

## POSTMODERNISM AND THE SOKAL HOAX

Two philosophers examine where the responsibilities should lie

In 1994, Alan Sokal, a theoretical physicist from New York University, submitted a paper "Transgressing the Boundaries – Toward a Transformative Hermeneutics of Quantum Gravity," to the cultural-studies journal *Social Text*. "Hermeneutics," written as a postmodernist criticism of science, was accepted after being reviewed by five members of the journal's editorial board. It was published in a special double issue of the journal entitled "Science Wars." Sokal then admitted in the journal *Lingua Franca* that the paper was, in fact, a parody.

The main ingredients of "Hermeneutics" were quotations from prominent postmodernist thinkers on science and mathematics that, as he was later to reveal, demonstrated little or no understanding of science or the scientific method. Nevertheless, Sokal praised these thinkers in his paper and used their quotations to produce a complicated yet meaningless stream of babble, peppered with ideas from such fashionable postmodern themes as deconstructive literary theory, New Age ecology, feminist epistemology and social-constructivist philosophy of science. (The first section of his paper is presented on Page 4.)

Needless to say, "Hermeneutics" generated a great deal of fallout in the form of editorials, articles and heated internet discussions. Philosopher Paul Boghossian, in "What the Sokal Hoax Ought to Teach Us" (Page 10), offers a critical examination of the entire affair. One of his sobering conclusions is that the parody "served as a flash point for what has been a gathering storm of protest against the collapse in standards of scholarship and intellectual responsibility that vest sectors of the humanities and social sciences are currently afflicted with."

On the other hand, philosopher and historian of science Mara Beller, in "The Sokal Hoax: At Whom Are We Laughing?" (Page 3), argues that some of the responsibility for the lack of scholarship in postmodernist science studies should be shared by the founding

fathers of quantum mechanics. In particular, members of the Copenhagen school of physics, led by Danish physicist Niels Bohr and inspired by the bizarre, non-classical behaviour exhibited by atomic and subatomic particles, travelled well beyond their reach to make bold philosophical declarations about the nature of the physical world. When examined carefully, many of these deliverances are as nebulous and convoluted as the postmodernists' statements parodied by Alan Sokal.

Nevertheless, the *Copenhagen interpretation*, despite early attempts by Einstein, Schrödinger and de Broglie to point out its weaknesses, became the dominant interpretation of quantum mechanics. Even worse, however, as Beller points out, is that an idea such as Bohr's *complementarity*, "while certainly legitimate as one of the possible interpretive options, was turned into a rigid ideology, misleading both scientists and educated nonscientists." Postmodernist thinkers and others have unfortunately embraced such ideologies.

### Inside this issue:

Editorial	2
The Sokal Hoax: At Whom Are We Laughing?	3
What the Sokal Hoax Ought to Teach Us	10
Letters to the Editor	15
Book Reviews	17
Forum Midterm Quiz	23
President's Message	24

## EDITORIAL

In its May meeting, UW's Senate wisely rejected the report of Senate Undergraduate Council advising the Vice-President, Academic and Provost on a process for reviewing and changing class grades. Senators voted to send the matter to the faculty councils for discussion. Proposals from the faculty councils will then be sent back to Senate for its consideration in the Fall 2002 term. It is our understanding that discussions have already begun in the Faculties of Science and Engineering.

The *Forum* intends to keep faculty members informed of progress in this matter. As a source of information, the September issue of the *Forum* will contain the following: (i) the original FAUW proposal (published in part in the October 2001 issue), (ii) the report of the Senate Undergraduate Council and (iii) a summary of the discussion in the May Senate meeting, as recorded in the minutes.

### **“Let's Make an Ask!”**

In June, UW senators had an opportunity to witness the evolution of the English language during the report of the Vice-President, University Relations on the status of UW's fund-raising campaign. The VP's PowerPoint presentation contained some fine examples of modern *business-speak*. For example, as part of the longer focus (24-60 months) of this campaign, we should “lever every \$ raised ...” and “significantly increase large prospect base.” A much more difficult phrase to decipher was “need aging demographics.” (Are the demographics aging? If so, are they people? Or do we require statistics on aging?) The VP also identified “donor stewardship

and management” and “delivery of results” as being important.

It also appears that UW has adopted a slick new term for funding requests: They are now called “asks.” Apparently, there are “asks in progress” and even “2 stage asks”. And the act of contacting a potential donor to solicit funds is referred to as “making an ask”. (I leave it to the reader to respond with obvious concoctions.) Although I am certainly not an expert in linguistics, I believe that this novel construction may represent a new leap in the evolution of our language. The past decade witnessed an upsurge in the phenomenon of “verbing,” the use of verbs as nouns – for example, “Let's dialogue”. UW's decision to “make asks” is perhaps defining a new trend: “nouncing.”

Finally, the following statement from the VP's report most probably qualifies for the Richard Mitchell Prize for Jargon:

“Branding outreach via communication vehicles.”

(See Prof. Mitchell's “Worm in the Brain,” *Forum*, June 2001.) Readers are invited to submit descriptions of the images conjured up in their minds by this vivacious phrase.

One can only wonder whether such pearls of communication are trickling down into the minds of those budding managers and fund-raisers who will eventually receive UW degrees.

*ERV*

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## THE SOKAL HOAX: AT WHOM ARE WE LAUGHING?

The philosophical pronouncements of Bohr, Born, Heisenberg and Pauli deserve some of the blame for the excesses of the postmodernist critique of science

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The hoax perpetrated by New York University theoretical physicist Alan Sokal in 1996 on the editors of the journal *Social Text* quickly became widely known and hotly debated. (See *Physics Today* January 1997, page 61, and March 1997, page 73.) "Transgressing the Boundaries – Toward a Transformative Hermeneutics of Quantum Gravity," was the title of the parody he slipped past the unsuspecting editors.<sup>1</sup> (See Figure 1.)

Many readers of Sokal's article characterized it as an ingenious exposure of the decline of the intellectual standards in contemporary academia, and as a brilliant parody of the postmodern nonsense rampant among the cultural studies of science. Sokal's paper is variously, so we read, "a hilarious compilation of pomo gibberish", "an imitation of academic babble", and even "a transformative hermeneutics of total bullshit."<sup>2</sup> Many scientists reported having "great fun" and "a great laugh" reading Sokal's article. Yet whom, exactly, are we laughing at?

As telling examples of the views Sokal satirized, one might quote some other statements. Consider the following extrapolation of Heisenberg's uncertainty and Bohr's complementarity into the political realm:

The thesis "light consists of particles" and the antithesis "light consists of waves" fought with one another until they were united in the synthesis of quantum mechanics. . . . Only why not apply it to the thesis Liberalism (or Capitalism), the antithesis Communism, and expect a synthesis, instead of a complete and permanent victory for the antithesis? There seems to be some inconsistency. But the idea of complementarity goes deeper. In fact, this thesis and antithesis represent two psychological motives and economic forces, both justified in themselves, but, in their extremes, mutually exclusive. . . . There must exist a relation between the latitudes of freedom  $\Delta f$  and of regulation  $\Delta r$ , of the type  $\Delta f \Delta r = p$ . . . . But what is the "political constant"  $p$ ? I must leave this to a future quantum theory of human affairs.

Before you burst out laughing at such "absurdities," let me disclose the author: Max Born, one of the venerated founding fathers of quantum theory.<sup>3</sup> Born's words were not written tongue in cheek; he soberly declared that "epistemological

lessons [from physics] may help towards a deeper understanding of social and political relations". Such was Born's enthusiasm to infer from the scientific to the political realm, that he devoted a whole book to the subject, unequivocally titled *Physics and Politics*.<sup>3</sup>

### Science and religion

Born's words are not an exception. One might even be more bewildered to read Wolfgang Pauli's philosophical publications and his unpublished scientific correspondence:

Science and religion must have something to do with each other. (I do not mean "religion within physics," nor do I mean "physics inside religion," since either one would certainly be one-sided, but rather I mean the placing of both of them within a whole.) I would like to make an attempt to give a name to that which the new idea of reality brings to my mind: the idea of reality of the symbol. . . . It contains something of the old concept of God as well as the old concept of matter (an example from physics: the atom. The primary qualities of filling space have been lost. If it were not a symbol how could it be "both wave and particle?"). The symbol is symmetrical with respect to "this side" and "beyond" . . . the symbol is like a god that exerts an influence on man.<sup>4</sup>

One of the more absurd examples of Sokal's satire, according to the author himself, involves the inference from quantum physics to Jacques Lacan's psychoanalytic ideas. "Even non-scientist readers might well wonder what in heaven's name quantum field theory has to do with psychoanalysis" – exclaimed Sokal in the *Lingua Franca* article in which he promptly revealed his hoax.<sup>1</sup> Nonetheless, a "deep" connection between quantum theory and psychology was extensively discussed in the writings of Pauli, Niels Bohr and Pascual Jordan. Jordan explored the "formal" parallels between quantum physics and Freudian psychoanalysis, and even parapsychology. Pauli, in all seriousness, proceeded from quantum concepts to the idea of the unconscious, to Jungian archetypes, and even to extra sensory perception.

The following words of Bohr are among the more sober statements of these founding fathers with regard to the

(Continued on page 5)

Full text available from [http://www.physics.nyu.edu/faculty/sokal/transgress\\_v2/transgress\\_v2.html](http://www.physics.nyu.edu/faculty/sokal/transgress_v2/transgress_v2.html)

## TRANSGRESSING THE BOUNDARIES: TOWARDS A TRANSFORMATIVE HERMENEUTICS OF QUANTUM GRAVITY

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Transgressing disciplinary boundaries . . . [is] a subversive undertaking since it is likely to violate the sanctuaries of accepted ways of perceiving. Among the most fortified boundaries have been those between the natural sciences and the humanities.

– Valerie Greenberg, *Transgressive Readings* (1990, 1)

The struggle for the transformation of ideology into critical science . . . proceeds on the foundation that the critique of all presuppositions of science and ideology must be the only absolute principle of science.

– Stanley Aronowitz, *Science as Power* (1988b, 339)

There are many natural scientists, and especially physicists, who continue to reject the notion that the disciplines concerned with social and cultural criticism can have anything to contribute, except perhaps peripherally, to their research. Still less are they receptive to the idea that the very foundations of their worldview must be revised or rebuilt in the light of such criticism. Rather, they cling to the dogma imposed by the long post-Enlightenment hegemony over the Western intellectual outlook, which can be summarized briefly as follows: that there exists an external world, whose properties are independent of any individual human being and indeed of humanity as a whole; that these properties are encoded in "eternal" physical laws; and that human beings can obtain reliable, albeit imperfect and tentative, knowledge of these laws by hewing to the "objective" procedures and epistemological strictures prescribed by the (so-called) scientific method.

But deep conceptual shifts within twentieth-century science have undermined this Cartesian-Newtonian metaphysics; revisionist studies in the history and philosophy of science have cast further doubt on its credibility; and, most recently, feminist and poststructuralist critiques have demystified the substantive content of mainstream Western scientific practice, revealing the ideology of domination concealed behind the façade of "objectivity". It has thus become increasingly apparent that physical "reality", no less than social "reality", is at bottom a social and linguistic construct; that scientific "knowledge", far from being objective, reflects and encodes the dominant ideologies and power relations of the culture that produced it;

that the truth claims of science are inherently theory-laden and self-referential; and consequently, that the discourse of the scientific community, for all its undeniable value, cannot assert a privileged epistemological status with respect to counter-hegemonic narratives emanating from dissident or marginalized communities. These themes can be traced, despite some differences of emphasis, in Aronowitz's analysis of the cultural fabric that produced quantum mechanics; in Ross' discussion of oppositional discourses in post-quantum science; in Irigaray's and Hayles' exegeses of gender encoding in fluid mechanics; and in Harding's comprehensive critique of the gender ideology underlying the natural sciences in general and physics in particular.

Here my aim is to carry these deep analyses one step farther, by taking account of recent developments in quantum gravity: the emerging branch of physics in which Heisenberg's quantum mechanics and Einstein's general relativity are at once synthesized and superseded. In quantum gravity, as we shall see, the space-time manifold ceases to exist as an objective physical reality; geometry becomes relational and contextual; and the foundational conceptual categories of prior science – among them, existence itself – become problematized and relativized. This conceptual revolution, I will argue, has profound implications for the content of a future postmodern and liberatory science.

My approach will be as follows: First I will review very briefly some of the philosophical and ideological issues raised by quantum mechanics and by classical general relativity. Next I will sketch the outlines of the emerging theory of quantum gravity, and discuss some of the conceptual issues it raises. Finally, I will comment on the cultural and political implications of these scientific developments. It should be emphasized that this article is of necessity tentative and preliminary; I do not pretend to answer all of the questions that I raise. My aim is, rather, to draw the attention of readers to these important developments in physical science, and to sketch as best I can their philosophical and political implications. I have endeavored here to keep mathematics to a bare minimum; but I have taken care to provide references where interested readers can find all requisite details.

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FIGURE 1. First section of Sokal's hoax article, unwittingly published by the editors of *Social Text* in their Spring/Summer 1996 issue.<sup>1</sup>

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(Continued from page 3)

connection between the quantum and the psychological domains:

This domain [psychology] is distinguished by reciprocal relationships which depend on the unity of our consciousness and which exhibit a striking similarity with the physical consequences of the quantum of action. We are thinking here of well-known characteristics of emotion and volition which are quite incapable of being represented by visualizable pictures. In particular, the apparent contrast between the conscious onward flow of associative thinking and the preservation of the unity of the personality exhibit . . . analogy with the relation between the wave description of the motions of material particles, . . . and their indestructible individuality.<sup>5</sup>

### The rarely noticed mistake

Like the deconstructionist Jacques Derrida, whom Steven Weinberg attacked in his 1996 *New York Review of Books* article on Sokal's hoax,<sup>2</sup> Bohr was notorious for the obscurity of his writing. Yet physicists relate to Derrida's and Bohr's obscurities in fundamentally different ways: to Derrida's with contempt, to Bohr's with awe. Bohr's obscurity is attributed, time and again, to a "depth and subtlety" that mere mortals are not equipped to comprehend.

Perhaps disclosure of another editorial oversight will demonstrate my point. In a widely used compendium of papers on quantum theory, edited by John Wheeler and Wojciech Zurek,<sup>6</sup> the pages of Bohr's reprinted article are out of order. That paper (Bohr's response to the famous 1935 Einstein-Podolsky-Rosen critique of the standard Copenhagen interpretation) is widely cited in contemporary literature by physicists and philosophers of science. Yet I have never heard anybody complain that something is wrong with Bohr's text in this volume. The mistake, it seems, is rarely noticed, even though it occurs in both the hard- and the soft-cover editions.

When physicists failed to find meaning in Bohr's writings, no matter how hard they tried, they blamed themselves, not Bohr. (Einstein and Schrödinger were among the rare exceptions.) Carl von Weizsäcker's testimony is a striking example of the overpowering, almost disabling, impact of Bohr's authority. After meeting with Bohr, Von Weizsäcker asked himself: "What had Bohr meant? What must I understand to be able to tell what he meant and why he was right? I tortured myself on endless solitary walks."<sup>7</sup> Note that von Weizsäcker did not ask, "Was Bohr right?" or "To what extent, or on what issue, was Bohr right?" or "on what issues was Bohr right?" but, quite incredibly, he wondered what must one assume and in what way must one argue in order to render Bohr right?

Astonishing statements, hardly distinguishable from those satirized by Sokal, abound in the writings of Bohr, Heisenberg, Pauli, Born and Jordan. And they are not just casual, incidental remarks. Bohr intended his philosophy of comple-

mentarity to be an overarching epistemological principle – applicable to physics, biology, psychology, anthropology. He expected complementarity to be a substitute for the lost religion. He believed that complementarity should be taught to children in elementary schools. Pauli argued that "the most important task of our time" was the elaboration of a new quantum concept of reality that would unify science and religion. Born stated that quantum philosophy would help humanity cope with the political reality of the era after World War II. Heisenberg expressed the hope that the results of quantum physics "will exert their influence upon the wider fields of the world of ideas [just as] the changes at the end of the Renaissance transformed the cultural life of the succeeding epochs."

So much confidence did these architects of the quantum theory repose in its far-reaching implications for the cultural realm, that they corresponded about establishing an "Institute for Complementarity" in the US. The aim of such an institute, to be headed by Bohr, would be to promote Bohrian philosophy. The aging Born begged Bohr not to leave him out of this enterprise.<sup>8</sup>

### Postmodernist babble

Sokal's hoax was ingeniously contrived. The gradual slide from the Bohr and Heisenberg quotes at the beginning of his article into postmodernist babble about the connection between science and politics is all too natural. When feminists like Donna Willshire, or intellectuals of the left like Stanley Aronowitz, connect quantum physics with politics and wider social issues, they're treading a well-worn path legitimized by the scientific authority of the great quantum physicists, in whose writings we find the roots of the postmodernist excesses of today. When Sokal, in his *Social Text* article, wrote that Bohr's "foreshadowing of postmodernist epistemology is by no means coincidental," he was more correct than he intended to be.

We find ourselves in a peculiar predicament. On the one hand, either the whole enterprise of inferring from the scientific to the cultural and political is misconceived, unfounded and far-fetched – in which case some of our greatest physicists are no less guilty than our postmodernist critics. Or, on the other hand, drawing inferences from the scientific to the wider cultural domain is a meaningful and profound activity – in which case we must judge the undertaking of the postmodernist cultural analysts to be respectable, commendable and important, even though we might regret, and perhaps even condemn, the scientific illiteracy of some of them.

The focal point of the controversy is the issue of reality. Sokal and Weinberg repeatedly express, in an emotionally charged way, an ardent belief in scientific reality as something objective and independent of the observer. Weinberg disapprovingly quoted Kuhn's words: "I am not suggesting, let me emphasize, that there is a reality which science fails to get at. My point is rather that no sense can be made of the notion of reality as it has ordinarily functioned in



FIGURE 2.  
BOHR AND  
HEISENBERG  
IN 1927.



(Courtesy of the American Institute of Physics Emilio Segrè Visual Archives, Segrè Collection)

philosophy of science."<sup>9</sup>

Kuhn's words can be supported by the following, stronger ones:

"The physical world is real. . . ." [That] statement appears to me, however, to be, in itself, meaningless, as if one said: "The physical world is cock-a-doodle-do." It appears to me that the "real" is an intrinsically empty, meaningless category (pigeon hole). . . .<sup>10</sup>

This is not from Derrida or Kuhn, and not even from Bohr or Heisenberg. The words belong to Albert Einstein – a staunch believer in observer-independent reality. Similar statements appear many times in Einstein's published and unpublished writings. The idea of a physical theory as a mirror of reality was completely foreign to Einstein: "[The physicist] will never be able to compare this picture with the real mechanism, and he cannot even imagine the possibility or the meaning of such a comparison."<sup>10</sup>

While Einstein's belief in an objective reality is similar to that of Weinberg and Sokal, his arguments for his conception of reality are not. In fact, Einstein was no "naive realist," despite such caricaturing of his stand by the Copenhagen orthodoxy. He ridiculed the "correspondence" view of reality that many scientists accept uncritically. Einstein fully realized that the world is not presented to us twice – first as it is, and second, as it is theoretically described – so we can compare our theoretical "copy" with the "real thing". The world is given to us only once – through our best scientific theories. So Einstein deemed it necessary to ground this concept of objective reality in the invariant characteristics of our best scientific theories.

The founders of quantum physics – Bohr, Born, Pauli and Heisenberg – misrepresented and ridiculed Einstein's "naive" belief in an objective, observer-independent reality. Bohr's complementarity principle, they claimed, inevitably implies that one can no longer construct a unified, objective,

observer-independent description in physics. (The relevant quotations are conveniently available at the beginning of Sokal's article).

In the quantum domain one can have only partial, equally correct, yet mutually incompatible perspectives, disclosed in mutually exclusive experimental arrangements. In some of these arrangements an electron behaves as a wave, in others as a particle. It is not possible to combine the partial pictures into a unified picture, and it is not meaningful to talk about physical reality as existing independently of the act of observation. Inspired by Bohr's far-reaching "revision of our concept of reality," some physicists, interpreting John Bell's theoretical results and Alain Aspect's experiments, contend that "the moon is demonstrably not there when nobody looks".<sup>11</sup> (See also *Physics Today* April 1985, page 38.)

John Wheeler's description of an imaginary dialogue between a physicist and the universe about their respective "realities" is a telling example: The universe says to a physicist, "I supply the space and time for your existence. There was no before, before I came into being, and there will be no after [after] I cease to exist. You are an unimportant bit of matter located in an unimportant galaxy." "How shall we reply?" asks Wheeler. Shall we say, "Yes, OK universe, without you I would not have been able to come into being. Yet you, great system, are made of phenomena; and every phenomenon rests on an act of observation. You could not even exist without an elementary act of registration such as mine."<sup>12</sup>

#### A female way

If physical reality is nothing but a scientist's act of registration, then perhaps – some social scientists have argued – historical and social reality is nothing but an act of interpretation. The following lines by the sociologist Don Handelman are typical:

No longer may we assume with ease that nature (and culture) exist "out there," to be mapped and discovered

without evaluating our own roles and operations at one and the same time. The particle physicist, Werner Heisenberg . . . put it this way: "When we speak of a picture of nature provided by contemporary exact science, we do not actually mean any longer a picture of nature, but rather a picture of our relation to nature. . . ." As we now understand "forces of nature" (and culture) to be accessible to us through ourselves, so these have become our "subject." These views have some prominence in postmodern science.<sup>13</sup>

Donna Wilshire draws more far-reaching (some would say far-fetched) inferences from the writings of Heisenberg, Bohr and Pauli. She concludes that quantum mechanical description is "wildly illogical", and that there is, in fact, no substantive difference between science and art: "Werner Heisenberg and Niels Bohr have written that what happened in the discovery of quantum physics *united the methods of science and art* [italics in the original]. . . . Science, literature and art must value one another and incorporate and share one another's methods and forms. In [quantum mechanics], emotion, passion, and wild speculation become essential to science."<sup>14</sup>

Wilshire must have been inspired, or at least reassured, by something like the following quote from Bohr:

Such considerations involve no lack of appreciation of the inspiration which the great creations of art offer us by pointing to features of harmonious wholeness in our position. Indeed, in renouncing logical analysis to an increased degree and in turn allowing the interplay of all strings of emotion, poetry, painting and music to contain possibilities of bridging between extreme modes as those characterized as pragmatic and mystic. . . . The aim of our argumentation is to emphasize that all experience, whether in science, philosophy or art, which may be helpful to mankind, must be capable of being communicated by human means of expression.<sup>14</sup>

Inspired by Bohr's union of the pragmatic and the mystic way of knowing, Wilshire presents her vision of a female way of doing science – a vision that Sokal's satire could have quoted verbatim:

I anticipate the day when all discussions of ideas and science will include poetry, oral history, literary and emotional allusions. I am eager to read the astronomer-mathematician who gives as much attention to the rhythms, music, and dance she experiences in her body while she is observing as she gives to the observed: the cosmic dance, flow, and energy she is reducing to formula or speculating about.<sup>14</sup>

When Einstein warned Bohr about the irresponsible, "shaky game with reality" that Bohr was playing, could he have had this kind of argumentation in mind? Could Einstein have foreseen the state of affairs satirized by Sokal?

### The rhetoric of inevitability

When Bohr speculated about parallels between "wave-particle duality" in physics and the "complementarity" of reason and emotion, or complementarity between different cultures, he asserted that the comparisons were not just vague analogies; they flowed necessarily from "the very analysis of the logical use of our concepts." Bohr and his supporters presented his dualistic philosophy of complementarity in physics not as one feasible way of interpreting the quantum formalism, but rather as the only logically possible way.

This rhetoric of inevitability implied the logical impossibility of any alternative to the Copenhagen philosophy, thus concealing the fruitful interpretive freedom of the quantum mechanical formalism. In this way, the philosophy of complementarity, while certainly legitimate as one of the possible interpretive options, was turned into a rigid ideology, misleading both scientists and educated nonscientists.

By using simple analogies and intuitively appealing, yet misleading, metaphorical images, Bohr established supposedly necessary connections between acausality, wave-particle duality and the impossibility of an objective unified description in the quantum domain. One needed no technical knowledge of quantum mechanics to read Bohr's operational analysis of mutually exclusive experimental arrangements consisting of bolts, springs, rods and diaphragms.

While publicly abstaining from criticizing Bohr, many of his contemporaries did not share his peculiar insistence on the impossibility of devising new nonclassical concepts – an insistence that put rigid strictures on the freedom to theorize. It is on this issue that the silence of other physicists had the most far-reaching consequences. This silence created and sustained the illusion that one needed no technical knowledge of quantum mechanics to fully comprehend its revolutionary epistemological lessons. Many postmodernist critics of science have fallen prey to this strategy of argumentation and freely proclaimed that physics itself irrevocably banished the notion of objective reality.

### 'We know better now'

In an exchange several months after his *New York Review of Books* article, Weinberg admitted that the founders of quantum theory had been wrong in their "apparent subjectivism," and declared that "we know better now."<sup>15</sup> What exactly do we know better now? Do we know better that one should not infer from the physical to the political realm – and if yes, why? Or do we know better that the "orthodox" interpretation of quantum physics – the one that confidently announced the final overthrow of causality and the ordinary conception of reality – is not the only possible interpretation, and that, ultimately, it might not even be the surviving one?

The philosophical pronouncements of Bohr and other founders of quantum physics are not just an anachronistic



**FIGURE 3. CARICATURES BY GEORGE GAMOW**, drawn at Bohr's Copenhagen institute in the the early 1930s. **Left:** Bohr, who did not tolerate dissent easily, in 1931 haranguing the bound and gagged Lev Landau, who had written a paper about the uncertainty relations in relativistic quantum theory with which Bohr did not agree. **Below:** Pauli as Mephisto in a parody of Faust performed at Bohr's institute in 1932. In later years, Pauli was given to unrestrained metaphysical speculation.

curiosity. A flood of popular writings by physicists and science writers continues to proclaim the victory of Bohr's conception of reality over Einstein's, especially since Bell's seminal theoretical results and their confirmation by Aspect's experiments in the early 1980s. These writers do not mention that the most prominent feature of Bell's results, nonlocality, is, in fact, naturally contained in David Bohm's causal, observer-independent alternative to the standard quantum theory. (See the article by Sheldon Goldstein in *Physics Today*, March, page 42 and April, page 38.) Bohm's nonlocal theory and recent variants of it incorporate the essence of Bell's results in an immediate way, without recourse to Bohr's philosophy.<sup>16</sup>

Paul Gross and Norman Levitt, whose book *Higher Superstition* inspired Sokal's undertaking, ridicule Aronowitz when he "naively echoes . . . the view that the causal and deterministic view of things implicit in classical physics has been irrevocably banished." To this end, Gross and Levitt cite the work of Goldstein, Detlef Dürr and Nino Zanghi along Bohmian lines.<sup>17</sup> But Aronowitz had been relying on the assertions of the inevitable and final overthrow of determinism, endlessly repeated by the most honored heroes of 20th-century physics. How can Aronowitz or other non-physicists resist the author-

ity of such past eminences, unless the physicists of our time publicly declare that the Copenhagen orthodoxy is no longer obligatory? Such a public declaration could have diminished greatly the explosive proliferation of the postmodernist academic nonsense, so appalling to Sokal and Weinberg.

The opponents of the postmodernist cultural studies of science conclude confidently from the Sokal affair that "the emperors . . . have no clothes."<sup>18</sup> But who, exactly, are all those naked emperors? At whom should we be laughing?

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## WHAT THE SOKAL HOAX OUGHT TO TEACH US

### The pernicious consequences and internal contradictions of "postmodernist" relativism

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In the autumn of 1994, New York University theoretical physicist, Alan Sokal, submitted an essay to *Social Text*, the leading journal in the field of cultural studies. Entitled "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity," it purported to be a scholarly article about the 'postmodern' philosophical and political implications of twentieth century physical theories.<sup>1</sup> However, as the author himself later revealed in the journal *Lingua Franca*, his essay was merely a farrago of deliberately concocted solecisms, howlers and non-sequiturs, stitched together so as to look good and to flatter the ideological preconceptions of the editors.<sup>2</sup> After review by five members of *Social Text's* editorial board, Sokal's parody was accepted for publication as a serious piece of scholarship. It appeared in April 1996, in a special double issue of the journal devoted to rebutting the charge that cultural studies critiques of science tend to be riddled with incompetence.

Sokal's hoax is fast acquiring the status of a classic *succes de scandale*, with extensive press coverage in the United States and to a growing extent in Europe and Latin America. In the United States, over twenty public forums devoted to the topic have either taken place or are scheduled, including packed sessions at Princeton, Duke, The University of Michigan, and New York University. But what exactly should it be taken to show?

I believe it shows three important things. First, that dubiously coherent relativistic views about the concepts of truth and evidence really have gained wide acceptance within the contemporary academy, just as it has often seemed. Second, that this has had precisely the sorts of pernicious consequence for standards of scholarship and intellectual responsibility that one would expect it to have. Finally, that neither of the preceding two claims need reflect a particular political point of view, least of all a conservative one.

It's impossible to do justice to the egregiousness of Sokal's essay without quoting it more or less in its entirety; what follows is a tiny sampling. Sokal starts off by establishing his postmodernist credentials: he derides scientists for continuing to cling to the "dogma imposed by the long post-Enlightenment hegemony over the Western intellectual outlook," that there exists an external world, whose properties are independent of human beings, and that human beings can obtain reliable, if imperfect and tentative knowledge of these properties "by hewing to the 'objective' procedures and epistemological strictures prescribed by the (so-called) scien-

tific method" (217). He asserts that this 'dogma' has already been thoroughly undermined by the theories of general relativity and quantum mechanics, and that physical reality has been shown to be "at bottom a social and linguistic construct" (217). In support of this he adduces nothing more than a couple of pronouncements from physicists Niels Bohr and Werner Heisenberg, pronouncements that have been shown to be naive by sophisticated discussions in the philosophy of science over the past fifty years.

Sokal then picks up steam, moving to his central thesis that recent developments within quantum gravity an emerging and still-speculative physical theory go much further, substantiating not only postmodern denials of the objectivity of truth, but also the beginnings of a kind of physics that would be truly "liberatory," of genuine service to progressive political causes (226). Here his 'reasoning' becomes truly venturesome, as he contrives to generate political and cultural conclusions from the physics of the very, very small. His inferences are mediated by nothing more than a hazy patchwork of puns (especially on the words 'linear' and 'discontinuous'), strained analogies, bald assertions and what can only be described as non-sequiturs of numbing grossness (to use a phrase that Peter Strawson applied to the far less deserving Immanuel Kant). For example, he moves immediately from Bohr's observation that in quantum mechanics "a complete elucidation of one and the same object may require diverse points of view" to:

In such a situation, how can a self-perpetuating secular priesthood of credentialed "scientists" purport to maintain a monopoly on the production of scientific knowledge? The content and methodology of post-modern science thus provide powerful intellectual support for the progressive political project, understood in its broadest sense: the transgressing of boundaries, the breaking down of barriers, the radical democratization of all aspects of social, economic, political and cultural life. (229)

He concludes by calling for the development of a correspondingly emancipated mathematics, one that, by not being based on standard (Zermelo-Fraenkel) set theory, would no longer constrain the progressive and postmodern ambitions of emerging physical science.

As if all this weren't enough, *en passant*, Sokal peppers his piece with as many smaller bits of transparent nonsense as could be made to fit on any given page. Some of these are of a purely mathematical or scientific nature that the well-known

geometrical constant  $\pi$  is a variable, that complex number theory, which dates from the nineteenth century and is taught to schoolchildren, is a new and speculative branch of mathematical physics, that the crackpot New Age fantasy of a 'morphogenetic field' constitutes a leading theory of quantum gravity. Others have to do with the alleged philosophical or political implications of basic science that quantum field theory confirms Lacan's psychoanalytic speculations about the nature of the neurotic subject, that fuzzy logic is better suited to leftist political causes than classical logic, that Bell's theorem, a technical result in the foundations of quantum mechanics, supports a claimed linkage between quantum theory and "industrial discipline in the early bourgeois epoch." Throughout, Sokal quotes liberally and approvingly from the writings of leading postmodern theorists, including several editors of *Social Text*, passages that are often breathtaking in their combination of self-confidence and absurdity.

Commentators have made much of the scientific, mathematical and philosophical illiteracy that an acceptance of Sokal's ingeniously contrived gibberish would appear to betray. But talk about illiteracy elides an important distinction between two different explanations of what might have led the editors to decide to publish Sokal's piece. One is that, although they understood perfectly well what the various sentences of his article actually mean, they found them plausible, whereas he, along with practically everybody else, doesn't. This might brand them as kooky, but wouldn't impugn their motives. The other hypothesis is that they actually had very little idea what many of the sentences mean, and so were not in a position to evaluate them for plausibility in the first place. The plausibility, or even the intelligibility, of Sokal's arguments just didn't enter into their deliberations.

I think it's very clear, and very important, that it's the second hypothesis that's true. To see why consider, by way of example, the following passage from Sokal's essay:

Just as liberal feminists are frequently content with a minimal agenda of legal and social equality for women and are "pro-choice," so liberal (and even some socialist) mathematicians are often content to work within the hegemonic Zermelo-Fraenkel framework (which, reflecting its nineteenth-century origins, already incorporates the axiom of equality) supplemented only by the axiom of choice. But this framework is grossly insufficient for a liberatory mathematics, as was proven long ago by Cohen 1966 (note 54, 242-243).

It's very hard to believe that an editor who knew what the various ingredient terms actually mean would not have raised an eyebrow at this passage. For the axiom of equality in set theory simply provides a definition of when it is that two sets are the same set, namely, when they have the same members; obviously, this has nothing to do with liberalism, or, indeed, with a political philosophy of any stripe. Similarly, the axiom of choice simply says that, given any collection of mutually exclusive sets, there is always a set consisting of exactly one member from each of those sets. Again, this clearly has nothing to do with the issue of choice in the abortion debate.

But even if one were somehow able to see one's way clear – I can't – to explaining this first quoted sentence in terms of the postmodern love for puns and wordplay, what would explain the subsequent sentence? Paul Cohen's 1966 publication proves that the question whether or not there is a number between two other particular (transfinite cardinal) numbers isn't settled by the axioms of Zermelo-Fraenkel set theory. How could this conceivably count as a proof that Zermelo-Fraenkel set theory is inadequate for the purposes of a "liberatory mathematics," whatever precisely that is supposed to be. Wouldn't any editor who knew what Paul Cohen had actually proved in 1966 have required just a little more by way of explanation here, in order to make the connection just a bit more perspicuous?

Since one could cite dozens of similar passages Sokal goes out of his way to leave telltale clues as to his true intent the conclusion is inescapable that the editors of *Social Text* didn't know what many of the sentences in Sokal's essay actually meant; and that they just didn't care. How could a group of scholars, editing what is supposed to be the leading journal in a given field, allow themselves such a sublime indifference to the content, truth and plausibility of a scholarly submission accepted for publication?

By way of explanation, coeditors Andrew Ross and Bruce Robbins have said that as "a non-refereed journal of political opinion and cultural analysis produced by an editorial collective *Social Text* has always seen itself in the 'little magazine' tradition of the independent left as much as in the academic domain."<sup>3</sup> But it's hard to see this as an adequate explanation; presumably, even a journal of political opinion should care whether what it publishes is intelligible.

What Ross and Co. should have said, it seems to me, is that *Social Text* is a political magazine in a deeper and more radical sense: under appropriate circumstances, it is prepared to let agreement with its ideological orientation trump every other criterion for publication, including something as basic as sheer intelligibility. The prospect of being able to display in their pages a natural scientist – a physicist, no less – throwing the full weight of his authority behind their cause was compelling enough for them to overlook the fact that they didn't have much of a clue exactly what sort of support they were being offered. And this, it seems to me, is what's at the heart of the issue raised by Sokal's hoax: not the mere existence of incompetence within the academy, but rather that specific form of it that arises from allowing ideological criteria to displace standards of scholarship so completely that not even considerations of intelligibility are seen as relevant to an argument's acceptability. How, given the recent and sorry history of ideologically motivated conceptions of knowledge – Lysenkoism in Stalin's Soviet Union, for example, or Nazi critiques of 'Jewish science' – could it again have become acceptable to behave in this way?

The complete historical answer is a long story, but there can be little doubt that one of its crucial components is the brush-fire spread, within vast sectors of the humanities and social sciences, of the cluster of simple-minded relativistic views

about truth and evidence that are commonly identified as 'postmodernist'. These views license, and on the most popular versions insist upon, the substitution of political and ideological criteria for the historically more familiar assessment in terms of truth, evidence and argument.

Most philosophers accept the claim that there is no such thing as a totally disinterested inquirer, one who approaches his or her topic utterly devoid of any prior assumptions, values or biases. Postmodernism goes well beyond this historicist observation, as feminist scholar Linda Nicholson explains (without necessarily endorsing):

The traditional historicist claim that all inquiry is inevitably influenced by the values of the inquirer provides a very weak counter to the norm of objectivity [T]he more radical move in the postmodern turn was to claim that the very criteria demarcating the true and the false, as well as such related distinctions as science and myth or fact and superstition, were internal to the traditions of modernity and could not be legitimized outside of those traditions. Moreover, it was argued that the very development and use of such criteria, as well as their extension to ever wider domains, had to be described as representing the growth and development of 'specific regimes of power.'<sup>4</sup>

As Nicholson sees, historicism, however broadly understood, doesn't entail that there is no such thing as objective truth. To concede that no one ever believes something solely because it's true is not to deny that anything is objectively true. Furthermore, the concession that no inquirer or inquiry is fully bias-free doesn't entail that they can't be more or less bias-free, or that their biases can't be more or less damaging. To concede that the truth is never the only thing that someone is tracking isn't to deny that some people or methods are better than others at staying on its track.

Historicism leaves intact, then, both the claim that one's aim should be to arrive at conclusions that are objectively true and justified, independently of any particular perspective, and that science is the best idea that anyone has had about how to satisfy that aim. Postmodernism, in seeking to demote science from the privileged epistemic position it has come to occupy, and thereby to blur the distinction between it and 'other ways of knowing,' myth and superstition, for example, needs to go much further than historicism, all the way to the denial that objective truth is a coherent aim that inquiry may have. Indeed, according to postmodernism, the very development and use of the rhetoric of objectivity, far from embodying a serious metaphysics and epistemology of truth and evidence, represents a mere play for power, a way of silencing these 'other ways of knowing'. It follows, given this standpoint, that the struggle against the rhetoric of objectivity isn't primarily an intellectual matter, but a political one: the rhetoric needs to be defeated, rather than just refuted. Against this backdrop, it becomes very easy to explain the behavior of the editors of *Social Text*.

Although it may be hard to understand how anyone could actually hold views as extreme as these, their ubiquity these days is a distressingly familiar fact. A front-page article in the *New York Times* of October 22, 1996 provided a recent illustration.<sup>5</sup> The article concerned the conflict between two views of where Native American populations originated the scientific archeological account, and the account offered by some Native American creation myths. According to the former extensively confirmed view, humans first entered the Americas from Asia, crossing the Bering Strait over 10,000 years ago. By contrast, some Native American creation accounts hold that native peoples have lived in the Americas ever since their ancestors first emerged onto the surface of the earth from a subterranean world of spirits. The *Times* noted that many archeologists, torn between their commitment to scientific method and their appreciation for native culture, "have been driven close to a postmodern relativism in which science is just one more belief system." Roger Anyon, a British archeologist who has worked for the Zuni people, was quoted as saying: "Science is just one of many ways of knowing the world. . . . [The Zunis' world view is] just as valid as the archeological viewpoint of what prehistory is about."

How are we to make sense of this? (Sokal himself mentioned this example at a recent public forum in New York and was taken to task by Andrew Ross for putting Native Americans "on trial." But this issue isn't about Native American views; it's about postmodernism.) The claim that the Zuni myth can be "just as valid" as the archeological theory can be read in one of three different ways, between which postmodern theorists tend not to distinguish sufficiently: as a claim about truth, as a claim about justification, or as a claim about purpose. As we shall see, however, none of these claims is even remotely plausible.

Interpreted as a claim about truth, the suggestion would be that the Zuni and archeological views are equally true. On the face of it, though, this is impossible, since they contradict each other. One says, or implies, that the first humans in the Americas came from Asia; the other says, or implies, that they did not, that they came from somewhere else, a subterranean world of spirits. How could a claim and its denial both be true? If I say that the earth is flat, and you say that it's round, how could we both be right?

Postmodernists like to respond to this sort of point by saying that both claims can be true because both are true relative to some perspective or other, and there can be no question of truth outside of perspectives. Thus, according to the Zuni perspective, the first humans in the Americas came from a subterranean world; and according to the Western scientific perspective, the first humans came from Asia. Since both are true according to some perspective or other, both are true.

But to say that some claim is true according to some perspective sounds simply like a fancy way of saying that someone, or some group, believes it. The crucial question concerns what we are to say when what I believe what's true according to my perspective conflicts with what you believe with what's

true according to your perspective? The one thing not to say, it seems to me, on pain of utter unintelligibility, is that both claims are true.

This should be obvious, but can also be seen by applying the view to itself. For consider: If a claim and its opposite can be equally true provided that there is some perspective relative to which each is true, then, since there is a perspective realism relative to which it's true that a claim and its opposite cannot both be true, postmodernism would have to admit that it itself is just as true as its opposite, realism. But postmodernism cannot afford to admit that: presumably, its whole point is that realism is false. Thus, we see that the very statement of postmodernism, construed as a view about truth, undermines itself: facts about truth independent of particular perspectives are presupposed by the view itself.

How does it fare when considered as a claim about evidence or justification? So construed, the suggestion comes to the claim that the Zuni story and the archeological theory are equally justified, given the available evidence. Now, in contrast with the case of truth, it is not incoherent for a claim and its negation to be equally justified, for instance, in cases where there is very little evidence for either side. But, *prima facie*, anyway, this isn't the sort of case that's at issue, for according to the available evidence, the archeological theory is far better confirmed than the Zuni myth.

To get the desired relativistic result, a postmodernist would have to claim that the two views are equally justified given their respective rules of evidence, and add that there is no objective fact of the matter which set of rules is to be preferred. Given this relativization of justification to the rules of evidence characteristic of a given perspective, the archeological theory would be justified relative to the rules of evidence of Western science, and the Zuni story would be justified relative to the rules of evidence employed by the relevant tradition of myth-making. Furthermore, since there are no perspective-independent rules of evidence that could adjudicate between these two sets of rules, both claims would be equally justified and there could be no choosing between them.

Once again, however, there is a problem not merely with plausibility, but with self-refutation. For suppose we grant that every rule of evidence is as good as any other. Then any claim could be made to count as justified simply by formulating an appropriate rule of evidence relative to which it is justified. Indeed, it would follow that we could justify the claim that not every rule of evidence is as good as any other, thereby forcing the postmodernist to concede that his views about truth and justification are just as justified as his opponent's. Presumably, however, the postmodernist needs to hold that his views are better than his opponent's; otherwise what's to recommend them? On the other hand, if some rules of evidence can be said to be better than others, then there must be perspective-independent facts about what makes them better and a thoroughgoing relativism about justification is false.

It is sometimes suggested that the intended sense in which the Zuni myth is "just as valid" has nothing to do with truth or justification, but rather with the different purposes that the myth subserves, in contrast with those of science. According to this line of thought, science aims to give a descriptively accurate account of reality, whereas the Zuni myth belongs to the realm of religious practice and the constitution of cultural identity. It is to be regarded as having symbolic, emotional, and ritual purposes other than the mere description of reality. And as such, it may serve those purposes very well – better, perhaps, than the archeologist's account.

The trouble with this as a reading of "just as valid" is not so much that it's false, but that it's irrelevant to the issue at hand: even if it were granted, it couldn't help advance the cause of postmodernism. For if the Zuni myth isn't taken to compete with the archeological theory, as a descriptively accurate account of prehistory, its existence has no prospect of casting any doubt on the objectivity of the account delivered by science. If I say that the earth is flat, and you make no assertion at all, but instead tell me an interesting story, that has no potential for raising deep issues about the objectivity of what either of us said or did.

Is there, perhaps, a weaker thesis that, while being more defensible than these simple-minded relativisms, would nevertheless yield an anti-objectivist result? It's hard to see what such a thesis would be. Stanley Fish, for example, in seeking to discredit Sokal's characterization of postmodernism, offers the following (Opinion piece, *The New York Times*):

What sociologists of science say is that of course the world is real and independent of our observations but that accounts of the world are produced by observers and are therefore relative to their capacities, education and training, etc. It is not the world or its properties but the vocabularies in whose terms we know them that are socially constructed.<sup>6</sup>

The rest of Fish's discussion leaves it thoroughly unclear exactly what he thinks this observation shows; but claims similar to his are often presented by others as constituting yet another basis for arguing against the objectivity of science. The resultant arguments are unconvincing.

It goes without saying that the vocabularies with which we seek to know the world are socially constructed and that they therefore reflect various contingent aspects of our capacities, limitations and interests. But it doesn't follow that those vocabularies are therefore incapable of meeting the standards of adequacy relevant to the expression and discovery of objective truths.

We may illustrate why by using Fish's own example. There is no doubt that the game of baseball as we have it, with its particular conceptions of what counts as a 'strike' and what counts as a 'ball,' reflects various contingent facts about us as physical and social creatures. 'Strike' and 'ball' are socially constructed concepts, if anything is. However, once these concepts have been defined once the strike zone has been specified there are then perfectly objective facts about what

counts as a strike and what counts as a ball. (The fact that the umpire is the court of last appeal doesn't mean that he can't make mistakes.)

Similarly, our choice of one conceptual scheme rather than another, for the purposes of doing science, probably reflects various contingent facts about our capacities and limitations, so that a thinker with different capacities and limitations, a Martian for example, might find it natural to employ a different scheme. This does nothing to show that our conceptual scheme is incapable of expressing objective truths. Realism is not committed to there being only one vocabulary in which objective truths might be expressed; all it's committed to is the weaker claim that, once a vocabulary is specified, it will then be an objective matter whether or not assertions couched in that vocabulary are true or false.

We are left with two puzzles. Given what the basic tenets of postmodernism are, how did they ever come to be identified with a progressive political outlook? And given how transparently refutable they are, how did they ever come to gain such widespread acceptance?

In the United States, postmodernism is closely linked to the movement known as multiculturalism, broadly conceived as the project of giving proper credit to the contributions of cultures and communities whose achievements have been historically neglected or undervalued. In this connection, it has come to appeal to certain progressive sensibilities because it supplies the philosophical resources with which to prevent anyone from accusing oppressed cultures of holding false or unjustified views.

Even on purely political grounds, however, it is difficult to understand how this could have come to seem a good way to conceive of multiculturalism. For if the powerful can't criticize the oppressed, because the central epistemological categories are inexorably tied to particular perspectives, it also follows that the oppressed can't criticize the powerful. The only remedy, so far as I can see, for what threatens to be a strongly conservative upshot, is to accept an overt double standard: allow a questionable idea to be criticized if it is held by those in a position of power, Christian creationism, for example, but not if it is held by those whom the powerful oppress, Zuni creationism, for example. Familiar as this stratagem has recently become, how can it possibly appeal to anyone with the slightest degree of intellectual integrity; and how can it fail to seem anything other than deeply offensive to the progressive sensibilities whose cause it is supposed to further?

As for the second question, regarding widespread acceptance, the short answer is that questions about truth, meaning and objectivity are among the most difficult and thorny questions that philosophy confronts and so are very easily mishandled. A longer answer would involve explaining why analytic philosophy, the dominant tradition of philosophy in the English-speaking world, wasn't able to exert a more effective corrective influence. After all, analytic philosophy is primarily known for its detailed and subtle discussion of concepts in

the philosophy of language and the theory of knowledge, the very concepts that postmodernism so badly misunderstands. Isn't it reasonable to expect it to have had a greater impact on the philosophical explorations of its intellectual neighbors? And if it hasn't, can that be because its reputation for insularity is at least partly deserved? Because philosophy concerns the most general categories of knowledge, categories that apply to any compartment of inquiry, it is inevitable that other disciplines will reflect on philosophical problems and develop philosophical positions. Analytic philosophy has a special responsibility to ensure that its insights on matters of broad intellectual interest are available widely, to more than a narrow class of insiders.

Whatever the correct explanation for the current malaise, Alan Sokal's hoax has served as a flashpoint for what has been a gathering storm of protest against the collapse in standards of scholarship and intellectual responsibility that vast sectors of the humanities and social sciences are currently afflicted with. Significantly, some of the most biting commentary has come from distinguished voices on the left, showing that when it comes to transgressions as basic as these, political alliances afford no protection. Anyone still inclined to doubt the seriousness of the problem has only to read Sokal's parody.

#### Notes

1. *Social Text* 46-47 (Spring/Summer 1996): 217-252.
2. "A Physicist Experiments with Cultural Studies," *Lingua Franca* (May/June 1996): 62-64.
3. "Mystery Science Theater," *Lingua Franca* (May/June 1996): 54-61.
4. "Introduction," in Linda Nicholson (Ed.), *Feminism and Postmodernism* (New York: Routledge, 1990).
5. "Indian Tribes' Creationists Thwart Archeologists," *New York Times*, October 22, 1996.
6. "Professor Sokal's Bad Joke," Op-Ed, *New York Times*, May 21, 1996.

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