Book Reviews

On Considering the Consequences

Science, Technology, and American Foreign Policy. EUGENE B. SKOLNIKOFF. M.I.T. Press, Cambridge, Mass., 1967. 346 pp. $8.95.

Many prescriptions for appropriately relating science to foreign affairs are based on extrapolations from particular experiences involving science and scientists in international research, cultural exchange, national defense, and technical assistance. Others are simply based on the assumption that there need be little difficulty in effecting suitable interactions between science and foreign affairs, if only our society were more attentive to the representatives of science. This assumption persists only because of the scarcity of sustained experience in guiding these interactions and the almost total lack, until now, of a general analysis of foreign-policy opportunities and problems based on such experience.

The great merit of this book is that its author, now a member of the department of political science at M.I.T., brings to it his considerable experience (1958–1963) in working for the Special Assistant to the President for Science and Technology, experience which serves as the basis for a thoughtful analysis of a major problem that confronts the United States. The problem is to maintain the established authority and responsibility for making foreign policy and yet exploit the opportunities and reflect the imperatives resulting from the advance of science and related technologies. The solution, as Skolnikoff sees it, is for the government officials and science advisers who should participate in making foreign policies to learn and constantly apply what can be known about the underlying and future significance (and insignificance) of scientific and technological developments in relation to basic issues in world affairs. This book contributes to this body of knowledge and stimulates the reader to ask many more questions which, once asked, should give rise to useful answers.

The book can be read in three ways, for as many purposes. First, it provides an insight into the characteristic actions and interests of the President's Special Assistant, the President's Science Advisory Committee, and the Office of Science and Technology. For analytic purposes, at least, the author classifies foreign-policy issues in terms of five different kinds of interactions with science: those in which technical objectives are dominant, those that are primarily political but depend heavily on scientific technology, those that result from the application of scientific methods to policy making, those that have been altered in a general way by science and technology, and those that arise now in anticipation of probable or possible developments in science and technology. The classification provides Skolnikoff with a framework for his study, but of course issues do not remain thus separable in actuality. As he himself shows, the political issue of "national prestige," for example, gave rise to scientific enterprises which in themselves became policy issues; and the application of quantitative analysis and simulation techniques in resolving any one issue generates further questions about the future character of foreign relations and the validity and limitations of these scientific methods in the foreign-policy process. Then too, his account makes it clear that official consideration of a particular foreign-policy issue in any of these terms has been a selective and unsystematic process, governed more by the initiatives of participants than by the character of the issue itself.

Second, the book may be read for the author's assessments of major issues, institutions, and individuals connected with foreign affairs—assessments which are, of course, his own, but which also afford glimpses of what may well be the prevailing views among his former associates about such matters as the political considerations pertaining to large-scale irreversible experiments, the U.N. conference on science and technology for the benefit of the developing nations, and a developing country's commitment to science.

Finally, this book provides considerable support for the author's major prescriptions for improving the foreign-policy process. He believes the White House and the Department of State are the center of formal foreign-policy making and should remain so. But he emphasizes that they lack the capacity to develop and sustain a position on issues having major technical aspects and must be encouraged to develop greater awareness of the complex interactions between technical and foreign-policy considerations. The author's essential point is that technical developments resulting from or giving rise to a policy issue should lead foreign-policy experts to ask the kinds of questions likely to elicit technical plans which would enhance the range of policy choices for which they are responsible. He is particularly concerned about situations where this sequence of interactions is curtailed. He shows that the science enterprises that gave rise to a policy regarding international cooperation in space programs and to the atoms-for-peace program were undertaken without sufficient and timely regard for the full range of foreign-policy considerations. He argues that technical agencies are not likely to offer alternative plans unless those with formal responsibility for foreign policy are competent enough to ask the right questions and are prepared to engage in a kind of adversary proceeding.

Improved policy formation depends on increased possibilities for the explicit influence of policy considerations in the course of developing and applying new technologies. This is a sensitive topic, but the author discusses it with special reference to the control of identifiable global, as well as American, technologies. Scientific activities may not provide the same strategic points for external influence; the author emphasizes that actual programs for such undertakings as international cooperation in science should be drawn up by scientists alone. Nevertheless, his general analysis and occasional references to conflicts within what is ordinarily considered the community of scientists and science-oriented organizations suggest that it may not be possible to inject foreign-policy consid-

erations into the processes of technological development without sometimes doing so in science as well.

Both the realities and the conventions separating science, technology, and related management and policy activities must be reexamined. It seems that whenever scientists are involved in the foreign-policy process for whatever reasons, the net effect is increased emphasis upon direct and distinctive contributions of science to foreign policy and on corresponding specifications for institutional arrangements and relevant competences. The proposition that foreign-policy processes may, as a result, come to reflect a distinctively scientific outlook is thereby reinforced. Fortunately, this proposition can be examined more systematically than heretofore because of Skolnikoff's analysis and the prescriptions which follow from it.

In discussing the style of operation of the Office of Science and Technology and in pointing to the need for something comparable in the Department of State, he draws attention to and pretty much accepts the selective approach of that office whereby a few issues or problems are pursued as targets of opportunity to the exclusion of others. This approach may be appropriate in science, but it tends, I think, to encourage the policy maker to overlook the pedestrian or less easily solved problems. Our government does sometimes neglect these in the pursuit of a selected goal, and one of the author's primary concerns is, indeed, that policies tend to be built around technologies which, in turn, derive their character more from scientific advances than from recognized national security or other foreign-policy needs. Nevertheless, it should also be pointed out that these needs have engendered increasing involvement of science on a more regular and comprehensive basis. At least, it is possible so to interpret the creation of science and technology offices for the President, the departments of State and Defense, the Arms Control and Disarmament Agency, and the Agency for International Development, whether or not the offices are yet adequate to the needs.

The same question of the possible influence of science on foreign-policy institutions and accommodations to them is suggested by the prevailing view about the competences required for appreciating the possible interactions between science and foreign policy. Skolnikoff points out that the directorship of the Office of Science and Technology, the directorship of the Office of International Scientific and Technological Affairs in the State Department, the deputy directorship of that office, the position of science attaché and the one of deputy science attaché are each presumed to require quite different qualifications, including varying degrees of recognized scientific eminence. It has not been assumed that an individual might advance from one position to another as he extended his experience and competence in science affairs.

When an occupant of one of these offices has been a disappointment, there is a tendency, one gathers, to attribute this to insufficient authority or personal unsuitability rather than to a mismatch between the position and the trained capacities sought in making the appointment. This is a remarkable situation. Skolnikoff recognizes the reasons for formal emphasis on scientific credentials, but in discussing particular policy issues he notes the need for different kinds of competence involving the social sciences and the imagination to consider the implications of major scientific and technical possibilities. Neither of these is directly correlated with creative scientific ability. He goes further by developing the interesting proposition that science affairs is a new subject, which ought to be studied, and that only if many foreign-affairs officials acquire competence in it will it be possible for the various science offices to contribute effectively to foreign policy.

Skolnikoff's thoughtful observations and discussions on these and many other questions should enhance the prospect that science will be harnessed more effectively to the nation's foreign-policy needs. Indeed, widespread appreciation of his analysis may diminish the importance which he now attaches to involving scientists in foreign-policy making on a more formal basis.

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Gas Dynamics

Physics of Shock Waves and High-Temperature Hydrodynamic Phenomena. Vol. 1. YA. B. ZEL'DOVICH and YU. P. RAIZER. Translated from the Russian by Scripta Technica. Academic Press, New York, 1966. 488 pp., illus. $18.

To our knowledge, this book integrates for the first time the various disciplines pertinent to high-temperature gas dynamics and reentry physics. It is written on three levels: it presents the physical fundamentals with plausible, deeply intuitive derivations; it then adds mathematic precision; and finally, it provides further important results for reference. It therefore should become essential to graduate students, teachers, and researchers in all aspects of this diverse field.

This first volume deals with basic principles. In a clear and logical presentation the fundamentals of hydrodynamics, acoustical disturbances, characteristics, simple waves, and shock waves are treated. Explosion and expansion problems are treated in some detail, but the interaction of a supersonic flow with a body is not. Dimensional and similarity arguments are used throughout. There follow sections on radiative transfer, thermodynamics of high-temperature gases, and line and continuum radiation emission from hot gases. The fundamentals of partially ionized gases are simply and clearly introduced. The book closes with a discussion of relaxation processes in molecular gases.

Occasionally basic physical formulas are introduced without a previous derivation. For the beginning student this may prove a slight hindrance. However, these omissions lead to an economy of presentation which more than compensates for any inconvenience. A few advanced results, such as the coupling of dissociative and vibrational processes are only briefly outlined, but perhaps they will be given more attention in volume 2, which is to deal with more advanced applications.

The most delightful aspect of this book is its style—a tribute to authors and translators. Deep intuitional arguments stimulate the reader's imagination, and simple numerical estimates whet his appetite for the mathematical derivations to follow. Clear motivation, alternative derivations, and simple examples abound. It is written in an almost breezy conversational style. It was a pleasure to review.

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