9 RHETORIC, KNOWLEDGE, AND "THE BRUTE FACTS OF NATURE" IN SCIENCE RESEARCH

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What is the relationship between rhetoric and reality in the creation of scientific knowledge? This question has caused considerable debate among rhetoricians and philosophers in the last twenty-five years. During this debate, only limited consideration has been given to views from scientific practice. This chapter considers the question from the perspective of such views, from scientific investigation itself, by examining examples drawn from research in experimental and theoretical physics. For this purpose, I begin by outlining some of the background theory relating to this discussion: the role of rhetoric in the creation of scientific knowledge and the ways in which one rhetorical figure in particular—metonymy—creates meaning. Drawing on this theoretical grounding, I then analyze several examples of the role of metonymy, the rhetorical figure that substitutes an attribute for the thing itself, in the construction of knowledge claims in experimental physics. I investigate how two experimental physicists used the rhetorical trope of metonymy as an argumentative strategy when revising a paper for publication to persuade the referee to accept their claim that a particular method of fabrication created good quality amorphous silicon thin films. Two additional examples from these physicists illustrate how metonymy works to bridge ontological realms of things and concepts in drawing conclusions from an experiment. Finally, I analyze one example from theoretical physics, specifically string theory, to explore how recent work in that field has tended to collapse the traditional distinctions between what is science and what is rhetoric. The chapter closes with a brief consideration of the implications of string theory for the question about the relationship between rhetoric and reality in the creation of scientific knowledge.

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RHETORIC AND ITS ROLE IN THE CREATION OF SCIENTIFIC KNOWLEDGE

The relationship between arguments and facts, especially in science, has been a matter of extensive debate over the last fifteen or twenty years by scholars in rhetoric of science. Some scholars have shown how scientists have adapted and used rhetoric, that is, techniques of persuasion, to present and argue for new knowledge claims based on their research (Moss, 1993; Myers, 1990; Rymer, 1988; Scott, 1976, 1993; Prelli, 1989; among others). Some of these same scholars, and others, have argued that in addition to contributing to the presentation of new insights, rhetoric has also aided scientists in actually generating new insights in the first place (e.g., Graves, 2005; Gross, 1990, 1991, 2006; Little, 2000, 2008;). With recent publications, this discussion has moved well beyond disputing whether or not rhetoric contributes to the generation of knowledge in science (epistemology) to assessing the extent to which rhetoric helps to constitute the entities that science studies in its research (ontology).

Questions about the relationship between rhetoric and ontology (existence) were first raised by Gross in 1991, although few scholars in rhetoric of science have addressed them since. During an exchange with McGuire and Melia (1991) in *Rhetorica* about the relationship between rhetoric and reality, Gross (1991) argued that scholarship in the rhetoric of inquiry "has insert[ed] itself into the inner sanctum of epistemological and ontological privilege," and this activity had strengthened "the case for the rhetorical construction of *all* [emphasis added] knowledge" (p. 285). In these statements, Gross (1991) argues that rhetoric mediates not only the development of knowledge in all disciplines, including science, but also the existence of entities upon which this knowledge is developed.

In response, McGuire and Melia (1991) argue that Gross's claim about rhetoric's contribution to developing knowledge "replace[s] scientific discovery with rhetorical invention" (pp. 303-4). They reject his claim that all science is rhetoric, and they propose a more moderate position: they suggest that the "facts" that make up reality may be both discovered (in other words, the facts exist prior to human experience) and constructed (that is, human effort brings them into existence). However, those facts must also exist independent of human perception. They warn that although rhetoricians may seek evidence of the "rhetoricity of scientific facts, 'the brute facts of nature' will turn out to be just those products of science that appear to be beyond rhetorical analysis" (p. 304). They insist on preserving some vestige of a reality outside of language (and rhetoric) that constitutes the source of facts about nature/science.

To shed light on this debate, I focus here on the role of style in the creation of scientific knowledge, because if we study the language that scientists use to conceptualize their objects of study (for example, how they use metaphor, metonymy, and analogy), we can gain insight into the role that rhetoric plays in both the epistemology (creation of knowledge about facts) and the ontology (existence of "facts") of science, principally in physics. In conventional wisdom, style, like rhetoric itself, has often been viewed as ornament—that is, the words chosen to express a thought have often been considered separate from the thought itself, especially in discussions of scientific fact and theory. Conventional wisdom dictates that the words used to describe a theory can change without changing the theory itself. In this chapter, I complicate these ideas about style by showing how the use of the rhetorical trope of metonymy by two physicists contributes to the process of knowledge creation in science, and, in fact, the generation of the brute facts of nature that become scientific knowledge.

A number of rhetoricians have studied the use of figurative language in science (Fahnestock, 1999; Graves, 2005; Little, 2000, 2008; Prelli, 1989) to describe the ways in which tropes such as metaphor and analogy serve an epistemic function in scientific discovery. For analytical perspectives on the tropes themselves (in other words, how metonymy functions to create meaning), recent work in cognitive linguistics offers some useful tools. Lakoff and Johnson (1980), and Lakoff and Turner (1989) have shown that metaphor should no longer be considered just ornamental or a captivating turn of phrase: it is, in fact, foundational to human experience of the world. Without metaphor, they claim, humans cannot communicate. More recently, Radden and Kövecses (1999), and Croft (1993) (and others) have explored the role of metonymy in human language. Similarly, Gentner (1988) and Gentner and colleagues (1997) have studied how analogy contributes to scientific discovery and insight. This research in cognitive linguistics suggests that rhetorical tropes and figures are not "just" stylistic devices. It argues that the words selected to express an idea actually shape that idea; using different language ultimately changes the idea, however subtly.

The work of these scholars supports that of rhetoricians, such as Fahnestock (1999), as well as my own work in *Rhetoric in(to) Science,* which argue that rhetorical tropes, such as metaphor or metonymy are useful in "extending language to represent new and innovative ideas" (Graves, 2005, p. 42). In other words, rhetorical tropes can contribute to the development of new ideas, not just describe the ideas after they are developed. Indeed, scholarship in rhetoric and cognitive linguistics has shown how metaphor and metonymy can and do serve as central tools in the development and creation of new ideas. For example, in theoretical physics, string theorists use the metonymy of a single string to stand in for the multitude of strings in the multiverse to help them build insight into individual string behaviour. It seems reasonable to assert that a stylistic trope such as metonymy does contribute to the development of scientific knowledge and ideas.

THE RHETORICAL TROPE OF METONYMY

Several scholars have tried to account for how metonymy creates meaning. Burke (1969) argued that metonymy is a metaphorical substitution, where a concept from an abstract realm of being is reduced or made concrete by comparing it with an entity from a less complex realm of being. He uses the example of “the heart” to refer to the “emotions,” for example, “my heart bleeds for you”—in other words, I feel badly for you. Research in an experimental physics laboratory has shown the physicists using metonymy as a way to reduce complex processes to single words or phrases (Graves, 2005). Other specialists fill in the background theory that the phrase evokes to comprehend immediately a complex idea.

Pointing to the difference between metaphor and metonymy, Croft (1993) explains that metaphor maps two concepts from different domains, while metonymy maps two concepts within a single domain matrix. For example, one of the physicists in my study referred to a “virgin sample,” meaning one that had not had any tests done to it. This metaphor maps from the domain of human sexual experience to the domain of a new thin film sample to illuminate the significant aspect of the film—that it is untested. In contrast, metonymy remains within one domain as illustrated by this use of metonymy (and metaphor) by a physicist to explain the concept of a quantum well:

> A quantum well is a one-dimensional well (imagine the furrows in a ploughed field where the individual furrow extends indefinitely in either direction, but is bounded on either side by the adjacent furrows) in which a particle or electron is trapped in the well with infinite boundaries (the length of the furrow) and infinite barriers (the adjacent furrows). The particle (or electron) can move along the plane of the well, but it cannot move through the barrier.... [But] if the barrier has a finite height and width, the quantized particle can tunnel or move through the barrier, rendering it transparent. (Graves, 2005, p. 212)

This physicist’s use of metonymy maps the domain of a three-dimensional well (an oil or water well) onto the domain of a one-dimensional well (an area where electrons are trapped). Listeners are expected to apply what they know about three-dimensional wells to the new situation to grasp the concept of a one-dimensional well.

According to Radden and Kövecses (1999), however, metonymy is not just a substitution of one term for another but interrelates two terms to “form a new, complex meaning" (p. 19). As the authors argue, metonymy creates meaning by relying on idealized cognitive models (ICMs) that encompass both encyclopaedic (the sum of our experience with a word or idea) and cultural models. In their description, idealized cognitive models comprise three different realms of being or existence: 1) the world of reality, which has to do with things and events; 2) the world of conceptualization or concepts; and 3) the world of language, which they call "forms." They argue that all three of these realms of existence are equally "real": the external world of things and events; how humans build concepts from their physical and intellectual experience of things and events; and how they use language to express and describe those concepts.

Metonymy creates meaning when we take an entity from one of these ontological realms and apply it to one of the other ontological realms. For example, the quantum well metonymy relies on listener knowledge of three-dimensional wells from the world of things when it applies this knowledge to the theoretical concept of the one-dimensional quantum well. Listeners understand the quantum well as holding something that cannot easily escape its container. The metonymy allows listeners to move intellectually from the world of things to the world of concepts when they apply their knowledge of the idealized cognitive model of a well to the new concept of a quantum well. It allows listeners to consider the existence of a quantum well based on their prior knowledge of the existence of an oil or water well. In the situation where the quantum well metonymy is introduced, the physicists do not know whether their measured data is evidence of a quantum well in their multilayered thin films or whether it is produced by some other unexplained phenomenon. As they deliberate over an explanation for these results, the physicists move back and forth between the realms of things and events, of concepts, and of forms. Through their use of metonymy, it is not always clear to which realm they are referring. In this way, the physicists develop arguments and evaluations that help them to decide whether the entity in question really exists or whether another more mundane explanation for the results is valid (ot was).

THE ROLE OF METONYMY IN EXPERIMENTAL PHYSICS

MacDonald and Tzu, two experimental physicists, had conducted basic research into the properties of different combinations of amorphous silicon (disordered, rather than crystalline silicon—the basis of the computer industry) semiconductors. They produced films using different methods and then examined the electrical and optical properties to make claims about the quality of the films and the usefulness of the methods of fabrication. Their research involved a series of experiments with a-SiN:H (hydrogenated amorphous silicon nitride) superlattices (multilayered thin films) with the goal of determining whether amorphous silicon semiconductors show evidence of a quantum mechanical effect referred to as confinement (this example contrasts the example discussed at the start of this chapter which studied single-layer non-hydrogenated amorphous silicon nitride thin films). The physicists wanted to determine whether they could observe quantum confinement in an amorphous semiconductor (quantum confinement was already well documented in crystalline superlattices). For this purpose, the physicists created superlattices with alternating layers of amorphous silicon that had different concentrations of nitrogen. These alternating layers could theoretically create a quantum well if the layers with a higher concentration of nitrogen formed the barrier layers and the layers with a lower concentration of nitrogen created the well layers. One of the experiments done to evaluate the properties of the superlattice was a measurement of the photoconductivity of the film, that is, the ability of the thin film to conduct electricity based on the intensity of light rays (infrared or visible light) being absorbed in it.

At one point in the course of their experiments, Tzu and Macdonald encountered persistent photoconductivity in a series of their thin film samples of a-SiNx. Persistent photoconductivity occurs when high levels of photoconductivity continue to be measured after the light source is removed from the film. Usually, the level decreases to its dark values as soon as the photons are no longer available for the semiconductor to absorb. As Tzu and MacDonald are trying to figure out the reason, MacDonald reads two sentences from a draft of an experimental article that Tzu has written (and MacDonald is revising) and then he thinks aloud about the ideas contained in the draft. In the draft and in the verbal explanation, both Tzu and MacDonald are using the metonymy of mechanism to describe the measurement of photoconductivity. Mechanism is a metonymy in this example because it refers to a single example of this degradation phenomenon to represent both the molecular structure of the film and the process that results in the measured change in photoconductivity. These are much larger and more complex entities, which the physicists have reduced to a single example as a way to conceptualize what might be taking place in the film to produce the measurements they have obtained. First, MacDonald reads the two sentences:

> Although hydrogen may play a role in the degradation mechanism [he is referring here to the decrease in the photoconductivity of the film], the former study suggests that it does not. In addition, the same degradation noted in the superlattice structures and the single layer films suggests that neither interface states nor carrier confinement in the wells influence the degra-

> dation mechanism very much. (Graves, 2005, p. 75)

Second, he explains the thinking behind the written text:

> I guess this [passage] is speaking to the [degradation] *mechanism* [emphasis added]. I guess ... the impression you've then made on the reader's mind is that, first of all, the mechanism is probably a characteristic of the silicon nitride [rather than some other effect], and the presence of these thin layers, or the barrier potentials, or the effect that occurs there doesn't seem to change that [degradation] *mechanism* [emphasis added] at all. The *mechanism* [emphasis added] is occurring in ... both the well layers and the barrier structures. (Graves, 2005, p. 75).

In this explanation, MacDonald describes how he intends readers to interpret the textual discussion about the degradation mechanism—they should conclude that structural characteristics of the silicon nitride caused the decrease in photoconductivity (rather than other possibilities like the presence of hydrogen or the width of the well or barrier layers).

From the perspective of metonymy, in this passage MacDonald is using mechanism as what Radden and Kövecses (1999) call an "Action ICM" (idealized cognitive model) of the result being substituted for the action and the action for the result. That is, mechanism stands for the result or cause (the physical object) and for the whole activity or action (the process). In this particular instance, mechanism also functions as a concept metonymy, taking the formula formA-conceptA for formA-conceptB, in which mechanism, the word, refers to mechanism, the physical object, and then mechanism, the word, shifts to stand for mechanism, meaning the process. Radden and Kövecses note that this type of metonymy is lexically polysemous, meaning "two senses of a word-form are relatable within the same ICM" (p. 27). The polysemous nature of mechanism in this example cuts across the ontological realms of things/events and concepts. The metonymy then infers the existence and operation of the process from the existence of the physical cause of the decrease measured in the film's photoconductivity. This concept of metonymy obscures the ontological status of the actual physical cause of PPC by proposing the mechanism as both a thing (thing/event) and a process (concept). It is difficult to determine, therefore, whether this phenomenon, which traverses the ontological space between an idea or theory and a physical entity, should qualify as real, that is, a "brute fact of nature."

This example shows that it can be difficult to distinguish between entities that are real (i.e., those "brute facts of nature") and those that are linguistic constructions (i.e., theoretical concepts), at least on the basis of studying the linguistic practices of working scientists. The difficulty of distinguishing at least opens the door to supporting Gross's contention (1991) that all knowledge is rhetorically constructed. At the same time, science has proceeded over the last 2000 years by seeking an accurate description of the natural world, a basis that assumes there is a "real world out there."

Another example, MacDonald and Tzu's efforts to revise a rejected manuscript based on their work, shows how the physicists' skillful use of metonymy works to persuade reviewers that their good-quality pure amorphous silicon nitride films do indeed exist. A referee for *Physical Review Letters* had objected to the evidence MacDonald and Tzu had offered for their claim that the fabrication method (ion beam assisted reactive deposition [IBAD]) produced good quality pure amorphous silicon nitride films. The referee demanded proof that using an ion beam actually did eliminate the dangling and wrong bonds, as well as the cracks and microvoids between atoms, to create a good quality film. Such proof of the improved quality was not available or even possible with the technology that MacDonald and Tzu had available at the time. Nor did they want to conduct additional tests, since the experiments had been concluded and Tzu was working on a different project.

Instead, they had to use a different tactic to persuade the referee of their films' improved quality: argument. In the first submission to the journal, they did not argue strongly for the improved quality of their films because they believed such a conclusion was obvious. The referee's response convinced them otherwise. They decided to present the pieces of evidence they had that suggested a certain conclusion and then to argue in defense of that conclusion. MacDonald treated the pieces of evidence metonymically, that is, as smaller parts of a larger puzzle that, when assembled, gave a clear picture of their films with fewer structural defects than other pure amorphous silicon nitride single-layer films. Through constructing a metonymic argument, MacDonald hoped to change their claim for this referee from an argument into a fact.

In fact, this is what MacDonald decided to do in revising his and Tzu's submission for *Physical Review Letters:* use rhetoric, in the form of argument, to change the referee's perception of their good quality pure amorphous silicon nitride films from non-existent to existing. MacDonald offered the referee two pieces of evidence, neither of which was particularly strong by itself, but together made a stronger argument than in their original draft. The first piece of evidence was an arithmetical calculation, To/T, drawn from Mott's variable range hopping theory (a theory about the movement of electrons under certain conditions in a film), that showed that the higher the nitrogen content in the film, the lower the density of defects in it. After Tzu calculated and graphed the density of states for their film, MacDonald used the graph to show that the density of states (or number of structural defects) was lower in their pure amorphous silicon nitride films made using IBAD than in the same types of films made using other fabrication methods. The graph was meant to act as a metonymy: in depicting the relationship between higher nitrogen content and lower conductivity, it constituted an attribute of films with a reduced number of structural defects. This attribute supported MacDonald and Tzu's argument that IBAD improved the quality of the films it produced.

MacDonald's revisions to the paper in this analysis show one way in which the so-called reality outside of language (i.e., the actual quality of the pure amorphous silicon nitride films made with IBAD) is called into or out of existence based on his use of language. In fact, the actual quality of the film exists in spite of the referee, but unless MacDonald and Tzu can persuade him to acknowledge or verify its existence through their use of argument and evidence, its actual quality does not matter to the larger scientific community because it will never see MacDonald and Tzu's unpublished letter.

The second piece of evidence that MacDonald included in his revision had to do with the type of conductivity (the movement of electrons through the film when it is illuminated) that Tzu measured in the films. Of the two types of transport—carriers hopping from one gap state or defect in the material to another or activated conductivity at high temperatures—Tzu had measured only the second type, activated conductivity, which can only be measured in films with fewer defects. By emphasizing in their argument that "*all* [they] saw were activated energies, but [they] only saw them at high temperatures" (Graves, 2006, p. 237), MacDonald assigned a metonymic function to this second piece of evidence as well: activated conductivity at high temperatures is an attribute of high-quality films. As noted, the quality of these thin films remained the same throughout the drafting and revision of this article. Until MacDonald and Tzu constructed a persuasive argument backed by convincing evidence, the referee refused to believe in its existence. However, MacDonald's skillful use of metonymy as an argumentative strategy conferred existence or ontological presence onto the high-quality pure amorphous silicon nitride films.

The issue of the unchanging existence of the quality of the thin films fits neatly into McGuire and Melia's (1991) phrase about "the brute facts of nature." This understanding of reality is based on a Newtonian view of physics and science, one that assumes that reality is separate and independent of the observer. This view of a stable reality assumes that the "properties of elementary particles are eternal and set by absolute law[s]" (Smolin, 2006, p. 62), but developments in early twentieth century physics suggested that elementary particles (those most basic ingredients of "the brute facts of nature") are contingent, varying with the history and environment in which they occur. Smolin (2006), a theoretical physicist at the Perimeter Institute for Theoretical Physics in Waterloo, ON, confirms this point. In *The Trouble With Physics,* Smolin (2006) explains that "the properties of elementary particles depend in part on history and environment .... [They] are contingent and depend on which solution of the laws is chosen in our region of the universe or in our particular era" (pp. 61-62). If we extrapolate from these insights about the properties of elementary particles, that the characteristics of elementary particles may change in different regions of the universe, or even over time, then our concept of reality is not necessarily independent and separate. Several scholars, including Barad (2000), a scientist, and Desilet (1999), a rhetorician, have explored the relationship between reality and the brute facts of nature from Bohr's perspective in Barad's case and Einstein's perspective in Desilet's case; their theories of agential realism and rhetorical ontology take into account the fact that the observer influences the observed. In agential realism, Barad calls for scientists to articulate the conditions surrounding an experiment to provide a fuller context for the observations and conclusions. She argues against science's conventional use of "constructed objectivity" in reporting experiments because this style obscures the mutually affecting relationship between the observer and the observed.

THE ROLE OF METONYMY IN THEORETICAL PHYSICS

String theory, the major focus of efforts in theoretical physics for the last thirty years, provides a fascinating new direction for questions about the relationship between rhetoric and reality. String theory grows out of 20th century experiments with particle accelerators. Between 1930 and 1960, physicists accumulated a great deal of data from accelerators about what happened when various kinds of strongly interacting particles collided. Analysis of this data yielded an interesting insight into the physical representation. According to Smolin (2006),

> particles could not be seen as points .... Instead, they were 'stringlike,' existing only in a single dimension, and they could be stretched, like rubber bands. When they gained energy, they stretched; when they gave up energy, they contracted—also just like rubber bands. And like rubber bands, they vibrated. (p. 103)

Based on this data, string theory argues that elementary particles are not point-like but the vibrations of strings.

Obviously, theoretical physicists have made extensive use of analogy and metaphor to develop string theory. The particles are not strings or rubber bands, but their properties indicate that they behave similar to strings or rubber bands. And once the analogy is accepted, the idea quickly passes into metaphor, as in "string theory" where the metaphor is conceptualized as a literal description for the purposes of making progress in understanding the ideas.

In describing the central components of string theory, Smolin uses metonymy in much the same way that MacDonald did in the PPC example. While there are an indeterminable number of strings (or entities that have been described as strings), the physicists refer to a single string as they try to conceptualize the architecture and the processes that give rise to the theory. A single, archetypal string stands in for all the others which are presumed to behave identically in the theory.

In describing the two constants associated with string theory, the string tension and the string coupling constant, Smolin (2006) notes this interesting point about the string coupling constant:

> Actually the string coupling constant is not a free constant but a physical degree of freedom. Its value depends on the solution of the theory, so rather than being a parameter of the laws, it is a parameter that labels solutions. One can say that the probability for a string to break and join is fixed not by the theory but by the string's environment—that is, by the particular multidimensional world it lives in. (pp. 108-109)

In this passage, Smolin refers to the behaviour of one particular string as a way to describe what is happening among the whole universe or dimension of strings. He also makes a fascinating point about the way that the string coupling constant is linked not only to an abstract idea but also to a facet of the particular environment in which the string exists. This concept of the string coupling constant clearly breaks down the barriers that we think of as existing between the world of ideas and the world of things and events because it is both theoretical and real.

As we have just noted, the theory itself shifts between ontological realms, and, following the passage just quoted, Smolin goes on to note this point: "This habit of constants migrating from properties of the theory to properties of the environment is an important aspect of string theory" (p. 109). This use of language that shifts and obscures the separation between the entity and the idea about the entity is a characteristic of this theory in theoretical physics, according to Smolin.

The result of metonymic language use seems to be that eventually the users see the theory or concept as evidence of the existence of the "real" thing or event. This has, in fact, happened in the discipline of theoretical physics, where many string theorists believe that their theory is true, even though they have not been able to test much of it, nor have they been able to use the theory to predict new aspects that can then be tested through experiment. These are some of the baseline requirements for a theory in science to be plausible. However, string theorists are talking about changing our understanding of science to reflect their belief in the validity of their theories (there seem to be approximately 10,500 different string theories—not infinite but close). Smolin (2006) summarizes the dilemma as follows:

> [String theory] has failed to make any predictions by which it can be tested, and some of its proponents, rather than admitting that, are seeking leave to change the rule so that their theory will not need to pass the usual tests we impose on scientific ideas. (p. 170)

Interestingly, string theorists adhere faithfully to their belief in its validity—even though it fails to meet the basic requirements of a valid theory in science, that of making predictions, being falsifiable, and being confirmable. So faithfully, in fact, that they propose redefining science as a field. String theorists might, therefore, be described as proposing to turn science into rhetoric. Science becomes rhetoric when rhetorical tropes such as metaphor and metonymy, as well as mathematical equations (i.e., analogies), provide the primary ways to affirm the existence of the reality described by string theory. While transforming science into rhetoric might be one solution to the dilemma proposed earlier in this chapter, it is not necessarily a satisfactory one from a number of perspectives. For example, in *The Trouble with Physics,* Smolin (2006) calls for a shift in financial and institutional support away from string theory and towards alternative research programs that will preserve science as science. He also calls on theoretical physics to develop a new philosophical stance beyond realism that takes into account how quantum physics has changed the relationship between the observer (human perception) and the observed (the real world). Both Barad (2000) and Desilet (1999) have proposed a version of this type of philosophy with their theories of agential realism and rhetorical ontology, but there is a great deal more work to do to expand these proposals into workable philosophies.

CONCLUSION

From the perspective of rhetorical studies, the claim that all science is rhetoric misses the mark. An accurate description of the relationship between rhetoric and reality will likely turn out to be far more complex, interesting, and illuminating than simply collapsing the fields of study into one another. Recent research in the rhetoric of science shows that rhetoric does play a central role in the creation of knowledge in science, and it can also make possible the perception of the entities that may become what we think of as the "brute facts of nature."

Let us revisit the warning issued by McGuire and Melia in their rebuttal to Gross in *Rhetorica* in 1991: that although rhetoricians may seek evidence of the "rhetoricity of scientific facts, 'the brute facts of nature' will turn out to be just those products of science that appear to be beyond rhetorical analysis" (p. 304). In this chapter, I have shown how the brute facts of nature can, in fact, be subject to rhetorical analysis without definitively resolving the issue.

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