ance, and . . . ecclesiastical latitude" set them apart from their fundamentalist and creationist successors.

Or such is the image that Livingstone uses history to cut for himself and the influential rump of evangelical evolutionists today. It may not prove attractive, first of all, to its intended audience because "the mainstream of the conservative Christian tradition" in America currently resembles the Strait of Hormuz. The belief in the inerrancy of the Bible, which Livingstone discounts as a factor inhibiting acceptance of evolution in the 19th century, has become the *sine qua non* of orthodoxy among militant neofundamentalists and creationists. From their embattled perspective, Livingstone's giants may tend to look a little vulnerable—like supertankers without an escort. None of them believed in the Bible as an inspired textbook of science.

A second reason why Livingstone may fail to carry conviction to his readers is that outsiders who know little of evangelical apologetics and frankly suspect its works will wonder how men who strained at the gnat of natural selection but swallowed the virgin birth can possibly be claimed as defenders of Darwin. The answer is that Livingstone abstracts natural selection from the context of Darwin's thought and offers it, safely sanitized from Lamarckian causal factors and naturalistic meanings, as a "theory of relative reproductive success," on the hypothetico-deductive model, suitable for amalgamation as "science" with supernaturalist metaphysics. In this he exceeds even the ingenuity of his ancestors, many of whom saw Darwin's work more organically, although his distinction, let it be said, comes straight from 20th-century neo-Darwinian apologists, who may now perceive how far they have unwittingly abetted their evangelical counterparts.

Finally, Livingstone will have a tough time persuading many colleagues among historians and philosophers of science that as an evangelical he has really got to grips with the Darwinian challenge. *Darwin's Forgotten Defenders* proffers a fairly conventional investigation of science, on the one hand, and Christianity on the other. Only weakly and belatedly does the book suggest how these may be jointly explicated as competing professional allegiances, or modes of ideological representation, or vehicles of social control. The notion that evolution itself might *explain* evangelical religion as an adaptive response in the struggle for existence—a notion supported in principle by Darwin and plausible enough to attract sociobiologists concerned with recent geopolitics—gets no time at all. For the most part Livingstone seems rather to be interested in maintaining a distinction between the content and the context of science under which a remark such as, "There was no direct relationship between evolutionary biology and nasty social practices" can safely shelter from the rain of historical refutations. Yet it is odd to encounter this remark in a book that elsewhere notes the confluence of theory and theology in the likes of the Reverend Thomas Malthus, while pointing up the indebtedness of modern science to the Puritan evangelical spirit, under which capitalism also prospered.

Non-believers will learn much from Livingstone that they might not otherwise have known. Some of his giants were giants indeed, and it is salutary to discover how deeply and thoroughly the evolutionary naturalists were imbued with un-Darwinlike metaphysical beliefs. Creationists, on the other hand, will learn much they may not wish to know, and it must not be supposed that *Darwin's Forgotten Defenders* will keep them from forgetting again. In the end, therefore, Livingstone has employed an impressive array of evidence to make a timely argument admirably adapted to the needs of a large and, I daresay, increasing number of "mainstream" American evangelicals who set store on intellectual upward mobility. If they succeed in embellishing their tradition with Darwin's name, anything is possible. It would certainly be a miracle.

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Relativity As a World View

The Comparative Reception of Relativity. THOMAS F. GLICK, Ed. Reidel, Dordrecht, 1987 (U.S. distributor, Kluwer, Norwell, MA). viii, 412 pp. $79. Boston Studies in the Philosophy of Science, vol. 103. Based on a colloquium, Boston, MA, March 1983.

In its early years Einstein's theory of relativity was often seen as a program with wide extrascientific implications rather than just a theory of physics. It became, like Darwinism and Freudianism, a world view, and as such its significance is independent of its actual scientific content and lies largely in its reception and dissemination. In recent years sociologically oriented "reception histories" have been generally recognized as a means of extending the perspective of standard historiography of science. Along these lines Thomas Glick edited in 1974 *The Comparative Reception of Darwinism*, to which *The Comparative Reception of Relativity* can be seen as a companion. In the present volume 11 scholars have contributed informative and interesting essays on how relativity was received in particular countries. Similar studies have been published before, and some of the contributors draw on these, but this is the first time we are offered what is purportedly a comprehensive, comparative analysis of the reception of relativity.

Although each of the contributions could merit individual attention, I shall only mention a few. Stanley Goldberg shows how the assimilation of relativity in the United States was based on misunderstandings of Einstein's theory, which was presented as an inductivist theory founded on and justified by experimental facts. Mistaken as this view was, it made relativity fit into an epistemological framework familiar to American science and education and in this way helped the new ideas to be assimilated. Barbara Reeves examines the political and cultural connotations of relativity in Italy, especially "relativity" interpreted metaphorically as a political theory in early Fascism. The strength of Thomas Glick's analysis, dealing with Spain, lies in its sociological approach, necessitated by the fact that theoretical physics barely existed in that country. He therefore focuses on "the scientific middle class" (engineers, physicians, pharmacists), arguing that relativity provided the engineers with an intellectual halo, which was a main reason for their espousal of the theory. Interestingly, support for relativity in Spain often came from conservative Catholics, who managed in this way to embrace science without opposing traditional Catholic values.

As in the present volume, reception and diffusion studies most often take the natural unit to be the national state. The countries dealt with are well chosen, covering scientific centers (Great Britain, France, Germany, the United States) as well as countries of more peripheral importance (the Soviet Union/Russia, Japan, Italy, Spain, Poland). Inclusion of countries with a very different cultural tradition might have added an interesting perspective, however. Rather than have two contributions on France, I would have preferred to know how relativity was received in, say, China, Egypt, or India. Although the importance of national styles in science is unquestionable, it does not follow that this is the only or most promising unit to study. Instead of asking how specific national environments influenced the reception of relativity, one might ask, for example, how the idea was received by different social classes or how reception var-

ied with sex, age, or religion. By and large the volume fails to address these other avenues and to present a coherent sociological basis for analyzing the reception of scientific ideas. It takes more than a number of excellent separate studies to make up a coherent, comparative whole. In a summary Glick tries heroically, but unsuccessfully, to extract similarities and differences in order to establish a more synthetic view. The reason for the failure is not, I think, that the national histories are too diverse, but rather that the present studies are too undisciplined and too different in approach. Stricter editorial guidelines might have provided the necessary discipline and coherence without violating historical data.

The difficulty of obtaining a synthetic view is illustrated by comparing Lewis Pyenson's essay on Germany with V. P. Vizgin and G. E. Gorelik's on Russia, two studies that seem to have virtually nothing in common. Pyenson deals with almost every conceivable cultural aspect of Wilhelmian Germany, much with the electromagnetic world view, and very little with Einsteinian relativity. Making a rather artificial parallel between political and scientific revolutions, he gives a brilliant and learned (but in my view misleading) interpretation of the Zeitgeist of German science prior to 1914. Vizgin and Gorelik see their task very differently. They deal with the reception of special and general relativity primarily among Russian physicists in the period 1900–1940 and are more interested in reviewing eminent Russian contributions to the field than in interpreting the reception of relativity in sociocultural terms.

In tracing the different layers and aspects of the reception of relativity, the authors make excellent use of a variety of sources, many of which do not belong to the standard sources of intellectual history; local newspapers, pamphlets, and obscure journals, for example, are profitably scrutinized. Other indicators used for evaluating the reception of relativity include the appearance of the first monographs on the subject, the incorporation of relativity into textbooks and syllabi, and the number and fluctuations of publications on relativity and alternative theories.

I find the volume a fine piece of scholarship, living up to the usual high standards of the Boston Studies series. With the reservations mentioned above I recommend it as stimulating reading for all parties who are interested in the historical and social aspects of science.

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Apocalyptic Imagery

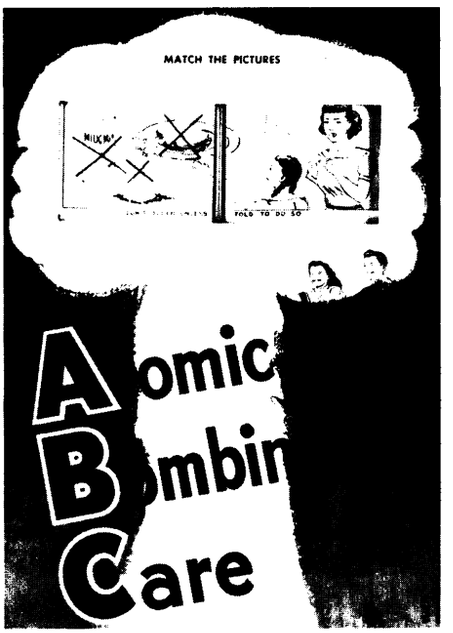
Nuclear Fear. A History of Images. SPENCER R. WEART. Harvard University Press, Cambridge, MA, 1988. xvi, 535 pp., illus. $29.50.

Spencer Weart's stated goal in *Nuclear Fear* is nothing less than a "total history" of the images associated with nuclear energy, taking into account "every force that has mattered, from the known laws of physics to the largely unknown influence of psychology" (p. 433). The potential rewards of such an enterprise are enormous. So are the hazards.

Like a number of other recent works—such as Paul Boyer's *By the Bomb's Early Light*, Paul Brians's *Nuclear Holocausts*, and *Nukespeak* by Stephen Hilgartner, Richard Bell, and Rory O'Connor—*Nuclear Fear* approaches the material history of nuclear weapons and energy through the context of the surrounding cultural history. Weart, however, attempts to set this cultural history in a still larger context, a neo-Jungian framework of universal psychological archetypes which, he argues, attain specific form in images leading to, and evoked by, nuclear devices. He finds the crucial beliefs and symbols associated with nuclear energy to have been present centuries earlier, and throughout a number of civilizations, in a structured cluster centered on the "tremendous concept" of "transmutation—the passage through destruction to rebirth" (p. 421). According to Weart, the discovery of nuclear energy early in the 20th century reifies this ancient cluster of images, which then both redefines and is redefined by the subsequent material and social history of nuclear science and engineering.

Weart's tale boldly sweeps from the futuristic White City of the 1893 Chicago World's Fair and the discovery of radioactivity in 1896 through Hiroshima and Star Wars to his own hoped-for future society when "the citizen will sing with both poets and engineers" (p. 420). The characters and images of the story are familiar: the mad scientist of 19th-century science fiction; the dazzling brave new world to be achieved by technocracy through unlimited energy; death rays; the apocalyptic "atomic bombs" of H. G. Wells's 1913 novel *The World Set Free* with their telling influence on Leo Szilard; the mushroom cloud; mutant monsters; the omnipotent atom pictured as a miniature solar system; President Reagan's pledge to unleash a new technology that will make nuclear weapons "impotent and obsolete"; and so on. But this book asks us to see all these in a new light.

Weart is quite correct to claim that the imagery associated with nuclear energy has



Game to instruct children. [Courtesy Harvard University Press and Library of Congress]

deep, early roots. In fact, 19th-century industrial iconography generated specifically nuclear images earlier than he realizes, even before the discovery of radioactivity, as evidenced in an 1895 novel not discussed by Weart, Robert Cromie's *The Crack of Doom*, in which an atom-splitting scientist points to "a common text-book" on physics where "you will find that one grain of matter contains sufficient energy . . . to raise a hundred thousand tons nearly two miles" (third edition, p. 20). Weart is certainly accurate in asserting that by the 1930s nuclear energy had become a highly charged symbol for the magical transmutation of human destiny—through atomic apocalypse or miraculous peaceful technology or both. He provides a very useful account of how the main images were promulgated by scientists such as Soddy and Rutherford, popular science journalists, and science fiction, though one serious omission is American fiction about radioactive and atomic superweapons prior to World War I.

When it comes to the crucial point at which nuclear energy and weapons move from the realm of the imagination to become central facts of modern existence, *Nuclear Fear* entices but disappoints by not developing in sufficient detail its picture of how the atomic scientists were lured by "the fantasy of setting the world free" and ending war with atomic energy (p. 96). We want to know precisely *how*, as Weart states later, people "projected their feelings onto bombs and reactors," making "our secret thoughts" take "form in metal" (p. 425).