Commonwealth Weapons Tests

A Very Special Relationship. British Atomic Weapon Trials in Australia. LORNA ARNOLD. Her Majesty's Stationery Office, London, 1987 (U.S. distributor, Bernan-Unipub, Lanham, MD). xviii, 323 pp. + plates. Paper, $13.95.

Britain's nuclear weapon tests in Australia in the 1950s produced a nuclear deterrent for the United Kingdom, a plutonium-contaminated proving ground in South Australia, and an Australian Royal Commission to inquire into the trials some 30 years later. The tests have also given rise to a recent spate of books that dissect in fine detail the use of Australian territory for experiments designed to enhance British power, prestige, and (arguably) security in the nuclear age.

A Very Special Relationship is the most measured and technically impressive of these books. Although it is not made entirely clear in the introduction, the book is apparently a semiofficial history. The author had wide-ranging access to classified British government documents, as well as to the mountain of documents tabled before the 1984–85 Royal Commission. The result is a detailed account of how, with considerable skill, efficiency, and economy, the British managed to squeeze their entire program of major trials for developing both atomic and thermonuclear weapons into less than 6 years—compared with 17 (postwar) years for the United States and 14 for the Soviet Union.

Arnold takes the reader through the history of Britain's decision to acquire nuclear weapons, the bureaucratic and scientific preparations for the test program, and each test conducted in Australia. These began with *Hurricane* in the Monte Bello Islands off Western Australia in 1952 — Britain's first atomic bomb test — and ended with the so-called "minor trials" at Maralinga in South Australia in 1963. Particularly impressive is Arnold's discussion of radioactivity, especially her explanation of the varying units of measurement and the controversy over its medical effects. Unfortunately no details of Arnold's scientific or other qualifications in this area are provided.

The main shortcoming of *A Very Special Relationship* is its determinedly British perspective. It almost totally ignores the findings of the Australian Royal Commission. Though Arnold does tackle some controversial aspects of the test program (and gives it an almost entirely clean bill of health), she fails to address the Royal Commission's many criticisms of both British and Australian conduct in relation to the tests. Though it may not be politic in a semiofficial publication to confront the conclusions of another government's inquiry directly, the Commission's findings could have been at least implicitly tackled.

The Royal Commission, for example, concluded that measures taken to ensure the safety of the aboriginal population during the *Buffalo* series demonstrated "ignorance, incompetence and cynicism." Arnold simply notes that the two Native Welfare Officers responsible for keeping aborigines out of a vast prohibited range had "an impossible task." Similarly, the Royal Commission accused the chairman of the Australian Weapons Tests Safety Committee, Ernest Titterton, of having concealed information from the Australian Government to facilitate the conduct of the tests. Arnold merely notes that "as a very new Australian with close United Kingdom ties and a Los Alamos background, his position was bound to be seen by many as an ambiguous one."

Arnold is especially uncritical of the "minor trials," which left a large area of the Maralinga test site littered with plutonium, one of the most toxic substances known and having a half-life of 24,000 years. The Royal Commission concluded that because of this, the *Vixen* series of minor trials should never have been conducted at the South Australian test site. Arnold notes uncritically that British ministers were "adamant" that the experiments could not take place in the United Kingdom because of the possible repercussions on public acceptance of other nuclear activities in Britain, such as the civil nuclear power program. Better to contaminate Australia than Britain.

Though *A Very Special Relationship* is a valuable account of British nuclear tests in Australia from the official British perspective, readers should be aware that there is another side of the story, told in such works as Robert Milliken's *No Conceivable Injury* (Penguin, 1986), Blakeway and Lloyd-Roberts's *Fields of Thunder* (Allen and Unwin, 1985), and Joan Smith's *Clouds of Deceit* (Faber and Faber, 1985).

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Questions of Realism

The Shaky Game. Einstein, Realism, and the Quantum Theory. ARTHUR FINE. University of Chicago Press, Chicago, 1986. xii, 186 pp. $25. Science and Its Conceptual Foundations.

In *The Shaky Game* Arthur Fine collects six of his recent papers in the history and philosophy of science, adding two new papers and an introductory essay. The primary topic is historical—Einstein's attitude toward the quantum theory and toward realism as a philosophy of science—but included also are two essays outlining Fine's new program in the philosophy of science, dubbed the "natural ontological attitude" (NOA).

Fine's essays on Einstein are distinguished from other such literature by his extensive use of the Einstein archive; in this regard, they should be models for philosophers of science looking to the "greats" for answers to philosophical questions. The archival evidence complicates our picture of Einstein's opinions, which is good, since it frustrates the all too common strategy of seeking sanction from Einstein for currently fashionable views.

The greatest dividends of Fine's archival research come from his reading of the Einstein-Schrödinger correspondence. In "Einstein's critique of quantum theory: the roots and significance of EPR" (1981), Fine draws attention to the importance of this correspondence for showing that Einstein was not wholly enthusiastic about the 1935 Einstein-Podolsky-Rosen (EPR) paper, which claimed to demonstrate the incompleteness of quantum mechanics. Einstein confided to Schrödinger that Podolsky wrote the paper and that he did not like the way it turned out because "the essential thing was . . . smothered by the formalism [Gelehrsamkeit]"; Einstein then presented a different incompleteness argument that invokes neither the EPR "criterion of physical reality" nor quantum limitations on the simultaneous definiteness of conjugate observables, this argument being based instead upon what Einstein calls the "separation principle" [Trennungsprinzip]. In a new paper, "Schrödinger's cat and Einstein's: the genesis of a paradox," Fine shows how the continuing discussion between Einstein and Schrödinger led to the famous Schrödinger "cat paradox" and to a similar but never-published Gedankenexperiment of Einstein's in which the incompleteness of quantum mechanics is held to be exhibited by a pile of gunpowder whose having exploded or not remains indefinite (until an observer examines it) because the triggering depends upon the decay of a radioactive atom.

The value of archival research is further demonstrated in Fine's essay "Einstein's realism" (1984). Many scientific realists claim to find in Einstein a co-religionist and ally in their holy war with the instrumentalists and other legatees of a moribund Viennese positivism. But Fine argues that Einstein's realism is not a philosophical doctrine, according to which theories derive their meaning and warrant from their aim of providing approximately true descriptions of an observer-independent reality, as opposed to providing merely a tool for prediction, as the instrumentalist asserts. Einstein's realism is instead, according to Fine, a program for scientific inquiry, based upon the belief that the way of formulating theories most likely to promote scientific progress is to posit real physical systems and associated, definite, observer-independent properties, in contrast to quantum theory in its Copenhagen version, which is portrayed as according the observer a primary role. The psychological significance of this belief is reflected in Fine's calling it "motivational realism."

Less convincing is the essay "What is Einstein's statistical interpretation, or is it Einstein for whom Bell's theorem tolls?" (1984). Most commentators attribute to Einstein a statistical interpretation of quantum mechanics, according to which the state function refers not to an individual system, as Bohr would claim, but to an ensemble of systems, quantum mechanical probabilities being explained in terms of the statistical distribution over the members of the ensemble of the various possible definite values of an observable. But Fine argues that Einstein's remarks about the state function better fit Fine's own "prism model," also a statistical interpretation, but distinguished from the standard one by the assumption that for every measurement there are some members of the ensemble for which no result is obtained. The prism model explains the puzzling results of the Bell experiments without having to admit any non-locality, whereas the standard statistical interpretation, ascribing definite values of all observables to all members of the ensemble, is, arguably, refuted by those experiments. Thus Fine hopes to spare Einstein an unhappy fate, but the resulting interpretation is anachronistic.

With Fine's two "NOA" essays—"The natural ontological attitude" (1984) and "And not antirealism either" (1984)—we shift from history to contemporary problems. NOA represents an important new turn in the old controversy over scientific realism, one that should find a sympathetic audience even more among scientists than among philosophers of science. Fine rejects the realists' grounding of the ontological assumptions and the truth claims of science upon some extratheoretical relation (such as "approximate correspondence") between theories and the world. He rejects as well the antirealists' replacement of belief in the reality of posits and in the truth of theories by something safer, like belief in their empirical adequacy. The root difficulty, according to Fine, is that both realist and antirealist see science as needing a global interpretation or justification. NOA, by contrast, takes science "on its own terms," allowing questions about the posits and truth claims of science, but insisting that they be answered by the methods and standards of science itself. The philosopher's role on NOA's ark (Fine's pun) is modest—alongside, not above the scientist. It is not unlike the role accorded the philosopher by recent antifoundationalist thinkers, such as Richard Rorty, and has much in common with the philosopher's role in that other nautical analogy, introduced by Otto Neurath and promoted by W. V. O. Quine, in which science is compared to a boat that must be reconstructed not in drydock but at sea, one plank at a time.

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Holistic Pest Management

Ecological Theory and Integrated Pest Management Practice. MARCOS KOGAN, Ed. Wiley-Interscience, New York, 1986. xx, 362 pp., illus. $54.95. Environmental Science and Technology. Based on a symposium, San Antonio, TX, Dec. 1984.

By contrast with contemporary ecological theory, which has been shaped by a rich blend of conceptual thought, mathematical modeling, and experimentation, the practice of managing pests in agriculture has been shaped mainly through immediate response to perceived need to control pests at any cost, usually involving the "magic-bullet" approach of pesticide application. For most of this century, there was relatively little concern with how herbivore pests interacted with the crop plants they ate or the predators, parasites, or pathogens that ate them. Beginning in the 1960s, however, pest management practitioners began to take a more ecological approach to pest control within a framework of integrated pest management (IPM). The philosophical core of IPM is holistic. Ideally, it provides for integration of approaches to maintaining pests below damaging levels and for attention to the effects human intervention may have on multiple components of the ecosystem. Even so, IPM has fallen short of attaining its ideals, at least partly because of its lack of a sufficiently broad and robust conceptual background rooted in ecological theory.

It is on account of the gap between tenets of ecological theory and designs of pest management systems that some of North America's most astute and provocative ecological theorists and ecologically minded pest management proponents were brought together for the symposium of which this collection of 12 papers is the proceedings. The volume provides, in my judgment, the most sophisticated treatment of related aspects of ecological theory and IPM practice available under one cover.

Richard Levins sets the holistic tone of the volume by providing an incisive overview of how the approach to pest control has proceeded from "brute force" tactics of pesticide overuse to IPM tactics, which are viewed as still relying too heavily on multiplicities of human intervention. Drawing upon his experience in ecological systems analysis and as an agricultural adviser to Third World countries, Levins makes a compelling case for an approach that embraces much greater recognition of large-area, ecosystem-level processes and gentler, less frequent intervention.

Three forceful chapters focus on theory relevant to interpreting population and community level processes. Daniel Simberloff evaluates aspects of the dynamic equilibrium theory of island biogeography in relation to management of insect pests of crops as well as to design of nature reserves. He comes to the arguable conclusion that theory may offer little of practical value in either vein. In fact, Simberloff contends that agriculture has benefited from not being hasty in putting an ecological theory to practice. In examining population theory in relation to pest outbreaks, Donald Strong emphasizes the looseness and stochastic complexity of density relationships among plants, herbivore pests, and natural enemies of pests, cautioning that it is unrealistic to expect tight equilibrium relationships and long-term stability in agricultural (or even natural) systems. Peter Kareiva explores one of the most intractable aspects of animal ecology bearing upon pest management in a critical analysis of movement patterns of pests, parasites, and predators in crops. He refers to some of his own inventive, mechanistically rooted field experiments and gen-