

Introduction: Some Significances of the Two Cultures Debate

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The notion of the existence of two opposed cultures, one literary and one scientific, has a long pedigree going back to nineteenth century. However, it was C.P. Snow's formulation of the idea in 1959 and F.R. Leavis's 1962 critique, which brought it to the fore in cultural discourse, where it has more or less remained ever since. The papers in this special double issue of *Interdisciplinary Science Review* examine the debate and its legacies from a variety of perspectives, while this introduction seeks to contextualise the issues raised and draw some contemporary lessons.

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At the end of February 2016 *The Observer* published an article by the newish President of the Royal Society of London, Deputy Director of the Laboratory of Molecular Biology in Cambridge and Nobel Prize winner, Sir Venki Ramakrishnan. Entitled 'Today, scientific awareness has never been more essential', he began by recounting what happens to him at parties when telling people that he is a scientist. He quickly sees 'the first sign of panic and disengagement' and changing the topic of conversation to literature or music. Put differently he was complaining that the latter are seen as a part of general culture while science, in his view, is not.¹ While that might be his experience of parties in Cambridge, it is certainly not universal, and a scientist should certainly know better than to draw general conclusions from the observations of a single individual. I found this article irritating due, in part, to a *déjà vu* feeling of somehow having slipped back to 1980, but mainly because that weekend I happened to be staying in a 14th-century country house where one of the principle topics of conversation was engineering and its history.

Ramakrishnan repeated his party story a week or so later in his Radio 4 'Life Scientific' interview with Jim Al-Khalili, so one is forced to accept that he really believes it. But perhaps, on reflection, it should not be found too surprising that the head of one of the world's oldest learned societies should express such dated views. Ramakrishnan was nominated for the Presidency in

March 2015 (six months later than would have been expected from the practice in recent election cycles). The previous month the physicist Brian Cox had been appointed the Society's first Professor for Public Engagement in Science, an appointment which guaranteed that the Society would resume its top down or deficit model of public engagement, asserting science was a special form of knowledge both in its content and methods of acquisition, though quite how the latter differs substantially from history, say, is not specified. The Royal Society of London's previous efforts in public engagement, mostly through the Committee on the Public Understanding of Science (COPUS discussed by Lock) came to a shuddering halt at the end of the 1990s in the wake of the public perceptions of the problems surrounding bovine spongiform encephalopathy, genetically modified organisms, global climate change and the measles, mumps and rubella vaccination. In February 2000 the House of Lords Select Committee on Science and Technology referred to a public crisis of confidence and trust in science.² Given the significant resources allocated to COPUS during the previous fifteen years the intellectual bankruptcy of the top down model was well evinced. Changing the word 'understanding' to 'engagement' without the Society making a fundamental ideological change in direction and attitude towards the public (neither of which are in evidence) simply does not solve the problem, which we know from the COPUS fiasco, cannot be achieved by a top down approach.³ Cox was made aware of what had happened in the 1980s and 1990s so quite how his views mesh with his assertion that 'above all we must promote reason above opinion' is not immediately apparent.⁴ Overall both stories provide evidence that the scientific community suffers from a collective historical amnesia about past efforts to link science, society and culture. It is not clear, whether this condition is intentional or just due to lack of knowledge or interest.

Although they may not be fully conscious of it both Ramakrishnan's party experiences and Cox's top down promotion of science are both framed in a supposed gulf between scientists and literary intellectuals that was termed the 'Two Cultures' by C.P. Snow, former chemist turned bureaucrat, novelist and pundit. The term may have been invented by Snow and the X-ray crystallographer and Nobel Prize winner Lawrence Bragg in the course of a train journey between Cambridge and London (Cole), but it was first used by Snow in a *New Statesmen* article published at the time of the Suez crisis in the autumn of 1956.⁵ Three years later he used it as the title for his 1959 Rede lecture to the University of Cambridge, which following an attack, nearly three years later, by the Cambridge literary critic Frank Leavis, the virulence of whose language still shocks to this day,⁶ provoked one of the major post-1945 cultural rows in Britain, excellently recounted by Ortolano (2009). It would seem that Leavis's intervention gave traction to Snow, his lecture and the term. Those who attended the lecture don't seem to have been overly impressed at the time and certainly did not anticipate the significance it would come to have. Martin Rudwick recounts his

puzzlement as to why he as a practicing geologist should know about thermodynamics to be counted as scientifically literate (Rudwick), while the geneticist Walter Bodmer didn't believe in the existence of the cultural divide Snow proposed and thought the call for more technologists was known by everyone but that Snow did make 'the obvious a little interesting!'.⁷

At one level it might seem extraordinary that a debate initiated nearly sixty years ago can still provoke strong views, as some of the papers published here indicate. But such longevity suggests the existence of underlying issues, which have not gone away. These include the anxiety of scientists about the place of science in culture and society (evinced by Ramakrishnan's *Observer* piece) and Britain's place in the world. It was scarcely a coincidence that Snow's first outing of the idea was during the lead up to the Suez crisis. This Anglo-French-Israeli invasion of Egypt demonstrably and unambiguously showed that British power had declined irreversibly and this probably explains the narrowly parochial outlook of the later lecture. The agonised debates unleashed after Suez about what Britain's post-imperial role in the world should be have never been resolved and show little prospect of being so (I am writing this in the midst of the EU referendum campaign). Both these underlying issues suggest a strong sense of insecurity and anxiety throughout large sections of British culture and society. Given all that, we should perhaps be less surprised that the issues surrounding the two cultures still retain significance and substance as all the papers in their different ways illustrate.

In many ways, Snow was actually an ideal person to give early expression to Britain's sense of insecurity and anxiety. Coming from a lower middle class family in Leicester, a provincial town in the English midlands, Snow displayed the abiding insecurity of members of that class who had moved socially upwards. Via Alderman Newton's School and University College, Leicester, he made his way in 1928 to Cambridge University where he became a tutor at Christ's College and a not especially good physical chemist – hence his interest in thermodynamics. He attracted the attention of Bragg following the latter's appointment as Director of the Cavendish Laboratory in 1938. Thereafter, despite having no formal connection, Snow attached himself to the Cavendish and wrote glowingly of it and the physics research undertaken there. For Snow, despite his own experiences as a researcher, Cavendish physics became the epitome of what science should be – a view that pervades both his Two Cultures lecture and his *Strangers and Brothers* novel series. In this sequence of eleven novels, published between 1940 and 1970, Snow makes his alter ego, Lewis Eliot, a lawyer rather than a scientist which might have been expected given Snow's cultural position. The inference one might draw is that in the late 1930s Snow believed (wrongly as it turned out) that, as a scientist, he would not be able to expect the career trajectory he had in mind for Eliot. Much more realistic,

therefore, to make Eliot a lawyer, a traditional route into the higher echelons of the civil service and politics. That Snow's view of science and its career opportunities became somewhat at odds with his experience in that he sought to make his own story better than it was, does suggest a degree of personal insecurity.

There is a tendency by non-historians to view issues and ideas, such as the Two Cultures, as timeless (which some recent work in intellectual history unfortunately supports). Ortolano's meta-theme of his paper opposes this trend by showing that Snow's role in the Two Cultures can only be fully understood in terms of the changing meaning of liberalism in twentieth-century Britain. By the 1970s liberalism had so transformed itself that Snow came to appreciate that he was out of political sympathy with the social changes that had been wrought. It is doubtful, however, that had he lived a year or two longer, Snow would have left the Labour Party to join the breakaway Social Democrat Party; he profoundly disagreed with Shirley Williams who as Secretary of State for Education and Science had implemented comprehensive secondary schooling to which Snow was firmly opposed – he got into serious political trouble for sending his son to Eton.

All this was tied up, as Ortolano discusses, with Snow, a committed technocrat, developing a serious dislike of modernist authors such as James Joyce, D.H. Lawrence, members of the Bloomsbury group such as Virginia Woolf, and others, all of whom he regarded as opposed to material progress which could only be delivered through having more scientists and technologists. He emphasised this point in *Strangers and Brothers* when characterising Austin Davidson, the high Bloomsbury future father-in-law of Lewis Eliot. Snow, using Eliot's first person voice, satirised Davidson for his difficulties about using a telephone: 'Davidson, who was so often the spokesman of the modern, whose walls were hung with the newest art, had never come to terms with mechanical civilization' (Snow 1956, ch.37). Snow's intellectual descendants, such as the science journalists Colin Tudge and Michael Kenward, have maintained this hostility to literary intellectuals referring to publications of Vita Sackville West's posthumous letters or Lawrence's annotated laundry lists (Lock) (despite the former being an impossibility and I, at least, have never seen the latter).

Snow and Leavis appear to have shared one assumption, namely the belief that literature and culture were the same thing. Snow hardly ever expresses any interest in the visual arts, music or architecture; presumably he approved the modernist architecture of Churchill College, Cambridge, which Ortolano points out was the material instantiation of Snow's ideological outlook. Snow's antipathy towards literary modernism and his indifference to other arts goes a long way to explain why did not understand that his (self-defined) cultures were far from divided both in the past and during his lifetime. Two of the papers here (Field and Ambrosio) deal specifically with the visual arts,

but identical points could as easily be made for literature.⁸ Field points out that terms such as art, science, architecture etc, had rather different meanings in the Renaissance than those that apply today. These differences mean that those figures, such as Piero della Francesca or Leonardo da Vinci, who look from today's perspective as if they were working across Snow's cultures, were doing no such thing, but operating within the conventions of their own day. Even though it may make it more difficult to understand how past events have affected us, it is always misleading, sometimes dangerously so, to read the past in terms of today's categories, as Snow conspicuously did in his lecture. On a proper historicist reading at least we would not have the nonsense that Leonardo invented the helicopter!

In the twentieth century, as Ambrosio shows, science and mathematics played a key role in modernist art, especially cubism – its very name after all invokes mathematical concepts. In particular Ambrosio discusses the influence on art of non-Euclidean geometry, the fourth dimension and X-rays. All this gives the lie to Snow's argument about intellectuals (literary or otherwise) not knowing anything about science; rather one could say that Snow knew very little about the modernists and science – cultural divides cut both ways after all.

So, aside from illustrating collective historical amnesia and contemporary ignorance, where did Snow's ideas come from? Very near the start of the lecture he commented:

Anyone with similar experience would have seen much the same things and I think made very much the same comments about them. It just happened to be an unusual experience. By training I was a scientist: by vocation I was a writer. That was all (Snow 1959, 1).

This overlooked his war work, something which until now has been rather opaque. Cole in his essay traces Snow's involvement, under Bragg's patronage, with the Central Register of scientists that started to be prepared in the summer of 1938 to meet the scientific needs for the coming war. Again Snow's own account of his role differs significantly from the actuality. Nevertheless, Snow's involvement with the Central Register was a crucial turning point in his career both from a practical and ideological viewpoint. He became part of a developing powerful coterie of civil servants, politicians and scientists which led to his appointment as a Civil Service Commissioner in 1945 and ultimately elevation to the House of Lords as junior Minister of Technology under Frank Cousins in Harold Wilson's first government of the mid-1960s (Ortolano and Ortolano 2009, 173-82). And his experience during the war also led him to the view that there was a need, both in war- and peace-time, to educate a larger number of people for the technical and specialist roles that modern industrial society required. Indeed in the wake of the debate he told Bragg that he thought his

lecture provided 'modest and practical educational proposals'.⁹ It was in the third section of his lecture that Snow made these proposals which were: 1. Train as many 'alpha plus scientists' as possible; 2. Educate a far larger number of 'alpha professionals'; 3. Produce an even larger number of technicians qualified to the standard of part I of the Cambridge Natural or Mechanical Sciences Tripos; and 4. Ensure that politicians and administrators 'know enough science to have a sense of what the scientists are talking about' (Snow 1959, 35-6). One does wonder how much he was influenced by Aldous Huxley's dystopian warning *Brave New World* (1932).

Of course technology (and engineering) had to be practically conducted by industry and Snow had difficulties with how scientists might be involved. For instance on 3 April 1944, he and Bragg had a meeting with the director of the GEC laboratories at Wembley, Clifford Paterson, to discuss his scientific manpower requirements. Snow told an incredulous Paterson that 'industry is such a place that no scientist wishes to go there unless compelled!'; Paterson was relieved to return to his 'cheery and buoyant colleagues and the inspiring atmosphere at Wembley' (Clayton and Algar 1991, 466). Quite how one should read this episode is not clear, especially as few months earlier Bragg and Snow had begun planning for the scientific manpower needs of industry after the war (Cole). Perhaps instead of scientists Snow meant alpha plus physicists, who, as his scientific ideal, should not sully themselves with such mundane matters as industry. Or perhaps he was failing to declare an interest, since from 1944 Snow also worked part-time for GEC's competitor, English Electric. Whatever the explanation, by 1959 Snow had come to see that in a technocratic society 'Industrialisation is the only hope of the poor' (Snow 1959, 24) and thus one of the reasons for training more scientists and technologists was to continue industrial expansion.

Snow, as a technocrat, took the view that world poverty would only be eliminated if 'trained scientists and engineers [were] adaptable enough to devote themselves to a foreign country's industrialisation for at least ten years out of their lives' (44-5). In other words Snow aimed to create a world entirely in the image of the technocratic Britain that he wanted to see. Of course the reality when different cultures meet is much more complex as Miller neatly illustrates in his study of the recent attempts to locate a major western scientific facility, the Thirty Meter Telescope, on Mauna Kea in Hawai'i. The ensuing and continuing controversy surrounding this project illustrates that the imposition of western ways of doing things no longer works, even in areas which have been subject to western political domination for significant periods. Perhaps, in view of the context provided by the Suez crisis, the spreading of western science and technology throughout the world was Snow's way of continuing British imperial power.

One problem with all of this, as Gosling, a physics graduate turned engineer, trenchantly argues in his paper, was that Snow misunderstood completely the relations between science,

engineering and technology, which immediately raises issues about their role in industry. Gosling is particularly offended by Snow's later suggestion that particle physics and aircraft design are much the same sort of activity. As a result Gosling believes that the two cultures episode resulted in some people becoming mediocre scientists rather than staying with technology. If this was so, then it illustrates that the row had profound significance to many individuals beyond those immediately concerned.

It must be a moot point whether Snow, a year and a half into the battle with Leavis, really believed that his lecture made modest proposals, if such they were, since it was his tests for scientific and literary literacy that provoked reaction:

A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking the scientific equivalent of: *Have you read a work of Shakespeare's?* (Snow 1959, 14 original emphasis and capitalisation retained)

On the following page he wondered whether the discovery of parity violation ('an experiment of the greatest beauty and originality') made a couple of years earlier by the particle physicists C.N. Yang and T.D. Lee had been discussed 'at every High Table in Cambridge'. Once again Snow's concentration on physics and the mores of Cambridge socialising formed the basis for his general concerns.

Consequences of the row included numerous attempts to 'bridge' the divide between the cultures. Haste looks at one such attempt to create a third culture and in the process reminds us that the issues at stake were not restricted to the parties of the chattering classes but had profound political and epistemological implications. In terms of politics Ortolano, Lock and Haste all point out the significance of Snow, through his network, in forming Labour Party policy and not just in science. Harold Wilson's speech to the 1963 party conference in Scarborough (his first as leader) is shot through with Snowian technocracy and attitudes to industrial management. The new socialist Britain would 'be forged in the white heat of this [scientific] revolution' (Pimlott 1992, 304). The scientific revolution to which Wilson referred was not that of the seventeenth century popularised by Snow's former protégé the historian of science Rupert Hall (1954). In this case the term, appropriated by Snow for the subtitle of his lecture and copied by Wilson, referred to the twentieth century (Rudwick). Snow became Minister of Technology the following year.

In terms of epistemology, Haste examines the work over the past decade or so of, among others, John Brockman, John Joe McFadden and Al-Khalili which argues that much of what we know from scientific research informs how we view our place in the world. The latter two scientists in their work on quantum biology point out that though what happens at the quantum level affects the macro level this may not happen in ways that might be expected, or indeed predictably, from conventional scientific knowledge. Such science, which has a strong popular following, will, if borne out, necessarily impact on how we understand the world and our place in it and suggests a possible return to natural philosophy, a term that fell out of fashion early in the twentieth century. Such approaches thus have the potential to combine aspects of the scientific and literary cultures, put in opposition by Snow, into a third culture.

Another approach which addressed the issues raised by the whole affair was the history of science and technology. The close link between the subject and the two cultures can be seen in the appointment of the Professor of the History of Science and Technology advertised by Imperial College in 1962: 'the first holder of the chair will have the opportunity to bridge one of the gaps between the humanities and the sciences'.¹⁰ The appointee, Hall, who despite his strong connection with Snow, was doubtful about the role assigned to history of science. He commented in his inaugural lecture that he preferred leaving bridge building to engineers.¹¹ Nevertheless, it is striking that in the next few years in addition to history of science groups already in existence at University College London and Cambridge University, new ones were also established at, among other institutions, the universities of Manchester, Leeds, Kent, Lancaster, Durham, Leicester, Bath, Aberdeen and Queen's Belfast. Although empirical research has yet to be undertaken on how and why most of these history of science groups came into existence, the timing does strongly suggest a close link, at least in some cases, with the two cultures debate. Once again its impact was substantive, not just rhetorical as the autobiographical accounts by Rudwick and Knight well illustrate. They both crossed from scientific training and practice to the history of science, but brought the knowledge and skills they had acquired to their history of science practice. In Rudwick's case this involved pioneering methods of visualisation in the history of science and showing the value of fieldwork in understanding and reconstructing the work of past geologists.

Despite much valuable teaching and research activity, history of science, unsurprisingly, failed to meet the cultural expectations placed on it and following the election of Margaret Thatcher as Prime Minister in 1979, the relationship of society, culture and science came to the fore, at least as far as the scientific community was concerned (Lock). Contrary to what Snow believed would happen when politicians were scientifically educated, the government led by Thatcher, who had read chemistry in Oxford in the 1940s, imposed drastic cuts on university and science budgets.

Besides the policies of the new government, other issues were also in play such as the retirement or death of scientists who had come to prominence as young men (and they were entirely male) in the war of 1939-1945 and who had then enjoyed long and powerful careers at the top of the scientific establishment and civil service. If they were replaced, it was not at the same level. The Royal Society of London responded to these challenges by establishing in April 1983 a committee chaired by Bodmer to enquire into the 'Public Understanding of Science'. The whole thrust of the Bodmer report showed, once again, the collective historical amnesia of significant sections of the scientific community. While the report contained fleeting references to scientists in the past who had popularised science, the report contained lines such as 'Scientists must learn to communicate with the public, be willing to do so, and indeed consider it their duty to do so' (Royal Society [of London] 1985, 6) as if this was an entirely novel insight. One consequence of such continuing amnesia is that nothing can be learned from the past, although this of course has the immediate effect of making the new practitioners look original, at least in their own eyes.

One outcome of the Bodmer report was the establishment of COPUS a joint committee of the Society, the Royal Institution and the British Association. Chaired initially by George Porter (for a while simultaneously Director of the Royal Institution and President of the other two organisations), he was followed by Bodmer, the developmental biologist Lewis Wolpert, and, finally, before its end, the former Director of the Wellcome Trust, Bridget Ogilvie. COPUS arranged a well-funded programme of varied activities (Lock, Haste) which led to renewed general discussion about the place of science in relation to society and culture and thus to a disinterment of the Two Cultures rhetoric and controversy, for example in the 1991 spat between Wolpert and the novelist Fay Weldon discussed by Lock.

The resurgence of such rhetoric took place in the new academic context of the development since the 1970s of science studies which partially displaced history of science in the allocation of resources, although there were close connections which remain. To a large extent developing the ideas proposed by the American physicist, turned historian and philosopher, Thomas Kuhn in his book *The Structure of Scientific Revolutions* (1962), science studies became associated, much to Kuhn's dismay, with ideas such as relativism, social constructivism and postmodernism stemming from the work of (mostly) French philosophers. Mediated through the work of scholars such as Bruno Latour, Stephen Woolgar, Harry Collins, Michel Foucault, Michael Lynch, Barry Barnes and Brian Wynne, such ideas challenged scientists' own perceptions (usually positivist) of their work, its epistemological status, as well as their place and function in society. Heated discussions developed (which became known as the "Science Wars") about who had the legitimacy to talk about science to the public, which seems to suggest a basic insecurity by scientists about their position. Despite

Wolpert announcing at the 1994 Loughborough meeting of the British Association that scientists had no interest in such matters, nevertheless he and other scientists spent considerable time and effort contradicting their science studies opponents (Lock).

Such turf wars reinforced popular ideas about the history of science. As Rudwick comments when he changed from being a geologist to an historian, some of his former colleagues told him that history of science was 'fit only for those who were senile or at least past being able to do intellectually serious research' that is retired scientists. In the media to this day there is a strong tendency to believe that only scientists (retired or otherwise) can comment publicly in non-specialist fora on the history of science or review books on the topic – one somehow doubts that the media would just go to politicians for the history of politics. Part of the problem here is that historians of science have not been able, despite their best efforts, to expunge the standard (whiggish) tropes about science or the history of science either from media discourse or from the general public. So, for example, there are constant popular references to entities called the scientific revolution or the industrial revolution or the two cultures or Renaissance man, a concept which Field argues is unhelpful to understanding the period. Related to such popular tropes are terms that many scientists love to use to describe their work such as breakthrough, cutting edge, blue sky, ground breaking, seminal etc, all of which both historians and sociologists of science have evinced in many many studies are meaningless at best. Until such terms and concepts disappear from the lexicon, it will be very difficult to sustain a properly informed discussion about science and its place in society and culture. If such linguistic change were achieved, however, we will then be well on the way to ensuring that everyone sees science as an integral part of culture with no need for top down dissemination or embarrassed conversations at parties.

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Note on guest editor

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¹ Venki Ramakrishnan. 'Today, scientific awareness has never been more essential', *The Observer*, 28 February 2016, p.35.

² House of Lords Select Committee on Science and Technology, *Report on Science and Society*, ordered to be printed 23 February 2000.

³ I should declare an interest here, since for most of the period I was a member of the COPUS executive committee which was an educative experience!

⁴ Brian Cox, endorsement of Henderson (2013).

⁵ C.P. Snow, 'The Two Cultures', *New Statesman*, 6 October 1956, pp.413-14.

⁶ F.R. Leavis, 'The Two Cultures? The Significance of C.P. Snow', *Spectator*, 9 March 1962, pp.297-303.

⁷ I am grateful to Sir Walter for providing me with an image of his diary entry 7 May 1959, the day of Snow's lecture.

⁸ For a more sophisticated view than Snow's of the relationship of modernist writing with science see some of the essays in Bud *et al.* (forthcoming). For other studies on the twentieth century which *inter alia* refute Snow's claims that science was not then part of mainstream culture see Forgan (1998), Boon (2008), Bowler (2009), Kirby (2011) and Jones (2014).

⁹ Charles Snow's secretary to Lawrence Bragg's secretary, 6 August 1963, RI MS WLB/93/S/89.

¹⁰ 'History of Science and Technology at the Imperial College', *Nature* 192, 1961, 1131. For the detailed background to this appointment see James (2012).

¹¹ A.R. Hall, 'Historical relations of science and technology', *Nature* 200, 1963, 1141–5.