

*Lecture I. The Sorcerer's Apprentice:
C. P. Snow and J. Bronowski*
*Lecture II. Science and Government:
C. P. Snow and the Corridors of Power*

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LECTURE I.
THE SORCERER'S APPRENTICE:
C. P. SNOW AND J. BRONOWSKI

On May 7, 1959, the eminent British scientist, novelist, and civil servant C. P. Snow delivered the annual Rede Lecture in the Senate House at the University of Cambridge. The topic he chose—*The Two Cultures and the Scientific Revolution*—did not come out of the blue; as Snow observed in his opening remarks, he had been turning over in his mind the problem he addressed for “about three years,” and had published an earlier version of the lecture in the *New Statesman* in 1956.¹ Nevertheless, the lecture caused a furor among practitioners of both the arts and the sciences, rising to a crescendo following the distinguished literary critic F. R. Leavis’s splenetic rebuttal of Snow’s argument in his 1962 Richmond Lecture, *Two Cultures? The Significance of C. P. Snow*.

Although he was deeply wounded by Leavis’s public assault, Snow chose not to reply publicly until almost two years later, in *The Two Cultures: A Second Look* (*Times Literary Supplement*, 1963; Cambridge University Press, 1964).² There, admitting that he had been unprepared for the uproar his lecture had caused, Snow specified that his friend Jacob Bronowski had written extensively on the potential dangers of a growing arts-science divide among British intellectuals, before he had ever thought of doing so. Initially, Snow wrote, response to his lecture was largely favorable, but gradually he “began to feel uncomfortably like the sorcerer’s apprentice,” that he had “unleashed a torrent of forces far beyond his own powers”.³

It was clear [he wrote] that many people had been thinking of this assembly of topics. The ideas were in the air. . . . It seems to be pure

A draft of this lecture was read by Guy Ortolano and Timothy Sandefur. I am extremely grateful to them for their comments, all of which I have endeavored to incorporate in my revised text. I did not discover Ortolano’s outstanding book, *The Two Cultures Controversy: Science, Literature, and Cultural Politics in Postwar Britain* (Cambridge: Cambridge University Press, 2009), until I was well into writing these lectures, and I greatly appreciate his having read and commented on my own efforts at short notice.

1. For a clear indication of how comparatively uncontroversial the lecture at first appeared, see the review in the *Times* published the following day (see the appendix).

2. Looking slightly forward in this lecture, Jacob Bronowski records in his personal diary, on October 25, 1963, “Snow’s TLS ‘A Second Look’ published.” So Bronowski had clearly been alerted to Snow’s return to his Rede Lecture, in which he would credit Bronowski with initiating the debate.

3. This latter quote is from D. Graham Burnett, “A View from the Bridge: The Two Cultures Debate, Its Legacy, and the History of Science,” *Daedalus* 128 (Spring 1999): 193–218.

chance that others had not found themselves, some time earlier, in the same apprentice-like position. Jacob Bronowski had, at various times in the fifties, dealt imaginatively with many aspects of these problems. Merle Kling in 1957 published an article—unknown to me until much later—which closely anticipated the first half of my lecture.⁴ . . . In 1956 and 1957 I myself wrote two pieces which, though shorter than the Rede Lecture, contained much of its substance. Yet none of us got much response. Two years later the time was right.⁵

I shall be devoting my second Tanner Lecture to what I maintain are the real issues raised in Snow's two-cultures lecture, and arguing for their lasting importance. In light of the close affinity affirmed by Snow himself between his and Bronowski's views on the matter dealt with in this controversy, I shall concentrate in my first lecture on how several facets of what the phrase *the two cultures* perhaps misleadingly suggests are a single problem, emerged together in the sometimes parallel and sometimes combined work of the two men. This will, I suggest, help us to disentangle the key strands in Snow's argument from the many-voiced, and often parochial, clamor that followed its publication, particularly after Leavis's intervention.



Jacob Bronowski (1908–74) was a mathematician and polymath, a public intellectual (on television and radio) whose talents and interests straddled the arts and sciences.⁶ He is best remembered today for his pioneering television series *The Ascent of Man*, first broadcast in 1973. He was also my father, and this lecture includes some previously unseen material from his personal papers, including his diaries, which I have been excavating for a forthcoming book-length memoir.

In 1959 Bronowski and Snow were old friends. Public clues to that personal friendship can be detected in Snow's somewhat excessively exuberant public pronouncements, prior to the Rede Lecture, when reviewing

4. For Merle King's article, see "The Intellectual: Will He Wither Away?," *New Republic* 136, no. 14 (1957): 14–15, consulted online.

5. Snow, *The Two Cultures: A Second Look*, in *The Two Cultures*, edited by S. Collini (Cambridge: Cambridge University Press, 1998), 54–55.

6. Early in his career he had wanted to be a professional poet and published significant amounts of poetry. He also founded and coedited a literary magazine at Cambridge University (1928–31) to which such eminent poets as T. S. Eliot and William Empson contributed. See J. Harding, "Experiment in Cambridge: A Manifesto of Young England," *Cambridge Quarterly* 27 (1998): 287–309; and K. Price, "Finite but Unbounded: *Experiment Magazine*, Cambridge, England, 1928–31," <http://jacketmagazine.com/20/price-expe.html>.

Bronowski's similarly themed work (Snow was at this point the celebrity novelist, Bronowski the public intellectual rising star)—for instance, in a review, first published in the *New Republic* in 1958, of Bronowski's book *Science and Human Values* (published in 1956).

That review is, for the 1950s, curiously conversational in tone: “Dr Bronowski has had a career which seems ironic to those who admire him most. He possesses one of the most lucid and articulate intelligences of our time; he has done creative work both in mathematics and poetry; he has considered force and authority of character.”⁷

Lamenting the fact that, in spite of his talents, “somehow it has all not quite added up,” and that Bronowski has not had the recognition he deserves, Snow goes on to sum up succinctly the thrust of the volume:⁸ “People who ought to know better, scientists among them, have been fond of thinking of science as being morally neutral. Nothing could be more naïve. The habit of truth, on which science depends as no other human activity does, is itself a moral act. . . . It is from this foundation that Bronowski has built a structure of values, . . . with poetic feeling and a passionate identification with the human future.” Bronowski's *Science and Human Values*, like his earlier *The Common Sense of Science* (1951), argues strenuously for the need fully to incorporate science and scientific thinking into Western culture as a whole, if our society is to save itself from self-destruction (the kind of self-destruction, he argues, presaged by the enormity of the damage inflicted by the atomic bombs dropped at Hiroshima and Nagasaki). Toward the end of *The Common Sense of Science* he had written:

Our ultimate survival is in our own hands. Our survival while we are learning is a much chancier thing. We had better be realistic about that. Meanwhile we had better settle down to work for our ultimate survival; and we had better start now. . . . Science and our social habits

7. *New Republic* 139, nos. 7–8 (1958): 26, consulted online.

8. Snow uses the curious phrase “although he has been a *reliable* and picturesque citizen, . . . it has never seemed quite good enough for a man so splendidly equipped.” When Bronowski's MI5 file was made public in April 2011, it became clear that an attempt in the late 1940s to gain employment with the Atomic Energy Authority had been blocked on grounds that he was politically “unreliable” in the 1930s and early 1940s. Again, in 1957, when he held a senior post in the National Coal Board's research wing, MI5 was approached by the AEA for information on Bronowski because “sensitive material” was to be shared with his department. Once again MI5 advised against. Bronowski never knew this, but Snow, as a senior civil servant, recruiting scientists for sensitive government departments, including the AEA, probably did.

are out of step. . . . We must learn to match them. And there is no way of learning this unless we learn to understand *both*.⁹

In *Science and Human Values* he writes with equal passion:

What science has to teach us here is not its techniques but its spirit: the irresistible need to explore. . . . It has created the values of our intellectual life and, with the arts, has taught them to our civilization. Science has nothing to be ashamed of even in the ruins of Nagasaki. The shame is theirs who appeal to other values than the human imaginative values which science has evolved. The shame is ours if we do not make science part of our world, intellectually as much as physically, so that we may at last hold these halves of the world together by the same values.¹⁰

There is no mistaking the sense of urgency here. Both books, I suggest, provide a context for Snow's own intervention in the arts-versus-sciences debate, though the tones of his Rede Lecture are rather more measured. Behind that lecture's urbanity lay a debate that already had an edginess to it, colored not least by the inclusion of discussion of the dropping of atomic bombs on Hiroshima and Nagasaki in 1945.

As a close friend, Bronowski did not have to wait until Snow's Rede Lecture was published in *Encounter* in June–July 1959 before he read it.¹¹ Like others among Snow's associates and colleagues, he saw it prior to publication, probably at Snow's instigation. As soon as it became clear the impact the lecture had had, Snow busied himself orchestrating letters of support from prominent figures in his circle, in both science and the arts.¹² An entry in Bronowski's diary records that he read the lecture just over two weeks after it was delivered, on May 26, 1959.

At the time of delivery of the Rede Lecture, Bronowski was putting the finishing touches to his textbook on intellectual history, *The Western Intellectual Tradition* (coauthored with Bruce Mazlish), first published

9. Bronowski, *The Common Sense of Science* (London: William Heinemann, 1951), 145.

10. Bronowski, *Science and Human Values*, rev. ed. (New York: Harper & Row, 1965), 72–73.

11. C. P. Snow, "The Two Cultures and the Scientific Revolution," pts. 1 and 2, *Encounter* 12 (June 1959): 17–24; 13 (July 1959): 22–27.

12. *Encounter* published a selection of responses in August 1959: "The Two Cultures: A Discussion of C. P. Snow's Views," *Encounter* 13 (August 1959): 67–73.

in 1960.¹³ It was here that Bronowski chose to make his own first public contribution to the debate.

On the first page of the introduction Snow is invoked as the inspiration for the book's project. The passage from Snow that Bronowski and Mazlish quote in support of their own work (but cite incorrectly) reads:¹⁴ "What is needed is that in the general history books the development of science should take its place along with political and economic developments, . . . for the world we live in is as much the product of science as of politics and economics. . . . There are few living historians who can write history in this way; but this is one way in which history must be written if the worlds of science and the humanities are not to drift still farther apart."¹⁵

Bronowski and Mazlish's book offers such a history of the West's intellectual development. As their introduction makes clear, their goal is to promote an intellectual agenda within which art and science are embedded equally, and which therefore draws those from within the different disciplines closer together: "The specific field with which [we] were concerned . . . was the field of history. Here, more even than in some other fields, there is a cleavage between the conventional presentation of history, and the recent but still specialized interest in the historical growth of science and of techniques. By contrast, [we] set out from the beginning to see all history, certainly all intellectual history, as a unity."¹⁶

The prominence of Snow's name here is certainly deliberate, and was added at a late stage in the book's production.¹⁷ Within months of Snow's two-cultures lecture, Bronowski and Mazlish chose to signal their support for the campaign he had initiated, and to suggest that their own

13. Direct references to putting the final touches to this—adding the index and proof-reading the text—are to be found in Bronowski's diary for 1959.

14. In fact, *The Western Intellectual Tradition* first reached Bronowski in April. See his diary entry for April 11, 1960: "receive first copy of *The Western Intellectual Tradition* from Cass Cornfield [?] jnr of Harpers & give it to Lisa for her birthday."

15. The authors reference this quotation as extracted from "an article 'Challenge to the Intellect' in *The Times Literary Supplement* of August 15, 1958," but it is not in that article. I have been unable to track its real source down. It is possible that Bronowski had a copy of Snow's manuscript version of the *TLS* piece that did include this quotation.

16. J. Bronowski and B. Mazlish, *The Western Intellectual Tradition: From Leonardo to Hegel* (New York: Harper & Brothers, 1960), vii–viii.

17. Timothy Sandefur (personal communication, April 5, 2012) writes: "[Bruce] Mazlish told me in an interview in fall, 2010, that they started writing [*The Western Intellectual Tradition*] while Bruno was a guest professor at MIT, and that although they were certainly aware of Snow, he was not the inspiration for the book; they saw him as an ally and not a precursor."

project should be seen as belonging to what is already coming to be seen as the Snow “camp.”¹⁸

Snow surely recognized Bronowski and Mazlish’s interpolated citation of his own words as an indirect reference to his Rede Lecture and the controversy it had given rise to (perhaps Bronowski drew it to his attention). In an enthusiastic review in the *Scientific American* in autumn 1960, Snow praised *The Western Intellectual Tradition* as “a real public service,” applauding its breadth and inclusiveness. The authors, he writes, have avoided succumbing to a restrictive version of “tradition” that pandered to particular sectarian intellectual interests: “Tradition is a dangerous term [he wrote]. The classic example of Cutting Tradition to Fit One’s Cloth is that of F. R. Leavis, one of the ‘new critics’ on the English novel. By eliminating Dickens and the rest, he proves to his own satisfaction that the great tradition of the English novel is Jane Austen, George Eliot, Henry James, Conrad, D. H. Lawrence. There is nothing so blinkered about the way in which Bronowski and Mazlish have set about selecting their tradition.”¹⁹

It seems possible that this gratuitous swipe at Leavis, embedded in an endorsement by Snow of a surreptitious piece of support for his version of the two cultures, contributed to the irritation that led the irascible critic into launching a full-frontal attack on Snow in his 1962 Richmond Lecture. At the very least it shows that Snow had Leavis in his mind while framing his argument about the “two cultures,” and that he felt confident enough of his own intellectual position at the intersection of science and the humanities to take a swipe at a distinguished literary critic.²⁰



So I am proposing that Bronowski contributed to Snow’s emerging thinking on the two cultures from the very outset. He continued, I am suggesting,

18. The fact that the reference Bronowski and Mazlish give for Snow’s quote is incorrect suggests that they were more interested in the sentiment, and yoking it (and the two-cultures controversy) to their own publication, than in the original source. Bronowski’s diary for 1962 shows him responding directly to the two-cultures debate; for example, August, 2: “record my two talks on ‘A Definition of Culture’ (Leavis &c).”

19. C. P. Snow, *Scientific American*, September 1960, 249–56. Cit. T. Sandefur, “*The Two Cultures and The Abacus and the Rose*,” Freespace, May 26, 2009, <http://sandefur.typepad.com/freespace/2009/05/the-two-cultures-and-the-abacus-and-the-rose.html>.

20. Guy Ortolano comments (personal communication), “Snow was often eager for FRL’s approval, so to see him taking aim publicly in 1960 testifies to his confidence about his standing, and about his lecture’s success.” Ortolano is dubious that Leavis would have seen the *Scientific American* review. For his own version of what prompted Leavis to retaliate, see Ortolano, *The Two Cultures Controversy*, 93–94.

to participate in the drama firsthand as it developed.²¹ Two years on, Bronowski was once again quick to consult the text of Leavis's Richmond Lecture, which turned what up until then had been a relatively civilized debate into a personalized and parochial firestorm. The Richmond Lecture was printed in the *Spectator* on March 9, 1962: Bronowski notes in his diary for Monday, March 26: "read 'Spectator' text & correspondence of Leavis-Snow controversy."²² Leavis's lecture was, from start to finish, a sneering ad hominem attack on Snow himself. A single quotation will convey its tone: "The judgment I have to come out with is that not only is [Snow] not a genius; he is intellectually as undistinguished as it is possible to be. . . . Snow's relation to the age . . . is characterised not by insight and spiritual energy, but by blindness, unconsciousness and automatism. He doesn't know what he means and doesn't know he doesn't know. That is what his intoxicating sense of a message and a public function, his inspiration, amounts to."²³ Leavis's contemptuous contention is that Snow has no credentials that allow him to pronounce on the state either of the humanities or of the sciences, and that as a result his "two cultures" argument is null and void. No wonder friends of Snow were quick to rally in his defense.

Direct links between Bronowski and Snow, and the developing Snow-Leavis quarrel, can be found in entries in Bronowski's diary. Leavis delivered his Richmond Lecture on February 28, at Downing College, in front of a packed audience, among whom were a number of Snow's friends and supporters, including J. H. Plumb and George Steiner. As the offensive nature of the lecture became clear, Plumb and others walked out. They certainly reported back on the content of the lecture to Snow. The *Spectator*, which was to publish the lecture, sought legal advice and was advised that "the work contains serious professional libels on Sir Charles Snow," meaning the text could not be published without Snow's permission. An assistant editor went to Snow's home and showed the lecture to him. He agreed to allow publication.²⁴

21. In November 1959, Bronowski took part in a program for Canadian television with Snow, on "'Two Cultures' & 'Sc[ience] & Human Values.'" Bronowski diary, November 12, 1959.

22. The *Observer* ran a comment piece on the lecture in its edition of May 24, which may have encouraged Bronowski to consult the text. See Burnett, "View from the Bridge," 201.

23. F. R. Leavis, *Two Cultures? The Significance of C. P. Snow* (London: Chatto & Windus, 1962), 10. Whereas Snow's Rede Lecture is available in numerous reprints and online versions, Leavis's, tellingly, can be consulted (so far as I have been able to ascertain) only in its original edition.

24. See Ortolano, *The Two Cultures Controversy*, 97.

So when, on March 3, just three days after the lecture, Bronowski had dinner with Snow and the editor of the *Scientific American*, Gerard Piel, at the restaurant Scott's in London, the Leavis lecture was surely a topic of conversation.²⁵ In the months that followed, Snow's and Bronowski's paths crossed unusually frequently. In May or June, Snow and Bronowski traveled to a meeting convened by Jonas Salk, of the Salk polio vaccine, in Paris or New York;²⁶ they dined together again in London on July 27 (I will return shortly to the primary purpose of these meetings, as also to a further series of meetings over the period 1959–63). The topic of the two-cultures debate, and Leavis's attack, is likely to have recurred more than once, and Bronowski was certainly supportive of Snow's position.

This time Bronowski contributed a significant composition of his own to the two-cultures controversy. Once again, he chose to do so somewhat indirectly, though this time the connection was made explicit in the body of the publication. Again, this is consistent with his belonging to the inner circle of Snow's friends: Snow's preference was for strong arguments to back up his thesis, widely distributed through current arts and science publications, rather than explicit messages of support in the letters columns of intellectual journals.²⁷

Over the summer (while vacationing on the Greek island of Corfu), Bronowski wrote a radio drama entitled *New Dialogue on the Two World Systems* (after Galileo)²⁸, later retitled *The Abacus and the Rose*.²⁹ The dialogue was broadcast on the Third Programme (the BBC's highbrow radio network) on November 6, 1962, and subsequently published in the *Nation*.³⁰

25. Bronowski diary, 1962, Saturday, March 3: "dinner Piel, Snows at Scotts." Snow may not yet have actually read the text of the lecture, but he had certainly been given vivid accounts of its content. I shall return to the other reason for this meeting between Bronowski, Gerard Piel, and C. P. Snow. They dined together again on July 27.

26. According to Bronowski's diary, on July 25 he was in Paris with Francis Crick and Jacques Monod, though it is not clear whether Snow was with them. On May 18 Bronowski flew to New York, "for signing-up meeting of Resident & Non-Resident Fellows [of the Salk Institute];" returning to London the following week, and it is likely that Snow, as a trustee, went too (Bronowski diary). He and Snow ("&c") certainly dined with William (Bill) Glazier, general secretary of the about-to-be-founded Salk Institute, on July 27 in London.

27. See Ortolano, *The Two Cultures Controversy*, 124–26. A number of prominent individuals, including Plumb and Bernal, obliged. George Steiner, however, was at this point more diffident about siding with Snow in an increasingly polarized—and, I am arguing, irrelevant—public quarrel. See *ibid.*, 125.

28. Bronowski calls Galileo's original *Dialogue on the Great World Systems*.

29. Bronowski diary, Saturday, August 18 (vacationing on Corfu with the family): "Begin writing my 'New Dialogue on the Two World Systems.'"

30. Bronowski, *The Abacus and the Rose: A Dialogue after Galileo*, *Nation*, January 4, 1964. Two recent articles have linked *The Abacus and the Rose* to Snow's two-cultures debate:

The Abacus and the Rose dialogue is conducted in a Swiss mountain restaurant. The two proponents of opposed worldviews are an irritable literary man in his thirties, Dr. Amos Harping, and an idealistic molecular biologist in his forties, Professor Lionel Potts, FRS. Their host is a genial, generous gentleman in his fifties, Sir Edward St. Ablish,³¹ “who represents the Establishment” and is as anxious to draw the participants’ attention to the quality of the food and wine as to chairing the dinner-table debate on the nature of beauty. The irascible literary figure is unambiguously modeled on F. R. Leavis, the avuncular host is clearly C. P. Snow, and the impatient scientist asks to be identified with Francis Crick (with a possible shade of J. D. Bernal in his Irish accent).

In fact, we can be fairly sure of the deliberate similarity between Potts and Crick. In the first place, phrases within the dialogue closely identify him with things Crick had publicly said (just as Harping quotes directly from Leavis’s Richmond Lecture). In the second, a copy of the printed text of the dialogue is to be found among Crick’s papers. Finally, I own a copy of the cover of the issue of the issue of the *Nation* that contains *The Abacus and the Rose*, inscribed by Bronowski to Crick.³² We shall see shortly that Crick was himself ultimately caught up in the fortunes of Snow’s two-cultures lecture alongside Bronowski.

Here is how Bronowski, in his preface to the revised 1964 edition of his book *Science and Human Values* describes how he was prompted to write *The Abacus and the Rose*:

At the end of [this edition of] *Science and Human Values*, I have also added a new dialogue, *The Abacus and the Rose*, which is essentially an extended note. It discusses the theme, which runs throughout the essays [in the book], that science is as integral a part of the culture of our age as the arts are. This theme was summed up by Sir Charles Snow in his Rede Lecture of 1959 in the telling phrase *The Two Cultures*.

Sandefur, “*The Two Cultures and The Abacus and the Rose*”; and R. Bud, “Life, DNA, and the Model,” *British Journal for the History of Science* (2011): 15–16, consulted online, doi:10.1017/S0007087411000653. Both authors also propose Crick as the model for Dr. Potts.

31. Ablish = “more or less able,” presumably. Ablish is the well-intentioned, moderately intelligent committeeman, or civil servant, resembling a number of characters in Snow’s novels.

32. “Bronowski’s character ends with a definition of a molecular biologist almost identical in wording to the one given by Crick himself in the 1960 BBC World Service broadcast: ‘He is a man who unravels the secrets of life by using the tools of physics. He shows—we have shown—that the structures of biology become intelligible when we treat them, not as strings of mysteries, but as strings of molecules.’ There is no need to intuit a parallel with Crick: there is a copy of the *Nation* article itself in the Crick papers.” Bud, “Life, DNA, and the Model,” 15.

Since then it has been debated with so much passion that it has seemed to me *natural and just* to present the arguments in the dramatic form of a dialogue. (emphasis added)

The curious choice of words—*natural and just*—betrays here Bronowski's awareness of (and sharing of) Snow's view that the attack on him by Leavis was *unjust*. And he goes on to name the absent adversary to whom his dialogue is addressed, and the occasion: "I have tried to make the dialogue do its work, and to put the arguments on each side fairly and with pleasure, in words which do not caricature its case. But where I have doubted my ability, I have thought it better to quote a criticism in the robust phrases which the critic himself has used. I have drawn in particular on the Richmond Lecture which Dr F. R. Leavis gave in 1962."³³

The Abacus and the Rose takes the arguments of the Rede and Richmond Lectures (put elegantly into the mouths of Potts and Harping, respectively), and elaborates on them in Bronowski's characteristic terms, so as to uncover the assumptions behind each of the protagonists' points of view. Although Harping is given plenty of space to justify himself (including quoting liberally from his "teacher," Leavis), by the end, he is exposed as a backward-looking bigot. Potts has the last word—the last word of a practicing molecular biologist, who is "a man who unravels the secrets of life using the tools of physics" and makes the structures of biology intelligible. In response to Sir Edward's final question, "Why are you [scientists] conquering the world, in spite of me . . . [and] in spite of Dr. Harping?" he responds, triumphantly: "Because ours is a vision and an activity together, Sir Edward. That is how Harping defined a complete culture, and it is: science is a culture. We are the visionaries of action; we are inspired with change. We think the past preserves itself in the future of itself, the way Isaac Newton is changed and still preserved in Albert Einstein. We are the culture of living change."³⁴ "The culture of living change" is a peculiarly Bronowski formulation for the outcome to be hoped for from closing the gap in intelligibility between arts and sciences. He puts his faith strongly in a shared language and culture, whereas

33. Bronowski, *Science and Human Values* (New York: Harper & Row, 1964), xi–xii. Bronowski ends this preface by returning to the atomic bomb at Nagasaki, thereby once again linking his discussion of the need for an integrated arts and science program of education and knowledge to the enormity of the events at Hiroshima and Nagasaki (this is also where *Science and Human Values* begins).

34. Bronowski, *The Abacus and the Rose*, in *Science and Human Values*, 118.

Snow places greater emphasis on process and institutional organization, but they acknowledge a common context and set of assumptions.³⁵

Snow was quick to acknowledge Bronowski's intervention. In a letter to him written at the beginning of December 1962, Snow is effusive in his gratitude for this elegant and nuanced contribution to his side of the debate. He had not heard the broadcast, but had read a transcript: "It is a tremendous support. It was gallant and generous of you to weigh in like this and I shall never forget it. It was a pure chance that you didn't have to bear the major weight of the controversy—as I have repeatedly said both in public and in private. If that had been the case I hope I should have behaved as handsomely as you have done. It means more to me than I can easily say."³⁶

On this occasion Bronowski's contribution can be seen directly influencing Snow's own developing articulation of the two-cultures problem. In *The Two Cultures: A Second Look*, first published in the *Times Literary Supplement* in October 1963,³⁷ and printed with the reprinted Rede Lecture by Cambridge University Press in 1964, Snow expresses regret that he originally chose the Second Law of Thermodynamics as his example of a piece of science incomprehensible to those trained in the humanities:

I have regretted that I used as my test question about scientific literacy, *What do you know of the Second Law of Thermodynamics?* . . . I should now treat the matter differently, and I should put forward a branch of science which ought to be requisite in the common culture, certainly for anyone now at school. This branch of science at present goes by the name of molecular biology. . . . Through a whole set of lucky chances, this study is ideally suited to fit into a new model of education. It is fairly self-contained. . . . It includes the leap of genius by which Crick and Watson snatched at the structure of DNA and so taught us the essential lesson about our genetic inheritance.³⁸

35. It is tempting to see this as a distinction between the scientist-poet (Bronowski) and the scientist-novelist (Snow).

36. Snow to Bronowski, December 10, 1962, folder 15, box 70, MS coll. 173, Bronowski Papers, University of Toronto Library. Cit. R. Bud, "Life, DNA, and the Model."

37. Bronowski read it on the day it came out, October 25, 1963. See note 1.

38. Snow, *The Two Cultures: A Second Look*, 72–73. On October 18, 1962, three weeks before the first broadcast of *The Abacus and the Rose*, Francis Crick, James Watson, and Maurice Wilkins were awarded the Nobel Prize for Medicine, for the discovery of the structure of DNA. This event also presumably contributed to Snow's change of emphasis—from physics to molecular biology.

Molecular biology, Snow suggests here, is the field most accessible to the ordinary nonscientific man or woman, and hence most likely to provide a platform for those in education and politics endeavoring to draw the two cultures together.



So far I have argued that Bronowski was aware of Snow's and Leavis's lectures and directly involved in the orchestrated responses on Snow's side that contributed to elevating that exchange from a parochial quarrel into an international debate. In this regard his contribution might be considered comparable with those of others who threw their hats into the ring on Snow's behalf—for instance, in published correspondence that accompanied each public pronouncement on the topic over the period 1959–64. It is possible, however, to confirm a series of closer, ongoing, connections between Bronowski and Snow, involving discussions that clearly influenced Snow's position. I am arguing, in other words, not simply that Bronowski was one among many influences on the developing debate during its early stages, but that his was a uniquely leading role.³⁹

Snow and Bronowski were particularly closely associated during this period with two other ventures that stood in a significantly close relationship to the debate and helped shape both men's attitudes, and Snow's contribution to it. First, both Snow and Bronowski were members of an elite group advising the British Labour Party in opposition. Second (and this is the context in which Snow might have had added motive for shifting from physics to biology as part of his argument), they were involved together at the highest level in Jonas Salk's planning and execution to establish the Salk Institute for Biological Studies at La Jolla, California, in 1962.⁴⁰



Between 1958 and 1963 Snow and Bronowski were members of the so-called Brumwell group—a gathering of Left-leaning scientists and

39. Roy Porter has explored the relationship between it and J. D. Bernal's work (Bernal was another old friend of Snow's). R. Porter, "The Two Cultures Revisited," *Cambridge Review*, November 1994, 74–80; consulted in *Boundary 2* 23 (1996): 1–17. David Cannadine includes correspondence between J. H. Plumb and Snow that reveals influence of another close friend. See D. Cannadine, "C. P. Snow: 'The Two Cultures' and the 'Corridors of Power' Revisited," in *Yet More Adventures with Britannia: Personalities, Politics, and Culture in Britain*, by W. Rogers Louis (London: I. B. Tauris, 2005), 101–15.

40. Sandefur notes the connection between the two-cultures debate and the founding of the Salk Institute; Bud, "Life, DNA, and the Model," notes a link between Crick, Snow, and the Gaitskell group; Ortolano does an excellent job incorporating the Gaitskell group (via the Blackett Papers, which contain its minutes and documents) into his argument about the two-cultures controversy.

politicians who met regularly under the chairmanship of the then leader of the Labour Party, Hugh Gaitskell.⁴¹ The group was convened by Marcus Brumwell—a wealthy Labour supporter and PR company owner—at the Reform Club in London, and had its first meeting, over dinner there, in July 1956. Bronowski was one of its founder members, alongside such distinguished scientists as Blackett, Glass, Lockspeiser, and Newitt.⁴²

The purpose of the group was to develop a policy for the Labour Party (then in opposition) on the topic of the importance of science in the nation as a whole, and for government in particular. Its Left credentials meant that it advocated diverting the 1.5 billion pounds spent annually on the armed forces (and in particular on the development of science's most remarkable recent achievement, the atomic bomb) and reallocating it, "which would provide plenty to give all the support and organisation required to science."

In June 1958 this group "began to focus on helping Labour win office."⁴³ As Brumwell wrote in a letter to Blackett in July 1958: "We have all agreed now that we will try and have meetings of a few of the senior scientists to work out these Cabinet papers, which is I think a suggestion known to you. . . . I am trying to organise the first meeting of this group for Friday 26 September. The group will consist of Snow, Bronowski, Bernal, Blackett and Williams."⁴⁴ In fact, the members of this VIP group as convened in the autumn were as follows: Professor J. D. Bernal, FRS; Professor P. M. S. Blackett, FRS; Dr. J. Bronowski, MA; Professor David Glass; Sir Ben Lockspeiser, Kt, KCB, FRS; Professor D. M. Newitt, MC, FRS; Sir Charles P. Snow, CBE, PhD; Professor B. R. Williams, MA; and Sir Solly Zuckerman, FRS ("occasional" member).⁴⁵

41. Another participant was Alfred, later Lord Robens, attending as shadow minister for science (succeeding James Callaghan). In 1960 the Conservative prime minister, Harold Macmillan, appointed Robens head of the National Coal Board, a post he took up in 1961. This removed him from the group and made him Bronowski's boss and line manager, in which role, in 1962–63, he intervened dramatically in Bronowski's career—a topic I shall cover elsewhere.

42. The main group seems to have met once or twice a year, the elite subgroup more frequently. The minutes of meetings are to be found in the Blackett Papers at the Royal Society: RS PB/5/2. For another account of the Gaitskell-Brumwell group and its relation to Snow's two-cultures debate, see Ortolano, *The Two Cultures Controversy*, 173–78.

43. Ortolano, *The Two Cultures Controversy*, 174.

44. RS Blackett Papers, PB/5/2/E25. I am extremely grateful to Dr. Noah Moxham, who photographed and transcribed in part the documents among the Blackett Papers referred to in this section of my lecture.

45. The only distinguished wartime scientist missing from the group is Tizard, who died in his seventies in October 1959.

It met as planned in September at Brown's Hotel, and subsequently fortnightly on Mondays, at Brumwell's home in Mayfair "over beer and sandwiches." At its next meeting, on Monday, October 13, the drafting of cabinet papers on specific scientific topics was parceled out to the committee members: Snow was to take scientific and technical manpower, Williams "science in industry," Blackett government machinery. The paper on "priorities" was allocated to Bronowski. The minutes of the meeting record that "as a first step [Bronowski] thought he would prepare something on Priorities in Industry, and would do so in consultation with Williams." This was confirmed at the following meeting.⁴⁶

This extraordinarily distinguished group (many of whom had held senior posts in sensitive or secret areas of scientific activity during the Second World War) drafted a series of cabinet papers for Gaitskell under the rubric "A Labour Government and Science." These included significant contributions from Snow and Bronowski on "science and industry" and "priorities," respectively.⁴⁷ On August 27, 1959, at a dinner meeting at Brown's, Gaitskell and Wilson announced that they were willing to accept the document as the basis for the science policy of any future Labour government.⁴⁸ Although Labour failed to win the general election in October of that year, the group continued to meet in an advisory capacity, first to Hugh Gaitskell and then to future Labour prime minister Harold Wilson.

In July 1962 Bronowski wrote a somewhat impatient letter to Brumwell, complaining about lack of focus and determination, based on the most recent dinner meeting that had taken place between the VIP group and key Labour MPs. All efforts should, he insisted, be focused on challenging the Conservative minister for science (Lord Hailsham), and stressing the Labour Party's more considered and consistent approach to integrating science into the larger political picture: "If the [Conservative] Minister for Science were constantly criticised for the short-comings, and particularly the short-sightedness, of Government policy on science, the press would report the criticisms. There would thus be created in the public mind the sense that the Labour Party is on the side of science,

46. RS Blackett Papers, PB/5/2/E27. Professor Bruce Williams is the only name on this list whose stellar credentials I have been unable so far to trace, and about whom I have learned little. He was, I believe, an economist at the University College of North Staffordshire and prominent in research on relations between science and business.

47. Bronowski's diary records, "write second draft of Cabinet Paper on priorities," on January 7, 1959.

48. See RS Blackett Papers, PB/5/2/E28.

is go-ahead, and knows what it will do.”⁴⁹ Other members wrote similarly to Brumwell, and in November a group letter was sent to Gaitskell, who responded in supportive, though guarded, terms, promising to “think about what you say” and write again.⁵⁰

The last meeting of the Brumwell group took place on June 24, 1963, five months after the sudden death of Hugh Gaitskell in January. This meeting was called at the request of Harold Wilson, newly elected leader of the Labour Party, whose commitment to the group’s activities showed none of Gaitskell’s political caution. At it he called for an “election statement” on science, to be produced by Snow and Bronowski together. A fortnight later Brumwell wrote to Blackett: “I shall press Bruno [Bronowski] and C P Snow to do their election manifesto.”⁵¹

It is not unreasonable to suggest that Wilson’s landmark “white heat of technology” speech (as it came to be known), delivered at the Labour Party’s annual conference on October 1, 1963, less than a year before Labour was returned to power under his leadership, owed everything to the work of the Brumwell group, and in particular to the combined persuasive eloquence of Snow and Bronowski. In it, phrases from the election-manifesto papers prepared by Snow and Bronowski come clearly through: “We are redefining and we are restating our socialism [Wilson announced] in terms of the scientific revolution. . . . That revolution cannot become a reality unless we are prepared to make far-reaching changes in economic and social attitudes which permeate our whole system of society. The Britain that is going to be forged in the white heat of this revolution will be no place for restrictive practices or for outdated methods on either side of industry.”⁵²

49. “It is a radical error to under value the post of Minister for Science. The Conservative Party made a bad mistake in appointing Lord Hailsham. The Labour Party could make great capital out of this. The key is in the House of Commons itself. If the Minister for Science were constantly criticised for the short-comings, and particularly the short-sightedness, of Government policy on science, the press would report the criticisms. There would thus be created in the public mind the sense that the Labour Party is on the side of science, is go-ahead, and knows what it will do. This is not merely a negative policy of criticism, because it would only be carried out by someone who understands science, is excited about it and knows how he wants it used. So far, the Parliamentary Labour Party has found no-one with these qualifications, though it should be said that when Robens looked after science, he proved that taking the job seriously and consistently could go a long way.” RS Blackett papers (transcript).

50. RS Blackett Papers PB/5/2/E33. Gaitskell seem always to have been somewhat guarded about the group’s deliberations, particularly its views on nonproliferation of nuclear weapons. Harold Wilson was far more positive, hence the “luck” for the group of Gaitskell’s sudden and entirely unexpected death in early 1963.

51. Brumwell to Blackett, July 9, 1963.

52. http://www.youtube.com/watch?v=K6SK34_-ssQ.

The Brumwell group's discussions, then, were centered on precisely the arts-science divide and its implications for the nation that Snow articulated in his Rede Lecture, with particular emphasis on the integration of art and science within government. As we shall see, this was the direction in which Snow was developing his two-cultures argument before the intervention of F. R. Leavis, in the Godkin Lectures, delivered at Harvard in 1960 and published in 1961, entitled "Science and Government."



I go back now to that occasion, three days after Leavis delivered his Richmond Lecture, when Snow, Bronowski, and Gerard Piel dined together at Scott's in London with their wives, and at which, I suggested, topics of conversation are bound to have included Leavis's Richmond Lecture and the two-cultures controversy.

Gerard Piel, editor of the *Scientific American*, was in London with a very specific purpose. For several years Jonas Salk—discoverer of the polio vaccine—had been in discussions on both sides of the Atlantic about the establishment in California of a scientific institute on a completely new model, what eventually became the Salk Institute.

The Salk Institute for Biological Studies was opened in 1962 (in temporary buildings) on twenty-seven acres of land given for its construction by the City of San Diego and paid for by the millions of dollars collected by the March of Dimes (the public funding initiative for a vaccine to counter the scourge of polio). Salk's vision was of a scientific institute that would not only find cures for diseases but also address "the problems of humanity that are the most important of the day."

He imagined an alliance of like-minded colleagues who valued "the freedom, integrity, and independence of the individual," which would preserve "flexibility and freedom" and reward "boldness and courage." Unlike traditional research institutes, this one would include humanists as well as scientists—people who had "a deep understanding and feeling for the problems of each other, and for the problems of humanity." Its senior members would be fellows for life, a self-governing body able to devote its attentions not only to pressing matters of health and disease, but also with "unencumbered time for contemplation and for action."⁵³

53. Jonas Salk, "Ideas for Salk Institute," circa 1957, Salk Papers, Mandeville Special Collections, UCSD, La Jolla, California [SP], MSS I, box 334, folder 9; memo to the folder, undated, SP MSS I, box 344, folder 1; "Suggested Additions to Foregoing for Consideration at Meeting of February 22, 1958," SP MSS I, box 344, folder 3. Cit. Stuart W. Leslie, "A Different Kind of Beauty": Scientific and Architectural Style in I. M. Pei's Mesa Laboratory and

In other words, Salk envisaged his institute in very much the terms of Bronowski's vision of a scientific community that embraced the humanities and defined a new culture combining art and science. This was a project for which Jonas Salk was particularly well qualified, since his polio-vaccine breakthrough had captured the public imagination. For the general public, "Salk" was a name to conjure with—as the representative of the public relations company assigned to "marketing" the Salk Institute in 1960 observed to Salk himself: "The name Salk is almost magical. . . . In the minds of the public, an institute, and the concept behind it tend to be vague intangible ideas. A person, however, is quite real and understandable to the public."⁵⁴

Piel's wooing of Snow and Bronowski paid off. On June 2, 1962, the *Times* of London announced the names of three distinguished British scientists who would be joining the newly founded Salk Institute: "Three British Scientists are to be associated with the new Institute for Biological Studies here, which plans to links science and the humanities, Mr. Gerard Piel, American editor and publisher, who is president of the institute's board of trustees, announced this [in San Diego, California] today. Dr. J. Bronowski will be a resident fellow [in humanities] for life as well as a trustee. Sir Charles Snow will be a trustee. Dr. F. H. C. Crick of Cambridge will be a non-resident fellow for six years."⁵⁵

Again, the negotiations running up to, and continuing after, this announcement, which involved both Bronowski and Snow, provide a further specific and focused context for Snow's views on the two cultures. These discussions, as Salk's personal papers show, returned again and again to the issue of combining humane and scientific research under one roof, to provide an entirely new model for progress toward an integrated arts-science future.



I am almost at the end of this stage-setting for our reconsideration of the two-cultures question (the subject of my second lecture), guided by Snow's own intellectual context and contacts over the period of five years (1959–64) during which the topic was most hotly debated. There remain, however, some historical observations to be made that may help us to

Louis Kahn's Salk Institute," *Historical Studies in the Natural Sciences* 38 (2008): 173–221, consulted online.

54. Frederick Whitney to Jonas Salk, May 6, 1960, SP MSS I, box 369, folder 9. Cit. Leslie, "A Different Kind of Beauty," 206.

55. The *Times* archive, June 2, 1962, consulted online.

understand the subsequent resolute swerve (as I see it) in the debate, away from the urgent need to incorporate the language, morality, and patterns of thought of science into Western culture, and toward a to-and-fro verbal battle about the virtues of a scientific and an arts education within the parochial framework of institutions of higher education in Britain and the United States.

In spite of the announcement I just referred to, the Salk Institute did not begin to operate fully, in La Jolla, California, until late in 1963, in temporary buildings (Louis Kahn's magnificent purpose-built buildings were not completed until 1967). Until then, its distinguished trustees and fellows continued with their previous lives, assembling regularly in London, Paris, New York, and San Diego for meetings. Thus, it is that Snow and Bronowski were still vigorously involved in the Brumwell group in 1963 and in the preparations for the 1964 general election, which took place in Britain in October of that year. As we have seen, a number of crucial documents for that election campaign were actually prepared by Snow and Bronowski together.

But by the time Labour won the election, and Harold Wilson became prime minister, Bronowski had already begun building a home in La Jolla. An interview he gave to the *Times* in September 1963 records his state of mind as he prepared to leave for America: "Dr Jacob Bronowski who is leaving Britain in 1964 to work in America, in an interview yesterday with the *Times*, spoke of a malaise sweeping Britain. He gave a warning that unless there were some radical changes, particularly in education, we should soon be relegated to the status of a third-rate power. . . . Before Britain could hope to regain her former stature, he said there would have to be more scientists and a greater recognition of the important role they had to play in such things as education, politics and industry."⁵⁶

These are familiar sentiments for the period, part of a rhetoric of national decline that Harold Wilson would try to counter with his vigorous promotion of science and technology as sources of Britain's future prosperity.⁵⁷ Nevertheless, they capture Bronowski's palpable disappoint-

56. The interview went on: "In politics more people are needed whose education was not grounded in minor Latin authors and other intellectual exercises which had no bearing on decision-making. . . . He did not believe in government by scientists, nor governments by experts of any kind, and this was what was happening at present when the politicians did not have the right background for modern life." http://www.thetimes.co.uk/tto/viewArticle.arc?articleId=ARCHIVE-The_Times-1963-09-17-07-007&pageId=ARCHIVE-The_Times-1963-09-17-07.

57. On the rise of a rhetoric of national "decline" in this period, see Ortolano, *The Two Cultures Controversy*, chap. 5, pp. 161–93.

ment at the absence of opportunity for innovation at the arts-sciences boundary, which he had encountered in Britain during the 1950s.⁵⁸

Meanwhile, Snow was growing skeptical of the possibility of making any real inroads into the “corridors of power” on behalf of science and the forces of modernity. In his novel of that name (*The Corridors of Power*), published in 1964, the enlightened protagonist on behalf of science fails in his bid to persuade Parliament to abandon its program for developing nuclear weapons in favor of civil science and scientific education.⁵⁹ And although he briefly held office in the new Ministry of Technology under the Wilson Labour government, he resigned, disappointed, after little more than a year and returned to writing his novels. As he had confided to his friend J. H. Plumb some years earlier: “We’ve never been able to collect men of spirit together to run an institution, even for a short time.”⁶⁰

Between Wilson’s “white heat of technology” speech at the 1963 Labour Party conference and his assuming power—when one of his first moves was to elevate Snow to the House of Lords and appoint him parliamentary secretary to the new Ministry of Technology—the energy had already begun to seep away from the passionate pioneering for science that had characterized the Brumwell group. Over the next ten years, the new dawn for Britain failed to materialize. Its champions turned to the United States instead.

APPENDIX

The *Times*’ Friday, May 8, 1959, review of Snow’s Rede Lecture:

Headline: SIR CHARLES SNOW ON WAY TO AVERT THREE MENACES
FACING MANKIND

The 1959 Rede lecture, entitled “The two cultures and the scientific revolution,” was delivered by Sir Charles Snow at Cambridge last night. It is being published in book form by the Cambridge University Press.

Speaking first about the two cultures, Sir Charles Snow said he believed the intellectual life of the whole of western society was

58. In my forthcoming memoir on my father and myself, provisionally entitled “Jacob Bronowski: Things I Never Knew about My Father,” I shall have more to say about the thwarting of Bronowski’s career ambitions in Britain in the 1950s.

59. Bronowski’s diaries record him reading Snow’s *The New Men* and *Corridors of Power* novels during this period.

60. Snow to Plumb, January 26, 1955. Cit. Cannadine, “The Two Cultures,” 117n23.

increasingly being split into two polar groups—literary intellectuals at one pole, at the other scientists—with between the two a gulf of mutual incomprehension.

The main issue of the scientific revolution—defined as the transformation brought about by the application of real science to industry—said Sir Charles Snow, was that the people in the industrialized countries were getting richer, and those in the non-industrialized countries were at best standing still; so that the gap between the industrialized countries and the rest was widening every day. On the world scale that was the gap between the rich and the poor.

Among the rich were the United States, the white Commonwealth countries, Great Britain, most of Europe, and the USSR. China was betwixt and between, not yet over the industrial hump, but probably getting there. The poor were all the rest. “Life for the overwhelming majority of mankind has always been nasty, brutish, and short,” he continued. “It is so in the poor countries still.”

“This disparity between the rich and the poor has been noticed,” Sir Charles Snow went on. “It has been noticed, most acutely and not unnaturally, by the poor. Just because they have noticed it, it won’t last for long. Whatever else in the world we know survives to the year 2,000, that won’t. Once the trick of getting rich is known, as it now is, the world can’t survive half rich and half poor. It’s just not on.

“The west has got to help in this transformation. The trouble is, the west with its divided cultures finds it hard to grasp just how big, and above all just how fast, the transformation must be.”

During all human history until this century the rate of social change had been very slow, Sir Charles Snow said. That was no longer so. The rate of change has increased so much that our imagination could not keep up.

“There is *bound* to be more social change, affecting more people, in the next decade than in any before. There is *bound* to be more change again, in the 1970s. In the poor countries, people have caught on to this simple concept. Men there are no longer prepared to wait for periods longer than one person’s lifetime.”

The only secret of the Russian and Chinese industrialization was that they had brought it off. That was what Asians and Africans had noticed. It had taken the Russians about 40 years. The Chinese had started with much less of an industrial base, but had not been

interrupted by wars, and it looked like taking them not much over half the time.

For the task of totally industrializing a major country, as in China today, it only took will to train enough scientists and engineers and technicians. There was no evidence that any country or race was better than any other in scientific teachability: there was a good deal of evidence that they all were much alike.

"There is no getting away from it," Sir Charles Snow went on. "It is technically possible to carry out the scientific revolution in India, Africa, south-east Asia, Latin America, the Middle East, within 50 years. There is no excuse for western man not to know this. And not to know that this is the one way through the three menaces which stand in our way—H-bomb war, over-population, the gap between the rich and the poor. This is one of the situations where the worst crime is innocence."

Since the gap between the rich countries and the poor could be removed, he said, it would be. If we were short-sighted, inept, incapable either of good will or enlightened self-interest, then it might be removed to the accompaniment of war and starvation; but removed it would be. The questions were, how, and by whom.

Only partial answers could be given, but that might be enough to set us thinking. "The scientific revolution on the world scale needs, first and foremost, capital: capital in all form, including capital machinery."

There were only two possible sources. One was the west which meant mainly the United States, the other was the USSR. The second requirement, after capital, was men. That was, trained scientists and engineers adaptable enough to devote themselves to a foreign country's industrialization for at least 10 years out of their lives. Here, unless and until the Americans and we educated ourselves both sensibly and imaginatively, the Russians had a clear edge. These men, whom we did not yet possess, needed to be trained not only in scientific but in human terms.

The third essential of the scientific revolution was an educational programme to compete as the Chinese, who appeared in 10 years to have transformed their universities and built so many new ones that they were now nearly independent of scientists and engineers from outside. Ten years! With scientific teachers from Britain and the

United States, and what was also necessary, with teachers of English, other poor countries could do the same in 20.

“That is the size of the problem,” Sir Charles Snow summed up. “An immense capital outlay, an immense investment in men, both scientists and linguists, most of whom the west does not yet possess. With rewards negligible in the short term, apart from doing the job: and in the long term most uncertain.”

LECTURE II.
SCIENCE AND GOVERNMENT:
C. P. SNOW AND THE CORRIDORS OF POWER

Let me begin by recapitulating. On May 7, 1959, Sir Charles Snow—C. P. Snow—delivered the Rede Lecture in Cambridge under the title *The Two Cultures and the Scientific Revolution*. Snow was a research chemist who had become a successful novelist, and who at the time of delivering the lecture was a civil servant with a career that spanned the Second World War in government scientific administration. In his celebrated lecture he set out to bring to public attention what he considered to be a fatal divide between the ethos, outlook, and practices of the sciences and those of the old humanities.

That lecture ignited a debate about the relative importance for British culture of the arts and sciences, and permanently enshrined the phrase *the two cultures* in popular parlance. Snow's text was rushed out for publication in the same year and has rarely been out of print since. It generated, and continues to generate, energetic, not to say agitated, debate. In the tradition of long-running disputes, neither side has been prepared to concede much ground, and practitioners in the two intellectual spheres remain myopically as far apart as they were fifty years ago.

In spite of the amount of ink that has been spilled on the so-called arts-science culture wars, I want to suggest in this lecture, building upon what I presented in my last, that since almost immediately after it was delivered, Snow's original lecture has been taken out of context, its real importance as a timely intervention misunderstood. Instead of drawing attention to a potentially fatal fissure within our intellectual and political world, as a matter of urgency, it has been annexed to a parochial squabble between taught arts and sciences, largely conducted within the humanities disciplines in Anglophone universities on both sides of the Atlantic.

Properly contextualized, I shall argue, Snow was not interested in whether the plays of Shakespeare or the Second Law of Thermodynamics was the more appropriate starting point for an educational system preparatory for a full and rich understanding of contemporary Britain, its community and culture. Nor was the focus of his attention whether scientists who could explain that Second Law of Thermodynamics or the humanities-trained who could quote Shakespeare at will were to be preferred as pillars of a civilized society. His rallying cry—which will be mine also—was that in an advanced democracy, arts and science education had

to proceed in tandem, side by side and hand in hand, and that failure to do so was politically dangerous for all of us.

Leaving aside the intricate influencing I traced in my last lecture, I suggest here that the lecture Snow gave in 1959 was the culmination rather than the beginning of a postwar debate about the role of science in British society. It was an argument that had begun in the final years of the Second World War, and had been enlarged on and developed in the course of the 1950s, in the context of discussion about the direction Britain should take in manufacturing and technology as the country came off a war footing. That debate eventually crystallized in Snow's mind in 1960 into a series of lectures he delivered at Harvard (the Godkin Lectures), which were published in 1961 under the title *Science and Government*.¹

In his Richmond Lecture, delivered at Downing College (from which he was shortly to retire), and published in the *Spectator* in March 1962, Leavis makes no reference to this second stage in Snow's argument. There is no reason to believe he had even read *Science and Government*, since it did not raise the rather small-minded Oxbridge-academic themes introduced by the unsuspecting Snow in *The Two Cultures and the Scientific Revolution* and seized upon by Leavis in his Richmond Lecture reply.² The Godkin Lectures were, however, I shall argue, strikingly better thought through and more compelling than the Rede Lecture and far clearer and more specific in their agenda, and in proposals for resolution of the issues raised.

Snow's argument was directly framed in the context of the critical years after the end of the Second World War and was meant as an urgent appeal to those who were shaping the policies and priorities of the post-war English-speaking world. Snow's awareness of the importance of the question he poses is to be detected in the two-cultures lecture, in spite of its sometimes infuriatingly bantering tone, in the repeated "I intend something serious [here]" of its opening paragraphs, and in Snow's reiterated

1. C. P. Snow, *Science and Government*, Godkin Lectures at Harvard University, 1960 (Oxford: Oxford University Press, 1961). See also C. P. Snow, *A Postscript to Science and Government* (Oxford: Oxford University Press, 1962).

2. Although Leavis probably had not read the Godkin Lectures, Michael Yudkin, who contributed a further assessment of Snow's Rede Lecture to the volume in which Leavis's Richmond Lecture was published, clearly had. See the note—perhaps added late in the publication process—in which he argues that "it is necessary for politicians to be sufficiently trained in science to understand the nature and meaning of the scientific advice which they receive" (39). The wording of this is so close to Snow's that I find it impossible to believe he had not read the "Science and Government" lectures. See M. Yudkind, "Sir Charles Snow's Rede Lecture," in *Two Cultures? The Significance of C. Snow*, by F. R. Leavis (London: Chatto & Windus, 1962), 39.

claims that the fracture across the humanities-science divide introduces a fatal flaw into contemporary planning for Britain's future purpose and prosperity. Taken as a whole, however, that lecture failed to drive home Snow's core message of concern for the future of the nation.

A passage from the original two-cultures lecture sets the scene for the more serious mood of the controversy as I shall deal with it here:

I believe the pole of total incomprehension of science radiates its influence on all the rest. That total incomprehension gives, much more persuasively than we realise, living in it, an unscientific flavour to the whole "traditional" culture. . . . It is the traditional culture, to an extent remarkably little diminished by the emergence of the scientific one, which manages the western world. This polarisation is sheer loss to us all. To us as people, and to our society. . . . The degree of incomprehension on both sides is the kind of joke which has gone sour.³

If the joke had gone sour in 1959, how much more has it done so today? That is the thrust of this second Tanner Lecture.



I suggested that the two-cultures debate had its origin in Britain in the immediate postwar period. So let us look back about ten years before Snow's landmark lecture, to a moment when the nervous anxiety caused in Britain by any proposal of close proximity between the two cultures, to which Snow wanted to alert his audience, is already becoming apparent. The moment in question is what was promoted at the time—and has regularly been characterized since—as an enthusiastic and supposedly wholehearted endorsement of Britain's progressive aspirations to bring science, art, and design permanently together: the Festival of Britain.

A 1951 exhibition was first proposed by the Royal Society of the Arts as early as 1943, while the war was still going on—an astonishing affirmation of confidence (or perhaps just hope) for an Allied victory. In September 1945, with the war at an end and a Labour government newly in power, Gerald Barry, editor of the Left-leaning newspaper the *News Chronicle*, addressed an open letter to Stafford Cripps, then president of the Board of Trade, proposing a trade and cultural exhibition in London as a way of commemorating the centenary of the Crystal Palace.⁴ "[The Festi-

3. Snow, *The Two Cultures*, 11.

4. F. M. Leventhal, "A Tonic to the Nation?: The Festival of Britain, 1951," *Albion: A Quarterly Journal Concerned with British Studies* 27 (1995): 445.

val of Britain] emerged as a definite proposition in 1947–8, in part to commemorate the centenary of the Great Exhibition of 1851, and in part to signal a relief from unparalleled austerity. The headquarters was in the Treasury, not surprisingly given the economic strait-jacket of the period, with an Exhibition Unit set up in the Central Office for Information. In April 1949 the two were merged to form the Festival of Britain Office, with Gerald Barry appointed Director-General under the chairmanship of General Lord Ismay.”⁵

The government’s agenda for the festival (with all-party support) was to promote a postwar program of technology-led prosperity and progress and to put the war years resolutely behind them. This determination inflected the festival’s every aspect, and so helps us to focus our retrospective attention on some lasting consequences of the way it developed in practice. As King George VI put it, in a speech delivered at the Guildhall in 1949: “As we look forward to the year 1951, each of us can share in the anticipation of an event which may be outstanding in our lives. The motives which inspire the Festival are common to us all—pride in our past and all that it has meant, confidence in the future which holds so many opportunities for us to continue our contribution to the well being of mankind, and thanksgiving that we have begun to surmount our trials.” But there is unresolved strain in the well-documented discussions among the organizers, about the transition the Festival of Britain would attempt to make from an “old” culture, rooted in the landscape of the British Isles as captured in art, crafts, and architecture, to a hoped-for “new” Britain, built on a foundation of trade and commerce, science and technology. The festival was unashamedly insular—deliberately ignoring the achievements and future prospects of its former colonies, now the Commonwealth—and made “the land and its people” the main focus for its explanatory narrative. It was obvious, Barry proclaimed, that “a worthy *national display*, through its challenge to every branch of creative effort, and with its proclamation of confidence in ourselves and in the future, would bring much credit and profit to the country.”⁶

5. S. Forgan, “Festivals of Science and the Two Cultures: Design and Display in the Festival of Britain, 1951,” *British Journal for the History of Science* 31 (1998): 219–20. “The essential background to the Festival was the post-war Labour government and the creation of the welfare state. In the foreground were the new Councils and cultural bodies set up with the aim of revitalizing British life.” Forgan, “Festivals of Science and the Two Cultures,” 219.

6. H. Atkinson, *The Festival of Britain: A Land and Its People* (London: I. B. Tauris, 2012), 15.

As a consequence, in its final form the festival preserves as a kind of “frozen moment” the dilemma faced by those seeking to promote a new science-inclusive culture as the promise for a prosperous, regenerated, yet romanticized Britain, in the years in which the country emerged—bruised and battered—from a state of war.

The Festival Exhibition in London was in fact two exhibitions, each with its explanatory catalog: the South Bank Exhibition, with its iconic Dome of Discovery and Skylon, and the South Kensington Science Exhibition.⁷

In spite of their accessible, ordinary-language clarity, these catalogs make strange reading today. On the one hand, extraordinary care is taken to underline the tight connection between pure science and its applications in everyday life. On the other hand, an equivalent amount of effort has apparently gone into making sure there is barely a mention of the most recent and richest location for demonstrating the potentially positive outcome of such a tight application of pure science to useful ends—the way rapid application of research science to the development of military technology had given the Allies the edge over Hitler in the Second World War.⁸

Probably the best example of the festival’s treatment of innovative science closely associated with the war is that of radar—that most brilliant and successful British wartime scientific advance, which we shall see shortly is the crux of Snow’s Godkin Lectures argument—which makes a single brief appearance in the section of the South Bank Exhibition entitled “Transport and Communications.” There, the original context for its accelerated realization is touched on and then moved on from as swiftly as possible. The caption for this section of the exhibition runs: “British scientists developed radar in the first instance to meet a military need, but now it is being freely applied for civil purposes. This section shows how it is used for supervising aircraft from the ground, or vessels from the shore, and how it aids the navigation of aircraft and ships whether in daylight, darkness or fog.”⁹ Meanwhile, elsewhere on the festival site, the South Bank’s Shot Tower (the only

7. There were also regional exhibitions and touring exhibitions.

8. “The emphasis was obviously on discovery, notably in the South Bank Exhibition. It focused above all on the British contribution to stories of discovery, and emphasized British leadership in particular areas of science and technology, not without justification in areas such as radioastronomy or crystallography. Furthermore, the science and technologies exhibited were ‘the story of British contributions to world civilization in the arts of peace’ and in true ‘swords into ploughshares’ spirit, all mention of the arts of war was excluded.” Forgan, “Festivals of Science,” 233.

9. South Kensington Exhibition, *Festival of Britain Guide*, 39.

building on the site not purpose-built for the festival) was refurbished as a radar station and fitted with a radar beacon and large reflector. Visitors could transmit messages to the moon and receive return signals—creating a sense of exciting futuristic possibilities as far removed as possible from the functional uses of radar to detect enemy aircraft in wartime.¹⁰



The watchword of the Festival of Britain was “Don’t mention the war,” both at the planning stage, on the part of the committee charged with mounting the Festival Exhibitions, and in its final execution. To recognize how self-conscious this omission was, we need only recall that wartime food rationing (sugar and butter) did not end until 1954, two years after the end of the festival. In 1951, as the exhibition opened, Britain entered the Korean War, sending troops in as part of the UN’s intervention there. The threat of nuclear war hung over the West: six months earlier, at the end of 1950, President Truman made the decision to proceed with tests of the hydrogen bomb (the first atmospheric test took place at the beginning of 1952, and the critical test on the Bikini Atoll in 1954).

Politically, Britain was in turmoil—the Labour government whose brainchild the festival was (to provide “a tonic to the nation” at the end of a long period of austerity) fell in October 1951. The new prime minister, Winston Churchill, whose personal antipathy toward the whole project was well known, was given a solid excuse for withdrawing government support from the exhibitions when King George VI died in early February 1952. Demolition of the temporary festival buildings was accelerated in order to provide open green space for the celebrations planned for the coronation of Queen Elizabeth II.¹¹

The tension between postwar realities and dreams for Britain’s future is clear in public pronouncements during the planning phase of the festival. In September 1950 Gerald Barry wrote in a magazine article justifying the exhibition, “How can you organise exhibitions while men are dying in Korea? To which I respectfully but very firmly answer that Korea, and all that Korea implies, makes our plans more timely than ever. Fighting, I mean, not necessarily with tanks and bazookas, but with every moral and spiritual weapon in our democratic armoury. This Festival of ours is a deadly serious affair.”¹²

10. Atkinson, *Festival of Britain*, 123–27.

11. “Coronation Celebrations” versus “Festival of Science Exhibitions” neatly captures the poles of Snow’s “two cultures” debate. Heritage versus progress.

12. Draft article for the New York magazine *Flair*, cit. Atkinson, *Festival of Britain*, 16.

The omission of all mention of either the war or the atomic bomb was certainly deliberate. Almost all those associated with the two exhibitions had worked on wartime scientific developments, including radar, strategic bombing, and ultimately the atomic bomb.¹³ By contrast, as we shall see, C. P. Snow, who had been involved with the recruitment of scientists for government positions throughout the war, thereby connecting first-hand with the major contribution research science made to the “gadgets” and strategies that eventually won the war, spoke openly about it.¹⁴

There could hardly be a clearer example of deliberate amnesia than in the case of the chairman of the Festival of Britain Committee, General Hastings Ismay, who had been created Lord Ismay for his wartime services in 1947 and who chaired the Festival Committee from 1948 to 1951. Lord Ismay had been Winston Churchill’s chief military assistant during the Second World War and was a close personal friend. He later served as the first secretary-general of NATO from 1952 to 1957. He had been at Churchill’s side throughout the war, advising him on all strategic military matters, and ultimately (in conjunction with Lord Cherwell, of whom more shortly) endorsing the decision to drop atomic bombs on Hiroshima and Nagasaki on the grounds that this would bring the war with Japan to a swifter end.¹⁵

The editor of the *News Chronicle* and prime mover behind the Festival of Britain published his open letter calling for a celebration of British achievements past, present, and future (which I referred to earlier) little more than a month after the second Allied atomic bomb was dropped

13. “Scientists advising on the Science Exhibition were also working simultaneously on internationally significant projects. One of the Festival’s Science panel, Sir Wallace Akers, was key to secret atomic development in Britain. . . . Another member of the Festival’s science committee, Sir Edward Appleton, was from 1941 also a member of the committee of the War Cabinet that advised the government that manufacture of an atomic bomb was feasible. Festival Science Committee member Sir Ben Lockspeiser was in 1946 appointed Chief Scientist of the Ministry of Supply. In this role he masterminded British research into problems of nuclear physics, supersonic flight and guided weapons.” Atkinson, *Festival of Britain*, 121.

14. “There are about fifty thousand working scientists in the country and about eighty thousand professional engineers or applied scientists. During the war and in the years since, my colleagues and I have had to interview somewhere between thirty to forty thousand of these—that is, about 25 per cent.”

15. In his own memoirs, though, Ismay records that he had had a “feeling of revulsion” on hearing that the bomb had actually been dropped. Confirmation of Lord Ismay’s being perceived as a military man is provided by the opening paragraph from the *New York Times* of March 13, 1952, announcing his appointment as the first secretary-general of NATO: “LONDON, March 12—General Lord Ismay, a British soldier with vast experience in military planning, strategy and administration, was appointed tonight to the new post of Secretary General of the North Atlantic Treaty Organization.” His prominent Festival of Britain role has already disappeared, and he is once more the military commander.

on Nagasaki.¹⁶ It is hard not to feel that as the enormity of the—as then largely uncomprehended—consequences in terms of civilian casualties (and the horrific nature of longer-term deaths and injuries) emerged, they cast a shadow over Gerald Barry’s forward-looking agenda.¹⁷ If science was to be represented as holding the key promises for Britain’s future, he must surely have believed it ought to be a science that was not associated with the horror of the unimaginable scale of human casualties and suffering of those final weeks of the war with Japan.

It was, I suggest, in suppressing the connection between the wartime activities of research scientists and their activities in peacetime that the organizers of the Festival of Britain created a confusion at the heart of subsequent discussions among administrators and educationalists concerning the place science should have in British life and thought as a whole (particularly in education), and its role in Britain’s hopes of postwar greatness.



At the end of the Second World War there was already, I am suggesting, ambivalence in high places toward the proposition that national cohesiveness, pride, and progress depended upon a strong commitment to science and technology and an educational framework that drew together the traditional humanities and the new science.

As a result, there is a detectable failure of political nerve around 1950, which is tangible in the realization of the Festival of Britain, in spite of its alleged science and technology emphasis. In the end, the festival’s lasting impact was largely in the form of science-influenced design (still to be seen in the fabric designs on the London Underground), rather than a serious new initiative in yoking together business, technology, and science as part of a new, innovative British culture.¹⁸

Meanwhile, the period between the end of the war in 1945 and 1959, when Snow delivered his two-cultures lecture, was one during which successive governments seem to have lost confidence in the need to introduce

16. *News Chronicle*, September 14, 1945.

17. For a sobering example of the kind of account available by the late 1940s of what had taken place in Hiroshima and Nagasaki, see J. Hersey, *Hiroshima* (New York: Alfred A. Knopf, 1947), first published in the *New Yorker* in 1946.

18. It became clear in the panel discussion that followed these lectures that these British feelings of ambiguity toward science as harbinger of progress, in the aftermath of Hiroshima and Nagasaki, were not shared in the United States during the same period. I am extremely grateful to Daniel J. Kevles, Stanley Woodward Professor of History at Yale University, for his perceptive comments on the disparity between US public opinion in the 1950s concerning both the use of atomic bombs at Hiroshima and Nagasaki and the future of science as a force for good.

a strong strand of science into the school curriculum, opting instead for a traditional version of elite education and a defining national culture built on the classic canon of humanities, as part of an agenda for rebuilding the nation. This trend was briefly interrupted by the five-month razzmatazz of the Festival of Britain—during which almost eight and a half million people visited the South Bank Exhibition and more than two hundred thousand the South Kensington Science Exhibition.

Even so, the entertainment of the South Bank Exhibition and associated Battersea Pleasure Gardens attracted a dramatically larger (and broader) audience than did the one at South Kensington, where the new pure fields of particle physics and molecular biology were explained in terms the general public could enjoy and understand. At South Kensington, we might note, the team of scientists and designers who came together to create a version of science that would be attractive and entertaining to the widest possible general audience included several of the scientists who would later attempt to steer the Labour Party toward a more integrated arts-science outlook, and whom we met in my last lecture. Indeed, the text of the South Kensington Exhibition catalog was written by none other than Bronowski, who wove his arts-science, two-cultures agenda (whose emergence I discussed in my first lecture) into the very fabric of the festival:

Key to the organisation of the Festival's Science Exhibition was Polish émigré scientist Jacob Bronowski, who wrote the exhibition catalogue and uniting captions, steering its conceptual framework. As Scientific Deputy to the British Chiefs of Staff Mission in Japan in 1945 Bronowski had written the extremely influential report, *The Effects of the Atomic Bombs at Hiroshima and Nagasaki*. Bronowski's *The Common Sense of Science*, a philosophical discussion of the potential of science to benefit nations and, at the same time to be used for malign purposes by its politicians, was produced in the same year as his work on the Festival.¹⁹

With the exception of the Festival of Britain, the postwar mood in Britain tended toward a nostalgic yearning for the “world we have lost” in its aspiration to widen access to knowledge and all things intellectual. Initiatives for raising the ambitions of the population like the Third

19. Atkinson, *Festival of Britain*, 121.

Programme (which began broadcasting in September 1946) were grandiose in their determination to offer a wide audience among the British general public a diet of high culture. But the broadcast content of that culture was resolutely traditional—the BBC goal was a new inclusiveness in old cultural terms, for its broadened audience. Here, for example, is how the then director-general of the BBC describes the purpose of the new Third Programme in the *Radio Times*:

The Third Programme will have no fixed points. It will devote to the great works the time they require. It will seek every evening to do something that is culturally satisfying and significant. It will devote occasional series of evenings to some related masterpieces, a Shakespeare historical cycle, all the Beethoven quartets, or a series of Mozart operas. It will, so far as circumstances permit, be international. Concerts, operas, plays will be taken from abroad as landline conditions improve. Its talks will include contributions from the great European thinkers. Its whole content will be directed to an audience that is not of one class but that is perceptive and intelligent.²⁰

The civilizing power of art and music was to bind the classes together into a “perceptive and intelligent” whole, poised to move forward into a new age of promise. And in the classroom, in a new era of free education for all (following the 1944 Education Act), this humane initiation into what had traditionally been an entirely elite sphere was held up as the gold standard to which the talented grammar school girl or boy might aspire.

The period 1939–45 had shown clearly that there were crucial life-and-death decisions to be made by those in high places for which a traditional education, however civilized, was not an adequate or sufficient preparation. It is worth pointing out that to a significant extent, the intellectual muscle behind crucial wartime applications of the so-called scientific revolution had come from immigrants from eastern Europe. One can detect not a little unease about this within the British establishment in the early 1950s, particularly as these same names appeared again as the driving forces behind the innovative components in the Festival of Britain.²¹

20. See Humphrey Carpenter, *The Envy of the World: Fifty Years of the Third Programme and Radio Three* (London: Weidenfeld & Nicolson, 1997).

21. See, for example, the letter of October 11, 1948, from the distinguished scientist A. V. Hill (who had worked on radar with Blackett and Tizard during the war) to Sir Henry Dale, former president of the Royal Society, concerning selecting a scientist for a British Council lecture tour of New Zealand. Hill expresses incredulity at the thought that a man

In the new Britain, how were those who had risen to the top of society through an arts education and a sophisticated engagement with great art and literature to decide whether to authorize public expenditure on, for example, the hydrogen bomb or the peacetime use of nuclear energy? How, indeed, were those at the government level charged with rebuilding British peacetime industry to make choices about where to concentrate investment or those in charge of the new National Health Service to decide what medical research areas to fund?

This is the context for Snow's two-cultures lecture. Behind the Oxbridge anecdotes that so infuriated Leavis, there lies a serious, not to say urgent, question: how are informed decisions to be made about matters as important as the development and use of nuclear weapons (or, in our own time, to decide on strategies designed to save the entire planet from man-made destruction), if successive governments stress the humanizing effects of traditional high culture, and if the education required to enter the governing elite does not include scientific training?²²



As I have said, the shape of Snow's argument in *The Two Cultures* is blurred by its tone and muffled by the subsequent ill-natured controversy. For confirmation that this is indeed the debate Snow wanted to launch, we can turn to the fuller treatment he gave to his theme a year after he delivered the infamous two-cultures lecture, in a series of lectures he gave at Harvard, entitled "Science and Government."

We live, Snow writes in *Science and Government*, in times when vital political decisions have to be made for which specialist scientific understanding is essential, but for which those charged with making the decisions have not been prepared: "One of the most bizarre features of any advanced industrial society in our time is that the cardinal choices have to be made by a handful of men: *in secret*; and . . . *by men who cannot have a first-hand knowledge of what those choices depend upon or what their results may be*" (emphasis added).²³

with a foreign name (Bronowski or Polanyi) might be sent to represent Britain. RS Dale Papers, HD 8 8 1 2 31.

22. We get an intimation of the serious matter on page 17 of the printed text: "The two cultures were already dangerously separate sixty years ago; but a prime minister like Lord Salisbury could have his own laboratory at Hatfield, and Arthur Balfour had a somewhat more than amateur interest in natural science. John Anderson did some research in inorganic chemistry in Leipzig before passing first into the Civil Service, and incidentally took a spread of subjects which is now impossible. None of that degree of interchange at the top of the Establishment is likely, or indeed thinkable, now." Snow, *The Two Cultures*, 17.

23. Snow, *Science and Government*, 1.

He has in mind decisions that “determine in the crudest sense whether we live or die,” and he names some of them. In recent British history, they have included “the choice in England and the United States in 1940 and 1941, to go ahead with work on the fission bomb: the choice in 1945 to use that bomb when it was made: the choice in the United States and the Soviet Union, in the late forties, to make the fusion bomb: the choice, which led to a different result in the United States and the Soviet Union, about intercontinental missiles.”²⁴

Snow goes on to include under his “live or die” rubric all significant decisions made in the public sphere that involve choices that ought to be informed by fundamental scientific understanding: “It is in the making of weapons of absolute destruction that you can see my central theme at its sharpest and most dramatic, or most melodramatic if you like. But the same reflections would apply to a whole assembly of decisions which are not designed to do harm. For example, some of the most important choices about a nation’s physical health are made, or not made, by a handful of men, in secret, and . . . by men who normally are not able to comprehend the arguments in depth.”²⁵ In the body of the “Science and Government” lectures, Snow dramatizes what it means for a “handful of men” to make decisions vital for the nation, using as his example a real-life confrontation between two erstwhile friends and scientific colleagues, during the war. His hero and villain are, respectively, the chemist Henry Tizard and the physicist Frederick Lindemann, better known by his later title of Lord Cherwell. Both were high-level wartime scientific advisers entrusted with decisions on the strength of which the war might have been won or lost. Tizard was responsible for the accelerated development of radar in the early war years; Snow credits him with being particularly quick to grasp the importance of radar as vital for national defense, facilitating its development, and making a crucial contribution to winning the war.²⁶ Lindemann set up the statistical office among whose calculations crucial for the war effort were those on how to achieve the maximum impact with bomb sizes and delivery.

Ultimately, however, it was Lindemann, Lord Cherwell, who became Churchill’s closest scientific adviser and who persuaded Churchill to

24. Ibid.

25. Ibid., 1–2.

26. On Tizard and the wartime development of radar, see S. Phelps, *The Tizard Mission: The Top-Secret Scientific Mission That Changed the Course of World War II* (Yardley, PA: Westholme, 2011).

adopt the strategic bombing initiative for the second half of the war—mathematically calculated saturation bombing of civilian targets in dense urban areas (the top-secret organization for which Bronowski worked between 1942 and 1945).

Tizard and Cherwell fell out conclusively, Snow recounts, in 1942, over the policy decision to adopt the statistical office's calculations in support of strategic bombing. In spite of considerable, well-documented, internal opposition, Cherwell took direct personal responsibility for the scientific paper that formed the basis for that decision:

It described in quantitative terms [Snow writes], the effect on Germany of a British bombing offensive in the next eighteen months (approximately March 1942–September 1943). The paper laid down a strategic policy. The bombing must be directed essentially against German working-class houses. Middle-class houses have too much space round them, and so are bound to waste bombs; factories and “military objectives” had long since been forgotten, except in official bulletins, since they were much too difficult to find and hit. The paper claimed that—given a total concentration of effort on the production and use of bombing aircraft—it would be possible, in all the larger towns in Germany (that is, those with more than 50,000 inhabitants), to destroy 50 per cent of all houses.²⁷

The issue here, Snow hastens to explain in his Godkin Lecture, is not the ethics of the proposal (though by 1960 he admits the reader is likely to find a discussion like this morally distasteful): “it was his calculations.”²⁸ It was the assumptions made for statistical purposes, and the mathematics itself, that formed the basis for the quarrel with Tizard: “The paper went to Tizard. He studied the statistics. He came to the conclusion, quite impregnably, that Lindemann's estimate of the number of houses that could possibly be destroyed was five times too high. . . . Everyone agreed that, if the amount of possible destruction was as low as that calculated by Tizard . . . the bombing offensive was not worth concentrating on. We should have to find a different strategy.”²⁹ In fact, Snow tells his

27. Snow, *Science and Government*, 48. The copy I own belonged to the author, media personality, and journalist Malcolm Muggeridge (1903–90). This is one of only two passages he has marked in the entire book, and he indexes it again on the back inside cover.

28. *Ibid.*, 49.

29. *Ibid.*, 49–50.

1960 Harvard audience, “the bombing survey after the war revealed that [Cherwell’s estimate] had been ten times too high.”³⁰

But Cherwell was the man at Churchill’s side, and he convinced him that strategic bombing was the right policy to pursue. For the remainder of the war, airpower that was badly needed in other areas—for example, to escort essential convoys of supply ships or to defend the British coastline—was diverted to concentrate on “saturation” aerial bombardments of Germany. In *A Postscript to Science and Government*, published a year later in 1962, Snow quotes from an article published in the *Scientific American* in 1961 by another of the scientists who had disagreed with Cherwell’s calculations about the effectiveness of his strategic bombing policy, in light of postwar analysis, the Nobel Prize-winning physicist Patrick Blackett (who, we recall, was a key member of the Brumwell-Gaitskell group, advising the Labour Party during this same period):

Without a doubt the area-bombing offensive was an expensive failure. About 500,000 German men, women and children were killed, but in the whole bombing offensive 160,000 US and British airmen, the best young men of both countries, were lost. German war production went on rising. . . . I confess to a haunting sense of personal failure, and I am sure that Tizard felt the same way. If we had only been more persuasive and had forced people to believe our simple arithmetic, . . . might we not have changed this decision?³¹

As scientific adviser to the prime minister, Lord Cherwell’s view prevailed. The opponents to strategic bombing were silenced, according to Snow, because one man, trusted by the prime minister—a prime minister without sufficient understanding of mathematics to agree with or disagree with the calculations on the basis of which the decision was to be made—was given the final say. No one, however expert and highly regarded, should ever be allowed that amount of license without other presentations of evidence and other argued positions being reviewed and considered before a decision was finally made, according to Snow: “If you

30. In his *Postscript to Science and Government*, Snow gives chapter and verse confirming this from the postwar four-volume history of the strategic bombing offensive, *The Strategic Air Offensive against Germany, 1939–1945*, by Sir Charles Webster and Noble Frankland (London: HM Stationery Office, 1961). Debate continues on which of the two men was right on this and other issues, but I am inclined to agree with Snow.

31. M. S. Blackett, “Tizard and the Science of War,” *Nature* 185 (1960): 647–53; *Scientific American*, April 1961, cit. Snow, *Postscript*, 29–30.

are going to have a scientist in a position of isolated power [Snow concludes], the only scientist among nonscientists, *it is dangerous whoever he is*. This was the lesson which burnt itself in upon many during the controversies of 1939–1945: whoever he is, whether he is the wisest scientist in the world, we must never tolerate a scientific overlord again.”³²

Snow is not here advocating government by teams of scientific experts (what in England at the time were known as “boffins”), or a society defined by its mastery of military hardware and associated science and technology, like the Soviet Union. He has a clear sense, on the basis of his own experience, of the way that, in government, advisory committees of informed individuals can work together toward a consensus—or at least informed disagreement. But their capacity to deliver agreed verdicts in matters of science, on which decisions can reliably be based, depends on there being enough of them who understand how scientific argument works.

Snow maintains that all those in positions of power and influence ought to be able to evaluate proposals put to them that involve science and technology. It may not be possible for them to master the arguments themselves, but they must be surrounded by those with a good-enough scientific background to follow the reasoning processes by which the proposed course of action was arrived at. The way to achieve this, says Snow, is to include science alongside art and literature, at the heart of the education received by everyone.³³

Here, then, is an argument that not only deserved to be taken more seriously in 1959, but continues to be of relevance today. More than a half century later, Snow’s ominous prophecy of a governing class lacking the competence to make informed policy choices where science and technology are concerned continues to reverberate. In recent debates about genetically modified crops, nuclear energy, and climate change, the public at large—and I include governments and senior administrators—has shown themselves liable to be swayed by the most persuasive of the advisers or interest groups, because they are not equipped with the knowledge

32. Snow, *Postscript*, 35.

33. Snow does, however, suggest in his conclusion that only the scientifically trained can actually contribute to a viable future Britain. See Snow, *Science and Government*, 80–83. I had an interesting discussion with Richard C. Levin, Frederick William Beinecke Professor of Economics and president of Yale University, following my Tanner Lectures. He maintained that in the field in which currently there is a gulf between public and professional understanding—economics—modern committee structures within government do provide balanced views on which administrators can base their decision making. I am certainly prepared to concede that things are not as bad in this respect as in the 1950s.

or the intellectual strategies needed to judge for themselves either the soundness of the scientific arguments or the data that support them.³⁴



For my conclusion, to drive home Snow's all-too-relevant message, let me return to the postwar period in which Snow framed his original so-called two-cultures argument, for one last story to underline the gravity of the situation he addressed, as he understood it.

In March 1945, as it became increasingly clear that the US government was inclining toward the use of the newly developed atomic bomb, Albert Einstein wrote a letter of introduction to President Roosevelt on behalf of the most senior scientist working on the secret development of the bomb, Leo Szilard.

It was Szilard who had discovered the nuclear chain reaction that led directly to the development of the atom bomb and he who headed the secret wartime Manhattan Project. I suspect Szilard's attempted interventions to try to prevent the use of the atomic bomb in 1945 may actually have been in Snow's mind as he wrote his two-cultures lecture. Szilard was working on the Second Law of Thermodynamics when war broke out, and he, like all his physicist colleagues, turned his attention to weapons of war. It was, of course, the Second Law of Thermodynamics that Snow chose as his example of a scientific reference that arts dons would be comfortable to admit they knew nothing of, and certainly did not understand.

Szilard had become increasingly concerned that those in government did not understand that the atomic bomb was not simply a bigger bomb, delivering a greater destructive payload, but was an explosive device of an entirely different kind and order, whose consequences were, according to Szilard's scientifically informed understanding, unthinkable if used against a civilian population.³⁵

In his letter, Einstein explained that because of the secret nature of Szilard's work, neither he nor Szilard was in a position to explain to the

34. For a detailed account of the absence of scientifically competent (let alone trained) members of the current British House of Commons, see M. Henderson, *The Geek Manifesto: Why Science Matters* (London: Bantam Books, 2012). See also his *Times* newspaper article, October 8, 2009.

35. For the full story of Szilard's and Einstein's attempts to dissuade Roosevelt and Truman from using the atomic bomb against Japan, see R. Rhodes, *The Making of the Atomic Bomb* (New York: Simon & Schuster, 1986). There is an equivalent story of Niels Bohr's unsuccessful attempt to intervene with Churchill in early 1945. See, for example, "Niels Bohr: Spurned Prophet of Arms Control," *Bulletin of Atomic Scientists* (November 1986): 41-45, consulted online.

president quite how catastrophic the use of the bomb on civilian targets would be—catastrophic beyond what was imaginable to anyone without firsthand access to and understanding of the science behind it. He therefore urged Roosevelt to see Szilard in person and hear his concerns firsthand. His letter ends like this:

The terms of secrecy under which Dr. Szilard is working at present do not permit him to give me information about his work; however, I understand that *he now is greatly concerned about the lack of adequate contact between scientists who are doing this work and those members of your Cabinet who are responsible for formulating policy*. In the circumstances I consider it my duty to give Dr. Szilard this introduction and I wish to express the hope that you will be able to give his presentation of the case your personal attention. (emphasis added)³⁶

Einstein's letter states with particular urgency the matter Snow urges us all to consider. It is "the lack of adequate contact between scientists who are doing [the] work and those members of [the] Cabinet who are responsible for formulating policy" that poses the greatest danger of the wrong policy decisions being made in matters with a considerable scientific content.

It is one of the tragedies of the twentieth century that President Roosevelt died only two weeks later, before he had met Szilard (though an appointment with his wife, Eleanor, had been made). From Snow's perspective, President Truman's decision to use the bomb—twice—on civilian populations at Hiroshima and Nagasaki, the following August, was the most powerful example that could be produced of the absolute necessity for permanently and irrevocably bridging the two-cultures divide.



So what ought we to conclude from this? Not that the humanities should be consigned to the status of "unaffordable luxury" in favor of vocational, goal-oriented technical and scientific educations for all, as currently appears to be happening on both sides of the Atlantic. Rather, we in the humanities (and I am assuming that many of my readers fall into

36. Bronowski recalls a conversation he had with Szilard shortly after the bombs had been dropped: "I had not been long back from Hiroshima when I heard someone say, in Szilard's presence, that it was the tragedy of scientists that their discoveries were used for destruction. Szilard replied, as he more than anyone else had the right to reply, that it was not the tragedy of scientists; it is the tragedy of mankind."

that category) need to argue strenuously that the future of democracy—and I put it as strongly as that—depends upon our being able to sustain informed debate on science with scientists, without necessarily becoming specialists ourselves.

Informed debate is the staple of the humanities. It is not intuitive (though some might pretend so); it is a set of high-level skills honed in university humanities classrooms. It can address and include any area of knowledge as long as the practitioner can take it on board and master it sufficiently to argue the case for and against one line of action against another. As things stand, however, in my experience, high-level humanities graduates are comfortable confessing total ignorance of any area of thought that involves numbers, equations, or scientific formulas (just as Snow complained).

I am arguing here that we have not moved as far beyond the situation Snow so deplored in the early 1960s as he and his fellow thinkers like Bronowski would have hoped. We may be on the road to a broader and more general understanding of science and scientific argument, but we still have a long way to go. Still, let me close on an optimistic note, with a passage from Bronowski's *Science and Human Values*, for which Snow professed such admiration, which sums up what I have tried to argue here. Bronowski, unlike Snow, was ever the optimist and believed that eloquent encouragement from people like himself would eventually convince the public at large that Western civilization depended on the shared creativity of and understanding between science and the humanities:

The body of technical science burdens and threatens us because we are trying to employ the body without the spirit; we are trying to buy the corpse of science. We are hagridden by the power of nature which we should command, because we think its command needs less devotion and understanding than its discovery. And because we know how gunpowder works, we sigh for the days before atomic bombs.

But massacre is not prevented by sticking to gunpowder; the Thirty Years War is proof of that. Massacre is prevented by the scientist's ethic, and the poet's, and every creator's: that the end for which we work exists and is judged only by the means which we use to reach it. This is the human sum of the values of science. It is the basis of a society which scrupulously seeks knowledge to match and govern its power. But it is not the scientist who can govern society; his duty

is to teach [all members of society] the implications and values in his work.³⁷

APPENDIX

March 25, 1945

The Honorable Franklin D. Roosevelt
The President of the United States
The White House
Washington, D.C.

Sir:

I am writing you to introduce Dr. L. Szilard who proposes to submit to you certain considerations and recommendations. Unusual circumstances which I shall describe further below induce me to take this action in spite of the fact that I do not know the substance of the considerations and recommendations which Dr. Szilard proposes to submit to you.

In the summer of 1939 Dr. Szilard put before me his views concerning the potential importance of uranium for national defense. He was greatly disturbed by the potentialities involved and anxious that the United States Government be advised of them as soon as possible. Dr. Szilard, who is one of the discoverers of the neutron emission of uranium on which all present work on uranium is based, described to me a specific system which he devised and which he thought would make it possible to set up a chain reaction in unseparated uranium in the immediate future. Having known him for over twenty years both for his scientific work and personally, I have much confidence in his judgment and it was on the basis of his judgment as well as my own that I took the liberty to approach you in connection with this subject. You responded to my letter dated August 2, 1939 by the appointment of a committee under the chairmanship of Dr. Briggs and thus started the Government's activity in this field.

The terms of secrecy under which Dr. Szilard is working at present do not permit him to give me information about his work; however, I understand that he now is greatly concerned about the lack of adequate contact between scientists who are doing this work and those members of your

37. Bronowski, *Science and Human Values*, 70-71.

Cabinet who are responsible for formulating policy. In the circumstances I consider it my duty to give Dr. Szilard this introduction and I wish to express the hope that you will be able to give his presentation of the case your personal attention.

Yours very truly,

Albert Einstein³⁸

38. http://www.nuclearfiles.org/menu/library/correspondence/einstein-albert/corr_einstein_1945.