Uses of Rhetoric in a Technological Age: Architectonic Productive Arts," in Lloyd Bitzer and Edwin Black, eds., *The Prospect of Rhetoric* (Englewood Cliffs, NJ, Prentice Hall, 1971); see also David Depew, "Revisiting Richard McKeon's Architectonic Rhetoric," in Mark. J. Porrovecchio, ed., *Reengaging the Prospects of Rhetoric* (New York: Routledge, 2010).

⁶ Jeanne Fahnestock, "Rhetoric in the Natural Sciences," in Andrea Lunsford, Kirt Wilson & Rosa Eberly, eds, *The SAGE Handbook of Rhetorical Studies* (SAGE Publications, 2008)

⁷ Alexander Rosenberg, *Instrumental Biology, Or The Disunity of Science* (University of Chicago Press, 1994)

⁸ Charles Bazerman, *The Languages of Edison's Light* (The MIT Press, 2002)

⁹ Steven Shapin and Simon Shaffer, *Leviathan And The Air Pump* (Princeton UP, 1989)

¹⁰ Richard Dawkins, "A Survival Machine," in John Brockman, ed., *The Third Culture* (Simon & Schuster, 1995), p. 76

¹¹ Finn Collin, "An Alternative Road for Science and Technology Studies and the Naturalization of Philosophy of Science," Chapter 10 in Collin, *Science Studies As Naturalized Philosophy* (Springer Press, 2010).