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and gripping account of the American military experience in Spain. The adventure is seen largely through American eyes, and it adds little to an understanding of the causes, course, or results of the Civil War. The aim of the book is quite different: to explain the nature of the American participation in that war.

Rosenstone's detailed and well-documented research clarifies two major disputed questions. He has turned up information on over half of the American participants, and is able to draw a composite picture of the average volunteer as a man in his twenties from an industrial center, foreign-born or first-generation American from a working-class background, with probably "some attachment to the secular faith of Marxism." Such a portrait is not surprising, but until now it has not been solidly established. On the role of the political commissars and the questions of terror and party discipline he avoids a doctrinaire position and begins with believable and varied human portrayals of soldiers and their leaders in combat. Successful political leaders were reasonable, effective, and in tune with the needs and outlook of their men. There were executions for desertion, as one would expect in a losing and disorganized army, and for rape, but at most Rosenstone can find evidence of no more than four *possible* political executions. The Lincolns were not bound together by fear but by a common opposition to fascism.

This book is more than a fresh reappraisal of the evidence about Americans in Spain; it is also a contribution to the end of the Cold War in American historiography. Rosenstone does not attempt to create an illusion of impartiality, and he shows his admiration for the Americans who risked their lives to oppose fascism and nazism. He lets the record of the American Communist Party speak for itself and is prepared to say that its adherents "were often honest, sensitive individuals responding to problems created by the malfunctions of our own socioeconomic system." His book eloquently makes the case that one cannot understand the Americans in Spain without seeing their radicalism as a native American response to the world of the 1930's.

Cruel or Not?

EDITOR:

Reading the paper by Harlow and Suomi in last month's *Engineering and Science* I am simply appalled that so much cruelty is used to extract meager and often quite trivial information from unfortunate monkeys.

I realize that any scientific discipline in its most primitive beginnings has to resort to model experiments. In medicine, biology, etc. this means unfortunately animal experimentation; however it is up to the scientific community to question itself how far it is needed and when the results obtained *do not* warrant the means. Indeed in this particular case one may argue like this: Either the psychological behavior of caged monkeys is much different from humans, in which case very little is gained from the experiments; or else the monkeys are psychologically much like humans, and we are only a small step removed from similar experiments with helpless humans; a little totalitarian ethic and we are there. Indeed I am sure that a search through the records from concentration camps, prison farms, orphanages, etc. around the world would furnish much of the information contained in this paper.

I much prefer the approach of Lorenz, Schaller and Van Rawdick-Goodal, i.e. observing behavorial pattern in the natural habitat.

H. W. LIEPMANN
Professor of Aeronautics
Caltech

Dr. Harlow replies:

We are in sympathy with the feelings Dr. Liepmann expresses concerning cruelty to animals, since we abhor cruelty of any kind needlessly inflicted upon any living form. More than half of our researches in the last decade have dealt with various kinds and aspects of love, and we believe we were the first research group to unravel the variables making it possible for higher primates to be raised in a laboratory with full possession of their social and sexual capabilities. I am certain that we are not sadists, and I recently served as chairman of a National Academy of Sciences subcommittee to formulate basic rules and provisions guaranteeing humane housing and husbandry for laboratory animals. Even if we were sadists, we would not attempt research on depression if the experimental procedures involved severe physical discomfort or pain, since such researches would be meaningless due to confounding of physical and psychological variables.

We believe that Dr. Liepmann was in error in stating that the information obtainable from our researches is meager and trivial. Had Dr. Liepmann been a guest at the last meeting of the National Academy of Sciences, he would have found that his opinion was not shared by many eminent psychologists, psychiatrists, and biochemists.

Such information as can be gleaned from "concentration camps, prison farms, orphanages, etc." was in large part acquired and evaluated some 20 or 30 years ago, and these data, their values, and their limitations are a part of the common knowledge of most behavioral scientists and some educated laymen.

Dr. Liepmann's comments in the middle of the second paragraph beginning "Either the psychological behavior . . ." leave us puzzled and bemused. It is as if the writer had intellectually drifted far up into outer space. Even if this is true, in view of his engineering honors, he will doubtless find a way to return intellectually to earth.

Dr. Liepmann closes his comments by expressing a preference for ethological and primate field research over rigid laboratory experimentation. This is an interesting and probably valuable autobiographical item, but nothing more.

Fission vs. Fusion

EDITOR:

We believe that Professor Roy Gould has overstated the case for fusion power in comparison with fission power in his article in the March 1970 *Engineering and Science* ["Controlled Fusion—Clean, Unlimited Power Generation"]. The attitude reflected in the article is common among scientists, who tend to prefer the exotic to the useful.

As Alvin Weinberg pointed out more than ten years ago [A. M. Weinberg, "Energy as an Ultimate Raw Material,"

Physics Today, November 1959, p. 18.], there is no advantage in the fusion process from the standpoint of fuel supply. There is sufficient cheap uranium to supply the world's need for electrical energy by means of breeder reactors for the indefinite future. In fact, there is probably enough cheap uranium to fuel the present type of fission non-breeding reactors well into the next century.

No one even knows what a fusion reactor would be like, much less what it would cost, while prototype breeder reactors have been operating for some years. Indeed, an experimental reactor of this type was the first reactor to demonstrate the production of electrical power in 1951.

While the feasibility of fission reactors followed by only three years the discovery of fission, the feasibility of reactors based on the fusion process has yet to be demonstrated although the basic process has long been known. No fusion experiment has yet reached a level comparable to that attained by the Chicago fission pile in 1942. Even so, it has taken almost 30 years to produce electrical energy on a competitive commercial scale from fission. Because of the engineering and development time required from feasibility to commercial application, a time which more often than not is grossly underestimated by the laboratory scientist, it seems unlikely that controlled fusion would play a "key role in our lives" by the end of the century.

In view of the fundamental uncertainties it is frivolous to cite a cost advantage for fusion over fission because "restrictions imposed by the environmental hazards of radioactive wastes will have little effect on fusion power costs."

We hesitate to predict that the basic technical problems will not be solved. But the zeal of dedicated researchers is not a reliable guide in this situation. As I. I. Rabi remarked about one of E. O. Lawrence's ill-fated schemes, "You can make anything defy the laws of physics, at least for a while, if you spend enough money on it."

VICTOR GILINSKY
MILTON S. PLESSET
Division of Engineering and Applied Science
California Institute of Technology

Dr. Gould replies:

My article in *Engineering and Science* was not intended to "make the case for fusion power in comparison with fission power" but to acquaint the readers with the fusion reactor concept and to apprise them of the substantial progress which has been made in containing a hot plasma. The containment problem has long been regarded as the bottleneck in fusion research, and experiments during the past few years have shown that it is possible under some circumstances to eliminate completely the anomalously high loss rates (Bohm diffusion). This is a major achievement, though it does not guarantee a successful fusion reactor.

Comparison with other possible sources of electrical power is inevitable, however. The possibilities for essentially limitless electrical power in the future are: a) fission breeder reactors, b) fusion reactors, and c) solar energy. Should the development of all three be successful, the choice of which of these to employ or what combination of them to employ will depend on an analysis of the inherent advantages and disadvantages of each of the systems. The choice will undoubtedly be influenced by cost, and by environmental and safety considerations; although the weight we and succeeding generations choose to attach to these latter considerations may well differ. Indeed, there are differing opinions at the present time. I do not believe it frivolous to consider the possible advantages and disadvantages of alternative power sources as we proceed with their development. While the fission breeder reactor is the most advanced of these systems, its engineering and/or economic success is still not completely assured. In any event, we must maintain the flexibility to meet different requirements with different alternatives.

Contrary to the assertions of Gilinsky and Plesset, there exists a substantial body of knowledge addressed specifically to the important engineering and technological problems of a fusion power reactor station. Furthermore, when we undertake the solution of the engineering problems of a fusion reactor, we do so from a vastly expanded technological base, in comparison with that available at the beginning of the fission reactor development almost 30 years ago. Fusion reactor development should take place more rapidly. Indeed, fusion reactor technology will benefit greatly from the already developed fission reactor technology in neutronics, materials, and energy transfer.