Book Reviews

Social Needs and Technological Promise

Science, while assiduously avoiding criteria of utility, has become an indispensably practical institution of modern society. Politics, the art of the possible, relies increasingly on science to define the limits of the possible and to illuminate technological pathways toward solution of social problems. World economic development is a case in point. The continuing pressures of population growth negate the productivity gains of many developing nations. The extraordinary rates of growth and change in science—greater than for any other social phenomenon—nurture the hope that new discoveries may hold the key to this predicament.

What effect does a decade's scientific progress have on prospects for economic development? This question is posed by Richard L. Meier in the second edition of **Science and Economic Development: New Patterns of Living** (M.I.T. Press, Cambridge, Mass., 1966. 292 pp., illus. Paper, $2.45), which he offers as "an experiment in judging the effects of progress in science upon the developmental prospects for the world." Rather than prepare a conventional modernization of his earlier text, Meier chose to let the original stand and to append comments to sections and tables where recent findings were of interest.

The first edition, in 1956, was an unusual attempt to combine a technical analysis of the interaction between human needs, population growth, natural resources, and developing technology with an imaginative exploration of the social problems and possibilities inherent in new patterns of living. After taking the measure of the world predicament—the need to achieve an adequate standard of life in the face of continuing population growth—Meier concluded that there were no material barriers to resolving it. Science, he found, could depict a range of possible futures to meet the challenge; the basic problem, not surprisingly, was to discover "how to get from where we are to that more desirable state." In other words, the overwhelming task was—and is—social, a matter of "revamping human institutions so that the opportunities presented by new technology can indeed be grasped."

The second edition, a decade later, finds minor changes in the scientific and technological aspects of the problem and a major shift in a key social parameter. Despite evident progress in many fields of applied research, the 13 problems in fundamental science listed by Meier in 1956 remain "unresolved" in 1966. He found no substantial change, furthermore, in the levels of production of food, fibers, energy, and materials which seem attainable on a global scale. Although science, using systematic methods and a cumulative body of knowledge, is useful for "clarifying choices in the range of possible futures," the product of a decade, as depicted by Meier, has had only a marginal impact on that range.

The most striking change is that earlier consensus views of future world population are now believed to have been serious underestimates. United Nations estimates of 1963 anticipate a population in 1970 equal to that projected for the year 2000 in the 1950 data used earlier by Meier, with population now expected to double again between 1970 and 2000.

How, then, do we interpret the data of this unusual "experiment"? It is here that the book is disappointing, for the author does not explicitly come to grips with the question which ostensibly motivates the new edition. Relatively little has been added for this edition, reinforcing the notion that the abundant scientific product of the intervening years does not require any qualitative change in the analysis. Because the implications of this result are so great, it is regrettable that Meier does not take a clear position on the interpretation of his findings or confront some of the obvious questions they raise.

Nevertheless, there are other values in a reappraisal of this work. The idea of "total systems analysis" of social problems was novel in 1956, but faith in its efficacy is growing more common at the moment. This case suggests both the value of the method and its weakness. Because of its scope, any analysis of this sort is necessarily open to questions of detail. Despite these, and despite overtones of technological reductionism—probably inherent in the technique—the result of Meier's work is effective and thought-provoking. Yet the rigor of the technical analysis is weakened by the vagueness of our understanding of society. Meier's dependence, for example, upon shifts in "informed opinion" about the central social parameter—rates of population increase—emphasizes the social character of the basic problem, but gives rise also to awkward questions about the validity of any analysis along these lines.

In sum, the book illustrates both the power of science and its limits. The social sciences, evidently, can have a multiplier effect on our ability to apply the methods and results of the "hard" sciences to large-scale social problems. Although sober analysis shows that known resources and known techniques can be used to attain a rationally established minimum standard of living, social and political obstacles to an "adaptive society" frustrate present hopes of realizing such a future. It would be a cruel joke if man's expanded sense of what is technologically possible were to serve only to make him aware of what he is denied by our primitive understanding of the social arrangements which might make such possible futures real. To escape this dilemma we require fundamental advances in the social sciences beyond any which can now be foreseen.

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Vision

Seeing changes with circumstances and with individual experience. Much of the process is rooted in the hereditary structures of the eye and the highly organized neuromuscular system. Comparative and evolutionary studies continue to tell us more about animal as well as human vision, and the excitement of these studies has been

captured by R. L. Gregory in **Eye and Brain: The Psychology of Seeing** (McGraw-Hill, New York, 1966. 254 pp., illus. Paper, $2.45). Gregory treats most of the biological foundations for seeing in his five early chapters, and that leaves him eight chapters for dealing with the complex problems of color vision, seeing movement, inadequacies and errors of seeing, how the artist through history learned to portray visual reality, and other fascinating principles and applications, including in the final chapter a discussion of why vision is likely to pose problems in the exploration of extraterrestrial space.

The two longest chapters of this book deal with illusions and with the question: Do we have to learn how to see? Since the answer to this question is both "no" and "yes," Gregory obviously has to rephrase it into a series of additional questions that take roughly the form: Does the individual (animal, child, adult) require certain experiences before his vision serves him in a given task, appreciation, or perception? Clearly the evidence is not yet all in, says Gregory, and the pursuit of it is one of the current areas of active investigation. (The authors of the book and of this review are among the participants.) Gregory is very effective in his review of conclusions that are drawn from studies of prism adaptation and recovery from congenital cataract. He is equally careful about generalizing from animal to infant vision or from visual behavior in the human infant to the much more highly discriminating older child or adult.

Eye and Brain is a part of the World University Library series, designed "to provide authoritative introductory books for university students which will be of interest also to the general reader," and its format and style of writing are appropriate to this purpose. It is exceedingly well illustrated, with color used effectively both to illustrate principles in color vision and to add realism to the photographs and diagrams of the eye and the brain. Gregory has referred to important sources both generously and in a most useful chapter organization. The bibliography is briefly annotated, and contains original as well as secondary sources suitable for further reading by student or general reader. Even the expert will find challenges in some of the restatements and documentations that Gregory provides on lively issues.

As an attempt to encompass much in relatively few pages, the book is highly successful, although sometimes the reader has to bring knowledge or educated guesses to bear on some paragraphs or quotations. For example, it is not clear why Polyak is saying in one of the intriguing quotations that 100 microns correspond to 20 feet or one-third of a degree of arc, and the curious reader must search the original for Polyak's analogy. Some of the references brought into the text are not to be found in the bibliography, or, as in the case of Hess's study of prism displacement in the chick, are attributed to the wrong author. But such errors are few enough not to mar seriously this exceptionally broad and appealing introduction to current knowledge.

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Blokhintsev's Textbook in Translation

Apparently D. I. Blokhintsev's classic Russian textbook, first published in 1944 during the days of Stalin, has not been much revised even in the fourth edition from which the present English translation, **Quantum Mechanics** (Reidel, Dordrecht; Gordon and Breach, New York, 1964. 551 pp., illus. $17.50), is made. The author restricts himself to nonrelativistic theories, but still could do better by discussing the Wigner symbols, nuclear shell models, Hartree-Fock method, and such developments that took place after "the Copenhagen epoch." In fact the main aim of the book seems to be to emphasize the materialistic view in contrast to the idealistic or positivistic view taken by "the bourgeois physicists" in "capitalistic countries." In looking at the references in this book it is amusing to find Engels next to Einstein and Lenin between Landau and Lorentz. The age of the book can also be seen in the references by finding older editions of Beth's and Heitler's books, for example. Such philoso-physical attitude, on the other hand, makes the book strong and valuable in discussing the physical meaning of some fundamental points such as the uncertainty relations (section 16), tunnel effect (section 97), and manybody problems. These discussions are clear and unique. Also the explanations of the classical limit ($\hbar \to 0$), uncertainty relations between energy and time, and Pauli matrices would help beginning students better than most other textbooks.

As a textbook for beginners, however, the book has a few drawbacks in addition to the fact that some materials are old: There are no exercise problems, and some definitions and notations are inconvenient. As an example of the last point: the author defines the spherical harmonics in the same way as Schiff did in his textbook. The definition differs from that given in Condon and Shortley, Landau and Lifshitz, Messiah, and most of the other standard books. Another example is that the book uses black letters for operators and matrices but not for vectors. Also I do not understand why the bracket notation is not used for the commutators. (Such notation is used only for commutators with the Hamiltonian.) If such points are supplemented by other books or by instructors, this book can be a good textbook in the beginning quantum mechanics course.

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Methods in Biochemistry

Biochemistry Laboratory Techniques (Wiley, New York, 1966. 177 pp., illus. $5.95), by Sterling Chaykin, was intended as a laboratory manual for beginning graduate students. It was, it is said, designed to provide "a basic working knowledge of a wide variety of laboratory techniques currently in use in biochemical research." Indeed, it does touch on buffers, methods of protein determination, preparation and properties of yeast alcohol dehydrogenase, the isolation of rabbit muscle aldolase, Sephadex in gel filtration, criteria of protein purity, structure of aldolase, radioisotopes, characterization of glycogen, glycolysis, enzymology of polysaccharide biosynthesis, oxidative phosphorylation, bacterial genetics, and glass blowing. However, it seems to do little more than touch on these subjects; procedures are only sketched in, and the discussions of principles are meager. The reason given for this