The 20th Century: Berkner's New Age or Boulding's Post-Civilization

The botanist John M. Coulter, questioned as to the proper length of a doctoral thesis, quoted the scriptural reminder that a man is not heard for his much speaking. Neither of the volumes reviewed here is thick. Lloyd V. Berkner's **The Scientific Age: The Impact of Science on Society** (Yale University Press, New Haven, Conn., 1964. $4) contains some 150 pages and Kenneth Boulding's **The Meaning of the 20th Century: The Great Transition** (Harper and Row, New York, 1964. $4.50) contains approximately 215 pages. Both volumes are significant, dealing as they do with human destiny in this neotechnical age. Taken together, as they should be, their value lies quite as much in contrast as in congruence.

Lloyd Berkner, president of the Graduate Research Center of the Southwest, is a self-powered, high-speed projectile in the impact, or better, bombardment, that he discusses. Unlike conventional missiles, Berkner is acutely aware of the spectacle in which he is involved.

The thesis of his clearly written chapters is revolution, based on scientific and technological developments, chiefly in the United States. In his view we have attained the age of plenty and have, almost within our grasp, the promise of a society surpassing all previous intuitive hopes. To attain it we must develop "a strategy of maturity." Such a strategy, in turn, requires a high and pervasive level of scientific literacy, sufficient to bridge the gap between scientist and humanist.

To this end "man must submerge his intuitive reactions and beliefs to the cold scientific logic of the situation, for the machine expects its own standards of perfection from its master" or it will come to dominate him. One awaits with interest the comments of the trained philosopher on this idea of submergence of the intuitive, in the light of Berkner's tribute to intangible sanctions.

For he says in a final page that our strategy must recognize "each social problem in accordance with a scale of its reality and [seek] solutions based on *moral, ethical,* and *political* principles developed in consonance with the environment" *(my italics).* Further, our maturity should recognize "that science and engineering are the manifestations of our time that have given our age its character."

Surely some thoughtful individuals will regard this as the statement of a dilemma rather than its resolution. That our traditional assumptions must face up squarely to scientific enlightenment is accepted by the greatest leaders in religion, logic, ethics, and esthetics today. But they, and doubtless many scientists, would insist on more emphasis being given to the wisdom of historical process than is—probably without intent—evident in the statement quoted above.

That intrepid hunter (scientist as well as warrior) General James Doolittle recently remarked that, if one is hunting bear, he must try to think like a bear. But bears are alive; machines are not. Certainly if we are to govern the machine, we must understand it, yet reserve the rights of experience.

One can wholeheartedly endorse Berkner's insistence on a high general level of scientific literacy and the importance of minimizing political uncertainties through scientific knowledge and perspective. More controversial are his belief that we must create expanding desire for the things we now produce with such facility and the extent to which he sees salvation measured by the crop of Ph.D.'s. This is acceleration with a vengeance.

Kenneth Boulding is an undismal professor of economics at the University of Michigan. Boulding, who was educated in England, writes with the clarity and range we have come to expect from one of that background. He is pungent as well.

Both authors agree that we are in the midst of a revolutionary transition, that the advance of science is responsible, and that we had better work out a grand strategy to meet the future successfully. Further, both are explicit in their belief that more, not less, science is necessary to achieve Berkner's New Age or Boulding's Post-Civilization.

Their difference, however, is important, although largely a matter of emphasis. Berkner indicts the decline of the liberal arts, calling for them to become revitalized through rapprochement with the sciences. In a brief paragraph on the social sciences, he views them as taking the first tentative steps toward their goal.

Boulding, on the other hand, himself a social scientist, takes considerable pains to explain the development in this field, and to factor out the problems of investigation and application. He stresses the need for continuing dialogue directed toward (if not attaining) consensus among the various disciplines of thought and experience.

He discusses in considerable detail the grave obstacles—the "traps" in his word—that must be dealt with in developing any effective strategy. These are the guidance of economic development on a world scale; the abolition of war; the control of population; and, in a chapter on the entropy trap, the need to reckon with thermodynamics in our planning. In effect, Boulding is urging the use of science for perspective in guiding its application. By so doing he upgrades the role of science from that of a source of devices to that of a source of vision.

This point of view is particularly congenial to students of natural history —biologists and geologists—who see process in the long background of time. Rightly or wrongly, they sense peril in our departure from the model of an open steady state which has enabled living communities to survive and function through the ages. This pattern has been based on the use of current energy income and a relatively efficient recycling of materials, along with a working equilibrium of numbers. Our great and growing vortices, which suck in fossil energy, water, and the products of field and mine, use them, and then spew out the end products in useless, often dangerous, form, have no counterpart in the natural world.

To the dilemmas arising from our neotechnical culture there can be no simple solution—certainly not the too widespread, passive confidence that "science," through sheer expanding activity, will bail us out of any extremity. Rather we must rely, with Boulding, upon the rich diversity of human talent and hope for its effective and continuing collaboration.

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Educational Trends

Schools in an Age of Mass Culture. An exploration of selected themes in the history of 20th-century American education. Willis Rudy. Prentice-Hall, Englewood Cliffs, N.J., 1965. x + 374 pp. $6.95.

Willis Rudy has written a simple, unloving account of recent trends in American education. He provides some helpful compendia of such matters as the controversy over religion in the public schools, the changing role of the school superintendency, the vicissitudes of intelligence testing, the ideology of life-adjustment education, and the background of the 1954 school-integration decision. But he also misapplies a whole generation of cultural criticism.

His major point he derives from the kind of social comment that became popular during the 1950's: America, he hears the critics say, has become a "mass culture" in which every failure to decide issues in favor of the intellectual minority is a step toward burying individualism. School superintendents he sees as men who have succumbed to the pressures of conformism but who may yet reassert their virtue. Religious education appears to him to have accepted American group-mindedness, relying on indoctrination rather than promoting "authentic personal experience." Racial integration leaves him wistful, and he laments that neither Negro nor white leaders have had the courage to advocate segregation on the basis of purely individual ability. But the "mass" that frightens Rudy is a slogan concept. He shows no curiosity about the content of popular culture, and no awareness that people whose education has been other than the conventional academic course may still produce authentic, unstereotyped intellectual responses. He is properly dissatisfied with the insipidity of official school culture, and with the insipidity that he thinks he sees in the lives of the mass of children. But he sets against this insipidity only last year's jargon about excellence.

Leadership he sees as a eugenic proposition, for which he finds authority in writings by Herbert Muller, Ernst Mayr, and Edward L. Thorndike. He accepts uncritically the older mechanistic conceptions of intelligence, making only enough concession to environment to conceal his ignoring of recent work on the emotional and cultural factors in cognition. But it is partly on these revisions in psychological thinking that planners have based their efforts to raise the quality of American education. Really excellent work has been tending not only toward the discovery and "pursuit of excellence," but also toward the solution of generic problems that have impeded the communication of ideas to individuals of all ages and all levels of ability.

No one, perhaps, wishes to bother denying genetic factors in intelligence, and there is room for serious argument whether modern social conditions tend to depress or elevate average genetic intelligence. But the mere eugenicist position is an out-of-date mediocrity that offers no help to the understanding of what has actually happened in the schools.

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The Many-Body Problem

Quantum Field Theory and the Many-Body Problem. T. D. Schultz. Gordon and Breach, New York, 1964. viii + 150 pp. Illus. Paper, $3.95; cloth, $5.95.

The beginning of a new series of books devoted to the "many-body problem," of which this book is the first volume, shows the recent wide interest in this particular branch of theoretical physics. Another book, much more detailed and advanced than the present volume, was published recently—*Methods of Quantum Field Theory in Statistical Physics*, by A. A. Abrikosov, L. P. Gorkov, and I. E. Dzyaloshinski [see the review in *Science* **143**, 599 (1964) for a general discussion of its subject matter]. Both books emphasize the so-called Green's function techniques. But the present book is better suited for use in an introductory study. It is written for those who are not familiar with the perturbation theory used in quantum field theory. It starts from the beginning, with second quantization and the definition and properties of one-particle Green's functions. The bulk of the book is devoted to diagrammatic representations of perturbation terms, and this is done for the many-fermion system and the electron-phonon system at zero temperature. The many-fermion system at finite temperatures is also treated briefly in the last chapter.

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Biochemistry

The Biochemical Approach to Life. F. R. Jevons. Basic Books, New York, 1964. 184 pp. Illus. $4.50.

F. R. Jevons' delightful book will serve extremely well as a stimulating introduction to biochemistry and should be comprehensible to anyone with an elementary knowledge of science. Jevons has given his treatment of biochemistry a strong historic flavor that enables the reader to view the whole of biochemistry in its proper perspective. This aspect is often overlooked in textbooks of biochemistry. Where, for example, can one find a narrative about the stormy controversy between Pasteur and Liebig which culminated in the little skit published by Wöhler in Liebig's *Annale der Chemie*? The mention of the Nobel prize winners throughout the text emphasizes that biochemistry is one of the frontiers of science.

The emphasis is placed on biochemistry as a way of explaining the phenomena of life, stressing the comparative aspects. The author has been very successful in building up a rationale of the biochemical approach. Beginning with a discussion of isolated molecules and events on the molecular scale, typified by proteins and isolated enzyme reactions (chapter 2), Jevons moves on to the collaboration between enzymes and finally to the organization