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The Science Wars: who exactly is the enemy?

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For at least the past 5 years, an undeclared war has been raging in many university departments in the USA, the UK, and Europe. I write as a veteran of these 'Science Wars' that have now reached the shores of Japan. Are the Science Wars the equivalent of an intellectual World War or are they little more than a series of local guerilla incursions? What role, if any, should Japanese scholars take in them? I am here to argue that, to a large extent, the Science Wars are an outgrowth of specifically Western developments in the relationship between science, technology, and society—and that the Japanese situation offers a useful distance from which to critique the assumptions that inform the Science Wars.

The first salvo of the Science Wars was fired in 1992 with the publication of two popular works, one by an American physicist (Weinberg, 1992) and the other by a British biologist (Wolpert, 1992). These books included extended critical discussions of a group of historians, philosophers, and sociologists of science who, over the past quarter-century, have been challenging many taken-for-granted views about the nature of science. Ironically, Weinberg and Wolpert provided the first exposure of these scholars of 'science studies' (or 'STS', for 'Science, Technology and Society') to the general public. Soon thereafter, science studies was connected with other broadly academic leftist movements, such as feminism, postmodernism, and multiculturalism. Arguments traceable to science studies started to appear in science policy forums, especially as grounds for cutting the budgets of expensive research projects and even the enrolments in science courses. In 1994, a biologist and a mathematician, Paul Gross and Norman Levitt, published the first full-length work devoted to these developments (Gross and Levitt, 1994). They claimed to be part of the 'Old Left' (Marxists who protested the 'military-industrial complex' in the 1960s) who had become disillusioned with the seemingly pointless radicalism of today's academic left. Science studies was portrayed as part of the 'New Left', and a major source of cynicism about science's abilty to solve the world's problems.

Are these charges well-founded? To be sure, science studies scholars have shown, often in considerable detail, that when science is regarded as a concrete human practice, it displays all the features one would expect of other similarly endowed social, economic, and political institutions. Put most pointedly, they claim that it is difficult to specify empirically the distinctly 'rational', 'objective', or 'truth-oriented' character of the

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scientific mind. It is not that scientists are less rational than the rest of humanity; rather, they are not *more* rational. Whatever rationality science has displayed is the product of either specific features of its social organization (which enables concentrated periods of both teamwork and criticism) or the control that scientists exert over recounting their own history, which leaves the impression of an overall 'progress' that is lacking in other human activities. I do not deny that these are controversial claims that often aim to 'demystify' science. However, many science studies scholars have made these points in the spirit of encouraging scientists to be more modest in their own claims, so that the public is not led to believe in things that are unlikely to happen. The failure of science to live up to its own expectations has probably done more damage to science's social standing than any explicit criticism from non-scientists.

In 1994, I organized the first conference that brought together major representatives of both sides of the Science Wars into dialogue. The conference received enormous national publicity in the UK, but nearly 3 years passed before it was repeated, this time by physicists at the University of Kansas in the USA. In the interim had occurred an event which made negotiations very difficult. An obscure theoretical physicist, Sokal (1996), had managed to publish an article in a special issue of a leading American cultural studies journal which parodied the style of writing of several notable science studies scholars. In particular, the article inferred wider cultural significance from highly technical scientific concepts and even equations: Einstein's relativity theory was said to imply philosophical relativism; Heisenberg's uncertainty principle implied interpretive indeterminacy; chaoplexity implied the fragmented world of the post-modern condition; etc. Moreover, although Sokal's article was the most highly documented in the special issue, it included some fabricated sources from mathematics and physics, which could have been easily spotted by someone trained in these fields. But the editors neglected to submit Sokal's article to scientific 'peer review' because they found his line of argument so congenial. At least, this was the 'spin' that Sokal gave the situation when he revealed the article to be a hoax on the front page of *The New York Times* in May 1996.

Soon, many began to see the controversial character of science studies claims as marks of arrogance and incompetence. But, equally, Sokal's hoax raised more general issues about the level of trust needed for any organized form of inquiry to occur. Given the expense involved in reproducing most scientific experiments today, even the hardest of 'hard' scientists are forced to take most of what their colleagues say in print at face value. In other words, Sokal unwittingly found himself teaching science studies by example! This became very evident when conservative political groups in the US began supporting conferences on the Science Wars. Sokal quickly distanced himself from these groups because they used the 'socially constructed' character of science as grounds for influencing what academics teach and research. In particular, they aimed to banish all research that could not meet the test of the marketplace and all teaching that did not foster the nation's cultural values. By those criteria, both theoretical physics *and* science studies appear to be dubious social constructions. By the time I debated Sokal in Kansas, there was enough common cause between us against the conservatives that the significance of his hoax faded by comparison.

This last point is rather important because it underscores the extent to which 'science' is presumed to be a cultural value by *both* sides of the Science Wars. Admittedly, just based on journalistic coverage, one could easily conclude that the battle is between forces 'pro' and 'anti' science. However, none of the major academic participants in the Science Wars has ever claimed to be 'anti-science'. After all, even the

scholars parodied by Sokal stood accused of seeing too *much*, not too little, cultural significance in recent scientific developments. Rather, the dispute has been over what it means for an activity to be 'scientific' and which activities should be counted as scientific. Generally speaking, professional scientists use the term 'scientific' to capture certain ideals of inquiry, whereas science studies scholars aim to capture how science is actually practiced, 'warts and all', as it were. Of course, there is a more personal way of posing the question: Who speaks for science: only natural scientists and maybe engineers and medical doctors? Or perhaps also historians, philosophers, and sociologists of science? While this should not be an exclusive choice, the polemical character of the Science Wars has generally made it seem that way.

Before Japanese readers decide to take sides in the Science Wars, you need to understand their unique historical significance. Western academics who are not themselves scientists have generally regarded the natural sciences in one of two ways, one corresponding to the humanities and the other to the social sciences.

On the one hand, humanists have usually condescended to the natural sciences in the form of 'benign neglect', because they could not see the larger cultural significance of a form of knowledge so intimately tied to technology, manual labour, and the craft tradition more generally. Difficult as it may be to believe now, as recently as 100 years ago, Western humanists objected to the placement of laboratories on university grounds because of the unseemly sights, sounds, and smells emanating from them. Indeed, these prejudices were substantially challenged for the first time with Japan's defeat of Russia in 1905, since Westerners generally knew that the university system established under the Meiji Restoration had placed the natural sciences and engineering at the centre of academic life. Shortly thereafter, laboratories started to be welcomed in Western universities, alongside calls for the spread of scientific and technical training. Nevertheless, the old humanistic prejudices remained, especially in political circles, as evidenced in Snow's (1959) famous lecture on the 'two cultures', that is often cited as a precedent for the Science Wars.

On the other hand, social scientists have generally regarded the natural sciences as disciplinary role models, not to mention providers of principles for the rational governance of society. Here it is worth recalling that Auguste Comte, who coined both 'positivism' and 'sociology', argued that the natural sciences ought to replace the Roman Catholic Church as the source of world order. Although Comte wrote in the early 19th century, this 'sacred' view of science has lasted well into the 20th century. Robert Merton, who is often credited with having founded the sociology of science, never actually observed 'science in action', in the sense of studying the places where science is done. Rather, he generalized from the accounts of scientific practice given by distinguished scientists and philosophers from the past. This is akin to relying exclusively on the testimony of theologians and saints as evidence when studying the sociology of religion. Social scientists have been traditionally reluctant to study the natural sciences as they would other social practices because of the implications that their findings might have for the status of their own work as 'scientists'.

Under these circumstances, perhaps, you will not be surprised to learn that the first generation of science studies scholars were actually trained scientists who had become disillusioned with the science's failure to live up to its public image as an exemplary truth-seeking enterprise. This generation, which came of age in World War II, consisted of such luminaries as Thomas Kuhn, Paul Feyerabend and Stephen Toulmin. Each had participated in routine scientific work for the war effort in their respective countries—the US, Germany, and the UK—after having completed a first degree in physics. The

founders of science studies had originally become scientists in order to pursue natural philosophy by experimental means and, thereby, acquire a comprehensive understanding of reality. Such a motivation was shared by Newton, Maxwell and Einstein, but it was out of place in a scaled-up, fragmented scientific enterprise that had come to be driven by military-industrial concerns. The level of disillusionment only increased among scientists who came of age in the following generation, which coincided with the Cold War and the Vietnam War. Thus, the new, post-Merton sociology of science that has been the focus of the Science Wars was conceived by scientists such as Barry Barnes and David Bloor, who defined science studies as the application of the scientific method to science itself. Just as sociology had contributed to the secularization of religion, science studies would contribute to the secularization of science.

So far I have said little about the role of technology in the development of either science or science studies. This is because technology has not figured as an issue in the Science Wars and, until relatively recently, has not even figured as a prominent research topic in science studies. Here, Japanese readers should keep in mind the strong cultural distinction between science and technology that is still drawn in the West. Of course, no one denies that over the past 150 years science has been instrumental in the development of new technologies, and that technology has always been an inspiration for scientific inquiry. But, the histories of science and technology are still told as very different stories, in which the *motivation* for undertaking research is crucial in determining whether someone's achievements belong in the history of science or the history of technology. A good case in point arose at the recent International Conference on Science, Technology and Society that was held in Tokyo, Hiroshima and Kyoto (16–22 March 1998) under the sponsorship of various Japanese agencies representing science, government, and industry. Here, Western scholars such as myself had a valuable opportunity to learn how the large Japanese science studies community framed its research agenda.

There were several indications that Japanese scholars understand the relationship between science, technology, and society in subtly different ways from the 'received view' of Western scholars. One clear example is the tendency of Japanese scholars to describe both Michael Faraday and Thomas Edison as 'scientists' in roughly the same sense and of roughly the same significance. To be sure, the two men had much in common. Both came from poor backgrounds, had little formal education, but went on to do experimental research that substantially illuminated the electromagnetic realm. And of course, both came to represent 'the scientist' in the popular imagination of their time. However, over the years, Western historians of science have shown much greater interest in Faraday than Edison—so much so that Edison's name is usually omitted from general histories of 19th and 20th century science. There turns out to be two relevant differences between Faraday and Edison. First, Faraday was motivated by a desire to fathom the fundamental forces of nature. This desire had a religious origin that makes his story somewhat more edifying than the largely instrumental and utilitarian concerns that informed Edison's research. Secondly, while both Faraday and Edison kept meticulous notebooks of their research, Faraday was much more methodologically self-conscious than Edison, who seemed to resort to a trial-and-error approach on almost all matters. (Here it is worth recalling that Edison is the one who said 'Genius is 1% inspiration and 99% perspiration'.) If one regards the natural sciences as the secular successor of Christianity, *a la* Comte, then Faraday's spirituality and discipline would clearly make him a more important figure than Edison.

My point here is that the definition of 'science' in both science studies and the Science Wars is strongly coloured by the way in which science has developed in the West,

namely as a competitor to organized religion. In that sense, science studies is like the Protestant Reformation, only applied to the scientific establishment. The controversies surrounding Copernicus and Darwin come to mind as precedents in challenging the orthodoxies of their day. Nevertheless, both heliocentric astronomy and evolutionary biology were introduced with relatively little resistance in Japan. Consequently, the history of Japanese science has not needed figures like Galileo or Huxley, who achieved heroic status by arguing that a choice had to be made between a scientific and religious way of relating to the world. In this respect, the history of Japan's selective incorporation of Western science during the Meiji Restoration offers an interesting critical perspective on the nature of science that transcends the cultural limits of the Science Wars.

It is generally known that the Westerners who advised the Japanese government on education and research policy in the last quarter of the 19th century had different goals from those of their Japanese hosts. Whereas the Japanese were interested in Western technical know-how for purposes of what has been called 'defensive modernization', the European and American advisors also wished to impart the cultural values, philosophical systems, and political ideologies that had attended the development of science in the West. Indeed, the latter assumed that the unique history of Western Europe provided the blueprint for all human progress. (Marxism is probably the 20th century philosophy that has most closely adhered to this 19th century assumption.) Thus, argued the advisors, if the establishment of scientific institutions in Japan was not accompanied by liberal capitalist democracy cloaked in a secularized Christian ethic and a materialist metaphysics, those institutions would never reach their full potential. For their part, the Japanese responded with a tactful skepticism that exploited what the economic historian Alexander Gerschenkron has called 'the relative advantage of backwardness'. This is the idea that latecomers to economic development have the advantage of learning from the mistakes and idiosyncracies of the innovators, especially by finding more efficient substitutes that draw on native resources.

I believe that Gerschenkron's idea can be applied quite generally, in the Japanese case, to cover both intellectual and material resources. For example, Japanese translations reduced Western scientific concepts to operational definitions stripped of metaphysical baggage that for centuries had been the source of many profound but inconclusive debates, that often only held up the course of experimental inquiry in Europe. A case in point is Newton's appeal to 'gravity' as a real force in nature, which some read as his attempt to introduce 'The Hand of God' into physics. That Japan succeeded in avoiding such debates can be seen in that it entered the top five world powers in science-based technology in one-tenth the time it took Western Europe to complete its own 'Scientific Revolution'. Although the Scientific Revolution is normally said to have occurred in the 17th century, as late as 1898 the same number of university students in Germany—the scientifically most advanced nation of the time—studied theology as all the natural sciences put together. In contrast, the religious and class taboos that delayed the assimilation of the natural sciences in European education did not affect Japan. Indeed, in several other respects, the selective appropriation of the history of Western science by Japan contradicts many of the overblown cultural claims for science made by *both* sides of the Science Wars.

As soon as 'science' began to stand for not only a highly disciplined pursuit of knowledge of nature but also the standard by which all knowledge in society is judged, a tension emerged as to whether science is primarily a critical or a cumulative enterprise. I have called the two poles of this tension the *Enlightenment* and the *Positivist* images of science, respectively. The former captures science's ability to criticize taken-for-granted

assumptions (including its own) by subjecting them to empirical and logical tests, whereas the latter stresses the reliable body of knowledge that is supposed to result from such relentless criticism. The historical tendency in the West has been to connect the Enlightenment image to what Karl Popper called 'the open society', in which everyone is called upon to use their critical reasoning abilities, and the Positivist image to a more 'closed society', in which public decision-making is increasingly delegated to experts whose judgement is supposedly less error-prone and more efficient than the ordinary citizen's.

One area where this clash of images has led to much confusion in the Science Wars concerns the expression 'public understanding of science'. This expression first gained prominence in a 1985 report of the Royal Society, which alleged, in the case of Britain, a connection between low levels of research funding and science literacy and a decline in industrial innovation and wealth creation, when measured against international rivals. The big assumption made in the report and most of the subsequent debate has been that an increased public understanding of both the findings and methods of science will reverse any perceived economic decline, presumably because citizens will become at least more receptive to the idea of increasing research funding levels and may even enrol in courses to become scientists themselves. However, this assumption is little more than a superstition. In fact, most studies show that as people learn more about science, they become more critical of its development and uses, *especially* in the context of technological applications. In true Enlightenment fashion, the public acquires a form of wisdom that consists of recognizing how little one really knows. Indeed, they come to realize that even the experts know much less about the likely consequences of technological innovations than their policy pronouncements might first suggest. All of this is quite healthy from a democratic standpoint, as it encourages both the public and the experts to assume a greater sense of responsibility for the uncertainties and risks implied in what they say and do. However, it is not clear how the cultivation of these attitudes relate to more growth-oriented goals associated with technological innovation. At the very least, the spread of the Enlightenment function of science means that public debates over increased investment in science-based technologies will need to be conducted at a more sophisticated level. I believe that this is the issue on which all parties to the Science Wars should focus their energies.

To their credit, the science studies community in Japan has begun to tackle this problem seriously. The recent International STS Conference showcased the results of the first Japanese consensus conference on the appropriateness of gene therapy for the treatment of various diseases whose genetic composition is already known. A 'consensus conference' consists of a quasi-experimental situation in which a sample of the public are exposed to the details of a technical policy issue and then asked to formulate the basic framework within which policymakers should take their decisions. In the West, consensus conferences have been promoted by two groups: environmental activists and political scientists interested in exploring 'deliberative democracy' as a practical alternative to the colonization of the public sphere by experts. The conferences have been generally successful on their own terms, in that ordinary citizens can acquire the technical knowledge needed to debate the relevant policy issues in a relatively short time and arrive at frameworks that appear reasonable, even in the eyes of experts. In this respect, consensus conferences are much like trials by jury—except that consensus conferences rarely feed into any actual ongoing policy process. In fact, the only country where consensus conferences are currently used to inform real policy decisions is Denmark, and that is usually attributed to the country's small and relatively

homogeneous population. In short, a sample of the public is readily seen there as a *representative* sample.

The Japanese initiative, organized by Professors Yukio Wakamatsu (Tokyo Denzi University) and Tadashi Kobayashi (Nanzan University), is distinctive in several respects. Most notably, it comes from the science studies community, which has so far failed to participate in any Western initiatives of this kind. This is somewhat surprising, since consensus conferences are designed to test empirically a claim frequently made in the Science Wars, namely that scientific experts do not have a monopoly on the knowledge needed to resolve complex science-based policy issues. In any case, the results of the conference were very encouraging, especially given the highly experimental and potentially controversial character of gene therapy. Wakamatsu and Kobayashi succeeded in facilitating dialogue between a wide range of experts and members of the public. This was due, in no small measure, to their own intervention in the process. Themselves no experts in biology, medicine, or economics, but informed by work in science studies, Wakamatsu and Kobayashi asked questions that raised points of uncertainty in the experts' testimony which helped give members of the public the confidence they needed to air their concerns and ask still more probing questions. The quality of the resulting policy framework was very high by the standard of consensus conferences. This has led the organizers to propose a future conference that will explore Japanese resistance to the Internet and information technology more generally. This seems, to me, an ideal way for science studies to cultivate a critically informed public for science and technology, while ensuring that it issues a constructive result. Given the importance of computer-based networking to the emergent 'post-industrial' economy, this forthcoming Japanese initiative may offer guidance to the West in 'squaring the circle' of the Enlightenment and Positivist images of science. We shall watch in eager anticipation.

Note

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