Transgressing the Boundaries: An Afterword

Alan D. Sokal
Department of Physics
New York University
4 Washington Place
New York, NY 10003 USA

Internet: SOKAL@NYU.EDU
Telephone: (212) 998-7729
Fax: (212) 995-4016

May 9, 1996

Biographical Information

The author is a Professor of Physics at New York University. In the summers of 1986–88 he taught mathematics at the Universidad Nacional Autónoma de Nicaragua. He is co-author with Roberto Fernández and Jürg Fröhlich of *Random Walks, Critical Phenomena, and Triviality in Quantum Field Theory* (Springer, 1992), and co-author with Jean Bricmont of the forthcoming *Les impostures scientifiques des philosophes (post-)modernes*.

> I did not write this work merely with the aim of setting the exegetical record straight. My larger target is those contemporaries who — in repeated acts of wish-fulfillment — have appropriated conclusions from the philosophy of science and put them to work in aid of a variety of social cum political causes for which those conclusions are ill adapted. Feminists, religious apologists (including "creation scientists"), counterculturalists, neoconservatives, and a host of other curious fellow-travelers have claimed to find crucial grist for their mills in, for instance, the avowed incommensurability and underdetermination of scientific theories. The displacement of the idea that facts and evidence matter by the idea that everything boils down to subjective interests and perspectives is — second only to American political campaigns — the most prominent and pernicious manifestation of anti-intellectualism in our time.
>
> — *Larry Laudan, Science and Relativism (1990, p. x)*

> Les grandes personnes sont décidément bien bizarres, se dit le petit prince.
>
> — *Antoine de Saint Exupéry, Le Petit Prince*

Alas, the editors of *Social Text* have discovered that my article, "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity", which appeared in *Social Text* #46/47, is a parody. In view of the important intellectual and political issues raised by this episode, they have generously agreed to publish this (non-parodic) Afterword, in which I explain my motives and my true views.[1] One of my goals is to make a small contribution toward a dialogue on the Left between humanists and natural scientists — "two cultures" which, contrary to some optimistic pronouncements (mostly by the former group), are probably farther apart in mentality than at any time in the past 50 years.

Like the genre it is meant to satirize — myriad exemplars of which can be found in my reference list — my article is a mélange of truths, half-truths, quarter-truths, falsehoods, non sequiturs, and syntactically correct sentences that have no meaning whatsoever. (Sadly, there are only a handful of the latter: I tried hard to produce them, but I found that, save for rare bursts of inspiration, I just didn't have the knack.) I also employed some other strategies that are well-established (albeit sometimes inadvertently) in the genre: appeals to authority in lieu of logic; speculative theories passed off as established science; strained and even absurd analogies; rhetoric that sounds good but whose meaning is ambiguous; and confusion between the technical and everyday senses of English words.[2] (N.B. All works cited in my article are real, and all quotations are rigorously accurate; none are invented.)

But why did I do it? I confess that I'm an unabashed Old Leftist who never quite understood how deconstruction was supposed to help the working class. And I'm a stodgy old scientist who believes, naively, that there exists an external world, that there exist objective truths about that world, and that my job is to discover some of them. (If science were merely a negotiation of social conventions about what is agreed to be "true", why would I bother devoting a large fraction of my all-too-short life to it? I don't aspire to be the Emily Post of quantum field theory.[3])

But my main concern isn't to defend science from the barbarian hordes of lit crit (we'll survive just fine, thank you). Rather, my concern is explicitly *political*: to combat a currently fashionable postmodernist/poststructuralist/social-constructivist discourse — and more generally a penchant for subjectivism — which is, I believe, inimical to the values and future of the Left.[4] Alan Ryan said it well:

> It is, for instance, pretty suicidal for embattled minorities to embrace Michel Foucault, let alone Jacques Derrida. The minority view was always that power could be undermined by truth ... Once you read Foucault as saying that truth is simply an effect of power, you've had it. ... But American departments of literature, history and sociology contain large numbers of self-described leftists who have confused radical doubts about objectivity with political radicalism, and are in a mess.[5]

Likewise, Eric Hobsbawm has decried

> the rise of "postmodernist" intellectual fashions in Western universities, particularly in departments of literature and anthropology, which imply that all

> "facts" claiming objective existence are simply intellectual constructions. In short, that there is no clear difference between fact and fiction. But there is, and for historians, even for the most militantly antipositivist ones among us, the ability to distinguish between the two is absolutely fundamental.[6]

(Hobsbawm goes on to show how rigorous historical work can refute the fictions propounded by reactionary nationalists in India, Israel, the Balkans and elsewhere.) And finally Stanislav Andreski:

> So long as authority inspires awe, confusion and absurdity enhance conservative tendencies in society. Firstly, because clear and logical thinking leads to a cumulation of knowledge (of which the progress of the natural sciences provides the best example) and the advance of knowledge sooner or later undermines the traditional order. Confused thinking, on the other hand, leads nowhere in particular and can be indulged indefinitely without producing any impact upon the world.[7]

As an example of "confused thinking", I would like to consider a chapter from Harding (1991) entitled "Why 'Physics' Is a Bad Model for Physics". I select this example both because of Harding's prestige in certain (but by no means all) feminist circles, and because her essay is (unlike much of this genre) very clearly written. Harding wishes to answer the question, "Are feminist criticisms of Western thought relevant to the natural sciences?" She does so by raising, and then rebutting, six "false beliefs" about the nature of science. Some of her rebuttals are perfectly well-taken; but they don't prove anything like what she claims they do. That is because she confutes five quite distinct issues:

1) *Ontology.* What objects *exist* in the world? What statements about these objects are *true*?

2) *Epistemology.* How can human beings obtain *knowledge* of truths about the world? How can they assess the *reliability* of that knowledge?

3) *Sociology of knowledge.* To what extent are the truths *known* (or *knowable*) by humans in any given society influenced (or determined) by social, economic, political, cultural and ideological factors? Same question for the false statements erroneously believed to be true.

4) *Individual ethics.* What types of research *ought* a scientist (or technologist) to undertake (or refuse to undertake)?

5) *Social ethics.* What types of research *ought* society to encourage, subsidize or publicly fund (or alternatively to discourage, tax or forbid)?

These questions are obviously related — e.g. if there are no objective truths about the world, then there isn't much point in asking how one can know those (nonexistent) truths — but they are conceptually distinct.

For example, Harding (citing Forman 1987) points out that American research in the 1940s and 50s on quantum electronics was motivated in large part by potential military applications. True enough. Now, quantum mechanics made possible solid-state physics, which in turn made possible quantum electronics (e.g. the transistor), which made possible nearly all of modern technology (e.g. the computer).[8] And the computer has had applications that are beneficial to society (e.g. in allowing the postmodern cultural critic to produce her articles more efficiently) as well as applications that are harmful (e.g. in allowing the U.S. military to kill human beings more efficiently). This raises a host of social and individual ethical questions: Ought society to forbid (or discourage) certain applications of computers? Forbid (or discourage) research on computers *per se*? Forbid (or discourage) research on quantum electronics? On solid-state physics? On quantum mechanics? And likewise for individual scientists and technologists. (Clearly, an affirmative answer to these questions becomes harder to justify as one goes down the list; but I do not want to declare any of these questions *a priori* illegitimate.) Likewise, sociological questions arise, for example: To what extent is our (true) knowledge of computer science, quantum electronics, solid-state physics and quantum mechanics — and our lack of knowledge about other scientific subjects, e.g. the global climate — a result of public-policy choices favoring militarism? To what extent have the erroneous theories (if any) in computer science, quantum electronics, solid-state physics and quantum mechanics been the result (in whole or in part) of social, economic, political, cultural and ideological factors, in particular the culture of militarism?[9] These are all serious questions, which deserve careful investigation adhering to the highest standards of scientific and historical evidence. *But they have no effect whatsoever on the underlying scientific questions:* whether atoms (and silicon crystals, transistors and computers) really do behave according to the laws of quantum mechanics (and solid-state physics, quantum electronics and computer science). The militaristic orientation of American science has quite simply no bearing whatsoever on the ontological question, and only under a wildly implausible scenario could it have any bearing on the epistemological question. (E.g. if the worldwide community of solid-state physicists, following what they believe to be the conventional standards of scientific evidence, were to hastily accept an erroneous theory of semiconductor behavior because of their enthusiasm for the breakthrough in military technology that this theory would make possible.)

Andrew Ross has drawn an analogy between the hierarchical taste cultures (high, middlebrow and popular) familiar to cultural critics, and the demarcation between science and pseudoscience.[10] At a sociological level this is an incisive observation; but at an ontological and epistemological level it is simply mad. Ross seems to recognize this, because he immediately says:

> I do not want to insist on a literal interpretation of this analogy ... A more exhaustive treatment would take account of the local, qualifying differences between the realm of cultural taste and that of science [!], but it would run up, finally, against the stand-off between the empiricist's claim that non-context-dependent beliefs exist and that they can be true, and the culturalist's claim

> that beliefs are only socially accepted as true.[11]

But such epistemological agnosticism simply won't suffice, at least not for people who aspire to make social change. Deny that non-context-dependent assertions can be true, and you don't just throw out quantum mechanics and molecular biology: you also throw out the Nazi gas chambers, the American enslavement of Africans, and the fact that today in New York it's raining. Hobsbawm is right: facts do matter, and some facts (like the first two cited here) matter a great deal.

Still, Ross is correct that, at a sociological level, maintaining the demarcation line between science and pseudoscience serves — *among other things* — to maintain the social power of those who, whether or not they have formal scientific credentials, stand on science's side of the line. (It has *also* served to increase the mean life expectancy in the United States from 47 years to 76 years in less than a century.[12]) Ross notes that

> Cultural critics have, for some time now, been faced with the task of exposing similar vested institutional interests in the debates about class, gender, race, and sexual preference that touch upon the demarcations between taste cultures, and I see no ultimate reason for us to abandon our hard-earned skepticism when we confront science.[13]

Fair enough: scientists are in fact the *first* to advise skepticism in the face of other people's (and one's own) truth claims. But a sophomoric skepticism, a bland (or blind) agnosticism, won't get you anywhere. Cultural critics, like historians or scientists, need an *informed* skepticism: one that can evaluate evidence and logic, and come to reasoned (albeit tentative) judgments *based on that evidence and logic.*

At this point Ross may object that I am rigging the power game in my own favor: how is he, a professor of American Studies, to compete with me, a physicist, in a discussion of quantum mechanics?[14] (Or even of nuclear power — a subject on which I have no expertise whatsoever.) But it is equally true that I would be unlikely to win a debate with a professional historian on the causes of World War I. Nevertheless, as an intelligent lay person with a modest knowledge of history, I am capable of evaluating the evidence and logic offered by competing historians, and of coming to some sort of reasoned (albeit tentative) judgment. (Without that ability, how could any thoughtful person justify being politically active?)

The trouble is that few non-scientists in our society feel this self-confidence when dealing with scientific matters. As C.P. Snow observed in his famous "Two Cultures" lecture 35 years ago:

> 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.[15]

A lot of the blame for this state of affairs rests, I think, with the scientists. The teaching of mathematics and science *is* often authoritarian[16]; and this is antithetical not only to the principles of radical/democratic pedagogy but to the principles of science itself. No wonder most Americans can't distinguish between science and pseudoscience: their science teachers have never given them any rational grounds for doing so. (Ask an average undergraduate: Is matter composed of atoms? Yes.

Why do you think so? The reader can fill in the response.) Is it then any surprise that 36% of Americans believe in telepathy, and that 47% believe in the creation account of Genesis?[17]

As Ross has noted[18], many of the central political issues of the coming decades — from health care to global warming to Third World development — depend in part on subtle (and hotly debated) questions of scientific fact. But they don't depend only on scientific fact: they depend also on ethical values and — in this journal it hardly needs to be added — on naked economic interests. No Left can be effective unless it takes seriously questions of scientific fact *and* of ethical values *and* of economic interests. The issues at stake are too important to be left to the capitalists or to the scientists — or to the postmodernists.

A quarter-century ago, at the height of the U.S. invasion of Vietnam, Noam Chomsky observed that:

> George Orwell once remarked that political thought, especially on the left, is a sort of masturbation fantasy in which the world of fact hardly matters. That's true, unfortunately, and it's part of the reason that our society lacks a genuine, responsible, serious left-wing movement.[19]

Perhaps that's unduly harsh, but there's unfortunately a significant kernel of truth in it. Nowadays the erotic text tends to be written in (broken) French rather than Chinese, but the real-life consequences remain the same. Here's Alan Ryan in 1992, concluding his wry analysis of American intellectual fashions with a lament that

> the number of people who combine intellectual toughness with even a modest political radicalism is pitifully small. Which, in a country that has George Bush as President and Danforth Quayle lined up for 1996, is not very funny.[20]

Four years later, with Bill Clinton installed as our supposedly "progressive" president and Newt Gingrich already preparing for the new millennium, it still isn't funny.

Notes

1. Readers are cautioned not to infer my views on any subject except insofar as they are set forth in this Afterword. In particular, the fact that I have parodied an extreme or ambiguously stated version of an idea does not exclude that I may agree with a more nuanced or precisely stated version of the same idea.

2. For example: "linear", "nonlinear", "local", "global", "multidimensional", "relative", "frame of reference", "field", "anomaly", "chaos", "catastrophe", "logic", "irrational", "imaginary", "complex", "real", "equality", "choice".

3. By the way, anyone who believes that the laws of physics are mere social conventions is invited to try transgressing those conventions from the windows of my apartment. I live on the twenty-first floor. (P.S. I am aware that this wisecrack is unfair to the more sophisticated relativist philosophers of science, who will concede that *empirical statements* can be objectively true — e.g. the fall from my window to the pavement will take approximately 2.5 seconds — but claim that the *theoretical explanations* of those empirical statements are more-or-less arbitrary social constructions. I think that also this view is largely wrong, but that is a much longer discussion.)

4. The natural sciences have little to fear, at least in the short run, from postmodernist silliness; it is, above all, history and the social sciences — and leftist politics — that suffer when verbal game-playing displaces the rigorous analysis of social realities. Nevertheless, because of the limitations of my own expertise, my analysis here will be restricted to the natural sciences (and indeed primarily to the physical sciences). While the basic epistemology of inquiry ought to be roughly the same for the natural and social sciences, I am of course perfectly aware that many special (and very difficult) methodological issues arise in the social sciences from the fact that the objects of inquiry are human beings (including their subjective states of mind); that these objects of inquiry have intentions (including in some cases the concealment of evidence or the placement of deliberately self-serving evidence); that the evidence is expressed (usually) in human language whose meaning may be ambiguous; that

the meaning of conceptual categories (e.g. childhood, masculinity, femininity, family, economics, etc.) changes over time; that the goal of historical inquiry is not just facts but interpretation, etc. So by no means do I claim that my comments about physics should apply directly to history and the social sciences — that would be absurd. To say that "physical reality is a social and linguistic construct" is just plain silly, but to say that "social reality is a social and linguistic construct" is virtually a tautology.

5. Ryan (1992).

6. Hobsbawm (1993, 63).

7. Andreski (1972, 90).

8. Computers existed prior to solid-state technology, but they were unwieldy and slow. The 486 PC sitting today on the literary theorist's desk is roughly 1000 times more powerful than the room-sized vacuum-tube computer IBM 704 from 1954 (see e.g. Williams 1985).

9. I certainly don't exclude the possibility that *present* theories in any of these subjects might be erroneous. But critics wishing to make such a case would have to provide not only historical evidence of the claimed cultural influence, but also *scientific* evidence that the theory in question is in fact erroneous. (The same evidentiary standards of course apply to *past* erroneous theories; but in this case the scientists may have already performed the second task, relieving the cultural critic of the need to do so from scratch.)

10. Ross (1991, 25–26); also in Ross (1992, 535–536).

11. Ross (1991, 26); also in Ross (1992, 535). In the discussion following this paper, Ross (1992, 549) expressed further (and quite justified) misgivings:

> I'm quite skeptical of the "anything goes" spirit that is often the prevailing climate of relativism around postmodernism. . . . Much of the postmodernist debate has been devoted to grappling with the philosophical or cultural limits to the grand

narratives of the Enlightenment. If you think about ecological questions in this light, however, then you are talking about "real" physical, or material, limits to our resources for encouraging social growth. And postmodernism, as we know, has been loath to address the "real," except to announce its banishment.

12. U.S. Bureau of the Census (1975, 47, 55; 1994, 87). In 1900 the mean life expectancy at birth was 47.3 years (47.6 years for whites, and a shocking 33.0 years for "Negro and other"). In 1995 it is 76.3 years (77.0 years for whites, 70.3 years for blacks).

    I am aware that this assertion is likely to be misinterpreted, so let me engage in some pre-emptive clarification. I am *not* claiming that all of the increase in life expectancy is due to advances in scientific *medicine*. A large fraction (possibly the dominant part) of the increase — especially in the first three decades of the twentieth century — is due to the general improvement in the standards of housing, nutrition and public sanitation (the latter two informed by improved scientific understanding of the etiology of infectious and dietary-deficiency diseases). [For reviews of the evidence, see e.g. Holland *et al.* (1991).] But — without discounting the role of social struggles in these improvements, particularly as concerns the narrowing of the racial gap — the underlying and overwhelming cause of these improvements is quite obviously the vast increase in the material standard of living over the past century, by more than a factor of five (U.S. Bureau of the Census 1975, 224–225; 1994, 451). And this increase is quite obviously the direct result of science, as embodied in technology.

13. Ross (1991, 26); also in Ross (1992, 536).

14. By the way, intelligent non-scientists seriously interested in the conceptual problems raised by quantum mechanics need no longer rely on the vulgarizations (in both senses) published by Heisenberg, Bohr and sundry physicists and New Age authors. The little book of Albert (1992) provides an impressively serious and *intellectually honest* account of quantum mechanics and the philosophical issues it raises — yet it requires no more mathematical background than a modicum of high-school algebra, and does not require any prior knowledge of physics. The main requirement is a willingness to think *slowly* and *clearly*.

15. Snow (1963, 20–21). One significant change has taken place since C.P. Snow's time: while humanist intellectuals' ignorance about (for example) mass and acceleration remains substantially unchanged, nowadays a significant minority of humanist intellectuals feels entitled to pontificate on these subjects in spite of their ignorance (perhaps trusting that their readers will be equally ignorant). Consider, for example, the following excerpt from a recent book on *Rethinking Technologies*, edited by the Miami Theory Collective and published by the University of Minnesota Press: "it now seems appropriate to reconsider the notions of acceleration and deceleration (what physicists call positive and negative speeds)" (Virilio 1993, 5). The reader who does not find this uproariously funny (as well as depressing) is invited to sit in on the first two weeks of Physics I.

16. I wasn't joking about that. For anyone who is interested in my views, I would be glad to provide a copy of Sokal (1987). For another sharp critique of the poor teaching of mathematics and science, see (irony of ironies) Gross and Levitt (1994, 23–28).

17. Telepathy: Hastings and Hastings (1992, 518), American Institute of Public Opinion poll from June 1990. Concerning "telepathy, or communication between minds without using the traditional five senses", 36% "believe in", 25% are "not sure", and 39% "do not believe in". For "people on this earth are sometimes possessed by the devil", it is 49–16–35 (!). For "astrology, or that the position of the stars and planets can affect people's lives", it is 25–22–53. Mercifully, only 11% believe in channeling (22% are not sure), and 7% in the healing power of pyramids (26% not sure).

    Creationism: Gallup (1993, 157–159), Gallup poll from June 1993. The exact question was: "Which of the following statements comes closest to your views on the origin and development of human beings: 1) human beings have developed over millions of years from less advanced forms of life, but God guided this process; 2) human beings have developed over millions of years from less advanced forms of life, but God had no part in this process; 3) God created human beings pretty much in their present form at one time within the last 10,000 years or so?" The results were 35% developed with God, 11% developed without God, 47% God created in present form, 7% no opinion. A poll from July 1982 (Gallup 1982, 208–214) found almost identical figures, but gave breakdowns by sex, race, education, region, age, income, religion, and community size. Differences by sex, race, region, income and (surprisingly) religion were rather small. By far the largest difference was by education: only 24% of college graduates supported creationism, compared to 49% of high-school graduates and 52% of those with a grade-school education. So maybe the worst science teaching is at the elementary and secondary levels.

18. See footnote 11 above.

19. Chomsky (1984, 200), lecture delivered in 1969.

20. Ryan (1992).

Works Cited

Albert, David Z. 1992. *Quantum Mechanics and Experience*. Cambridge: Harvard University Press.

Andreski, Stanislav. 1972. *Social Sciences as Sorcery*. London: André Deutsch.

Chomsky, Noam. 1984. The politicization of the university. In *Radical Priorities*, 2nd ed, pp. 189–206, edited by Carlos P. Otero. Montreal: Black Rose Books.

Forman, Paul. 1987. Behind quantum electronics: National security as basis for physical research in the United States, 1940–1960. *Historical Studies in the Physical and Biological Sciences* **18**: 149–229.

Gallup, George H. 1982. *The Gallup Poll: Public Opinion 1982*. Wilmington, Del.: Scholarly Resources.

Gallup, George Jr. 1993. *The Gallup Poll: Public Opinion 1993*. Wilmington, Del.: Scholarly Resources.

Gross, Paul R. and Norman Levitt. 1994. The natural sciences: Trouble ahead? Yes. *Academic Questions* **7**(2): 13–29.

Harding, Sandra. 1991. *Whose Science? Whose Knowledge? Thinking from Women's Lives.* Ithaca: Cornell University Press.

Hastings, Elizabeth Hann and Philip K. Hastings, eds. 1992. *Index to International Public Opinion, 1990–1991*. New York: Greenwood Press.

Hobsbawm, Eric. 1993. The new threat to history. *New York Review of Books* (16 December): 62–64.

Holland, Walter W. *et al.*, eds. 1991. *Oxford Textbook of Public Health*, 3 vols. Oxford: Oxford University Press.

Laudan, Larry. 1990. *Science and Relativism.* Chicago: University of Chicago Press.

Ross, Andrew. 1991. *Strange Weather: Culture, Science, and Technology in the Age of Limits.* London: Verso.

Ross, Andrew. 1992. New Age technocultures. In *Cultural Studies*, pp. 531–555, edited by Lawrence Grossberg, Cary Nelson and Paula A. Treichler. New York: Routledge.

Ryan, Alan. 1992. Princeton diary. *London Review of Books* (26 March): 21.

Snow, C.P. 1963. *The Two Cultures: And A Second Look.* New York: Cambridge University Press.

Sokal, Alan. 1987. Informe sobre el plan de estudios de las carreras de Matemática, Estadística y Computación. Report to the Universidad Nacional Autónoma de Nicaragua, Managua, unpublished.

U.S. Bureau of the Census. 1975. *Historical Statistics of the United States: Colonial Times to 1970.* Washington: Government Printing Office.

U.S. Bureau of the Census. 1994. *Statistical Abstract of the United States: 1994.* Washington: Government Printing Office.

Virilio, Paul. 1993. The third interval: A critical transition. In *Rethinking Technologies*, pp. 3–12, edited by Verena Andermatt Conley on behalf of the Miami Theory Collective. Minneapolis: University of Minnesota Press.

Williams, Michael R. 1985. *A History of Computing Technology.* Englewood Cliffs, N.J.: Prentice-Hall.