



# Science as a Social Construct

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## Introduction

This lesson discusses some of the ideas associated with the question of whether science may be viewed as a social construct, or may even be, in fact, merely a social construct. Since some of the other lessons in LIS 386.13 tend to take the point of view that science is largely a social construct, this lesson concentrates on arguments against that point of view. I trust that most of you will immediately grasp an implication of the previous sentence—viz., that it is quite possible to argue both for that point of view and against it. Further, I trust that you will realize that an additional implication is that conclusive evidence—evidence that would definitely settle the argument one way or the other—is lacking.

Still another implication, which is not necessarily obvious, is that you should always bring a skeptical attitude to what you read. I do not mean "skeptical" in the sense of denying anything and everything. That is not skepticism but cynicism, or even nihilism. I mean "skeptical" in the sense of questioning, of asking yourself what the author is trying to say, what reasons the author may have for saying it, and what point of view the author may be espousing. In short, think carefully, critically, and evaluatively about what you read, instead of blindly accepting other people's ideas and arguments.

## C. P. Snow and "The Two Cultures"

A bit of history dealing with society's view of science may help illuminate the question of whether science may be viewed as a social construct.

Before the 19th century, science—such as it was at the time—was generally regarded as one of the areas of knowledge, along with history, philosophy, and the arts, with which any well educated person was expected to be familiar. (Unfortunately, it needs to be noted that in those days, with but rare exceptions, the only well educated persons were men, because of the then prevailing attitude that women needed no education beyond reading, writing, and arithmetic—and perhaps for women of the upper classes, a foreign language.)

During the 19th century scientific and technical knowledge became to develop at a notable, and ever faster, rate. One consequence was that it became increasingly difficult for a well educated person to acquire and maintain an acquaintance with these areas, where new knowledge was being added much faster than in the arts and humanities. Inevitably, people were forced into choosing between being educated in scientific and technical areas, and being educated in the more traditional areas.

By the 20th century, this trend had produced the social divide to which [Sir Charles Percy Snow](#) (1905-1980) gave the name "The Two Cultures," the schism in interests and knowledge between scientists and non-scientists. Not only, argued Snow, had this schism arisen between persons professionally engaged in the sciences vs. persons engaged in other pursuits, but it had split well educated persons, in general, into two camps: those who had an interest in science and those who disdained science. This schism Snow chose as his subject when he was selected to deliver, in 1959, the celebrated annual Rede Lecture at Cambridge University. Already knighted, and to be raised to the peerage in 1964, he was in 1959 a successful and well regarded novelist (writing as C. P. Snow) who had been a research physicist in the 1930s, and in World War II a high administrator in British scientific research efforts. In short, he was undeniably a respectable member of both camps, scientists and non-scientists, and hence an ideal person to call attention to the division between the camps, a division he

regarded as a dangerous schism in modern society, worst perhaps in Britain but also a problem in other countries. In opening his Rede Lecture, he said (Snow, 1993):

I believe the intellectual life of the whole of western society is increasingly being split into two polar groups. When I say the intellectual life, I mean to include also a large part of our practical life, because I should be the last person to suggest the two can at the deepest level be distinguished. . . . Two polar camps: at one pole we have the literary intellectuals, who incidentally while no one was looking took to referring to themselves as 'intellectuals' as though there were no others. I remember G. H. Hardy once remarking to me in mild puzzlement, some time in the 1930's: 'Have you noticed how the word "intellectual" is used nowadays? There seems to be a new definition which certainly doesn't include Rutherford or Eddington or Dirac or Adrian or me. It does seem rather odd, don't y' know.' [Endnote 1]

Literary intellectuals at one pole—at the other scientists, and as the most representative, the physical scientists. Between the two a gulf of mutual incomprehension—sometimes (particularly among the young) hostility and dislike, but most of all lack of understanding. They have a curious distorted image of each other. Their attitudes are so different that, even on the level of emotion, they can't find much common ground. Non-scientists tend to think of scientists as brash and boastful. They hear Mr T. S. Eliot, who just for these illustrations we can take as an archetypal figure, saying about his attempts to revive verse-drama that we can hope for very little, but that he would feel content if he and his co-workers could prepare the ground for a new Kyd or a new Greene. That is the tone, restricted and constrained, with which literary intellectuals are at home: it is the subdued voice of their culture. Then they hear a much louder voice, that of another archetypal figure, Rutherford, trumpeting: 'This is the heroic age of science! This is the Elizabethan age!' Many of us heard that, and a good many other statements beside which that was mild; and we weren't left in any doubt whom Rutherford was casting for the role of Shakespeare. What is hard for the literary intellectuals to understand, imaginatively or intellectually, is that he was absolutely right. . . .

The non-scientists have a rooted impression that the scientists are shallowly optimistic, unaware of man's condition. On the other hand, the scientists believe that the literary intellectuals are totally lacking in foresight, peculiarly unconcerned with their brother men, in a deep sense anti-intellectual, anxious to restrict both art and thought to the existential moment. And so on. Anyone with a mild talent for invective could produce plenty of this kind of subterranean back-chat. On each side there is some of it which is not entirely baseless. It is all destructive. Much of it rests on misinterpretations which are dangerous. . . .

At one pole, the scientific culture really is a culture, not only in an intellectual but also in an anthropological sense. That is, its members need not, and of course often do not, always completely understand each other; biologists more often than not will have a pretty hazy) idea of contemporary physics; but there are common attitudes, common standards and patterns of behaviour, common approaches and assumptions. This goes surprisingly wide and deep. It cuts across other mental patterns, such as those of religion or politics or class. . . .

At the other pole, the spread of attitudes is wider. It is obvious that between the two, as one moves through intellectual society from the physicists to the literary intellectuals, there are all kinds of tones of feeling on the way. But I believe the pole of total incomprehension of science radiates its influence on all the rest. That total incomprehension gives, much more

pervasively than we realise, living in it, an unscientific flavour to the whole 'traditional' culture, and that unscientific flavour is often, much more than we admit, on the point of turning anti-scientific. The feelings of one pole become the anti-feelings of the other. If the scientists have the future in their bones, then the traditional culture responds by wishing the future did not exist. 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. It is at the same time practical and intellectual and creative loss, and I repeat that it is false to imagine that those three considerations are clearly separable. . . . The degree of incomprehension on both sides is the kind of joke which has gone sour. . . .

As one would expect, some of the very best scientists had and have plenty of energy and interest to spare, and [in talking to many scientists, I and some colleagues] came across several who had read everything that literary people talk about. But that's very rare. Most of the rest, when one tried to probe for what books they had read, would modestly confess, 'Well, I've tried a bit of Dickens', rather as though Dickens were an extraordinarily esoteric, tangled and dubiously rewarding writer, something like Rainer Maria Rilke. In fact that is exactly how they do regard him: we thought that discovery, that Dickens had been transformed into the type-specimen of literary incomprehensibility, was one of the oddest results of the whole exercise.

But of course, in reading him, in reading almost any writer whom we should value, they are just touching their caps to the traditional culture. They have their own culture, intensive, rigorous, and constantly in action. This culture contains a great deal of argument, usually much more rigorous, and almost always at a higher conceptual level, than literary persons' arguments—even though the scientists do cheerfully use words in senses which literary persons don't recognise, the senses are exact ones, and when they talk about 'subjective', 'objective', 'philosophy' or 'progressive', they know what they mean, even though it isn't what one is accustomed to expect. . . .

But what about the other side? They are impoverished too—perhaps more seriously, because they are vainer about it. They still like to pretend that the traditional culture is the whole of 'culture', as though the natural order didn't exist. As though the exploration of the natural order was of no interest either in its own value or its consequences. As though the scientific edifice of the physical world was not, in its intellectual depth, complexity and articulation, the most beautiful and wonderful collective work of the mind of man. Yet most non-scientists have no conception of that edifice at all. Even if they want to have it, they can't. It is rather as though, over an immense range of intellectual experience, a whole group was tone-deaf. Except that this tone-deafness doesn't come by nature, but by training, or rather the absence of training.

As with the tone-deaf, they don't know what they miss. They give a pitying chuckle at the news of scientists who have never read a major work of English literature. They dismiss them as ignorant specialists. Yet their own ignorance and their own specialisation is just as startling. A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was

asking something which is about the scientific equivalent of: *Have you read a work of Shakespeare's?*

I now believe that if I had asked an even simpler question—such as, What do you mean by mass, or acceleration, which is the scientific equivalent of saying, *Can you read?*—not more than one in ten of the highly educated would have felt that I was speaking the same language. So the great edifice of modern physics goes up, and the majority of the cleverest people in the western world have about as much insight into it as their neolithic ancestors would have had.

The foregoing quotation is somewhat lengthy, but I think that the length is justified by the importance of what Snow was saying. At the very least, you should now be able to appreciate why "The Two Cultures" aroused ire within both camps, and why it has been cited thousands of times in the over four decades since it was published.

A further historical note is offered by Stefan Collini [Endnote 2] in the substantial essay that constitutes his introduction, to and review of, the controversy ignited by Snow's 1959 lecture and by the essay, "The Two Cultures: A Second Look," which Snow published in 1963. Reinforcing Snow's comments about the narrowing of the meaning of the word "intellectual," Collini (in Snow, 1993) writes:

Intellectual activity, including the meta-activity of reflection on the forms of knowledge, is, of course, shaped by different national traditions and anchored in a range of social practices. One can trace a specifically British genealogy for the 'two cultures' anxiety, arising out of a distinctive development of the social institutions within which education and research were carried on. This distinctiveness was reflected in the linguistic peculiarity by which the term 'science' came to be used in a narrowed sense to refer just to the 'physical' or 'natural' sciences. This appears to have become common in English only in the middle of the nineteenth century. The compilers of the Oxford English Dictionary, setting to work in the late-nineteenth century, recognised that this was a relatively recent development; the dictionary gives no example of this sense before the 1860s, and it is revealing that its first illustrative quotation implicitly points to the way English usage had started to diverge from other European languages: 'We shall . . . use the word "science" in the sense which Englishmen so commonly give to it; as expressing physical and experimental science, to the exclusion of theological and metaphysical.' Similarly, the coinage 'scientist' and its restriction to those practising the natural sciences is no older than the 1830s and 1840s. . . . [T]he term first appeared in an article of 1834 reporting on how the lack of a single term to describe 'students of the knowledge of the material world' had bothered meetings of the British Association for the Advancement of Science in the early 1830s, at one of which 'some ingenious gentleman proposed that, by analogy with *artist*, they might form *scientist*', though the same report records that 'this was not generally palatable'. Its subsequent currency reflected the growth of a self-conscious sense of professional identity among those who studied the natural world, an essential social precondition for later concerns about the divide between rival 'cultures'.

In short, in a social phenomenon that began in the middle of the 19th century and had become widespread by the middle of the 20th century, well educated people—especially in the Anglophone countries—could be fairly said to have divided themselves into two somewhat hostile camps, separated according to whether they liked or disdained science. Needless to say, people in each camp possessed a view of what constituted "science" that was different from the view of "science" held by those in the opposite camp.

### **The Two Cultures Today: Science Under Fire, and Sokal's Hoax**

What is the situation with respect to the two cultures today? Unfortunately, the schism celebrated by C. P. Snow seems to be stronger than ever. One example is an incident related by Edward W. Kolb in his book, *Blind Watchers of the Skies* (1996). Just prior to the passage quoted below, Kolb has been discussing the many uses in astronomy of the fact that each chemical element, when suitably energized (e.g., heated), displays in the spectrum of visible light a distinctive set of lines—a set of lines different from those of any other element. This phenomenon was discovered in the 19th century by Gustav Kirchoff, Joseph von Fraunhofer, and others. Kolb then comments:

By 1859 Kirchoff knew enough about the spectra of gases from laboratory studies to identify the chemical elements in the Sun responsible for the dark lines in the solar spectrum. Thus, on the basis of experiments done on Earth, he could discern that the Sun is not made of any heavenly substance like quintessence [as hypothesized by Aristotle] but of everyday earthly elements. The accomplishment is remarkable in many ways. About twenty-five years previously the French philosopher Auguste Comte, founder of Positivism, had confidently stated about the Sun and the stars that "we can never by any means investigate their chemical composition...."

I often wonder why history doesn't take more notice of Kirchoff's accomplishment. The idea that we learned what the Sun and the stars are made of would have astonished the ancients—it still astonishes me. Some philosophers and historians are so alienated from science that the significance of the discovery is hardly mentioned. This was made painfully clear to me one spring day in 1989, when, during a banquet at a physics conference in Rome, I found myself sitting next to a physicist's spouse who happened to be a historian at the University of Rome. Although astronomy is a highly specialized profession, I am always amazed by the degree of specialization in other fields. She was an expert on European history of the year 1859 (presumably the university has one hundred nineteenth-century European historians). In a clumsy attempt at polite dinner conversation, I asked why she happened to concentrate on that year. With a "surely you must know" tone, she replied that it was a very significant year because of the development of a remarkable idea. I made the mistake of asking if she was referring to Kirchoff's discovery of the chemical composition of the Sun. She stared at me so long, with such a curious expression on her face, that I thought surely I must have linguini stuck to my chin. But no, she was simply amazed by the naïveté of my question. Finally, she informed me that the significant event of the year 1859 was the publication of *A Critique of Political Economy*, by Karl Marx. I further compounded my errors by asking how a mere economic theory could be compared to the discovery of the composition of the stars. I suppose that a biologist might ask why she considered Marx's book more important than another book published in 1859, *On the Origin of Species*, by Charles Darwin. After another long stare, with a sigh of exasperation she turned to the person sitting on her other side, presumably searching for more enlightened conversation. I am embarrassed to admit that in the intervening years I still haven't understood why the development of a (since discredited) economic theory is of more lasting importance than learning the stuff of which the stars are made. Perhaps one day I will.

I also wonder why the significance of scientific discoveries is so often dismissed by historians in favor of political, military, or economic developments. As noted by Arthur Koestler, in Somervell's abridged version (if more than six hundred pages can be considered abridged) of Toynbee's *A Study of History*, the names of Copernicus, Galileo, Descartes, and Newton do not appear. (Kolb, 1996, 162-163)

In recent decades, whole schools of philosophy and sociology have concerned themselves with attacking science on various grounds: for example, charging that science neglects human values, that it has produced terrifying weapons of war, even that it is merely an elaborate structure based on nothing more solid than frail and suspect human perceptions of the world and the universe that fail to deal with an underlying reality that is unknowable to human beings; and that the whole structure is, therefore, an artifact, an illusion constructed by people who call themselves "scientists." Such, at least, are the most extreme views of science as a mere "social construct," views held by some postmodernists and deconstructionists.

A concise description of these views was provided by [Napoleon A. Chagnon](#) (1995) in an editorial entitled "The Academic Left and Threats to Scientific Anthropology":

There have been increasing concerns in many academic disciplines, especially the social sciences, about the threat posed to scientific inquiry by a collection of intellectual ideas and academic movements termed "the academic left" by Paul Gross and Norman Levitt in their 1994 book, *Higher Superstitions: The Academic Left and its Quarrels with Science*. Most of us recognize some of these ideas by names like "postmodernism," "deconstructionism," and "political correctness." . . .

The origins of these ideas are complex, but the field of literary theory has played a major role in developing some of the most influential of them and exporting them to other disciplines—ideas from [Jacques] Derrida and [Michel] Foucault in particular. Joseph Carroll's recent (1994) book, *Evolution and Literary Theory*, provides us with an excellent overview of the development and applications of these ideas, and he attacks them from within literary ranks. He argues eloquently for a view of human nature derived from research inspired by Darwinian theory. He suggests that literature makes more sense once an accurate, informed view of human nature is defined, and argues that the most accurate and informed view can only come from understanding the evolution of humans.

Space does not permit an overview of how the current antipathetic views of science from the academic left have affected specific disciplines (and there is considerable variation). In general, this view of science proposes that there is no such thing as an objective observation, facts are political constructs, and science is an instrument of oppression and therefore must itself be oppressed and silenced (cf. Gross & Levitt, 1994). The natural sciences are less affected than the social sciences, and the humanities are the most affected. Gross and Levitt's book is a good general source on the topic, and the quarterly journal of the National Association of Scholars, *Academic Questions*, deals with and contests assaults on academic freedom from all varieties of the academic left.

An even harsher view of the critics of science comes from a distinguished astronomer, [Arthur Upgren](#), who sees some of the criticism as stemming from groups that would prefer that science be suppressed, at least wherever scientific findings clash with the cherished beliefs of those groups. Upgren (2002) writes that:

In the last few years, it has become fashionable to disparage science from the academic left. Charges have been leveled such as the one that categorized the central figures in the rise of science and, to a lesser extent, European civilization in general as DWEMs (Dead White European Males) and therefore no longer worthy of study or applicable in this postmodernist society.

Whereas almost every civilization has made contributions to our sum of knowledge, they did not do so equally. To ignore one of them in favor of another is to misunderstand both. *Guns, Germs, and Steel: The Fates of Human Societies*, the recent bestseller by Jared Diamond [Endnote 3], presents a much more balanced and benign view of the reasons for the

early dominance of Europe (along with eastern Asia). No assertion is made that those who lived there were smarter than those who did not. For the most part their predominance was an accident of geography.

In a grand send-up of the postmodernist point of view, Alan Sokal wrote, submitted, and published an article to a fashionable American cultural studies journal [*Social Text*] in 1996. The satirical essay was entitled "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity." It is a parody of the type of work, common in the last few years, that expounds on what has become known as the postmodernist point of view. Among its absurdities is the contention that such physical staples as the ratio,  $\pi$ , and Newton's gravitational constant,  $G$ , are no longer to be thought of as constant and enduring, relevant, or part of an external world, independent of humanity. Summarizing the parody in their book *Fashionable Nonsense*, Sokal and Jean Bricmont [1998] show that this and other critiques of science go beyond attacks of its worst aspects (militarism, sexism, etc.) by others, into a condemnation of science as an "intellectual endeavor aimed at a rational understanding of the world" by those who do not themselves comprehend science.

Godel's theorem, Heisenberg's uncertainty principle and quantum physics in general, Mandelbrot sets and fractals, chaos theory, the big bang, the double helix, and the special and general relativity theories of Einstein are all among current scientific esoterica. Some by their very nature are recondite matters at best, but this is no argument against their validity. They are often used and thoroughly misunderstood by those who detail the argument against rational thought of the post-Renaissance enlightenment. In these entanglements is the postmodern left so far from the know-nothing attitude of the far right? Many of the latter cling to their moribund beliefs in the Bermuda Triangle, astrology, Atlantis as a midocean continent bearing an advanced civilization, the Full Moon effect, the Shroud of Turin as clothing worn by Christ, along with creationism and religious intolerance, which all go to fulfill a more traditional distrust of science. . . .

Science is getting squeezed between the postmodernism of the left and the more serious mumpsimus (complete with a choir of angels) from the right. We see Kansas and other states pass laws favoring creationism over evolution in the classroom (the Kansas statute itself has fortunately been repealed). We see books such as John Horgan's *The End of Science* [Endnote 4] pick up the theme pronounced but then shrugged off by physicists a century ago, right after the discovery of relativity and quantum physics, that the big questions in the physical sciences have all been answered as much as they can be answered. Horgan quotes reputable scientists as being discouraged about their field of research, but his sensational account misses the point. After a time in which the science enterprise has seen a period of unparalleled growth, the discouragement is not with the research field per se, but with the dwindling support for funding of science by society through government, along with the fallout of science through the dumbing of America, particularly in our schools. Not by chance does the fitness craze demand "scientific breakthroughs" each day on the televised news programs with little or no corroboration.

What [Alan Sokal](#) and Jean Bricmont have to say about the origin of "Sokal's Hoax" (Endnote 5), as the former's satirical article in *Social Text* has come to be known, is just too rich to resist quoting here (Sokal and Bricmont, 1998):

The story of this book begins with a hoax. For some years, we have been surprised and distressed by the intellectual trends in certain precincts of American academia. Vast sectors of the humanities and the social sciences seem to have adopted a philosophy that we shall call, for want

of a better term, "postmodernism": an intellectual current characterized by the more-or-less explicit rejection of the rationalist tradition of the Enlightenment, by theoretical discourses disconnected from any empirical test, and by a cognitive and cultural relativism that regards science as nothing more than a "narration", a "myth" or a social construction among many others.

To respond to this phenomenon, one of us (Sokal) decided to try an unorthodox (and admittedly uncontrolled) experiment: submit to a fashionable American cultural-studies journal, *Social Text*, a parody of the type of work that has proliferated in recent years, to see whether they would publish it. The article, entitled "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity", is chock-full of absurdities and blatant non-sequiturs. In addition, it asserts an extreme form of cognitive relativism: after mocking the old-fashioned "dogma" that "there exists an external world, whose properties are independent of any individual human being and indeed of humanity as a whole", it proclaims categorically that "physical 'reality', no less than social 'reality', is at bottom a social and linguistic construct". By a series of stunning leaps of logic, it arrives at the conclusion that "the  $\pi$  of Euclid and the G of Newton, formerly thought to be constant and universal, are now perceived in their ineluctable historicity; and the putative observer becomes fatally de-centered, disconnected from any epistemic link to a space-time point that can no longer be defined by geometry alone". The rest is in the same vein.

And yet, the article was accepted and published. Worse, it was published in a special issue of *Social Text* devoted to rebutting the criticisms levelled against postmodernism and social constructivism by several distinguished scientists. For the editors of *Social Text*, it was hard to imagine a more radical way of shooting themselves in the foot.

A powerful critic of the view of science as a social construct has been [Steven Weinberg](#) (Endnote 6). He recently published a collection of essays, *Facing Up: Science and Its Cultural Adversaries*, that includes three sharp critiques of postmodernism and deconstructionism: "The Methods of Science . . . [sic] and Those by Which We Live," "Sokal's Hoax," and "Science and Sokal's Hoax: An Exchange." Here are some excerpts from the first two of these essays (Weinberg, 2001):

I would also like to point out that, at least within the area of physics, which is what I mostly know about, and within this century, whenever [the physics community became universally convinced of something], it has never been simply wrong. To be sure, sometimes the truth turns out to be more complicated than what had been thought. For example, before 1956 there had been a consensus that there is an exact symmetry between right and left, and then we learned that the symmetry is not exact. But it is a good approximation in certain important contexts. The thirty years of theoretical physics research that relied on that symmetry to understand nuclear and atomic problems was not wrong; there were just small corrections that physicists didn't know about. No consensus in the physics community has ever been simply a mistake, in the way that in earlier centuries you might say, for example, that the theory of caloric or phlogiston was a mistake.

Now, all of this is of course a social phenomenon. The reaching of consensus takes place in a worldwide society of physicists. This fact has led to a second fallacy: that, because the process is a social one, the end product is in whole or in part a social construct.

Not even the social milieu of physics research is well described by postmodern commentators. It is far less oppressive and hegemonic than many would imagine. In many cases the great breakthroughs are made by



youngsters like 't Hooft, of whom no one has heard before, while the famous graybeards who have senior positions in the leading universities often get left behind. Werner Heisenberg and (to a lesser extent) Paul Dirac were left behind by the physics community after 1945, as were Einstein and Louis de Broglie after 1925. Heisenberg and de Broglie rather discredibly tried to force their views on the physics communities in Germany and France. Einstein and Dirac, gentler souls, simply went their own ways. But even Heisenberg and de Broglie were not able to damage German or French physics for very long. The exact sciences show a remarkable measure of resilience and resistance to any kind of hegemonic influence, perhaps more than any other human enterprise.

The working philosophy of most scientists is that there is an objective reality and that, despite many social influences, the dominant influence in the history of science is the approach to that objective reality. . . .

I think we scientists need make no apologies. It seems to me that our science is a good model for intellectual activity. We believe in an objective truth that can be known, and at the same time we are always willing to reconsider, as we may be forced to, what we have previously accepted. This would not be a bad ideal for intellectual life of all sorts. . . .

Like many other scientists, I was amused when I heard about the prank played by the NYU mathematical physicist Alan Sokal, who late in 1994 submitted a sham article [Sokal, 1996a] to the cultural studies journal *Social Text*. In the article Sokal reviewed various current topics in physics and mathematics, and, tongue in cheek, drew various cultural, philosophical, and political morals that he felt would appeal to fashionable academic commentators who question the claims of science to objectivity.

The editors of *Social Text* did not detect that Sokal's article was a hoax, and they published it in the journal's Spring/Summer 1996 issue. The hoax was revealed by Sokal himself in an article [Sokal, 1996b] for another journal, *Lingua Franca*, in which he explained that his *Social Text* article had been "liberally salted with nonsense," and in his opinion was accepted only because "(a) it sounded good and (b) it flattered the editors' ideological preconceptions." Newspapers and newsmagazines throughout the US and Britain carried the story, and Sokal's hoax appeared likely to join the small company of legendary academic hoaxes, along with the pseudofossils of Piltdown man planted by Charles Dawson and the pseudo-Celtic epic *Ossian* written by James Macpherson. The difference is that Sokal's hoax served a public purpose, to attract attention to what Sokal saw as a decline of standards of rigor in the academic community, and for that reason it was disclosed immediately by the author himself.

The targets of Sokal's satire occupy a broad intellectual range. There are those "postmoderns" in the humanities who like to surf through avant-garde fields like quantum mechanics or chaos theory to dress up their own arguments about the fragmentary and random nature of experience. There are those sociologists, historians, and philosophers who see the laws of nature as social constructions. There are cultural critics who find the taint of sexism, racism, colonialism, militarism, or capitalism not only in the practice of scientific research but even in its conclusions. Sokal did not satirize creationists or other religious enthusiasts who in many parts of the world are the most dangerous adversaries of science, but his targets were spread widely enough, and he was attacked or praised from all sides. . . .

I thought at first that Sokal's article in *Social Text* was intended to be an imitation of academic babble, which any editor should have recognized as such. But in reading the article I found that this is not the case. . . . In fact I got the impression that Sokal finds it difficult to write unclearly.

Where the article does degenerate into babble it is not in what Sokal himself has written but in the writings of the genuine postmodern cultural critics he quotes. Here, for instance, is a quote that he takes from the oracle of deconstruction, Jacques Derrida:

The Einsteinian constant is not a constant, is not a center. It is the very concept of variability—it is, finally, the concept of the game. In other words, it is not the concept of something— of a center starting from which an observer could master the field—but the very concept of the game.

I have no idea what this is intended to mean.

I suppose that it might be argued that articles in physics journals are also incomprehensible to the uninitiated. But physicists are forced to use a technical language, the language of mathematics. Within this limitation, we try to be clear, and when we fail we do not expect our readers to confuse obscurity with profundity. It never was true that only a dozen people could understand Einstein's papers on general relativity, but if it had been true, it would have been a failure of Einstein's, not a mark of his brilliance. The papers of Edward Witten of the Institute for Advanced Study at Princeton, which are today consistently among the most significant in the promising field of string theory, are notably easier for a physicist to read than most other work in string theory. In contrast, Derrida and other postmoderns do not seem to be saying anything that requires a special technical language, and they do not seem to be trying very hard to be clear. But those who admire such writings presumably would not have been embarrassed by Sokal's quotations from them. . . .

Maybe . . . Sokal was naughty in letting the editors rely on his sincerity, but the article would not have been very different if Sokal's account of physics and mathematics had been entirely accurate. What is more revealing is the variety of physics and mathematics bloopers in remarks by others that Sokal slyly quotes with mock approval. Here is the philosopher Bruno Latour on special relativity:

How can one decide whether an observation made in a train about the behavior of a falling stone can be made to coincide with the observation of the same falling stone from the embankment? If there are only one, or even two, frames of reference, no solution can be found. . . . Einstein's solution is to consider *three* actors. . . .

This is wrong; in relativity theory there is no difficulty in comparing the results of two, three, or any number of observers. In other quotations cited by Sokal, Stanley Aronowitz misuses the term "unified field theory." The feminist theorist Luce Irigaray deplores mathematicians' neglect of spaces with boundaries, though there is a huge literature on the subject. The English professor Robert Markley calls quantum theory nonlinear, though it is the only known example of a precisely linear theory. And both the philosopher Michael Serres (a member of the Académie Française) and archpostmodernist Jean-François Lyotard grossly misrepresent the view of time in modern physics. Such errors suggest a problem not just in the editing practices of *Social Text*, but in the standards of a larger intellectual community. . . .

After Sokal exposed his hoax, one of the editors of *Social Text* even speculated that "Sokal's parody was nothing of the sort, and that his admission represented a change of heart, or a folding of his intellectual resolve." I am reminded of the case of the American spiritualist Margaret Fox. When she confessed in 1888 that her career of séances and spirit rappings had all been a hoax, other spiritualists claimed that it was her confession that was dishonest. . . .

I have to admit at this point that physicists share responsibility for the widespread confusion about such matters. Sokal quotes some dreadful examples of Werner Heisenberg's philosophical wanderings, as for instance: "Science no longer confronts nature as an objective observer, but sees itself as an actor in this interplay between man [sic] and nature." (Heisenberg was one of the great physicists of the twentieth century, but he could not always be counted on to think carefully, as shown by his technical mistakes in the German nuclear weapons program. ) More recently scientists like Ilya Prigogine [Endnote 7] have claimed a deep philosophical significance for work on nonlinear dynamics, a subject that is interesting enough without the hype.

So much for the cultural implications of discoveries in science. What of the implications for science of its cultural and social context? Here scientists like Sokal find themselves in opposition to many sociologists, historians, and philosophers as well as postmodern literary theorists. In this debate, the two sides often seem to be talking past each other. For instance, the sociologists and historians sometimes write as if scientists had not learned anything about the scientific method since the days of Francis Bacon, while of course we know very well how complicated the relation is between theory and experiment, and how much the work of science depends on an appropriate social and economic setting. . . .

[Sokal's] targets often take positions that seem to me (and I gather to Sokal) to make no sense if there is an objective reality. To put it simply, if scientists are talking about something real, then what they say is either true or false. If it is true, then how can it depend on the social environment of the scientist? If it is false, how can it help to liberate us? The choice of scientific question and the method of approach may depend on all sorts of extrascientific influences, but the correct answer when we find it is what it is because that is the way the world is. . . .

I have come to think that the laws of physics are real because my experience with the laws of physics does not seem to me to be very different in any fundamental way from my experience with rocks. For those who have not lived with the laws of physics, I can offer the obvious argument that the laws of physics as we know them work, and there is no other known way of looking at nature that works in anything like the same sense. Sarah Franklin (in an article in the same issue of *Social Text* as Sokal's hoax) challenges an argument of Richard Dawkins that in relying on the working of airplanes we show our acceptance of the working of the laws of nature, remarking that some airlines show prayer films during takeoff to invoke the aid of Allah to remain safely airborne. Does Franklin think that Dawkins's argument does not apply to her? If so, would she be willing to give up the use of the laws of physics in designing aircraft, and rely on prayers instead? . . . .

Sokal was not the first to address these issues, but he has done a great service in raising them so dramatically. They are not entirely academic issues, in any sense of the word "academic." If we think that scientific laws are flexible enough to be affected by the social setting of their discovery, then some may be tempted to press scientists to discover laws that are more proletarian or feminine or American or religious or Aryan or whatever else it is they want. This is a dangerous path, and more is at

stake in the controversy over it than just the health of science. As I mentioned earlier, our civilization has been powerfully affected by the discovery that nature is strictly governed by impersonal laws. As an example I like to quote the remark of Hugh Trevor-Roper that one of the early effects of this discovery was to reduce the enthusiasm for burning witches. We will need to confirm and strengthen the vision of a rationally understandable world if we are to protect ourselves from the irrational tendencies that still beset humanity.

### What Can One Conclude about Science as a Social Construct?

In conclusion, we can again ask the question of whether science may be viewed as a social construct, or may even be, in fact, merely a social construct. You have just seen some strong arguments against that view, but you have also been made aware that there are some well respected people who support that view. I trust that my own opinion about whether science is a mere social construct is obvious. But you are welcome to disagree.

Let me reiterate what I said at the beginning of this lesson: You should always bring a skeptical attitude—one of healthy questioning—to what you read, and you should continually think carefully, critically, and evaluatively about what you read. In short, become informed, so that you can then decide for yourself where you stand, whatever the issue.

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## Endnotes

1. [Ernest Rutherford](#) received the Nobel Prize in Chemistry in 1908; [Paul Adrien Maurice Dirac](#), the Nobel Prize in Physics, 1932; and [Edgar Douglas Adrian](#), the Nobel Prize in Medicine, 1932. [Sir Arthur Eddington](#) (1882-1944) was a distinguished British astronomer and astrophysicist. [G. H. Hardy](#) (1877-1947), who held professorships (successively) at both Oxford and Cambridge, was one of the leading mathematicians of his time.
2. Stefan Collini is Professor of Intellectual History and English Literature, University of Cambridge, U.K.
3. [Jared Diamond](#) is a recipient of a MacArthur Foundation Fellowship (often called a "Genius Award") and has been since 1966 a Professor of Physiology in the School of Medicine, University of California, Los Angeles. The book to which Uppgren refers is: Diamond, Jared. (1997). *Guns, Germs and Steel: The Fates of Human Societies*. New York, NY: Norton.
4. The book to which Uppgren here refers is: Horgan, John. (1997). *The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age*. Boston, MA: Little, Brown and Company. [Currently a freelance writer, Horgan was formerly a Senior Writer at *Scientific American* magazine.]
5. The full text of "Sokal's Hoax" is available online at: <http://www.physics.nyu.edu/faculty/sokal/weinberg.html>
6. Steven Weinberg is one of the most eminent members of the UT-Austin faculty. Awarded the Nobel Prize in Physics in 1979, he holds the Jack S. Josey-Welch Foundation Chair in Science, is a Regental Professor, and directs the [Theory Group](#) in the Department of Physics. He spoke eloquently concerning his regard for, and concerns about, the University of Texas at Austin when he delivered the University's [2001 Commencement Address](#).
7. [Ilya Prigogine](#), another very eminent member of the UT-Austin faculty, is the other Nobel Laureate (Chemistry, 1977) who is currently at UT-Austin. He is a Regental Professor and holds the Ashbel Smith Professorship in the Department of Physics.

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Last updated 2003 Feb 28 by R. E. Wyllys

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