

voices, having the potential to challenge the misinformation and harmful propaganda that often precede crises. The U.S. government did this effectively through the USIA-produced “Agreement for Peace” program, which broadcast information on the international peace negotiations on Kosovo over Albanian television during the two weeks between the February and March rounds of talks. The program allowed Kosovar journalists to interview key U.S. officials in a live prime-time news program that reached three quarters of the population of Kosovo.

Developing U.S. strategic information capabilities to engage a new constellation of international and inter-entity allies is a challenging task that will require fresh approaches and creative thinking. Facing this challenge will be a defining element of U.S. foreign policy in the next century. Contrary to many predictions of the “information age,” the nation-state does not appear to be wilting away. The decentralization and democratization of access to information and the ability to disseminate it widely, however, are changing the dynamic of international relations in fundamental ways. States hoping to retain advantages in traditional areas of power, including military and the economic, must engage this decentralized environment in new and creative ways in order to retain these advantages and develop new synergies between old and new actors. To retain current levels of relevance into the next century, governments must recognize and internalize this transformation.

#### ENDNOTES

<sup>1</sup>See Jonathan Alterman, “New Media, New Politics: From Satellite Television to the Internet in the Arab World,” Washington Institute for Near East Policy, Policy Paper 48, Washington, D.C., 1998.

<sup>2</sup>Robert Keohane and Joseph Nye, “Power and Interdependence in the Information Age,” *Foreign Affairs* 77 (5) (September/October 1998): 86.

<sup>3</sup>Anne-Marie Slaughter, “The Real New World Order,” *Foreign Affairs* 76 (5) (September/October 1997): 183–197.

<sup>4</sup>Margaret Keck and Kathryn Sikkink, *Activists Beyond Borders: Advocacy Networks in International Politics* (Ithaca, N.Y.: Cornell University Press, 1998).

## A View from the Bridge: The Two Cultures Debate, Its Legacy, and the History of Science

THE JOB MARKET FOR HISTORIANS OF SCIENCE, while not as bad as in the recent past, has not yet grown so vigorous that one could safely consider saying “no” to much of anything asked in interviews. Hence, when asked recently in a grim voice (before I had taken my seat in the interview stall at the American Historical Association meeting) if I could teach a lecture course on Medieval England, I heard myself, like a voice from afar: “Yes. Yes, I will. Yes!” I suspect my enthusiastic version of Molly Bloom fooled no one, as a glimpse of my curriculum vitae evidenced not the least qualification in this regard.

The small and middle-tier institutions that had advertised an interest in a historian of science had, as it turned out, a variety of ideas about what I might add to their teaching-oriented history programs—a scientific revolutions course, a history of technology class, a class on Darwin. These seemed reasonable to me; I had prepared to show such capacities. However, something else was on the mind of several department heads. An affable chair from a small college in the South told me that the scientist on the committee was quite keen to learn what I would do to improve scientific literacy for non-science majors on campus. Would I be willing to teach science courses for non-scientists? Could I help bridge the “two cultures” divide at his institution?

I answered, of course, in yet another breathless tumble of affirmatives, but a long evening waiting for callbacks left plenty of time to reflect on the durability of C. P. Snow's formulation and its relationship to the field of history of science. This was not a new reflection, but one tinged with a new irony. My first encounter with Snow's 1959 Rede Lecture, "The Two Cultures and the Scientific Revolution," came at the impressionable age of sixteen, when I found a copy on the shelf of my high-school headmaster. I surveyed the jacket photo of Snow's large and serious face and started in—believing I was making a foray into a major and significant subject, that I was reading a very grown-up book.<sup>1</sup> My understanding of the text at the time had a palpable influence on my decision to pursue the history of science in college, work that led to a graduate fellowship to read for a Ph.D. in the field at Snow's own beloved Cambridge. On one of my first days there, I passed the cobbled walk behind the Senate House (where the Rede Lectures are given) and took it into my head to make my way through Snow again, this time less naively. A term under the supervision of Stefan Collini (who that year had completed a new edition of the "Two Cultures" with a very helpful introduction) gave me a new distaste for the essay—its *ex cathedra* pronouncements, its somewhat self-important anecdotal style—along with a strong sense that it could be held responsible for the perpetuation of many of the ailments in Anglo-American intellectual life that it set out to diagnose.

My purpose in this essay will be to revisit Snow's Rede Lecture of forty years past, and the subsequent disputes—notably a vitriolic rebuttal by F. R. Leavis—that arose around it. Part of my purpose in doing so will be to establish the magnitude and longevity of the public interest in the "Two Cultures" diagnosis. One not infrequently hears academics carp that their work fails to reach that coveted and elusive "broader audience." Snow's lecture had an astoundingly rapid and broad impact on how reading people in Britain and the United States (at least) talked about the relationship between the sciences, on the one hand, and the arts and humanities, on the other. Using a collection of contemporary reviews and essays I will sketch the lineaments of the debates that opened in scholarly and

semischolarly publications, focusing on early lines of criticism. I will go on to suggest that the legacy of Snow's formulation remains active today in unexpected contexts, where it continues to function as a structure for undermining the significance of a range of nonscientific enterprises. Finally, I want to show what the history of science can contribute to a full account of this original "two cultures debate," while asking at the same time what the history of these debates can tell us about the past and the future of the discipline of history of science.

#### SNOW AND THE TWO CULTURES

Suppose one gave a one-hour lecture and left the room having substantially reformulated the way a large number of people describe their past, present, and future. Imagine stepping away from the rostrum having generated a language that would gradually insinuate itself into the way that intellectuals and popular journals alike describe history, current events, and future priorities. This happens infrequently, but it happens. For evidence one need look no further than the Rede Lecture of 1959. There, Charles Percy Snow, Sir Charles, later Lord Snow—a less-than-fully-successful physical chemist turned lauded British novelist and science-policy pundit—offered his listeners a way of talking about intellectual life that would not go away.<sup>2</sup> In the mid-1980s Snow's essay remained on reading lists at more than five hundred universities around the world.<sup>3</sup> Not so long ago, the elusive dark horse of American arts and letters, Thomas Pynchon, dignified Snow with an adjectival coinage: in an essay in the *New York Times* on the New Luddites, Pynchon invoked the specter of what he called the "Snovian Disjunction."<sup>4</sup> It is a disjunction regularly lamented in scholarly symposia, cited by academic administrators, and invoked to help account for everything from the "science wars" to the history of environmental policy.<sup>5</sup> The Rede Lecture cannot be dismissed.

After my juvenescent encounter with the essay, I had a question: What could be done to mend this dreadful fissure in Western thought? After my second pass through the text five years later, I had a new question: How was it that these fifty-

one pages, “neither original,” as one commentator at the time put it bluntly, “nor deep, nor witty, nor closely reasoned,” touched off such an extensive and often hot-tempered debate?<sup>6</sup> What distinctive element of “The Two Cultures” has made it—despite the best efforts of many—the most frequently cited articulation of the relationship between science and society, a touchstone for several generations of commentary? Snow claimed to be as stumped as others, writing later that he felt something like the sorcerer’s apprentice, having unleashed a torrent of forces far beyond his own powers. Later still he mused regretfully that the lecture had entangled him in a ceaseless cycle of public presentations and defenses—a lecturing life that had distracted him from his literary life, and (he intimated) perhaps cost him the Nobel Prize for literature.<sup>7</sup>

While “The Two Cultures” can indeed be read as a pastiche of earlier arguments about the necessary ascendancy of science—one thinks here of H. G. Wells and J. D. Bernal, among others—Snow’s formulation did not merely recapitulate these earlier discussions, but extended them and rendered them timely and solemn by means of an emphasis on the global geopolitical context of different forms of knowledge. The premise of his presentation was this: Snow claimed to have acceded to a vantage point that afforded him a unique perspective on the topography of intellectual life around the world. He put himself forward as a witness to the increasing bifurcation of the world’s educated population into two mutually exclusive and noncommunicating “cultures,” one scientific and one literary. Asserting that his unusual formation, “by training a scientist, by vocation a writer,” had enabled him to watch these two cultures exchange increasingly hostile glares across a divide of mutual incomprehension, Snow went on to catalog the international causes and costs of this intellectual polarization. He left no doubt that, in his view, the burden of responsibility fell heavily on the literary culture.

In what became perhaps the most celebrated passage of the lecture (which quickly became a best-selling short book) Snow described his own amphibious capacity to cross from the physics laboratories of Cambridge to the literary parties of Chelsea, and the frightful things he found in this traverse:

A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is about the scientific equivalent of: *Have you read a work of Shakespeare’s?*

The lack of communication between belletrists and scientists—what Snow called the “polarity” of the intellectual life of Britain and America—was not, in his assessment, merely an unfortunate or inevitable effect of increasing specialization. Rather, as Snow wound his way through the remaining three sections of his talk, it became clear that he considered these poles very much charged. At the positive end were the scientists, whose pragmatic concern with getting things done drew them ineluctably to the future, a future they construed with dogged optimism and to which they applied their skills in the interest of material progress; scientists and engineers, Snow famously asserted, “have the future in their bones.” At the negative pole huddled the cold spirits of the literary life, who, to paraphrase Fitzgerald (though Snow did not), “beat on, boats against the current, borne back ceaselessly into the past.”

What began then as a lamentable division between specialists, and merely that, became on further development nothing less than a full-blown indictment. Not only had literary intellectuals (here standing in for all humanists and artists) been unable to come to terms with the realities of technological and scientific progress—in Snow’s view, they merely held their nose and looked the other way during the industrial revolution—but, even worse, their overdeveloped faculties for neurasthenic self-absorption, indeed their collapse into solipsistic commune with their own pain, had led to a literature void of “social hope.” In its most extreme forms (and here Snow singled out Yeats, Pound, and Wyndham Lewis) this had led to a literature of the “most imbecile expressions of anti-social feeling.” To drive the point home, Snow cited approvingly the disgusted question of one of his well-read physicist friends, who asked, “Nine out of

ten of those who have dominated literary sensibility in our time—weren't they not only politically silly, but politically wicked? Didn't the influence of all they represent bring Auschwitz that much nearer?"

Little argument could be offered to Lionel Trilling's restrained comment on this aspect of Snow's claim, that "there can be no other interpretation of his lecture than that it takes toward literature a position of extreme antagonism."<sup>8</sup> Had this been all, "The Two Cultures" would have been both less audacious and less interesting. After all, his account of the nineteenth-century literary response to the industrial revolution was manifestly wrong (as a number of contemporary scholars were quick to point out), and his characterization of the navel-gazing of literary artists and critics, while polemical, could hardly be described as particularly original or important. Snow, however, had bigger fish to fry. In his view, this lamentable "literary culture" transcended some isolated community of novelists and dons. In fact, he went on to argue, the spirit of the Luddite literary culture beat at the very heart of the nebulous "traditional culture" of Britain. This "traditional culture" included, in effect, everyone but the scientists: schoolteachers, civil servants, business magnates, and, most distressingly, those in positions of political power.

Having thus expanded the ambit and scale of his two cultures division, Snow the diplomat and policy advisor sketched its global geopolitical context. In the final section of his talk, entitled "The Rich and the Poor," Snow looked out from the Senate House at the world. In the southern hemisphere he saw poverty, disease, and suffering—a world waiting to take the great leap forward, a world waiting to industrialize and take its share of global prosperity. To the east and the west Snow saw two superpowers likely, at the very least, to eclipse Britain's international stature. Worse, the glare of the Cold War and the recent tests of hydrogen bombs suggested that something considerably more urgent than education policy lay at stake. Set on this dramatic stage, the two cultures division—"litero-traditional" versus "techno-scientific"—was something much worse than an unfortunate drain on creativity or an obstacle to truly enlightened high table conversation. Set on this stage, the two cultures division became, for Snow, fatal.

In somber tones Snow promised that the have-not nations would not long be kept out of the wealth of industrialization. Their modernization would demand capital and technological assistance from wealthy industrialized states, aid that could only be provided by those countries that had educated a surplus of scientists and engineers, and that possessed leaders informed about the scientific world—in other words, countries not suffering from the debilitating effects of an intellectual house divided. The United States and the USSR were producing, Snow asserted, more scientists and engineers; they understood. Britain's educational system needed an overhaul—giving a new priority to techno-scientific education—not merely to save Britain, but because of an urgent and pressing duty to the poor of the world, who needed to become the collaborative project of developed nations. Without a collaborative overseas enterprise, who knew what might become of superpower tensions? Without attention to the poor of the world, a global revolt of the have-nots rumbled on the horizon. "Isn't it time we began?" Snow concluded in a hortatory peroration.

This, then, was the sweeping formulation of Snow's "Two Cultures": a past wherein literature and the traditional intelligentsia had neglected science and technology; a present in which scientific illiteracy was morally culpable and educational reform cried out for urgent attention; and a future where there would be, as Snow put it, "jam" for the underprivileged, and global cooperation to that end. The story presented few wholly new elements, but it linked together an array of issues—some timely, some perennial—in a powerful way. Scholarly antipathies, cultural disjunction, educational anxieties, class resentments, economic development, social responsibility—Snow welded all these into a synthetic diagnosis accompanied by a noble and visionary prescription. There was much more to his lecture than just an observation about how scientists and artists had difficulty chatting.

#### THE PUBLIC LIFE OF "THE TWO CULTURES"

When I went to Stefan Collini to ask how Snow had managed to create such a resilient scholarly sound bite, he offered two approaches to a solution. The first, quite rightly, was a reading

of his own introductory essay on the lecture. There Collini does the important work of situating Snow's lecture in the broader context of political and social change in the late 1950s and early 1960s. The launch of *Sputnik* and the opening of the Cold War, the emerging process of decolonization in Africa, the proliferation of atomic resources—all these events led to a high profile for science; they make it easier to understand how Snow's cocktail of education, economics, technology, and moral duty could have become a cultural incendiary. Collini (like John de la Mothe in his book *C. P. Snow and the Struggle of Modernity*) points to a broader "crisis" in English education in the period and shows that "The Two Cultures" must be read as a contribution to that debate, just as it must be understood as an intervention in the endless and subtle negotiations of class, merit, and entitlement that are the very stuff of English civic life.

Collini's second suggestion pointed me to the archives of the Cambridge University Press, where he had seen a substantial collection of contemporary reviews and commentaries that had been cut out and preserved by the editors and maintained in a set of scrapbooks. For several months that autumn I rode my newly acquired bicycle out Trumpington Road to Brooklands Avenue and then down to the main press building, where I was given a table and a large album with pale green pages stiffened with the dry glue on hundreds of clippings. The archive provided a striking record of the reception given to Snow's lecture and its subsequent printed editions, an archive that made it possible to sketch out the shape and magnitude of public response.

From the very start Snow's statement received remarkable attention. One of the most telling documents in the collection was a transcript of the weekly news broadcast on the BBC European Service the morning after the lecture, where Donald Tyerman, the chief editor of *The Economist*, passed over the Shah of Persia's state visit and municipal elections in London to call Snow's public presentation "the most significant news event of the week."<sup>9</sup> The "quality" press followed suit. The *Observer* claimed that Snow's prescience had revealed a national and international "time of crisis," a theme echoed by another commentator who wrote in *Encounter* that the lecture had "beautifully exposed the basic crisis of our existence."<sup>10</sup> The analysis

of the split in intellectual life between literary intellectuals and scientists was "brilliant" and "profoundly important," "easily the most important statement on English education" in the better part of a century.<sup>11</sup> From early on, however, the issues were seen to reach beyond Great Britain and English schooling. The southern hemisphere saw itself placed at center stage, and the *Times of Ceylon* and a South African journal cited Snow's argument, praising it for its relevance to industrializing nations. From Puerto Rico to Japan, Israel to Argentina to Ghana, C. P. Snow's characterization of the two cultures and global needs found a forum.

Publication in pamphlet form brought another wave of praise. Snow's identification of the "lamentable division" was lauded as "brilliant" and "important," "shrewd" and "sane."<sup>12</sup> The *Listener* followed up on its original praise, claiming that Snow had opened the "great debate" on science and the cultures of the book, and that "a general agreement" had emerged in English society concerning the importance and veracity of his analysis.<sup>13</sup> The *New Statesman* review accepted Snow's notion of literary Ludditism unmodified and preempted critics by declaring that Snow's historic essay was "not likely to be controverted."<sup>14</sup> Scientific and technical journals reflected, unsurprisingly, a particular enthusiasm: the *Bulletin of the Institute of Physics*, *Physics Today*, the *American Scientist*, and *Nature* all devoted portions of their book-review space to lengthy quotations, accepting Snow's thesis with little criticism or reservation. *Nature* even saw in Snow's prescriptions for scientific progress a call for a "new missionary spirit" in the service of technology.<sup>15</sup> While not all scientific publications followed suit with such unconditional praise (*Scientific American* was a notable exception), in general the scientific press seized on Snow with enthusiasm surpassing that of mainstream journals.

In 1962, when F. R. Leavis delivered his venomous Richmond Lecture entitled "Two Cultures? The Significance of Lord Snow," debates around Snow's thesis came to be subsumed into the "Leavis-Snow controversy." But the Cambridge University Press archive reveals that a number of critical approaches to Snow had emerged between 1959 and 1962. These can be conveniently divided into three groups: first, those arguing that Snow's

binary division was inadequate in that it overlooked the social sciences or other modes of human inquiry; second, those presenting criticisms of Snow's use of history or his understanding of literature; and third, a set of what might be called "foundational attacks" on the principles (stated or implied) in Snow's essay. Brief examples will serve as a context for understanding the structure of the public debate that preceded Leavis.

Characteristic of the first line of criticism, Asa Briggs, the distinguished historian of modern Britain whose *Age of Improvement* had been published that year, wrote in the *Scientific American* of October 1959 that Snow had left "completely out of the picture" consideration of "the growing territory of the social sciences."<sup>16</sup> The *Bulletin of the Atomic Scientists* concurred, and turned a review of "The Two Cultures and the Scientific Revolution" into a four-page history of the rise of the social sciences, criticizing Snow for his apparent "total ignorance" about that "third culture—that concerned with man in society—in which humanistic and scientific modes of thought are inextricably intertwined."<sup>17</sup> The *Northwest Review* also pointed out that Snow's overly tidy division between the two cultures neglected a large and growing set of intellectual endeavors: "Whether patrons of social hope or not, there are in fact members of a third 'culture' who presume to take as their field of competence a knowledge of human behavior which comprehends the scientific, the literary, the technological, the religious, the rich and the poor—not as separate 'cultures' but as parts of a whole bound together by the intangible web of tradition."<sup>18</sup> Interestingly, Snow proved sensitive to this "third culture" critique. In his 1963 "Second Thoughts," accompanying a republication of the lecture, Snow passed entirely over the substance of Leavis's recent polemic but did claim that the two cultures thesis should be revised to include the "third culture" of social science. Despite accepting this notion, Snow never acknowledged that this "third culture" actually linked his polarized "two cultures" or bridged the perceived gap. Rather, he preferred to see the social sciences as a third island in the atoll of his insular intellectual geography.

Instances of the second line of critique were plentiful. Snow's rather sloppy suggestion that Anglo-American literature had

done little more than muster "a scream of horror" by way of response to the industrial revolution provoked G. H. Bantock to give his article in the *Listener* of September 1959 that very title. A colleague of Leavis's at Cambridge, Bantock had just completed a study of the fiction of Leopold Hamilton Myers, and this work, along with a more intimate acquaintance with the nineteenth-century English novel, led Bantock to question Snow's appreciation of the complexity of the literary intellectuals' response to industrialization. "At the heart of their discontent," he wrote, "repeated time and time again, and especially during the nineteenth and twentieth centuries, lies a distaste for the assertive will which appears always to accompany the development of technical control over the forces of nature."<sup>19</sup> Bantock even intimated the lines of Leavis's future attack, writing, "My point is that the objections of the literary intellectuals to the trend of events Sir Charles is concerned to further have a long history; moreover they are based ultimately on considerations of psychic and spiritual health."

Foundational attacks focused on the ethical postulates of Snow's lecture and accused him of being unclear on, or naive to, the ethical principles of his own argument. Such critiques charged him with making claims about happiness, human goods, and moral responsibility without laying appropriate groundwork for such claims. In general, commentators using this approach tried to bring to light the ethical dimensions of what was perceived to be Snow's thinly veiled scientism, and they called on Snow to provide an explanation of what he called "the moral component right in the grain of science itself." For those who adopted this line of criticism, the two cultures debate was really a debate over the moral high ground, a debate about what kind of human knowledge and intellect deserved precedence in addressing human well-being. The earliest critique of Snow fitting this description saw publication in August of 1959 in the *Spectator*, the same journal that would later publish Leavis's controversial Richmond Lecture. In this review, the philosopher of aesthetics Richard Wollheim called into question the deep commitments driving Snow's claims about the need for increased cultural assimilation of science. Given the unavoidable risks and cost of incorporating a technocracy into liberal

political theory, Wollheim asked what fundamental doctrines could justify Snow's advocacy. While Wollheim suggested some that might (for instance, the pursuit of a pure meritocracy), he expressed concern that Snow never made clear which ones he considered valid: "The trouble with the lecture is that it is written absolutely outside any theory of man or culture, and it is this philosophical deficiency that gives it a biscuit-like dryness and places it at quite the opposite end of a scale from discussions of the same matter by Mill or Newman."<sup>20</sup>

Other critics pursued this line in questioning the soundness of Snow's plea for educational reform. What did Snow consider the "purpose" of education? Unless that stood clearly articulated, plans for educational reform could never be sound or systematic.<sup>21</sup> Refusing to accept scientific "progress" as its own justification, several commentators went on to question the right of science to lead itself in the name of social progress.<sup>22</sup> As K. W. Blythe wrote in the *Cambridge Review* in November of 1959, "As long as the question is 'how?' the scientist is supreme; when he has answered it, the question becomes 'which?' and the answer is looked for elsewhere."<sup>23</sup> In a complex essay published in *Encounter* in September of 1959, the historian and philosopher of science Michael Polanyi called attention to the pitfalls of the attempt to coax from "scientific rationalism" anything like a moral agency:

Yet it would be easy to show that the principles of scientific rationalism are strictly speaking non-sensical. No human mind can function without accepting authority, custom and tradition. . . . Empirical induction, strictly applied, can yield no knowledge at all and is a meaningless ideal. . . . And as to the naturalistic explanation of morality, it must ignore, and so by implication deny, the very existence of human responsibility. It is too absurd.<sup>24</sup>

On this line of argument (splaying Snow on the tines of Hume's fork), scientific investigation could never provide a "moral organ," nor could its epistemology fairly be claimed to be inherently ethical in any important way. Perhaps the most concise articulation of this foundational critique can be found in a discussion of the two cultures held by the Philosophy of

Sciences group of the Newman Association of Great Britain. In the first sentence of this commentary, Snow is challenged for having brought forward a "criticism" of both the scientific and literary communities without providing the "ideal or ideals which such criticism implies."<sup>25</sup>

#### F. R. LEAVIS: FROM PUBLIC DEBATE TO PUBLIC CONTROVERSY

The Columbia University library holds a copy of the 1963 American edition of the Leavis essay "Two Cultures? The Significance of Lord Snow." A carefully penciled marginalia greets the reader at the top of the first page: "Gentle reader, you are approaching the most virulent, petty, feculent string of ad hominem ever produced by internecine British snobbery. Forewarned!" One doubts it is Lionel Trilling's hand, but it accurately reflects his assessment of the piece.<sup>26</sup>

Leavis was a curious figure. As a literary critic of immense authority, he could legitimately claim to have been (in important ways) the herald of Eliot, Conrad, and Lawrence. His journal, *Scrutiny*, maintained a scowling outsider's perspective on the academic life of Cambridge even as it significantly reshaped the study of English literature in Britain as a whole. Unswerving in his Arnoldian quest to make the study of literature the "criticism of life," Leavis presided over a faithful coterie of like-minded critics who treated the life of letters as something of a calling: a spiritual devotion in which initiates plumbed the vital essence of humanity by the close and continuous reading of literature. No portrait of this luminously puritanical man rivals the *elogue* written by George Steiner in 1963, the year of Leavis's retirement.<sup>27</sup> There and elsewhere the Richmond Lecture was recalled as a sad testimony to the dark shadow of vituperation that lengthened over Leavis's criticism in his later years.

Having devoted much of his professional life to articulating a vision of literature as a salvific force, standing in opposition to the spiritual and personal decay of postindustrial civilization, Leavis found Snow's optimistic scientism a testament to the bleak condition of intellectual life. His irascible sensibilities enraged by what he saw as largely favorable public response,

Leavis created in his rebuttal something like a catalog of withering slights, beginning with the opener, in which he notes of Snow's tone that "while only genius could justify it, one cannot readily think of genius adopting it." Needless to say, Leavis assessed Snow as being considerably below the rank of genius, asserting that he was "as intellectually undistinguished as it is possible to be." And, from Leavis's perspective, it was this that made treating the argument of the "Two Cultures" a tricky business: "The intellectual nullity is what constitutes any difficulty there may be in dealing with Snow's panoptic pseudocogencies, his parade of a thesis: a mind to be argued with—that is not there."

This being the case, Leavis argued that he had no choice but to treat Snow and his essay less as subject than as omen, a "portent" of the world to come. Leavis used the term, in one form or another, no fewer than eight times as he sputtered incredulously at the popular reception "The Two Cultures" received. For Leavis, the whole affair—Snow's rise to the status of sage and social prophet, the praise greeting his novels, the ubiquity of "The Two Cultures" on sixth-form reading lists—had to be treated as a sign of the deep illness of the body politic. This approach heralded Leavis's blisteringly personal attack on Snow, which, cleverly, Leavis could deny had any personal aim at all: Snow, after all, was merely a symptom, not even conscious of his own inanity. Few were fooled by comments such as, "Snow is, of course, a—no, I can't say that; he isn't: Snow thinks of himself as a novelist," followed by, "As a novelist he doesn't exist; he doesn't begin to exist. He can't be said to know what a novel is." While these may have proved not entirely inaccurate assessments of Snow's literary work (Leavis stated baldly that Snow's novels would not last), they were deemed beyond the pale of cultured debate about the two cultures.

Published in the *Spectator* on March 9, 1962, Leavis's lecture was greeted the following week by a storm of seventeen angry letters, all condemning him and particularly his tone. The published letters (a small portion of those received) came from a variety of notables, but they shared a general dismissive distaste for Leavis's outburst. "I read to the end of this attack because I could not make out what it was all about or why Dr.

Leavis wrote it," wrote Dame Edith Sitwell archly, and Leavis was charged throughout with jealousy, bitterness, gossip, and spleen. Lord Boothby called Leavis's "breed" a "canker," and even Stephen Toulmin accused Leavis of "illogic so gross" that it "amounts to an abuse of language," consigning him to the "Dark Ages." "Laughable," "ill-mannered, self-centered and adolescent," "destructive," full of "insincerity, incapacity and envy"—such was the language used by those who rose to Snow's defense.

When Alan Sokal published his hoax article in *Social Text* in 1996, it was disheartening to watch how quickly an opportunity for serious discussion of substantive disagreements about science and society degenerated into a scandal over scholarly manners. Something quite similar happened to the two cultures debates in the wake of Leavis's contribution.<sup>28</sup> Pious condemnations of Leavis's tone stood in for a serious engagement with the substance of his attack on "The Two Cultures." Substance there was. Read in the context of the pre-1962 criticisms of Snow, "The Two Cultures? The Significance of Lord Snow" can be understood as a potent hybrid of what I identified as the second and third types of critique: on the one hand, Leavis argued forcefully that Snow had misunderstood the history and significance of literary life; at the same time, Leavis offered a devastating attack on Snow's lack of philosophical rigor.

In searching for the ethical foundation for what he calls a naive, unconscious, and irresponsible argument making claims about human goods, Leavis found nothing but a "portentous" confounding of "standard of living" and "quality of life." Snow's avuncular shorthand for human goods, "jam," betrayed him. For Leavis, anchoring "social hope" in "jam" represented the most barbarous neo-Wellsianism. "It is a confusion," he wrote, "to which all creative writers are tacit enemies." If Snow truly understood the "individual tragedy" of solitude and death (as he explicitly claimed), how did he propose to transcend it and buy "social hope" with material goods? The confusion of "jam" with "salvation" represented the "terrifying distortion and falsification" of the reality of the human experience, a malady not only beyond reparation by the benefices of science and technology but, in fact, one that traced its etiology to the very ethos of

production that arose out of Snow's precious "industrial revolution."

Having thus called on a Ruskin-like argument to undermine the organizing principle of "The Two Cultures," Leavis turned to a moving defense of literature. Neither science nor technology, he argued, would ever bridge the gap between the individual and society; neither could help the soul escape from the "individual tragedy" of solitude. For Leavis, only language and its heart, literature, allowed human beings to be more than themselves. Through the community of readers, through a "necessary faith" in the process of reading, it became possible, in his view, to move into a "third realm," an intellectual space neither entirely personal nor entirely "public." In the dialogue of reading and in the conversation of criticism, readers craft a "cultural community or consciousness" that serves as the base of ethical life. Leavis caught the essence of this process in two potent phrases: gathered over a text, two readers ask, "This is so, isn't it?" and answer one another again and again, "Yes, but. . . ." For Leavis this process represented the only hope for humanity.

#### THE TWO CULTURES AND THE HISTORY OF SCIENCE

How old is the two cultures debate? By tweaking the terms of the argument its genealogy can be extended nearly indefinitely. Among the most certain lineal ancestors of the Leavis-Snow controversy are the shadow debates of T. H. Huxley and Matthew Arnold in the late 1870s and early 1880s. Huxley's "Science and Culture" called for the culture of the book to yield up its stranglehold on the university, calling science a new and ascendant "criticism of life" that had rendered the traditional modes of humanistic inquiry (here Erasmus got trucked in, only to be dismissed) obsolete. Arnold's rejoinder, "Literature and Science," was itself a Rede Lecture in the year 1882. Arnold granted that science could rightfully claim a more significant place in education, but he strenuously denied that literature and the arts served merely as ornament, insisting instead that the humanistic enterprises would become only more vital as the innovations of technology and science increasingly transformed

what individuals had long held true about themselves and the world. It would be the special purview of the humanities and arts "to exercise the power of relating the modern results of natural science to man's instinct for conduct, his instinct for beauty."<sup>29</sup> Herein, certainly, lies the model for Leavis's similar conclusion: "The advance of science and technology means a human future of change so rapid and of such kinds . . . that mankind—and this is surely clear—will need to be in full intelligent possession of its full humanity."<sup>30</sup> This early debate set the terms in other ways as well. In Arnold's challenge to the scientists of his day—he noted that he had met people who thought themselves educated who could not construe a climactic line from *Macbeth*—one hears the forerunner of Snow's one-liner on the Second Law of Thermodynamics: "I was asking something which is about the scientific equivalent of: *Have you read a work of Shakespeare's?*"

Earlier antecedents present themselves: the two cultures debates of the 1950s and 1960s represent a particularly mid-twentieth-century version not merely of the romantic versus the utilitarian but of the early Enlightenment contest of the ancients versus the moderns as well. The primordial "two cultures," to push back still farther, were not the *humanities* and the *sciences* but rather the *humanities* and the *divinities*; not until Bacon's *Great Instauration* and the early seventeenth century would "Natural Philosophy" be thrust into the midst of the more traditional division.<sup>31</sup> It has been put forward that the absolutely aboriginal two cultures division can be traced all the way back to the thirteenth century, during which manuscripts of Euclid's *Elements* became widely available in Latin, separating mathematical adepts from other readers and establishing the rift between the *trivium* and the *quadrivium*.<sup>32</sup> There lie superb clues to the depreciation of the linguistic arts in the etymological links between *trivium* (grammar, logic, rhetoric) and *trivial* (of no consequence).<sup>33</sup> Who is to say that the fissure does not take rise still farther back, in the distinction between the banal and liberal occupations familiar to the Greeks?<sup>34</sup>

Many historians of science would argue that this game of pushing the roots of the "binary economy" of science and the humanities/arts back in time cannot begin to be truly interesting

unless accompanied by the detailed work of historicizing the categories themselves.<sup>35</sup> Some of Peter Galison's work, for instance, asks how scientists in different places and at different times have argued for the "unity" of their enterprise. Given the heterogeneity of the sciences, how did the "culture" of science come to identify itself as one and argue, against considerable odds, for the (anagogical? analytical?) convergence of profoundly diverse scientific inquiries?<sup>36</sup> Another approach might be to ask, as Lorraine Daston and others do, how the "artistic" virtues of imagination and intuition came to be juxtaposed with proper operations of the scientific method, and in answering this begin to explain how scientific "facts" came to be defined in opposition to texts and artifacts.<sup>37</sup> Still other scholars have taken on the story of the late Enlightenment split between the *Geistwissenschaften* and the *Naturwissenschaften* in considerable detail.<sup>38</sup> For historians of science, the question of how science came to define itself—and particularly how that process of definition proceeded by the invocation of binary oppositions with other forms of knowledge—does not just constitute a central problem. In some sense it is *the* problem, for to answer it is to say nothing less than how science got to be what it is.

This historicized two cultures, however, was not what the search committee from that small liberal arts college had in mind when they brought the subject up. Rather, they envisioned me, in my capacity as a historian of science, "bridging" the disciplinary divisions in the strictly Snovian sense—I was to address the obvious and immediate problem that English majors could say nothing suitably respectful about the Second Law of Thermodynamics. They gave away their wholly synchronic sense of the term when they set "bridging the two cultures" right next to "increasing science literacy [sic]" in their checklist of interests. I think all working historians of science would agree that our discipline does not currently strive to be a conduit between science and the humanities. Interestingly, however, the modern origins of the discipline lie in precisely that project. In fact, Snow's seemingly distinctive formulation of the two cultures problem—the threat of imminent global tragedy as a result of the noncommunication between scientists and other intellectuals—saw precise articulation thirty years earlier, in a

book by the founding father of history of science as a discipline in the United States, George Sarton. In *The History of Science and the New Humanism*, based on lectures given at Brown University in 1930, Sarton wrote, "The most ominous conflict of our time is the difference of opinion between men of letters, historians, philosophers, the so-called humanists, on the one side, and scientists on the other."<sup>39</sup> For him, the only hope lay in the very field he pioneered: "Between the old humanists and the scientist, there is but one bridge, the history of science, and the construction of that bridge is the main cultural need of our time." The history of science in the United States, then, emerged specifically to span the perceived two cultures division and to ameliorate its pernicious effects.

Recalling my original mandate, I wish to see what a historian of science can offer by way of a bridge linking the pugnacious oppositions of the two cultures debate proper, the Leavis-Snow controversy.<sup>40</sup> Attention to the historical entanglements of science and culture can indeed show deep links between the most disparate (even self-consciously antithetical) modes of knowing and making. Snow bemoaned that he could not find a nonscientist who could explain the Second Law of Thermodynamics; Leavis dismissed any comparison between the laws of thermodynamics and the sacred sphere of literature as "a cheap journalistic infelicity." For the historian of science a double irony binds these claims. The Second Law of Thermodynamics, articulated in different forms from the 1850s forward by Lord Kelvin (William Thomson) and Clausius (Rudolf Gottlieb), states that while energy is conserved, entropy (or disorder) appears to be constantly increasing in the universe.<sup>41</sup> The implications—that energy tends to disperse, that the universe appears headed for maximum entropy or "heat-death"—gradually came to be understood as a frigid challenge to late Victorian progressivism. Popular journals depicted in images and words the last hours of civilization shivering in the cold sleet of an expiring solar system; the question of the ancients about whether the world would end in fire or flood had been superseded by a proof: it would end under solid ice. Wrote Joseph Conrad of the import of the Second Law, "If you take it to heart it becomes an unendurable tragedy. If you believe in improve-

ment you must weep, for the attained perfection must end in cold, darkness and silence.”<sup>42</sup> Physicists cited Tennyson (“What hope of answer or redress?”) as they drove home the point that the earth seemed to be headed for a frozen end.<sup>43</sup> Not only has recent work on the history of thermodynamics traced an elaborate story of the impact of the Second Law on late-nineteenth-century British popular religion, but several scholars have shown clear links between the pessimism the Second Law engendered and the movement of the decadent writers in France and Britain.<sup>44</sup> The very decay Snow decried in the moral fiber of literary culture, it turns out, cannot be fully understood without reference to the history of his own beloved Second Law.

At the same time, to read Leavis dismiss the Second Law with a wave and then, right in the midst of his anti-Snow polemic, turn to a reading of Conrad’s *The Shadow Line* is, in light of that author’s own reflections, no less ironic.<sup>45</sup> In this compressed and disturbing “confession” Conrad transforms the tropics into the entropics—a young captain sits indefinitely becalmed at his first command, a tableau starkly rendering the dissolution that attends the subsidence of useable energy. *The Shadow Line*, which Leavis brought forward as a self-evident proof of the irrelevance of the Second Law, would be better read as a parable of its broad cultural significance. For all the power of Leavis’s description of the collaborative process of reading, it required of him a particular kind of shortsightedness not to realize that the constitutive dialogue on which he grounded our humanity, “It is this, isn’t it . . .” followed by “Yes, but . . .,” has occurred not merely standing before poems but standing before the natural world as well, where it has been and continues to be no less significant. To show this will always be the object of the history of science.

#### CONCLUSION

When I arrived at Columbia to take up my postdoctoral position in the Society of Fellows in the Humanities, my office was empty, with a single exception. On the desk lay a copy of the university’s research broadsheet, *21<sup>st</sup>C*. The issue that welcomed me featured a focus on “the sciences and the humani-

ties,” and, taking it up with interest, I discovered a set of essays written by people on and off campus discussing different interdisciplinary projects that cut across the “Snowian Disjunction.” The editors’ leader, however, raised an eyebrow: after suggesting that the sciences and the humanities have long danced an “uneasy *pas de deux* with neither partner consistently leading,” they infelicitously rephrased the issue as a showdown between reason and the irrational. The issue of which culture will dominate in the twenty-first century, I read on, comes down to whether we pursue an “Age of Logic or an Age of Luddites.” How, one might well ask, did literary culture—in paragraph one hand in hand with science—come by paragraph three to be the dark path to atavistic illogic?

Here, I fear, the editors have followed their Snow too closely. My sketch of the structure of “The Two Cultures” should suggest a precedent for precisely this trajectory: first a division, then a more-or-less veiled indictment, then a discursive plea concerning our urgent future. What I am suggesting is that in very real ways the formulation of “The Two Cultures” still carries much of the baggage of its original context; it continues to do a kind of work for those who deploy it, a work not at all well disposed to humanistic inquiry. Lest it be thought that an obscure university publication makes a weak test case, one need look no further than a recent (and very well received) book by one of the most respected scientists in America, E. O. Wilson.

Wilson’s *Consilience*, published last year and widely excerpted in a number of journals, returns to an early-nineteenth-century neologism (the coinage of William Whewell) to express the author’s optimistic program: with luck and hard work the sciences, social sciences, and even the humanities and arts should begin to “jump together” and gradually become integrated in content and method. This is no small claim, and it proceeds from a man of great ability and considerable sensitivity—to nature, to our responsibilities to the earth and one another. Nevertheless, the argument has the distinct flavor of Snow: Wilson locates the split between reason and antireason in the early romantic period, and he footnotes Snow when he says it was then that the literary and scientific cultures ceased commu-

nicating.<sup>46</sup> Moreover, he recapitulates the central structure of Snow's argument, emphasizing the two cultures disjunction, assimilating the nonscientific to the nonrational, and then invoking imminent crisis (in this case ecological) as part of an exhortation for a new and vast extension of the domain of science. Wilson wants to "bridge" the two cultures by an investigation of how culture and biology interact. He writes, "[The two cultures] can be stated as a problem to be solved, the central problem of the social sciences and the humanities, and simultaneously one of the great remaining problems of the natural sciences."<sup>47</sup> Here is a kind of bridge one might eye with suspicion, for the message comes through clearly: the humanities and social sciences represent science's last frontier. Let us build a bridge, he effectively proposes, and take over your island.

Caricature, Wilson might claim, and I would not dispute it. His own sense of the sophisticated interdisciplinary work to be done in advancing sociobiology might belie my suggestion that he advocates scientific solutions to the "problem" of human culture. Put this aside. It remains clear that Snow's formulation is very much with us, and that attention to the history of the two cultures debates casts considerable light on its active legacy. In addition, it remains clear from my job interviews that "bridging the two cultures" and "teaching science courses for nonscientists" are synonymous enterprises for a fair number of people in the broader academic community, some of whom also think this the function of a historian of science.

Is the answer, then, to raise the ramparts? Certainly not. Nor should I be interpreted as advocating ignorance of science. The lessons to be drawn from these observations include a wariness of the irenic tropes that often crop up in discussions of the two cultures: bridges over the fissure, fertile zones on the disciplinary margin, the terra incognita of interdisciplinary work. Bridges are not common ground; fertile marginal zones are still marginal. In seeking evidence of promising changes in how these matters are addressed, one might point to two issues of *Dædalus*. In 1965, as the debates around the two cultures degenerated into reciprocal pastiche, Gerald Holton dedicated an issue of *Dædalus* to "Science and Culture: A Study of Cohesive and

Disjunctive Forces," with essays by such luminaries as Margaret Mead, Herbert Marcuse, and Talcott Parsons; scientists that wrote included Harvey Brooks and René Dubos, and James Ackerman and Harry Levin were among the humanists involved. Last year *Dædalus* revisited some of the questions in a volume under a slightly (but significantly) different title: instead of *Science and Culture* the volume was called *Science in Culture*.

Science is indeed *in* culture, just as it is *in* history. If I had it to do again, I would answer the chair like this: I can, in a sense, ameliorate the split between the "two cultures" on your campus. If you put me in a classroom I will try to tell the story of their coming to be, the reverse story of their erasure. Whether this will help depends on what you have in mind.

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#### ENDNOTES

<sup>1</sup>I will refer to the lecture and the printed versions of this piece by the more common short title "The Two Cultures." The printed version saw a number of changes from the original lecture; and later printed versions saw additional slight revisions. No variorum edition exists. For a discussion see John de la Mothe, *C. P. Snow and the Struggle of Modernity* (Austin: University of Texas Press, 1992), 49, especially n. 4 and 5. I have used C. P. Snow, *The Two Cultures*, ed. Stefan Collini (Cambridge: Cambridge University Press [Canto], 1993).

<sup>2</sup>On Snow's scientific career, see J. C. D. Brand, "The Scientific Papers of C. P. Snow," *History of Science* XXVI (1988): 111–127. Twayne's English Authors Series (TEAS) provides a useful volume for an introduction to Snow's literary oeuvre: David Shusterman, *C. P. Snow*, rev. ed. (Boston: Twayne, 1991). For the relationship between his "two lives" see Nora Calhoun Graves, *The Two Culture Theory in C. P. Snow's Novels* (Hattiesburg: The University and College Press of Mississippi, 1971); or (for the opposite con-

- clusions) Nail Bezel, "Autobiography and 'The Two Cultures' in the Novels of C. P. Snow," *Annals of Science* 32 (1975): 555–571.
- <sup>3</sup>De la Mothe, *C. P. Snow and the Struggle for Modernity*, 51.
- <sup>4</sup>*New York Times Book Review*, 28 October 1984, 1.
- <sup>5</sup>For instance, see references in Andrew Ross, ed., *Science Wars* (Durham: Duke University Press, 1996). On a recent use of the "Two Cultures" idea to explain certain dimensions of environmental policy in the United States, see Leo Marx, "The Environment and the Two Cultures Divide," in *Science, Technology, and the Environment*, ed. James Fleming and Henry Gemery (Akron: University of Akron Press, 1994). Caroline A. Jones and Peter Galison cite Snow as a salient instance of the assumed "binary economy" of art and science. See Caroline A. Jones and Peter Galison, eds., *Picturing Science, Producing Art* (New York: Routledge, 1998), introduction.
- <sup>6</sup>The quotes are from *Blackfriars*, May 1964. Leo Marx describes much the same reaction in "The Environment and the Two Cultures Divide," 10 n. 5.
- <sup>7</sup>De la Mothe, *C. P. Snow and the Struggle of Modernity*, 51.
- <sup>8</sup>Lionel Trilling, "Science, Literature & Culture: A Comment on the Leavis-Snow Controversy," *Commentary* (June 1962): 464.
- <sup>9</sup>BBC transcript in Cambridge University Press archives.
- <sup>10</sup>*Observer*, 24 May 1959; *Encounter*, August 1959.
- <sup>11</sup>*Encounter* and elsewhere; *Listener*, September 1959.
- <sup>12</sup>*Observer*, 24 May 1959.
- <sup>13</sup>*Listener*, September 1959.
- <sup>14</sup>*New Statesman*, 6 June 1959.
- <sup>15</sup>Review in *Nature*, Snow document collection at Cambridge University Press, n.d.
- <sup>16</sup>*Scientific American*, October 1959.
- <sup>17</sup>*Bulletin of the Atomic Scientists*, October 1961.
- <sup>18</sup>*Northwest Review*, July 1960.
- <sup>19</sup>*Listener*, 17 September 1959.
- <sup>20</sup>*Spectator*, 7 August 1959.
- <sup>21</sup>See Michael Yudkin, "Sir Charles Snow's Rede Lecture," *Cambridge Review*, 1960. This was republished in the 1963 Random House volume containing Leavis's lecture, F. R. Leavis, *Two Cultures? The Significance of C. P. Snow. Being the Richmond Lecture, 1962* (New York: Pantheon Books, 1963).
- <sup>22</sup>*Monthly Labor Review*, October 1960.
- <sup>23</sup>*Cambridge Review*, 21 November 1959.
- <sup>24</sup>Michael Polanyi, "The Two Cultures," *Encounter* 13 (September 1959): 62.
- <sup>25</sup>*Philosophy of Sciences Group*, The Newman Society, January 1960.
- <sup>26</sup>The doyen of literary studies at Columbia wrote, "A lively young person of advanced tastes would surely say that if ever two men were committed to England, Home, and Duty, they are Leavis and Snow—he would say that in this they are as alike as two squares." Trilling, "Science, Literature & Culture," n. 8.
- <sup>27</sup>This is reproduced in David Lodge, *20th Century Literary Criticism: A Reader* (London: Longman, 1972).
- <sup>28</sup>A number of responses to the Richmond Lecture were collected in *Cultures in Conflict: Perspectives on the Snow-Leavis Controversy*, ed. David K. Cornelius and Edwin St. Vincent (Chicago: Scott, Foresman and Company, 1964).
- <sup>29</sup>*The Works of Matthew Arnold* (London: Macmillan, 1903–1904), vol. IV, 340–341.
- <sup>30</sup>Leavis, *Two Cultures? The Significance of C. P. Snow*, 46.
- <sup>31</sup>See the *Oxford English Dictionary* under "Humanities" for a sample chronology of uses.
- <sup>32</sup>Lynn White, Jr., "Science and the Sense of Self: The Medieval Background of a Modern Confrontation," *Dædalus* 107 (2) (Spring 1978): 54.
- <sup>33</sup>This point is made by Leo Marx in "The Environment and the Two Cultures Divide," 12–13 n. 5.
- <sup>34</sup>*Ibid.*, 12.
- <sup>35</sup>I am borrowing the terms "binary economy" from Jones and Galison, eds., *Picturing Science, Producing Art*, 2–8 n. 5.
- <sup>36</sup>Peter Galison, "The Americanization of Unity," *Dædalus* 127 (1) (Winter 1998). See also the essays in Peter Galison and David Stump, eds., *The Disunity of Science* (Stanford: Stanford University Press, 1996).
- <sup>37</sup>Lorraine Daston, "Fear and Loathing of the Imagination in Science," *Dædalus* 127 (1) (Winter 1998).
- <sup>38</sup>Peter Hanns Reill, "Science and the Construction of the Cultural Sciences in Late Enlightenment Germany: The Case of Wilhelm Von Humboldt," *History and Theory* (33) (1996): 345–366.
- <sup>39</sup>Cited in Loren Graham, "History of Science in the University Curriculum," in *Scientific Education and Humane Values*, Seminar Reports 4, Spring 1975, Columbia University.
- <sup>40</sup>This is in keeping with the vision of several commentators at the time: reviews in the *Times Literary Supplement*, *Blackfriars*, and several other sources drew attention to history of science as a discipline that defied Snow's polarization and that was reshaping social understanding of science.
- <sup>41</sup>Those not expert in physics may now develop some appreciation for the intricacies of thermodynamics by consulting one of the volumes in the *Scientific American Library*: P. W. Atkins, *The Second Law* (New York: W. H. Freeman and Company, 1984). Those prepared to do the math may consult C. Truesdell, *The Tragicomic History of Thermodynamics 1822–1854* (New York: Springer-Verlag, 1980).

<sup>42</sup>Jerome Hamilton Buckley, *The Triumph of Time: A Study of the Victorian Concepts of Time, History, Progress, and Decadence* (Cambridge, Mass.: Harvard University Press, 1966), 66.

<sup>43</sup>See Greg Meyer, "Nineteenth-Century Popularizations of Thermodynamics and the Rhetoric of Social Prophecy," in *Energy and Entropy*, ed. Patrick Brantlinger (Bloomington: Indiana University Press, 1989), 327.

<sup>44</sup>A good starting place for the (extensive) literature on thermodynamics and religion is Erwin N. Hiebert, "The Uses and Abuses of Thermodynamics in Religion," *Dædalus* 95 (4) (Fall 1966): 1046–1081. More recently, see Bruce Clarke, "Allegories of Victorian Thermodynamics," *Configurations* (4.1) (1996): 67–90. On the link to decadent literature and art, see Stephen Brush, *The Temperature of History: Phases of Science and Culture in the Nineteenth Century* (New York: B. Franklin, 1978); Meyer, "Nineteenth-Century Popularizations of Thermodynamics and the Rhetoric of Social Prophecy," 312–313 n. 44; and Bruce Clarke, *Energy Forms: Allegory and Science in the Era of Classical Thermodynamics, 1850–1930* (Ann Arbor: University of Michigan Press, forthcoming).

<sup>45</sup>Joseph Conrad, *The Shadow Line: A Confession* (New York: Doubleday, 1917). The novella was first serialized in the *Metropolitan Magazine* and subsequently appeared in the *English Review* (seven parts, September 1916 to March 1917).

<sup>46</sup>E. O. Wilson, *Consilience* (New York: Knopf, 1998), 40.

<sup>47</sup>*Ibid.*, 126.

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