BOOK REVIEWS

Science and Civilisation in China. Volume 4, Physics and Physical Technology. Part 1, Physics. By Joseph Needham. 434 pp. Cambridge Univ. Press, New York, 1962. $15.00. *Reviewed by J. Arol Simpson, National Bureau of Standards.*

ON the dust jacket of this book, paragraphs are cited from reviews in highly respected journals of London, New York, Calcutta, Peking, and Moscow, of the first three volumes of this monumental work. These excerpts abound in phrases such as "The importance of this work cannot be overestimated", "Nothing by Western writers on China comparable in richness of material and depth of insight", "Masterpiece of modern scientific study". I must offer my apologies to the authors of these reviews, as well as the authors of the book, and to the thirty-one distinguished scholars who read part, or all, of this volume in manuscript, and who must have approved it (since their names appear on page xxi), and enter a dissent. Volume 4, at least, and I suspect much of the entire series, is based upon what I consider an untenable assumption.

This assumption is that parts of different civilizations (here the systematic descriptions of the physical universe) are congruent enough to enable one to make meaningful comparisons between them when the cultures (basic philosophies, Weltanschauung) are as diverse as those of China and the West. Physics, as we comprehend it, is a projection on the universe of the Greco-Christian-Renaissance epistemology, with certain definite ideas on causality, etc., which is essentially noncongruent with the Mohist-Taoist-Buddhist epistemology of China.

A few examples taken from the book illustrate the difficulty. In the West, the great triumphs of early physics were in the dynamics of material bodies; the epic struggle to formulate the concepts of momentum, energy, mass, and force is one of the glories of Western thought. In China, this effort can be covered by the author in a sentence, "Mechanics was weakly studied and formulated, dynamics almost absent." Or consider optics: the observations of the Chinese were flawless as to the focal properties of lenses and mirrors, yet they had no deductive geometry; hence, the Chinese never developed optics to the quantitative level of Ptolemy (2nd century A.D.). Or consider acoustics, where the author presents proof that the Chinese may have discovered equal temperance a few years before the West, in the mid-16th century. The Chinese, however, had been writing major texts on acoustics a thousand years earlier but, since their "music" was based upon timbre rather than pitch as ours is, it is rather hard to comprehend their significance.

The author presents what seems to be conclusive arguments that the properties of the magnetic compass were known in China several centuries, perhaps a thousand years, before they were in the West. But typically, for most of this time, lodestones and magnetic devices were used for geomancy and other forms of soothsaying and were only applied to navigation by the Chinese about a century before the ship's compass was used in the West.

Rotating book wheel, an early approach to information retrieval. 18th century Chinese copy of 16th century Italian engraving. (*The Bettmann Archive*)

I believe that I have made my point; the book is less than a success because ancient China had no physics to study. The ancient Chinese did develop a picture of the universe which must have been in some manner philosophically satisfying to them, but the book under review, despite its great wealth of fascinating material, fails, for this reviewer at least, to supply any clue as to its nature. The author, in his introductory note, acknowledges some difficulty of this sort but feels that all that is lacking is further detailed research. I am afraid that he is mistaken and we will never understand the civilization and science of China if we consider, as the author does, Taoist geomancy to be "pseudo-science".

This essential flaw in the book is a great pity, for otherwise it is an awe-inspiring effort and a model of painstaking scholarship with its 60 pages of bibliography, acres of footnotes, and an excellent index. The senior author, who is responsible for the great bulk of the writing, has a style that is extremely readable, and his scientific, political, and cultural opinions are forcefully presented. The production, with clear print, wide margins, and excellent reproductions, does credit to the publisher and makes the book a joy to own. I wish I could say as much for the contents. But I urge anyone remotely interested to get the book and decide for himself, since I long ago learned that a sure way to miss the start of a morning's APS meeting session is to start a discussion of the philosophy of science in the lobby the night before.