be an enormous difference in accuracy between points along the route and points even a mile or so off it, not to mention points 10 or 20 miles away. This fact must be constantly kept in mind by the compiler as he struggles to reconcile various surveys into a map.

The problems of chronometric longitudes are not much discussed in this book, which takes the point of view of the 1930's, when radio time signals became available. In some ways, this is unfortunate, since the most serious errors in the older surveys are often those in longitude, owing to the lack of accurate time.

The style of the book is lively, though marred by occasional Teutonisms. A theoretical example of carrying a survey across a wide expanse of marshy country suddenly develops into a galloping narrative as the reeds catch fire, the camels panic, and the whole caravan stampedes. The problem is intended to illustrate, and does illustrate, the extremely uneven nature of the problem and the resourcefulness required.

This book is recommended for those who must either make or use maps of areas where there is no topographic survey, and especially for those whose interest is in central Asia.

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Optics. The science of vision. Vasco Ronchi. Translated from the Italian and revised by Edward Rosen. New York University Press, New York, 1957. 360 pp. Illus. $10.

Vasco Ronchi, well-known among astronomers, amateur telescope makers, and those who must test optical devices for his grating test, announced in 1925, is director of the National Institute of Optics in Arcetri, Italy, a suburb of Florence. Much excellent optical research has been published from this center of Italian optics, and the workers at the institute enjoy a well-deserved reputation for scientific competence.

As the term is universally used today, *optics* embraces all but a very few phenomena associated with radiation, and such a discipline would exist without eyes to see. The term is a convenient carryall when the common characteristics of radiation phenomena are in question.

In this discursive, polemical book Ronchi proposes to limit the term to those aspects in which the eye—and the eye of sentient, sensing man only—is involved. This regressive step is made in all seriousness, and those limited parts of optics in which the eye is involved are carefully, logically, and clearly, though largely nonmathematically, explained and developed from a few principles. Ronchi characterizes the optics which to him constitutes the heart of the subject as "anthropomorphic optics," the same field that was understood until the 17th century to be all of optics.

Ronchi develops this viewpoint with great skill, but he inevitably produces a false impression of the richness of the discipline he is discussing. It is very doubtful that any idea of this fullness can be conveyed without detailed physical, physiological, and psychological explanations. For these there is no room in the book, and no hint that the old saw "the eye receives light, but the mind sees," has a profounder meaning than that exemplified in the "effigies," the mental constructs from sense data defined on page 70, and in the examples Ronchi discusses.

The position adopted by the author leads to some surprising conclusions, of which the most startling is in the following statement, taken from page 288: "The virtual image is purely a mathematical fiction. It may be useful as an intermediate solution in the study of complex optical systems. . . ." This is indeed unsound doctrine, unsupportable by any argument known to me, and refuted every time a man shaves the man in the mirror (virtual man, beard, and razor), or a woman powders the nose of the virtual woman with a virtual puff loaded with virtual powder, or an ametrope puts on his spectacles.

The book is well printed and bound, and the errors that I caught are relatively few in number. The translation is smoothly done, no traces of the original Italian remaining, unless it be in the unusual term *centric,* used for Airy disk, or *effigy,* the mental construct alluded to in a preceding paragraph. Lines 9, 10, 11 on page 231 seem to be an incomplete sentence; the figure illustrating astigmatism, on page 268, is unclear and misleading; and Fig. 20, on page 78, is inverted: the trochlear pulley is actually above the globe of the eye.

It is difficult to identify the intended reading public. As a textbook or a reference work, the book is limited in scope, and the controversial features would mislead the casual reader whose knowledge of physics or optics is an insufficient guide to the good that is in the book. The lack of any bibliographic references whatever makes impossible the verification of questioned statements and seriously impairs the value of the book. Nevertheless, I found it interesting reading.

The book falls into two parts. The first, of six chapters, constitutes approximately three-quarters of the volume and deals with the history of optics, elementary physiology of seeing, and the arguments centering around "anthropomorphic optics." The second part deals with wave motion. This section is notable for the clear physical arguments the author advances for the elementary wave phenomena he discusses. Very little mathematics is required to understand the arguments, though trigonometry and differential calculus are sparingly used.

ALLEN E. MURRAY
Bausch & Lomb Optical Company

Lectures on Rock Magnetism. Being the second Weizmann Memorial lectures, December 1954. P. M. S. Blackett. Weizmann Science Press of Israel, Jerusalem, 1956. 131 pp. Illus. $5.

In this engaging little book, P. M. S. Blackett reviews the present state of knowledge in a new and very active field of research. The abundance of data that is rapidly accumulating on the intensity and direction of the natural "permanent" magnetization of geologically dated rocks has shown that rock magnetism may become a powerful tool to trace the history of the earth's magnetic field and of the movement of land masses over its surface. Although he is one of the chief investigators in this field, Blackett has maintained an admirable objectivity in discussing the various controversial hypotheses that are being so avidly championed. The three chapters of the book—the general discussion of rock magnetism and its application, the description of the experimental work, and the synthesis of the recent results—are succinct and lucid expositions which are sufficiently complete to introduce any technical reader to rock magnetism and are "meaty" enough to be of interest to those already acquainted with it.

The first chapter is a review of the historical development of the subject and includes straightforward descriptions of how rocks acquire their magnetism, of the various mechanisms by which this magnetism can be reversed by physical-chemical changes, and of the observed reversals in rocks and their possible significance in terms of reversal of the earth's magnetic field.

The second chapter discusses the various laboratory measurements that can be made on rock and mineral samples and the pitfalls that are inherent in them. Blackett's conclusion is that much can be learned from such laboratory tests, but, because many of the mineralogical and chemical properties of the rocks change in the course of these tests, great care must be taken before the results are applied to natural phenomena.

The first part of the third chapter is a synthesis of the results of measurements of rock magnetism, throughout