completely ignored. But it may be fairly at the same time rather more Western than Eastern, considering that, in the main, Westerners will read it, and that Western methods of government and education continue to spread over the world. Then there are two points on which I am happy to agree entirely with Mr. McCabe. The first is that our view of history from the first should cover all classes, and not the eminent or wealthy who fill the larger place in the older books. This does not mean that art or beautiful things should be ignored, but that they should be regarded as part of the patrimony of the poor as well as of the rich. The second, and perhaps most important of all the aspects of history, is the growth of knowledge and the use of knowledge for the welfare of mankind. On this point Mr. McCabe is sound and strong. What he needs is a kindlier and truer realization of the place of religion in history, and the value of religion to the poor as well as the aspiring, both in the East and the West.

F. S. MARVIN.

FROM COUNTING TO THE CONTINUUM

Number: the Language of Science

By Prof. Tobias Dantzig. Second revised and enlarged edition, based on the third American edition. Pp. xi+320+11 plates. (London: George Allen and Unwin, Ltd., 1940). 10*s*. net.

PROF. DANTZIG'S title raised my hopes. As a biometrician concerned in an attempt to substitute mathematical expressions for such useful, if slightly vague, biological expressions as race, type, heredity, and variation, I hoped that he might show why science is inevitably and progressively doomed to use mathematics as its language. He might even furnish me with arguments to be used on my non-mathematical colleagues.

I was disappointed. The book is written from a historical angle, and shows how the concept of number grew from the stage of finger-counting to transcendental and complex finite numbers, and transfinite cardinals. Practically nothing is said of further generalizations such as vectors and Kronecker ideals, though the former at least have more place in the language of science than transfinite cardinals.

The historical survey is full of interesting quotapions, and illustrated by an excellent series of portraits, but it is somewhat over-simplified. Thus, on p. 30 we read that the Greeks did not create even a rudimentary algebra, and that positional numeration originated in India. This enables the author to evade the very interesting questions of why Diophantus's algebra remained rudimentary, and why the Babylonians, who used positional numeration to some extent, did not invent zero or the decimal point.

The account of Cantor's work is particularly clear. But the same cannot be said for the treatment of mathematical reasoning. On p. 66 we read that a conclusion is logically flawless, if "we have examined our premises and found them free from contradictions". Surely a less acquaintance than Prof. Dantzig's with the history of mathematics should have made him pause before he wrote this sentence. For two thousand years Euclid's axioms were supposed to be free from contradictions. But Prof. Dantzig's Chapter xi on transfinite numbers is full of awful warnings against pushing the assertion that the whole exceeds the part beyond its proper domain; and quite recently Gödel has shown that no system of axioms can be proved to be free from contradictions. It can be tested for hidden contradictions, but a failure to find them is no proof that it is logically flawless.

This book has its proper place, in the library of amateurs of mathematics, or of schoolmasters who wish to make elementary mathematics as interesting as possible. But it does not tell us why in some periods mathematics develops in response to the demands of science, and at other times independently. Thus, the first transcendental functions were invented because observations became sufficiently accurate to make them valuable. Then function theory ran ahead of practice. To-day science has caught up mathematics in many fields, and unfortunate biologists like Sewall Wright and myself are compelled to investigate probability distributions (one of the most interesting generalizations of number) because the mathematicians have not yet done the work for us.

Prof. Hogben, to take a recent and justifiably well-known example, has told us how mathematics grew up in response to scientific demands. Prof. Dantzig tells us something of how it grew under the stimulus of its own internal contradictions. I am waiting for an author who will combine these two points of view, and give us a real philosophy of mathematical progress; and I hope that when such a book is written it will be better bound than "Number".

J. B. S. HALDANE.