

"Weapons that can neither prevent war nor defend in war"

The Fate of the Earth

J. Schell

244 pp. Knopf, New York, 1982. \$11.95

Nuclear Illusion and Reality

S. Zuckerman

154 pp. The Viking Press, New York, 1982. \$10.95

Reviewed by Jerrold R. Zacharias

A well-known cartoon shows a man talking into a funnel that leads to his own ear. The cartoon could represent my writing a review of two books about nuclear explosives for the readers of *PHYSICS TODAY*. I, like many others, believed that the fear of atom bombs, which I've lived with since July of 1945, could not be increased by anything that I might read, see, or hear. But something more than unenlightened fear is necessary. So it happens again and again; I keep learning. By *Dr. Strangelove*, by the mobilization of American military forces in 1973, by *The Effects of Nuclear War* (a report of the Office of Technology Assessment) and now by two excellent but very different pieces of writing: *The Fate of the Earth* by Jonathan Schell, and *Nuclear Illusion and Reality* by Lord Solly Zuckerman.

Schell, a writer and a journalist for the *New Yorker*, proceeds by ruthlessly exploiting the scientific device called "pushing to the limit." Lord Zuckerman, a scientist and science adviser, proceeds by the gentle ways of the historian to say how it all happened, how the world painted itself into the box it is now in.

Schell first. The nuclear swords of Damocles, he points out, will remain as long as people and the laws of physics remain. The existence of nuclear explosives is unavoidable. Therefore, we and all succeeding generations must learn to live in just enough fear so that we continue to find ways not to stress too much the hairs holding the swords. Schell suggests that the nature of national sovereignty be altered, a notion that deserves renewed attention, but that at the moment sounds far from possible. Schell might have suggested other more practical ways for nations to anticipate sources of possible disputes and to air them early. There are examples of such workings of tolerance between sovereign states. William F.

Buckley Jr, in a syndicated column in the *Washington Post* (16 May 1982), says, "...If we had a disagreement with Mexico tomorrow, it is unlikely that President Reagan would deliver a speech ending, 'Remember the Alamo!' Ongoing negotiations between East and West Germany concerning trade, cultural exchange and this and that are nowadays conducted without any refer-

details of the proposed device that demonstrate its fundamental flaws. In the nuclear case the proper approach is the opposite: Go at the details. Neither Schell nor Zuckerman goes to the details and proceeds to "study the hot spots, cool down the hot spots, and keep talking."

In a chapter entitled "The Second Death" (the death not of so many indi-



Robert Osborn, from *Missile Madness*, © 1970 by Herbert Scoville and Robert Osborn, published by Houghton Mifflin Company

ence at all to the Berlin Wall." But while numerous examples of this sort are to be found, they require detailed study of root causes. The approach is opposite to what physicists are accustomed to doing. A physicist will discount a perpetual motion machine by applying the second law of thermodynamics, avoiding a description of the

viduals, but of the human race), Schell describes the spectrum of possibilities—the destruction of an economy, of a civilization, of a species, of all living things. The reader should not be put off by simplistic analogies such as, "Is there a sound if there is no one there to hear it?" The discussion is ingenious, careful and profound. Even if this part

of his book appears as a *gedanken* experiment, and even though it is heavy going and at first glance redundant, it merits close attention by literate technologists as well as nontechnologists who are broadly educated and have wide interests.

Both authors try to deal with the insane matter of deterrence policies. Let them speak. Zuckerman:

According to the O.E.D., to deter means "to restrain from acting or proceeding by any consideration of danger or trouble." . . . In the popular mind, however . . . the word "deterrent" today means a nuclear weapon . . . [A] sane government will be deterred from embarking on hostile acts against another country if, in its judgment, such action would entail either a certain or a significant risk that its own people, its economy and its apparatus of state control, would suffer disproportionately more than would be justified by the value of whatever prizes victory might bring. It is axiomatic that no sane government would initiate or permit acts which, in its opinion, might escalate to a level that would trigger "unacceptable" nuclear retaliation.

Schell:

The central proposition of the deterrence doctrine—the piece of logic on which the world theoretically depends to see the sun rise tomorrow—is that a nuclear holocaust can best be prevented if each nuclear power, or bloc of powers, holds in readiness a nuclear force with which it "credibly" threatens to destroy the entire society of any attacker, even after suffering the worst possible "first strike" that the attacker can launch. Robert McNamara, who served as Secretary of Defense under Presidents Kennedy and Johnson, defined the policy, in his book *The Essence of Security*, published in 1968, in the following terms: "Assured destruction is the very essence of the whole deterrence concept. We must possess an actual assured-destruction capability, and that capability also must be credible. The point is that a potential aggressor must believe that our assured-destruction capability is in fact actual, and that our will to use it in retaliation to an attack is in fact unwavering." Thus, deterrence means the certainty of suicide to the aggressor, not merely to his military forces, but to his society as a whole.

These ideas should not be difficult to understand. George A. Miller, in his book *Spontaneous Apprentices*, about language learning by small children,



Above, the typical spur-and-gully wall morphology (butte is 20 km wide) in the lower Kasei Vallis canyon of Mars; at right, a residual loess hill (1 km wide) streamlined by flood erosion in the scabland of Washington state. These images illustrate Victor R. Baker's hypothesis, in *The Channels of Mars* (198 pp. U. of Texas P., Austin, 1982. \$39.95) that catastrophic flooding cut through the now arid Martian surface to produce some of the largest channels in a manner similar to the way Pleistocene flooding formed the scablands of the Columbia plateau.



devotes a page to the following game between two 4-year-olds:

Girl (on play telephone): David!

Boy (not picking up other phone): I'm not home.

Girl: When you'll be back?

Boy: I'm not here already.

Girl: But *when you'll be back*?

Boy: Don't you know if I'm gone already, I went *before* so I can't talk to you!

This does not imply that every child can understand such logical subtleties, but people who are elected or appointed as national leaders should be able to carry the logic lines that some four-year-olds can.

In a chapter entitled "Fighting with Nuclear Weapons," Lord Zuckerman completely demolishes the notion that wars waged with nuclear weapons can be anything but outrageous and that "predictions" can be anything but guesses. For instance, two sentences show the kind of detail one can find in his book:

In one war game in which it was assumed that only the defending British forces used nuclear weapons, but in which the Russians for some reason or other refrained from using them, the detonation of sixty nuclear weapons . . . still failed to prevent the Russians from crossing the River Weser in force. [The Russians] were, however, held in another war game, in which [they] again did not fire nuclear weapons but . . . our troops used 130 nuclear weapons.

The easiest way to summarize all of this is to quote from the introduction to Lord Zuckerman's book:

The central facts are merely lost in technicalities. What matters is that a nuclear exchange could blot out civilization in both the Eurasian and North American continents; that nuclear warheads are too dangerous to use in war; and that while nuclear weapon states might be deterred from turning their nuclear arsenals on each other, the existence of nuclear weapons can neither prevent war nor defend in war.

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Theory and Experiment in Gravitational Physics

C. Will

341 pp. Cambridge U. P., New York, 1981. \$75.00

The apparent incompatibility between the Newtonian conception of gravity and special relativity, rather than direct experimental evidence, led Albert Einstein to formulate the general theory of relativity. In his original papers, Einstein proposed three experimental tests: Mercury's perihelion shift, gravitational red shift, and light deflection by the Sun. Einstein demonstrated that general relativity agrees with the—by then known—perihelion shift. The second test, the red-shift experiment, demanded technological sophistication not available during the first half of this century and had to wait