Epilogue

HOME TO ROOST: SCIENCE WARS AS BOUNDARY-WORK

As I was hunting down the last few references for this book, I received a letter from a prominent philosopher of science asking if I would serve on the advisory editorial board for a new book series, "Science and Technology Studies." Such are the routine burdens of the scholar, but this particular invitation seemed to me a sign of the times: "We hope that the series will help raise the level of the current debate on science and technology, by sticking to the standards of rationality and the concern for empirical tests that characterize modernity." Translation: "We believe that you stand with us in the science wars, on the side of reason, empiricism, and truth of science, and against postmodernism, relativism, and radical social constructivism." How should I respond? There was evidently more at stake here than the time and energy I might have to read an occasional manuscript. Where do *I* stand with respect to reason and empiricism, relativism and constructivism? Where was *I* on this philosopher's cultural map of science? The cartographic quandary was now no longer George Combe's or Albert Howard's or John Tyndall's, but mine: Boundary-work comes home to roost.

This epilogue ends with my answer to this loaded request. My decision may surprise, and so I offer first a brief contextualization—one that will also serve to review the central message of this book. Why bother to bring up "current events"—the science wars rage as I write—at the tail end of a painstaking and dispassionate sociological study of old credibility contests in which rival parties manipulate the boundaries of science in order to legitimate their beliefs about reality and secure for their knowledge making a provisional epistemic authority that carries with it influence, prestige, and material resources?[1] I do so because these science wars are credibility contests in which rival parties manipulate the boundaries of science in order to legitimate their beliefs about reality and secure for their knowledge making a provisional epistemic authority that carries with it influence, prestige, and material resources. I seek to make the science wars historically mundane by showing that they are of a piece with the five episodes of cultural cartography I have just explored. By removing the science wars from the heat of battle and by cooling them off with a douse in sociological theory and precedent, I hope to show the commonplace character of our most recent, but surely not our last, episode of boundary-work. What good is sociology if it cannot pick out otherwise overlooked but consequential patterns from the ground of history and use them to make sense of where we are now?

It is difficult, especially from the inside, for anyone to put a finger on the start of the science wars or to locate their many and diverse incidences or to say with confidence just what they are all about. *In medias res* is hardly a propitious time for summing up. Blood has been shed, but nobody has won anything yet, and it is not even clear what would count as victory for either side—let alone how to pursue it. What we have so far is a scattered set of maybe disconnected happenings afterward lumped together as constituting today's "science wars."

- Biologist Paul Gross and mathematician Norman Levitt defend science in their 1994 book *Higher Superstition,* an admittedly polemical assault on anti-science attitudes proffered by a so-called academic left of social constructivists, cultural theorists, feminists, multiculturalists, and some extreme environmentalists.[2]
- Also in 1994, a permanent exhibition "Science in American Life" opens at the National Museum of American History (part of the Smithsonian chain) in Washington, D.C. Less than one year later, the

1. Barbara Herrnstein Smith *(Belief and Resistance)* offers a measured assessment of intellectual controversy in general, with its tendencies toward polarization, reflexive loops, and asymmetries (I'm right because that is the way reality is; you are wrong because you are demented or demonic).

2. Paul Gross and Norman Levitt, *Higher Superstition: The Academic Left and its Quarrels with Science* (Baltimore: Johns Hopkins University Press, 1994). Starting the war here may be Amerocentrist: publication of Lewis Wolpert, *The Unnatural Nature of Science* (London: Faber and Faber, 1992), and especially the exchange between Wolpert and Harry Collins in the *Times Higher Education Supplement* (September 16, 1994), anticipated many of the arguments that would become common after *Higher Superstition.* Because they are "data," these traces of the science wars appear only in footnotes and are not listed in the bibliography of secondary works.

American Chemical Society, which provided financial backing for the show, in effect disowns the exhibition's representation of science—a representation they characterize as skewed toward the evils of science (atomic destruction, chemical pollution) rather than toward its palpable benefits. The anti-science tone is blamed on postmodernist sentiments among some curators and members of the advisory board.[3]

- The conference "Flight from Science and Reason," held in the spring of 1995 at the New York Academy of Sciences, draws participants from all around the academy—natural scientists, social scientists, humanists. Most have come to decry the assault on rationalist ideals of the Enlightenment fomented by postmodernists, (de)constructivists, and others who would take up "cudgels against science."[4]
- In a special issue entitled "Science Wars," the cultural studies journal *Social Text* publishes the paper "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity," by physicist Alan Sokal. Full of references to leading figures in science studies (Bloor, Haraway, Latour, Pickering, Woolgar) and replete with hard-to-chew passages from Derrida, Lacan, Lyotard, and Irigary, Sokal's paper is revealed to be a hoax. He admits almost immediately in the gossip rag *Lingua Franca* that he had written it to demonstrate the cronyism, decline of academic standards, pseudoradicalism, and unintelligibility rampant in cultural studies of science.[5]
- On May 16, 1997, the *Chronicle of Higher Education* runs "The Science Wars Flare at the Institute for Advanced Study." The article describes how the appointment of Princeton University historian of science Norton Wise (coauthor of a prize-winning biography of Lord Kelvin, with doctorates in both history and physics) to the permanent faculty of the School of Social Science was blocked by critics inside and outside the Institute "hostile to science studies." The article also

3. I was a member of that advisory board, and twice wrote up my experiences: Gieryn, "Policing STS [Science and Technology Studies]" and "Balancing Acts."

4. The phrase is taken from an advertising blurb announcing arrival of the conference proceedings in book form in late 1996 (Paul Gross et al., eds., *Flight from Science and Reason* [New York Academy of Sciences, 1996]; reissued under the same title by the Johns Hopkins University Press, 1997). The conference was reviewed in David H. Guston, "The Flight from Reasonableness" *Technoscience* 8 (1995): 11–14.

5. Alan Sokal, "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity," *Social Text* 14 (spring/summer 1996): 217–52; Sokal, "A Physicist Experiments with Cultural Studies," *Lingua Franca* 6 (May/June 1996): 62–64.

points out that six years earlier, Bruno Latour's candidacy for the same position met the same fate for (evidently) the same reason.[6]

- Two edited collections of papers help to harden the divisions between "sides" in the "war": Andrew Ross, coeditor of *Social Text*, augments the special issue on the science wars for stand-alone publication; philosopher of science Noretta Koertge parries with *A House Built on Sand: Flaws in Postmodernist Accounts of Science.*[7]
- Whispers of reconciliation or truce are nevertheless heard: conferences at Durham in December 1994 and at Kansas in early 1997 bring scientists together with those who study their history and sociology; a "Science Peace Workshop" is held at Southampton in July 1997; chemist Jay Labinger publishes a "view from the petri dish" in *Social Studies of Science;* exchanges between physicist David Mermin and science studies warriors Trevor Pinch and Harry Collins appear in *Physics Today;* calls for pax on both houses are made in an editorial in *Nature;* even *Newsweek* discusses a group of Princeton lab scientists and historians of science (called "Reality Check") who meet "once a month to talk about how science can be skewed by ideology and how to make it more objective."[8]

It is not plain who makes up the sides of the science wars and what beliefs about science separate them. It is far too simple to see natural scientists lined up against those who do history or sociology or cultural

6. Liz McMillen, "The Science Wars Flare at the Institute for Advanced Study," *Chronicle of Higher Education,* May 16, 1997, A13. Cf. Colin Macilwain, "'Science Wars' Blamed for Loss of Post," *Nature* 387 (May 22, 1997): 325.

7. Andrew Ross, ed., *Science Wars* (Durham: Duke University Press, 1996); Noretta Koertge, *A House Built on Sand: Flaws in Postmodernist Accounts of Science* (New York: Oxford University Press, forthcoming).

8. Jay Labinger, "Science as Culture," *Social Studies of Science* 25 (1995): 285–306; N. David Mermin, "The Golemization of Relativity," *Physics Today,* April 1996, 11–12 and "What's Wrong with This Sustaining Myth?" *Physics Today,* March 1996, 11–12; Harry Collins and Trevor Pinch, N. David Mermin, letters, in "Sociologists, Scientist Continue Debate about Scientific Process," *Physics Today,* July 1996, 11, 13, 15; "Science Wars and the Need for Respect and Rigour," editorial in *Nature* 385 (January 30, 1997): 373; Sharon Begley, "The Science Wars," *Newsweek,* April 21, 1997, 54–56 (Begley, along with Adam Rogers, had already written a piece on Alan Sokal's hoax: "'Morphogenic Field' Day," *Newsweek* June 3, 1996, 37). For an overview of the issues, see Colin Macilwain, "Campuses Ring to a Stormy Clash over Truth and Reason," *Nature* 387 (May 22, 1997): 331–33. In trying to ring a conciliatory note, the editorial in *Nature* argued: "Where public perceptions of science are undermined by slipshod scholarship and misrepresentation, let the battle continue. But scientists who reflect at all about the wider significance of their work stand to benefit from a sharpened awareness of the genuine insights that science studies can offer" (373).

studies of science, just as it is far too simple to see in "science" truth, reason, and empiricism lined up against relativism, constructivism, and ideology. Pro-science versus anti-science is about as misleading in this context as pro-life versus anti-life is in the American controversy over abortion; nor do participants fall out cleanly along liberal-conservative political lines. There are too many Simmelian crosscutting alliances and fifth columns for the science wars ever to be a neat battle to the finish: an *n*-sided, ever shifting mess is more likely. Still, the apparent antagonists must be labeled something, and so—at the risk of reifying or homogenizing a mixed bag and polarizing the sides even further—I propose "science defenders" and "science studies," to refer respectively to (a) those who see science as under attack by (b) those who examine science as a historical, sociological, and cultural phenomenon.

Though the wars are a muddle just now, it is nevertheless possible to look at them sociologically and ask: What are they a specimen of? The answer is no surprise. Look back at the introduction to this book for the five telltale markings of cultural cartographies involving science.[9]

1. CONTESTED CREDIBILITY

Boundary-work is brought on by disputes over credibility: Who has the legitimate power to represent a sector of the universe—on what grounds? by what methods or virtues? in which circumstances? Cultural maps showing a space for science get drawn when it is not clear how epistemic authority is to be allocated among a variety of claims makers. The maps are interpretative justifications of the restriction of legitimate knowledge to this space and its denial to other spaces, served up as

9. In making these current events into a specimen of the cultural cartography of science, I restrict my attention to materials produced explicitly for the science wars—mostly published commentaries (web postings number in the thousands). I have not followed Paul Gross back into his biological work, nor have I followed Harry Collins, Bruno Latour, or Donna Haraway back into their scholarly studies of technoscience. What interests me here—as in the five episodes that precede this discussion—is how science gets rhetorically constructed as a cultural space, in public contests for credibility and wars over representational legitimacy. Emphatically, I do not respect the full range of conceptualizations of science floating about in science studies—constructivists, feminists, Mertonians, Edinburghians, manglers, Latourians—but pay attention only to what is said about science (and about science studies) by those of my peers actively engaged in the science wars. In the same way that representations of phrenology in testimonials for Combe are not faithful mirrors of what actually happened when fingers met skull, so too are these wartime representations of science by those from science studies an unfaithful portrait of what it is in the relatively pacific but divergent scholarly writings of Collins, Latour, and Haraway.

guides for those who wish to know what to believe and how to locate the credible knowledge on which they can base practical decisions. In this contest, each side draws a different map to create "science" as a distinctive ontological preserve over which they have legitimate claim to authoritative representation. The science wars are "a rumbling debate about the nature of scientific practice and knowledge, about who is qualified to pronounce on either."[10] Each side makes science into something best understood through the methods and tools it uniquely brings to the job: "science is nature" for its defenders; "science is culture" for historians and sociologists.

Science studies brings hermeneutic skills to the study of science: historians and sociologists are adept at deciphering the meaning of texts or material objects, discerning unanticipated consequences of ordinary practices, locating events in a historical flow or at a particular place, interpreting the institutional structures that bind and steer chosen lives and decisions. Many of those in science studies would accept Richard Levins's proposition that "the pattern of knowledge and ignorance in science is not dictated by nature but is structured by interest and belief." Nature typically (not always) becomes beliefs-about-nature or accounts-of-nature when the focus is on facts as collective suppositions—suppositions that are consensually stabilized over time and space via through contingent processes of laboratory tinkering, or inscription making, or ally enlisting. Literary critic Stanley Fish distinguishes social constructivism from nihilism: "What sociologists of science say is that of course the world is real and independent of our observations but that accounts of the world are produced by observers and are therefore relative to their capacities, education, training, etc. It is not the world or its properties but the vocabularies in whose terms we know them that are socially constructed—fashioned by human beings." On this, Marxist and feminist agree: Stanley Aronowitz writes "that all processes of knowledge, including science, are mediated . . . by the social and cultural context within which it has developed, [and] its truths are inevitably relational to the means at hand for knowing"; and Ruth Hubbard acknowledges that "though nature is material and real, our descriptions and understandings of it are necessarily mediated by the culture of science."[11]

10. Macilwain, "Campuses Ring to a Stormy Clash," 331.

11. Richard Levins, "Ten Propositions on Science and Antiscience," in Ross, *Science Wars*, 183; Stanley Fish, "Professor Sokal's Bad Joke," *New York Times*, May 21, 1996, A23; Stanley Aronowitz, "Alan Sokal's 'Transgression,'" *Dissent* 44 (winter 1997): 107, 110; Ruth Hubbard, "Gender and Genitals: Constructs of Sex and Gender," in Ross, *Science Wars*, 169.

With this constructed and artifactual character, science is just like all the other things explored by social scientists and historians—politics, crime, stratification, religion, gender, power. There is nothing distinctive about science as institution, organized practices, networks, collective beliefs, or symbols that would preclude its description and understanding with time-tested empirical methods used effectively by these disciplines for other social and cultural objects—ethnography, interviews, interpretation of documents, discourse analysis, surveys, and censuses. "In this respect," as sociologist Trevor Pinch argues, "science is no different from any craft activities like pottery, carpentry, and cooking. . . . Knowledge always goes with people." Neither gene nor quark has much interest for sociologists and historians of science except as something endowed with meaning—put into language or other symbol, manipulated by hand or machine, embedded in networks of resources and power, the object of thought and human action. Donna Haraway puts it this way: "Questions about what counts as knowledge need to be examined in terms of practice, institutions, people, funding and language." But in rejecting the idea that science is "a version of some universal truth that is the same in all times and places," as Andrew Ross does, science studies does not necessarily deny the value of scientific knowledge—as Katherine Hayles suggests: "It is a fallacy . . . to think that culturally contingent knowledge is not reliable. . . . Knowledge is useful to us because, not in spite of, the fact that it is limited, partial, and perspectival."[12]

Defenders of science argue that all of this misses what makes science science: nature. Indeed, if science were nothing but a discourse—nothing but practices and texts, material instruments and artifacts, networks of power and resources, institutions and organizations, beliefs and actions—then it would in many ways be indistinguishable from politics, religion, or poetry. Only by considering how nature intrudes in science can its distinctiveness be seen—and, in turn, the grounds for its distinctive epistemic authority appreciated. Michael Holmquest streamlines the defenders' position: "Science is nature, and therefore the very opposite of culture." Philosopher of science Michael Ruse concurs: "With its aim of yielding real insight into the nature and workings of the world, science uniquely transcends culture." Physicist Steven Weinberg suggests that the truth or falsity of scientific claims is not a matter of negotiation or

12. Trevor Pinch, "Science as Golem," *Academe* 82 (January/February 1996): 16; Donna Haraway quoted in Liz McMillen, "Science Wars Flare," A13; Andrew Ross quoted in Janny Scott, "Postmodern Gravity Deconstructed, Slyly," *New York Times,* May 18, 1996, A1; N. Katherine Hayles, "Consolidating the Canon," in Ross, *Science Wars,* 233.

hope but of the evidential facts of the case: "If scientists are talking about something real, then what they say is either true or false. If it is true, then how can it depend on the social environment of the scientist? . . . The correct answer . . . is what it is because that is the way the world is." Science is the progressively better (more accurate, more complete, more parsimonious, more efficient) representation, explanation, and prediction of natural reality, despite the fact that it is never finished and always corrigible, as Alan Sokal points out: "Every scientist knows perfectly well that our knowledge is always partial and subject to revision—which does not make it any less objective." New facts replace earlier illusions-passing-as-facts when nature does not do what scientists suppose it should do; concepts like evolution and instruments like particle accelerators are created to tighten the grip of science on nature, but they last only until nature makes them obsolete; facts and evidence are decided by nature, not constructed by people. For chemist Dudley R. Herschbach, "science . . . exalts Nature: she is the boss; we try to discover her rules; she lets us know the extent to which we have done so."[13]

It is trivially true that science has culture and a past: its symbols, instruments, ambitions, resources, collaborations, and accomplishments are indelibly human. Sociologist of science Stephen Cole, speaking for the defense: "Clearly social factors play an important role in the evaluation of new knowledge; but so does evidence obtained from the natural world. . . . Yes science is socially constructed, but yes how it is constructed is to various degrees and extent constrained by nature." But the social goings-on are prologue to what matters about science: the gradual nonlinear convergence of knowledge and nature, the winnowing away of beliefs incongruent with reality. There is room for sociologists to ply their trade in the prologue, but what they can say about the justification of scientific truth is tiny, according to Gross and Levitt: "Perspectivism has interesting things to say about the history of science, the shape of modern

13. Michael Holmquest, "Sokal's Hoax: An Exchange," *New York Review of Books,* October 3, 1996, 54; Michael Ruse, "Struggle for the Soul of Science," *Sciences* 34 (November/December 1994): 41; Steven Weinberg, "Sokal's Hoax," *New York Review of Books,* August 8, 1996, 14; Alan Sokal, "Pourquoi j'ai écrit ma parodie," *Le Monde,* January 31, 1997 (author's translation); Dudley Herschbach, "Imaginary Gardens with Real Toads," in Gross et al., *Flight from Science and Reason,* 18. Philosopher Susan Haack distinguishes belief from justification: "Warrant is social in the sense that talk of how warranted a scientific claim is, is elliptical for talk of how justified a scientific community is in accepting it; but how justified they are in accepting it does not depend on how justified they *think* they are, but on how good their evidence is" ("Towards a Sober Sociology of Science," in Gross et al., *Flight from Science and Reason,* 262; cf. Gross and Levitt, *Higher Superstition,* 17).

science as a social institution, the rhetoric of scientific debates. When it comes to the core of scientific substance, however, and the deep methodological and epistemological questions—above all, the incredibly difficult ontological questions—that arise in scientific contexts, perspectivism can make at best a trivial contribution." Practices at the bench (or the drafting of technical papers) are of little consequence except as they yield claims or interpretations that stand up to nature better or worse than rivals. Constructivists especially have a tendency to slice into the process of fact making too early—when everything does indeed look messy and "cultural"—but lose sight of the "big picture" of stable background truths and new evidential findings that eventually settle the matter into truth. Physicist N. David Mermin suggests that "certain sociologists ... confuse the scaffolding with the self-supporting edifice." Defenders also easily admit that science again becomes a cultural entity when facts leave labs and journals to enter the public.[14]

The breach is opened, the gauntlet thrown down: in these tales from the front, nature is excluded from science by those in science studies (or just made into the upshot of meaningful practices); culture is excluded from science by its defenders (or just made into an upstream prelude for the later meetings with nature that truly matter). Each side in the science wars defends its epistemic authority over the representation of science by making it into something for which its tools are the right ones for the job. If science is culture, the best tools for its understanding are interpretative, hermeneutic, ethnographic; if science is nature, the best tools

14. Stephen Cole, "Voodoo Sociology," in Gross et al., *Flight from Science and Reason*, 284; Gross and Levitt, *Higher Superstition*, 40; Mermin letter, in "Sociologists, Scientist Continue Debate," 15.

Physicists Gottfried and Wilson imply that Edinburghian constructivists unjustifiably extend their (useful) studies of scientific *practice* to a social explanation of the content of scientific *facts* visible only in the end. So Andrew Pickering gets into trouble when "the strong programmes's methodology is applied by them to scientific knowledge, and not just to practice, because now the sociologist is now really acting as the judge of scientific knowledge, assumes the power to stop the clock at an arbitrary point, thereby ignoring subsequent evidence as to whether some bandwagon fell over the cliff or stayed on track" (Kurt Gottfried and Kenneth G. Wilson, "Science as a Cultural Construct," *Nature* 386 [April 10, 1997]: 545–47). Dudley R. Herschbach uses the same image of science to separate the cultural stuff upstream from the nature-driven evidential facts that come out at the end of the day: "At its frontiers, science-in-the-making is inevitably a messy and uncertain business, easily misunderstood by policy makers, funding agencies, reporters, students, and sometimes even the researchers. Those who decry science often confuse its rude frontiers with its civilized domains or foundations" ("Imaginary Gardens," 15–16). Gottfried and Wilson suggest that constructivism may be more applicable to "science in the public arena: courtrooms, Chernobyl, and so on" than to the facts inside real science ("Science as a Cultural Construct," 547). My own willingness to wade into the science wars rests exactly on the sociological poverty of essentializing a boundary between science in the lab (real) and science in public arenas (merely cultural).

are quark, accelerator, and PCR machines. Characterizations of the other side become caricature: science studies is said to deny altogether that natural reality exists, just as defenders are said to deny the existence of anything cultural or historical. Sokal wonders: "Is it now dogma in cultural studies that there exists no external world?" Popperian Noretta Koertge says that "there are also extreme social constructivists who engage in a form of 'biodenial' whereby they deliberately downplay or even totally ignore the role of nonsocial elements." And Herschbach tosses out the archetypal there-are-no-relativists-at-30,000-feet: "When asked to refute Bishop Berkeley, Ben Johnson simply kicked a rock. To a cultural constructionist, we might likewise point out an airplane, say." If science studies is said to live with denatured reality, science defenders must live in a decultured world. Norton Wise says that "Weinberg presents us with an ideology of science, an ideology which radically separates science from culture," while feminist philosopher Sandra Harding suggests that defenders' views "have been obscured by preoccupations with representations of ideal science as an undistorting mirror of a fixed and perfectly coherent nature."[15]

Both sides see the science wars as a battle for the legitimate right to represent just what science is—culture, nature, a little of both? Haack lays bare the contested credibility: "And as for those who argue that since scientific knowledge is nothing but a social construction, the physical sciences must be subordinate to the social sciences, the only reply needed is that it isn't, so—thank goodness!—they aren't." From the other side, anthropologist George Levine suggests that science defenders are engaged "in a self-defeating crusade to keep people who are affected by science but don't 'do' science from having anything to say about it," and Hilary Rose agrees: "Science is one of few cultural activities where the practitioners have always sought (indeed, rather successfully) to stay in charge of the story about science. . . . There is more than a whiff of an ideology of the authority of the ultimate expert who is alone qualified to say what is and what is not science." This is all boundary-work of a sort: culture and nature are demarcated, and science is put on one side or the other. So whose science is it?[16]

15. Sokal, "A Physicist Experiments," 62; Noretta Koertge, "Wrestling with the Social Constructor," in Gross et al., *Flight from Science and Reason*, 267; Herschbach, "Imaginary Gardens,"18; Norton Wise, "Sokal's Hoax: An Exchange," *New York Review of Books*, October 3, 1996, 55; Sandra Harding, "Science Is 'Good to Think With,'" in Ross, *Science Wars*, 23.

16. Haack, "Towards a Sober Sociology of Science," 264; George Levine, in "The Sokal Hoax: A Forum," *Lingua Franca* 6 (July/August 1996): 64; Hilary Rose, "My Enemy's Enemy Is—Only Perhaps—My Friend," in Ross, *Science Wars*, 86.

2. MAPPING OUT

This boundary-work is then used to delegitimate the other side's pretensions to official renderings of science: cartographic exclusions become the order of the day, buttressed by a strong insiderism (it takes one to know one).[17] It is said that historians and sociologists of science do not practice science and therefore cannot know it; that natural scientists do not know history or social science and therefore cannot do it.

Defenders of science effect a volatile double exclusion: science studies is located outside the cultural space for "science," which raises doubts both about its ability to comprehend or interpret that which it is not a part of and about its general ability to produce credible (accurate, reliable, honest) accounts of anything—on the assumption that such credibility marks the genuinely scientific. A penumbra of invidious places is found for science studies: theology, philosophy, mysticism, ideology, charlatanism and nonsense, smug "smartasserie," Nazism.[18] Because science studies is outside science, it cannot hope to get it right. Gross and Levitt suggest that the field concocts "a model of 'science' [that] is a lot like the wicker-and-mud mock-up of a C-47 [aircraft] built by the cargo cultists." They elaborate: "A serious investigation of the interplay of cultural and social factors with the workings of scientific research . . . above all . . . requires an intimate appreciation of the science in question, of its inner logic and of the store of data on which it relies, of its intellectual and experimental tools. . . . We are saying, in effect, that a scholar devoted to a project of this kind must be, inter alia, a scientist of professional competence, or nearly so." Other defenders agree: "It is unlikely that any account from the outside can ever capture what is really happening on the inside." This ignorance of how science works makes those in science studies equally unequipped to map its borders and territories: "Because the constructivist-relativists ignore science, they are incapable of distinguishing it from pseudoscience;" or maybe such inaccurate cartography is intended: "Postmodernism blur[s] the distinction between [science] and 'other ways of knowing'—myth and superstition, for example." Although science studies cannot know science as only scientists can, they are nonetheless dead set against it: "Our antiscience colleagues are characterized by their appalling ignorances of the very object of their attack, namely science." Historian of science Gerald Holton also puts radical constructivists in the territory of anti-science and describes them as a "challenge to the very legitimacy of science," while Cole suggests that science studies takes glee in giving natural scientists their comeuppance: "Many correctly perceived the constructivist approach as an attack on the natural sciences and were pleased to see these sciences, which have long lorded it over the social sciences, knocked off their pedestal." Herschbach takes Sandra Harding's equivalence of Newton's *Principia* and "a rape manual" as evidence that science studies is out to "deprecate not only science but all objective scholarship and public discourse."[19]

Science defenders are simultaneously lumpers and splitters in their representations of the other side. Lumping together relativists and constructivists, feminists and Marxists, history of science and cultural studies, sociologists and afrocentrists, postmodernists and environmentalists tars them all with the sins of the most strident. Gross and Levitt create an altogether new nation labeled "the academic left," defined by its prominent landmarks: antipathy toward real science and resentment of its authority, success, or resources; ignorance about what science really is; old leftist political projects retreaded and now passing as scholarly advance. Boundaries that would separate academic historical studies of science from tree-hugging or faith healing are drawn ever so faintly by Gross and Levitt—overshadowed by the thick black line between science and its non- or anti-. It matters little, in this war of maps, that animal

17. Merton, "The Perspectives of Insiders and Outsiders," in *Sociology of Science*, chap. 5.

18. Collins and Pinch are said to impose "theological standards" (Belver C. Griffith, letter, in "Discussion of Nature of Science Provokes Hit-or-Myth Debate," *Physics Today*, January 1997, 13). "We should evaluate Collins and Pinch's arguments by treating them as philosophy, rather than trying to subject them to the methods used in science to discover truth" (Joseph F. Dolan, letter, in "Discussion of Nature of Science Provokes Hit-or-Myth Debate," *Physics Today*, January 1997, 11). "Mysticism or freewheeling, intellectual deceit or antiintellectualism . . . " (Mario Bunge, "In Praise of Intolerance to Charlatanism in Academia," in Gross et al., *Flight from Science and Reason*, 96). "We must talk about the intellectual virtues that are constantly guiding science and not cede the moral high ground to ideologues" (Koertge, "Wrestling with the Social Constructor," 272). For science studies as charlatanism and nonsense, see Alan Sokal, in "Mystery Science Theatre [Symposium]," *Lingua Franca* 6 (July/August 1996): 57; its characterization as "smartasserie" is from Norman Levitt, "More Higher Superstitions," *Skeptic* 4 (1996): 82. Arguing that existentialism is among the roots of today's science studies, Bunge maintains: "Heidegger was a Nazi ideologist and militant. . . . Existentialism is no ordinary garbage: it is unrecyclable rubbish. Its study in academic courses is justified only as an illustration of, and warning against, irrationalism, academic imposture, gobbledygook, and subservience to reactionary ideology" ("In Praise of Intolerance," 97).

19. Gross and Levitt, *Higher Superstition*, 41, 235; Anthony G. Basile, letter, in "Discussion of Nature of Science Provokes Hit-or-Myth Debate," *Physics Today*, January 1997, 13; Paul Boghossian, "What the Sokal Hoax Ought to Teach Us," *Times Literary Supplement*, December 13, 1996, 15; Bunge, "In Praise of Intolerance," 105 and 101; Gerald Holton, "Science Education and the Sense of Self," in Gross et al., *Flight from Science and Reason*, 552; Cole, "Voodoo Sociology," 276.

rights advocates and Bruno Latour may have different intellectual or political ambitions, or that they choose different strategies for pursuing them: they are one in their threat to science, alike in the illegitimacy of their representations of science, misguided in their designs on our future.[20]

Casual modifiers—"extreme" relativists, "radical" constructivists—expose a different (but just as effective) battle plan, whereby defenders of science divide science studies in order to conquer it. Hoping to turn the other side against itself, they insert boundaries between domesticated historical or sociological studies (no threat to science and maybe even exemplifying its normative standards of truth making) and a lunatic fringe. For example, Haack locates the boundary this way: "Bad sociology of science is thus *purely* sociological, whereas good sociology of science, acknowledging the relevance of evidential considerations, is not. Good sociology of science, in consequence, requires some grasp of scientific theory and evidence, while bad sociology of science does not."[21] The potential slippery slope is high and steep in such boundary-work, obvious in the incidents at Princeton's Institute for Advanced Study. Some defenders took Latour's inventive ontologies and playful prose as warrant for his placement on the fringe outside the Institute's School of Social Science. But could the same as easily be said of Norton Wise, with a graduate degree in physics, whose sober book on Kelvin was thought by some historians to be too full of formulae, who heads a doctoral program at Princeton that requires its historians to have training in the science they hope to study? The lunatic fringe was stretched so far in order to gobble up Wise that many were left to wonder if that was all there was to science studies.[22] In the Smithsonian controversy, the territory of the

20. "Differences [among the academic left] are soft-pedaled in the interest of an overriding common purpose, which is to demystify science, to undermine its epistemic authority and to valorize 'ways of knowing' incompatible with it" (Gross and Levitt, *Higher Superstition,* 11).

21. Haack, "Towards a Sober Sociology of Science," 260. Gottfried and Wilson, both physicists, distinguish the cultural studies ("a fringe group, ill-informed about science") from "the more sophisticated and troubling view of scientific knowledge as put forward by . . . the 'Edinburgh' school of sociology" ("Science as a Cultural Construct," 545).

Such boundary-work does not prevent at least one defender from pointing out that natural scientists actually *need* those who live on the fringe of biology, chemistry, or physics: "Frequently, what might appear as the most promising path up the mountain does not pan out; there are unanticipated roadblocks. Then it is vital to have some scientists willing to explore unorthodox paths, perhaps straying far from the route favored by consensus. By going off in what is deemed the wrong way, such a maverick may discern the right path" (Herschbach, "Imaginary Gardens," 16).

22. Perhaps relevant is Wise's active involvement in the science wars during the months before his fate was decided: his review of Gross and Levitt in *Isis* was caustic, and he went after

unacceptable and threatening expanded to include not just radical constructivist science studies and their more moderate cousins, but all of the cognate disciplines that feed into studies of science: the American Chemical Society requested that all displays of *social science* be removed from the story "Science in American Life."[23]

Savage cultural cartography like this is not the monopoly of defenders of science. Soldiers from science studies create spaces for the other side just as useful for delegitimating *their* accounts of science: guard dogs, fundamentalists, priests, academic police, Inquisitors, apocalyptics, and apologists.[24] I do this myself, in a review of Michael Friedlander's *At the Fringes of Science,* a book I characterize as "missionary work" (although I have to point out that Friedlander used the phrase first). Friedlander, I write, "plays science cop, patrolling and protecting its frontiers not just from pretenders to its authority over nature but from those outside science who mistakenly believe that they too have warrant to decide for themselves which science is good or bad, real or pseudo." What a grenade! I locate Friedlander adjacent to Velikovsky, because both give "off the appearance of science . . . but lacking endorsement from specialists in the many fields" they traverse. I deny this physicist the epistemic authority to speak the sociology of science, just as he denies Velikovsky the legitimacy to speak cosmology, astronomy, and geophysics: on this map of mine, both belong to pseudo-land. Science defenders are banished

Nobel physicist Steven Weinberg in the *New York Review of Books.* For public confessions of why Wise was not enough for the institute, see McMillen, "Science Wars Flare."

23. Marvin Lang, a chemist and colleague of mine on the exhibition advisory board, complained about input from "social scientists and pseudo-scientists who had no idea of how science worked" (quoted in Colin Macilwain, "Smithsonian Heeds Physicists' Complaints," *Nature* 374 [March 16, 1995]: 307).

24. Speaking about encounters with Gross and Levitt, Harry Collins recalls: "In the early days, it was as if we were entering this native village, and all the guard dogs came out and started biting our ankles. . . . It was a mistake to try to have a discussion with the guard dogs" (in Macilwain, "Campuses Ring," 332). The descriptions "fundamentalist" and "priest" come from Collins and Pinch, who add: "We are falling into a style of discourse more appropriate to a McCarthy-style hearing or a religious inquisition"(letter, in "Sociologists, Scientist Continue Debate," 11). On the Sokal hoax, Latour writes: "L'affaire me paraît beaucoup plus intéressante qu'une simple question de police académique. . . . Ce n'est plus la guerre contre les Soviétiques, mais celle contre les intellectuels 'postmodernes' venus de l'étranger" ("Y a-t-il une science après la guerre froide?" *Le Monde,* January 18, 1997). Sharon Traweek wonders "if we're back to the Inquisition?" (in McMillen, "Science Wars Flare," A9). "Apocalyptics" is from Ross's introduction to *Science Wars,* 11; and "apologists" is from George Levine, "What Is Science Studies for and Who Cares?" in Ross, *Science Wars,* 133. For good measure, Sarah Franklin writes that "Gross and Levitt espouse a paternalistic Right-to-Life discourse concerning the vital essence of the scientific ethos" ("Making Transparencies: Seeing through the Science Wars," in Ross, *Science Wars,* 165).

from science studies—no training, no license, no endorsement from insiders—to a territory reserved for those ignorant of its aims and accomplishments, peopled by aging natural scientists looking back wistfully (but not analytically or theoretically), by journalists who parody and caricature, and by anyone else who shoots from the hip (without reading Latour and Wise, or getting them right). Sokal is thus seen as having tried "to ventriloquize work he [doesn't] fully understand"; Wolpert may be "a knowledgeable and competent scientist [but] this should not lead us to think that this qualifies him as an authority in the philosophy of science"; and Gross and Levitt's "criticisms [are] questions not of fact but of interpretation in history, sociology and especially philosophy in which [they have] no special competence."[25] Evidence for the defenders' incompetence at science studies is their "lumping" inability to recognize and appreciate huge differences separating the field's various battalions.[26]

25. Thomas F. Gieryn, review of *At the Fringes of Science,* by Michael Friedlander, *Isis* 87 (1996): 767–68; George Levine, "Sokal's Hoax: An Exchange" *New York Review of Books,* October 3, 1996, 54; Michael Lynch, "Detoxifying the 'Poison Pen Effect'" in Ross, *Science Wars,* 241; Roger Hart, "The Flight from Reason: *Higher Superstition* and the Refutation of Science Studies," in Ross, *Science Wars,* 284. Stanley Aronowitz notices the obvious asymmetry in the defenders' position: "While everybody, including physicists and molecular biologists, is qualified to comment on politics and culture, nobody except qualified experts should comment on the natural science[s]" ("Politics of the Science Wars," in Ross, *Science Wars,* 203).

Norton Wise's review of *Higher Superstition* suggests that its authors understand neither the history of science nor its sociological analysis: "Here colorless white is 'Enlightenment'—not the historical Enlightenment, made up of all colors of the spectrum, but a stereotyped essence in disembodied realm of ideas." And then, after recounting Gross and Levitt's injunction that those who do history and sociology of science must know the science first, Wise hoists them by their own petard: "As their book so painfully demonstrates, this same need for professional competence applies to historical research and writing" ("The Enemy Without and the Enemy Within," *Isis* 87 [1996]: 323, 327). After Wise was denied the position at the Institute for Advanced Study, Frederick Gregory (as president of the History of Science Society) wrote to the *Chronicle of Higher Education:* "I can only conclude that the persons responsible for this regrettable mistake in judgment either deliberately ignored or are not familiar with the balance achieved by Professor Wise in his scholarship" (unpublished letter).

And, in a nice reflection of Gross's C-47 science constructed by the cargo cult also known as science studies, we have Lynch's comment on how "Gross and Levitt construe the constructivist stance (or, rather, [how] they *mock it up*)" (Lynch, "Detoxifying," 249; emphasis mine).

26. Wise continues his assault on *Higher Superstition:* "The rhetorical technique is always the same. Pick out a stereotyped set of figures, make them stand in for a wide range of different and often conflicting positions in a complex movement, and ignore all aspects of that movement that do not fit the stereotype" ("The Enemy Without," 324). In the midst of a battle with Norman Levitt, Richard Olson writes about his and Gross's tactics: "Nearly all persons who accept the notion that cultures have any bearing on the content of science in any degree are caricatured by identifying their views with the most radical cultural constructionists, post-modernists, academic feminists, and ecologists. ("Where Is Knowingness to Be Found?" *Skeptic* 4 [1996]: 83). Anthropologist Emily Martin says: "None of us recognize ourselves in these diatribes" (in

3. WHAT SCIENCE BECOMES HERE AND NOW

In struggles for credibility, the cultural space for science takes diverse pragmatic shapes, and distinctive landmarks are located within or without, as contestants squeeze and stretch its borders in order to best justify their own reality claims as legitimate and persuasive. As it happens, all contestants in these science wars—defenders and even supposed attackers—want to locate their own inquiries inside science for the same reason that Howard, Pons, Fleischmann, Combe, Tyndall, and sociologists lacking professional self-esteem do, to benefit from the long historical association of "science" with credibility and (though not necessarily their explicit intent) to secure that epistemic authority until at least the next round of boundary-work. Moreover, there is remarkable agreement on both sides of the battle lines about how—methodologically—proper science should be practiced. They disagree, of course, on just who is being proper.

Many of those from science studies are at pains to show that they are not only pro-science, but that they *do* the science of science properly. Barry Barnes told *Nature* that the goal of Edinburgh's "strong programme" was "to understand the nature of knowledge in a scientific manner," and his former colleague Steven Shapin adds: "We have great respect for what scientists actually do. . . . If our fundamental philosophical position was anti- anything, it was anti-rationalist philosophy, not anti-science." Norton Wise puts science studies within the same cultural space as Steven Weinberg's physics: "All historians, philosophers and sociologists that I know share Weinberg's hope for rational understanding and . . . none of them deny objective reality as Weinberg presents it." Levine says that "nobody [in science studies] is trying to shut science down," and Nelkin suggests that this is because the field—as much as physics or chemistry—relies on its "scientificity" to sustain its credibility: "The role of science as a model of rationality in human affairs is not really in question. In particular, the historians and sociologists who study science have always had to justify their work to scientists and to validate its credibility in terms of scientific standards." Sometimes the self-location of science studies within science is achieved through the deportation of a lunatic fringe. For the Marxist Aronowitz, "the point is not to debunk

McMillen, "Science Wars Flare," A9). Biologist Richard Lewontin joins the parade: "The hopeless muddle they make of the category renders the term *academic left* useless for any analytic purpose, yet it appears over and over" ("À la recherche du temps perdu: A Review Essay," in Ross, *Science Wars,* 296).

science or to 'deconstruct' it in order to show it is merely a fiction. This may be the postmodern project, but it is not the project of science studies." For feminist Evelyn Fox Keller, "it is not science that is threatened by the hapless publication of gibberish; it is science studies itself."[27]

These maps—showing the history and sociology of science snuggled up inside science with physics and chemistry—may be as hard a sell these days as they were just after World War II (chapter 2). Prominent defenders parade their hard scientific credentials (Gross is a biologist, Levitt a mathematician, Sokal a physicist) to deny authority to soft impostors. Still, those from science studies may have learned a thing or two from their studies of rhetoric, and they devise a sly cartographic response that at once preserves the appearance of science as rational and objective while at the same time excluding Gross, Levitt, Sokal & Co. In this counterargument, the boundary-work of science defenders is severed from whatever good and hard science they do in their day jobs. "Science" now becomes a space for fair debate, the proper tribunal for respectfully sorting out contrasting claims, where those who disagree can engage each others' work honestly and collectively, avoiding misrepresentation or stereotype. Those high-profile science cops do not fit science so drawn. David Edge complains that Paul Gross treats his adversaries in the science wars with "contempt and derision": "abandoning all pretense of trust and respect," he does not engage in "fair, honest and well-informed disputation," and because of this "demean[s] (and will eventually destroy) the very science and reason that we are all so anxious to conserve and extend." After accusing science defenders of conducting a witch-hunt against Norton Wise at the Institute for Advanced Study, Bruno Latour says that it is the "Sokalites" "who are anti-science . . . against the objectivity of science, against intellectual freedom. . . . They are not to be found in the ranks of science studies." Collins and Pinch add that defenders "hide behind creation myths, witch-hunts, censorship and suppression [and] in doing so . . . will destroy the democratic foundation of the science they say they love." Wise writes that *Higher Superstition* "will be deeply saddening to anyone committed to the free and open investigation of the workings of science." Lewontin believes that the

27. Barnes and Shapin in David Dickson, "Champions or Challengers of the Cause of Science?" *Nature* 387 (May 22, 1997), 333; Wise, "Sokal's Hoax: An Exchange," 55; Levine, "What Is Science Studies For?" 128; Dorothy Nelkin, "The Science Wars: Responses to a Marriage Failed," in Ross, *Science Wars*," 121; Aronowitz, "Alan Sokal's 'Transgression,'" 110; Keller, in "The Sokal Hoax: A Forum," *Lingua Franca* 6 (July/August 1996): 58.

book is so far outside science that its authors do not even get the science right: "The 'science' of Gross and Levitt is something out of a high school textbook."[28] Sokal's hoax becomes a deceptive "breach of ethics" and "caricatur[e] of complex scholarship" rather than an open and informed confrontation of ideas. Even worse, as the "experiment" he hoped for, it is poorly designed and thus proves nothing.[29] Meanwhile, sociologists of science give their field features that should make any bench scientist feel as if they are working shoulder-to-shoulder: their work is realist, "maxi-

28. David Edge, letter, in "Evolution Teaching," *Science* 274 (November 8, 1996): 904; Bruno Latour, "Science as Culture Newsgroup," electronic posting, May 21, 1997; Collins and Pinch letters, in "Sociologists, Scientist Continue Debate," 13; Wise, "The Enemy Without," 323; Lewontin, "À la recherche du temps perdu," 297.

Basil O'Neill writes that Gross and Levitt suffer from a "failure to read properly," and they "tear passages out of context, and corral thinkers into positions that they then attack. . . . What is more surprising is [their] incapacity to be logical" ("Here Be Dragons," *Times Higher Education Supplement*, July 1, 1994, 23). Hayles accuses them of "a systematic pattern of misleading and unfair quotation, a failure to read accurately, a failure to grasp an argument's main thrust, opportunistic and biased use of sources, and the use of character assassination and verbal abuse rather than reason to discredit an opponent's work" ("Consolidating the Canon," 227). For Lynch, *Higher Superstition* displays "a severely uncharitable reading of the texts, focusing on factual errors, tendentious remarks, and outrageous claims" ("Detoxifying," 248); while for Hart "omission, misrepresentation, caricature, ad hominem remarks and altered quotations combine to form [their] attacks" ("Flight from Reason," 273). I have not seen these sins turn up *inside* anybody's map of science.

29. Bruce Robbins and Andrew Ross, in "Mystery Science Theatre [Symposium]," 54; Ross in Scott, "Postmodern Gravity," A1; Stanley Fish suggests that "Professor Sokal's legacy" is "fraud" in that he goes "beyond error to erode the foundation of trust on which science is built" ("Professor Sokal's Bad Joke," A23).

Here are the weaknesses of Sokal's experimental design: he identified himself to the editors at *Social Text* as a physicist, which allowed them later to say that they had accepted the piece—warts and all—because it came from a scientist who was at least trying to consider cultural studies on its own terms, although "his article would have been regarded as somewhat outdated if it had come from a humanist or a social scientist" (Robbins and Ross, in "Mystery Science Theatre," 55). Boghossian suggests that Ross and the editorial board of the journal may even have bowed to the physicist's authority: "The prospect of being able to display in their pages a natural scientist—a physicist, no less—throwing the full weight of his authority behind their cause was compelling enough for them to overlook the fact that they didn't have much of a clue exactly what sort of support they were being offered" ("What the Sokal Hoax Ought to Teach Us," 14). Robbins admits that "we thought he was a progressive scientist, a physicist who was willing to be publicly critical of scientific orthodoxies" ("Reality and *Social Text*," *In These Times*, July 8, 1996, 28).

Moreover, if Sokal's objective was to discredit the entire field of the cultural studies of science (and not just *Social Text* or its editors), he should have remained silent about the hoax—to see if readers and other practitioners would also have read his paper as sincere. Sokal later said that he went public with the ruse because word of it had leaked out, and the beans would have been spilled almost immediately either way (see Babette E. Babich, "Physics vs. *Social Text:* Anatomy of a Hoax," *Telos*, no. 107 [spring 1996]: 45).

mally objective, accurate and comprehensive"; they are "simply subjecting science to the same ruthless criticism that corresponds to the scientific ideal of self-critical inquiry."[30]

Now if we look at the defenders' maps of science, the landmarks of good scientific practice are no different, but it is of course science studies that does not measure up. Boundary-work is epitomized in Gross and Levitt's contrast of real science with the academic left:[31]

Academic left	Science
muddleheadedness (1)	reliable and rests on a sound methodology (2)
insularity and ignorance (7)	reliable factual knowledge (12)
mythmaking, symbolic wish-fulfillment (8)	open-endedness (17)
sloganeering (8)	powerful, systematic, and ever-expanding (17)
weakness of fact and logic (8)	deep epistemological skepticism (21)
polemical (11)	internal logical consistency, empirical verification (24)
radical epistemological skepticism (11)	science works (49)
unprovable and bootless speculation (12)	objective truth about the world (52)
impressionistic description (12)	cogent, self-consistent, logically coherent, requiring patience, diligence, humility, and intellectual energy (53)
subjective hermeneutics (12)	nature might provide a template (58)
trendy doctrine, windy generalization (37)	deep and surprising predictions about the real world (62)
perverse theories (43)	exacting logical analysis of abstract models (62)
rush hell-for-leather toward unalloyed twaddle (43)	rigorous (81)
tooth-fairy hypothesis (47)	driven by the unyielding contours of reality (81)
sloppy, full of holes (48)	verification and falsification (81)
covert appeals to emotion and prejudices (48)	hard-won truth (85)
turgid and opaque (50)	severe tests of meaningfulness (86)
incoherent (51)	epistemic dignity (90)
hallucinatory (52)	vast and serious (122)
vulgarizations; amateurs (52)	self-correcting (139)
hermeneutic hootchy-koo (53)	rationality itself (165)
paradox and contrarian whimsy (60)	controlled experiments of rational design (186)
fallacious (65)	knowledge (195)
ideological (68)	reality-driven (234)
priesthood (73)	reliable, profound, and productive (256)
pretentiousness (79)	
untrammeled relativism (84)	
narratives of superstition (85)	
conceptual freak show (88)	
pseudoscientific (90)	
philosophical styrofoam (98)	
intellectual tinsel (100)	
febrile delusion (103)	
dogmatisms (112)	
metaphors (112)	
old-time camp meeting (113)	
overdue for deep psychoanalysis (121)	
multicultural gravy train (131)	
epistemological Merry Pranksters (136)	
academic inner city (136)	
millenarian longings (169)	
moonbeams and fairy-dust (176)	
unsupported by any evidence (211)	
pathetic gullibility (212)	
psychotalk (239)	
sheer puffery (246)	
incipient Lysenkoism (252)	

30. Harding, "Science Is 'Good to Think With,'" 20; Aronowitz, "Politics of the Science Wars," 205. Science studies may even be as committed to "realism" as any physicist: "Voilà une discipline [l'histoire sociale des sciences] à peu près inconnue, qui propose de l'activité scientifique une vision enfin réaliste, dans tous les sens du mot" (Latour, "Y a-t-il une science après la guerre froide?").

31. These terms all appear in Gross and Levitt's *Higher Superstition*, to which the page numbers in parentheses refer.

Science as such retains its worthy virtues, its putative grounds for credibility. But now the proponents of science studies are "the enemies of learning, rigor, and empirical evidence . . . who proclaim that there is no objective truth, whence 'anything goes,' [and] who pass off political opinion as science and engage in bogus scholarship." Sokal writes that "Aronowitz distorts [his critic's] positions," that "much of his essay is based on setting up and demolishing straw opponents," that "such investigations need to be [but are not] conducted with due intellectual rigor." Gross responds to Edge's criticism of *Higher Superstition:* Edge "cannot have read the book" and serves up "ad hominem arguments." Cole takes their illogic and duplicity as a sign that those in science studies are simply wrong: "They know that what they say cannot hold water and, when pushed to its real foundations, is logically absurd. Therefore, the only way to defend themselves is to say that they never said what I said they

said (or if they said it they did not mean it)."[32] So although rivals in the science wars may be divided by their ontological commitments to science-as-nature or science-as-culture, they come together in agreeing that science-the-method is objective, fair, reliable, and honest. But only the good guys do science the way it is supposed to be done.

4. CONTINGENT STAKES

Cultural cartography happens when there is something valued on the line: material resources, prestige, the truth of a cherished claim, power. If the present science wars are anything like the five episodes of boundary-work that came before, this is not a merely academic or scholastic exercise. What is it about science just now—politically, economically, symbolically—that gives these wars their vitriol? As in my other case studies, the stakes for all sides become part of the cartography: interests are attached (to others) or denied (on our side) in order to legitimate our map as an accurate rendition, rather than some self-interested distortion, of a "real" culturescape.

According to science studies, these may not be the best of times for scientists—politically or economically. That assertion then becomes a premise for delegitimating the defenders' cultural maps as poorly disguised efforts to secure more reliable funding for science or a more salutary climate of public opinion (by scapegoating science studies). Sociologist Dorothy Nelkin suggests that the science wars are "really" about "strains on federal support for science," and Richard Olson elaborates: "The passing of the 'Golden Age' of research and development associated with the Cold War [has] created a real short term threat to the economic health of the science and engineering communities, with physics being hit particularly hard." Anthropologist George Levine links this retrenchment to the science wars: "Counter-aggression of scientists hostile to 'postmodernism' is surely the consequence of an economic pinch hurting them." Levine continues elsewhere: "The squabbles that followed have now been inflated to holy wars because there is so much at stake: intellectual authority, educational direction, disciplinary turf, the allocation of

32. Bunge, "In Praise of Intolerance," 96; "Alan Sokal Replies," *Dissent* 44 (winter 1997): 111; Paul Gross, letter, in "Characterizing Scientific Knowledge," *Science* 275 (January 10, 1997): 142; Cole, "Voodoo Sociology," 281.

Bunge singles out feminists for special exclusion from science: "They denounce precision—in particular, quantitation, rational argument, the search for empirical data, and the empirical testing of hypotheses as so many tools of male domination" ("In Praise of Intolerance," 100).

big money." Thinking about sciences like molecular biology, Ross suggests that "a sequestered craftlike pursuit has been undermined by the wholesale proletarianization of scientific labor in commercial production." Nelkin adds: "The growing importance of industry-university collaborations has left a public impression that science is for hire, that some scientists are simply indentured scholars to a corporate entity, and that scientific information is less a public resource . . . than a private commodity." Philosopher Silvan S. Schweber puts it all together: "Doubtless part of the reason for their participation [in the science wars] lies in the post-cold-war marginalization of physicists both within the academy and industry, as evidenced by the cancellation of the Superconducting Super Collider and the 'downsizing' physics departments and industrial laboratories." Well-publicized instances of research misconduct and fraud are said to have tarnished the public image of science as well.[33]

Such a bleak picture is vigorously denied by science defenders as a cause of the science wars. It stands to reason: their boundary-work is compromised if maps of a wonderful science—surrounded by fierce wolves in skins of postmodernism—were shown to be merely self-serving cartographic instrumentalities designed to restore science budgets or to justify questionable research on human fetuses. No, structural contractions of science (however severe or imagined to be) are pushed to the background. Paul Gross asks (and answers): "Is it reasonable to think that people like [physicist Steven] Weinberg started to make a fuss about [science studies] because he was getting his funding cut? It's ridiculous." Weinberg himself is only a little facetious when he admits: "In years of lobbying for federal support of scientific programs, I never heard anything remotely postmodern or constructivist from a member of Congress." Alan Sokal "dismisses the criticism that his concern about the growing influence of . . . 'constructivist' ideas about science reflects worries about a decline in both funding for physics and [its] social status with the end of the Cold War." Although these political and economic stakes are far from the minds of science defenders, they are seen as an essential element of the other side: "Social constructivism is not simply an intellectual movement, a way of looking at science, but it is an interest group that tries to monopolize rewards for its members or fellow travellers and

33. Nelkin, "What Are the Science Wars Really About?" *Chronicle of Higher Education*, July 26, 1996, A52; Richard Olson, "Whose Is the Higher Superstitution?" *Skeptic* 4 (1996): 33; Levine, "Sokal's Hoax," 54, and "What Is Science Studies For?" 125; Ross, introduction to *Science Wars*, 9; Nelkin, "Science Wars," 119; Schweber speaks reconciliation and peace: "Reflections on the Sokal Affair: What Is at Stake?" *Physics Today*, March 1997, 73.

exclude from recognition those who question any of its dogma."[34] This argument thus completes the mutual imputation of polluting self-interest.

Science defenders offer their own cultural cartography as an altruistic mission designed to rescue the epistemically gullible from seductions of relativism, constructivism, or radical environmentalism. The "real" stakes of the science wars are reason, logic, evidence, and objectivity—virtues secure for now within the walls of science, but imperiled outside among impressionable students and fad-hungry journalists (to whom postmodernists can feed tales of the Enlightenment's complicity with power and implication in environmental degradation, racial and gender inequities, colonial domination). Gross and Levitt make this plain in *Higher Superstition:* "The academic left's rebellion against science is unlikely to affect scientific practice and content. . . . The danger, for the moment at least, is not to science itself. What is threatened is the capability of the larger culture, which embraces the mass media as well as the more serious process of education, to interact fruitfully with the sciences, to draw insight from scientific advances, and, above all, to evaluate science intelligently." Sokal is more pointed: "My goal isn't to defend science from the barbarian hordes of lit crit (we'll survive just fine, thank you)." Bunge believes that the world as we know it is down the tubes if science studies succeeds: "Spoil the charlatan and put modern culture at risk. Jeopardize modern culture and undermine modern civilization. Debilitate modern civilization and prepare for a new Dark Age."[35]

The stakes for science studies may be more desperate: survival. In retrenched universities, an old union rule is sometimes enforced: last aboard, first to go. Interdisciplinary programs and departments in science and technology studies are relatively vulnerable newcomers. The judicious Schweber drops the other shoe in suggesting that cultural cartography by science studies is no more easily detached than that of its detractors from struggles for funding and a secure base on campus: "The current science wars and culture wars will make support for the humanities and the social sciences more difficult." Sheila Jasanoff implies that the threats to science and technology studies from the science wars are far greater than the threats of constructivism or feminism to physics and

34. Gross quoted in Macilwain, "Campuses Ring," 333; Weinberg, "Sokal's Hoax: An Exchange," 56; Sokal quoted in David Dickson, "The 'Sokal Affair' Takes Transatlantic Turn," *Nature* 385 (January 30, 1997): 381; Cole, "Voodoo Sociology," 274.

35. Gross and Levitt, *Higher Superstition,* 4; Sokal, in "Mystery Science Theatre [Symposium]," 57; Bunge, "In Praise of Intolerance," 110.

chemistry. "When money is tight, you tend to cut out the things that are considered non-essential. The curriculum in academic life is becoming more market driven than 'intellect' driven. The sociology of scientific knowledge is an easy thing to target, and appears to stand for a lot of things that some people say are going wrong in society." The implication is that efforts, for example, by right-wing academic watchdogs (such as the National Association of Scholars) to root out any challenge to Enlightenment virtues of truth and reason—like feminism, postmodernism, or constructivism—is itself an abrogation of those virtues (which, of course, science studies demonstrably embodies). Thus both sides in effect must argue that *everybody* will suffer if the other side of the science wars is victorious.[36]

5. OUTCOMES: WINNERS AND NON-LOSERS?

Given obvious power differences between natural scientists and those who study them, it is a bit odd that this war has gone on for as long as it has (and that it seems unlikely to cease any time soon).[37] Really, how many physicists does it take to quash a sociologist or two? Could it possibly be—in contrast to the five other episodes of cultural cartography, where epistemic authority typically was a zero-sum game—that the science wars are a win-win deal? Maybe science defenders and science studies both have reasons to perpetuate a contrived pseudo-war that belies the interests they share. Indeed, such talk of common interests has lately been heard. Levine says that both sides will sink or swim together amid government budget cutting (and, one might add, attacks from anti-intellectualist extremists): "We" should take "this awkward moment as an occasion for recognizing common interests." Enemies can be allies

36. Schweber, "Reflections," 74; Jasanoff in David Dickson, "Science Studies Braces for the Fall-Out" *Nature* 387 (May 22, 1997): 332. For example, remembering that Sokal fashioned himself as the "real" Left pitted against postmodern impostors, Schrecker writes: "the Right is fighting a broad-based campaign to demonize those sectors of the academic community that encourage critical thinking and offer an alternative perspective on the status quo. . . . Sokal's merry prank may well backfire" (in "The Sokal Hoax: A Forum," 61).

37. Stop press! The *Chronicle of Higher Education* reports on its "Daily News" Web site (November 13, 1997) that the science wars were a factor in the "retirement" of Katherine Livingston, long-time book review editor at *Science.* Ongoing battles continue to receive high-profile media coverage: Madhusree Mukerjee, "Undressing the Emperor," *Scientific American* 278 (March 1998): 30–31; "You Can't Follow the Science Wars without a Battle Map," *Economist* 145 (December 13, 1997): 77–79 (this title confirms my choice to present the phenomenon as an instance of cultural cartography). For more vitriol from a science defender, see Jean Bricmont, "Science Studies—What's Wrong?" *Physics World* 10 (December 1997): 15–16.

against other enemies. Pinch sees a silver lining: "A lot of the shouting that's gone on has been most unfortunate. . . . But I see this as a great opportunity to address issues that need to be addressed and haven't been." His collaborator Harry Collins agrees: "The whole timbre of the discussion has become useful and productive."[38] Useful and productive for what, for whom?

For a fledgling academic pursuit like science studies, the limelight is preferable to obscurity: we sociologists get giddy just to be noticed in *Nature* or *Science*. Because of the science wars, science studies makes it to the front page of the *New York Times* (courtesy of the Sokal hoax), becomes a noticed blip on radar screens of university administrators and department heads (thanks to the *Chronicle of Higher Education*), and assumes a reality for many natural scientists who have learned only lately what was being said about them (as they read *Physics Today*). The attention alone may be salutary for science studies, even if it comes at a risk that university administrators (and the publics in line behind them) will believe every nasty word that Gross and Levitt have written.

Science defenders may also benefit from protracted science wars—even if they should somehow "lose." That is, the image that science studies constructs for science may—in a not so unlikely scenario—add still more legitimacy to scientists' cultural hold on epistemic authority. To make science "culture"—a human endeavor, and therefore hesitant, flawed, fallible, incomplete, uncertain, corrigible—might get scientists off the Superman hook as they enter techno-debates over public policy. No physicist or chemist or biologist can possibly live up to the heroic myth in which science speaks with absolute finality and assuredness, lifts every veil of complexity and confusion, guarantees inevitable outcomes. Science studies sustains scientists' epistemic authority by replacing these unrealistic images with useful facts about the provisional qualities of scientific knowledge and the bricolage of scientific practice. Philosopher Steve Fuller believes that science studies could "lead the public to have saner expectations of science. Words like *truth, rationality* and *objectivity* have [in the past] inspired unrealistic hopes for what science can accomplish." Hayles says it better: "Properly framed, the challenge that the cultural and social studies of science pose to objectivism should make science stronger, not weaker, by clarifying its connections to the complexities of instantiated and situated human life." With that, even physicist Mermin could agree: "Scientists who set themselves up as sorcerers are a menace to the public and to science."[39]

38. Levine, "Sokal's Hoax: An Exchange," 54; Pinch and Collins quoted in Macilwain, "Campuses Ring," 331. "I urge that we find out who our allies are in various disciplines, including the sciences, and work to forge alliances with them" (Hayles, "Consolidating the Canon," 233).

In short, the skill and expertise of scientists will still be worth seeking out even after "the public . . . understand[s] that expert disagreement is part and parcel of scientific life. Scientists then are skilled experts like any other skilled experts, such as realtors, plumbers and chefs." A peacemaking *Nature* editorial suggests that science studies can help natural scientists as they enter public controversies: "Those who have been developing our knowledge of science from this perspective are playing an increasingly important role in mediating the relationship between science and society [and] only a deep understanding of science as a social (as well as intellectual) process will enable us to strengthen the bridge between the worlds of science and politics." Levine sums up: "The best thing that could happen to science, if it wants to convince society as a whole that it deserves support, would be to reject the arrogant language of holy war and humanize itself." Science studies can help by showing "how science is involved in culture, how science *is* culture."[40]

Enough symmetry. To study boundary-work does not preclude the need (at times) to do boundary-work. And so in *defense* of science studies, and

39. Steven Fuller, "Does Science Put an End to History, or History to Science? Or, Why Being Pro-science Is Harder than You Think," in Ross, *Science Wars*, 49; Hayles, "Consolidating the Canon," 235.; Mermin, "What's Wrong with This Sustaining Myth?" 11.

40. Pinch, "Science as Golem," 18; "Science Wars and the Need for Respect and Rigour," 373; Levine, "What Is Science Studies For?" 124. There is, of course, another side to this coin, as Langdon Winner cynically reminds us: "An upper-level NSF administrator . . . noted that EVIST [the funding program Ethics and Values in Science and Technology] had gained support within the foundation because it helped the scientific community respond to political pressures from Congress and the general public. As problems in ethics or values of science arose in matters of, say, nuclear power or molecular biology, scientists could respond that qualified experts in the humanities and social sciences were looking into the matter" ("The Gloves Come Off: Shattered Alliances in Science and Technology Studies," in Ross, *Science Wars*, 107).

Not everybody in science studies is content with this cooptation of their field—or is "sucking up" the term?—in the service of saving science from the mythic images that scientists themselves have elsewhere so often trotted out to legitimate their claims or to protect their autonomy from scrutiny. Those who fault constructivism for its supposed critical impotence—like Winner—are inclined to see science wars as deflecting attention away from what is really troubling about science: not the epistemology of its fact making, but the political and human consequences of its facts. But even such a political critique of science demands science: "Concepts such as objectivity, rationality, good method, and science need to be reappropriated, reoccupied and reinvigorated for democracy-advancing projects" (Harding, "Science Is 'Good to Think With,'" 19–20).

as a self-exemplifying distillation of everything I have said in this book about where epistemic authority comes from, here is my reply to the philosopher who asked me to join his editorial team.

June 30, 1997

Dear Professor ——,

I am pleased to accept your invitation to join the Advisory Editorial Board for the new book series on Science and Technology Studies.

I share your desire to improve the quality of debate in our field, and—being a scientist who happens to study science as a cultural and historical phenomenon—I heartily endorse your efforts to maintain standards of rationality, empirical test and modernity.

However, precisely because of my scientific studies of science, it is clear to me that the meaning of such terms as "rational," "empirical," "modern"—and even "science"—are highly variable, negotiated and contingent (rather than universal or transcendent).

Indeed, I have come to see such concepts not as a set of rules for proper fact-construction, but as rhetorical tools deployed in the pursuit or defense of epistemic authority, or in efforts to deny legitimacy to rival claims.

I look forward to working with you.

Sincerely,

Thomas F. Gieryn
Professor of Sociology

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