cussions of the nature of mathematics and mathematical thinking, some old-fashioned and some up-to-date. They illustrate the principle that there are at least as many ways of thinking about mathematics as there are mathematicians. There are many biographical and historical selections. Since the chief interest of mathematicians, outside of mathematics, seems to be the personalities of other mathematicians, there is much here to interest the professionals. There are remarks on the general subject of "numbers," ranging from an enquiry into the question of whether birds can count to Dedekind's own account of irrational numbers. There is fascinating material on applied mathematics (my term, not the editor's), much of which seems to be more applications than mathematics: the discovery of Neptune, the problem of determining longitude, the periodic table of the elements, Haldane's famous essay *On being the right size*, Eddington on the constants of nature, Malthus on population. There is an assortment of essays on probability and statistics (it is a pity that room could not have been found for Feller's deflation of the St. Petersburg paradox, when so much of the traditional well-meant nonsense about it is included). There is a lucid exposition of Gödel's theorem by Nagel and Newman, and there is an essay that Lewis Carroll would have enjoyed (written especially for this anthology by Nagel) on *Symbolic notation, Haddocks' Eyes, and the dog-walking ordinance.* There are particularly interesting essays on computing machines by von Neumann, Turing and Shannon. Apparently just to show how far one can attempt to go, there are selections from G. D. Birkhoff's writings on ethics and aesthetics. A real novelty is the inclusion of five selections from mathematics in fiction, ranging from *Gulliver's Travels* to *The New Yorker.*

All in all, this is an anthology with the faults of its genre and more virtues than most specimens of its kind, especially in the set of mathematical anthologies of which it is almost the only example. It has as legitimate a place in any mathematician's library as the *Oxford Book of English Verse* has in that of a specialist in English literature.

R. P. BOAS, JR.

Logic, semantics, metamathematics. Papers from 1923 to 1938. By Alfred Tarski; translated by J. H. Woodger. Oxford, Clarendon Press, 1956. 14+471 pp. 60 shillings.

Since most of the papers that make up this volume have become an essential part of the modern logician's equipment by now, it would be out of place to offer a review of their content at this time; what follows is a brief descriptive report.

Although Tarski has written extensively on several parts of mathe-

matics (e.g., set theory, geometry, Boolean algebra, measure theory), his principal contributions are along the lines of logic. The present volume contains his early logical work. (It does *not*, for instance, contain the Banach-Tarski paradox.) The seventeen papers that appear here in English translation, occasionally with slight changes, corrections, and additions, were first published in German, or French, or Polish. Since some of them were published in more than one part, or in more than one version, a complete list of the original sources would contain not seventeen but something more like thirty titles.

The longest paper is the famous *Wahrheitsbegriff;* it covers 127 pages. Since the first version of this work is in Polish, and the second (in German) appeared in a journal not readily available to mathematicians (Studia Philosophica), the reviewer, for one, would have rushed out to buy the book even if it contained nothing else. It does, however, contain a lot more. Here are a couple of tempting samples: the 1930 paper on the sentential calculus (with Łukasiewicz), and the 1933 paper on ω-consistency and ω-completeness.

The translation seems smooth. A noteworthy feature is the fact that, frequently, the notation was "translated" as well as the text; the letters (or digrams) used in this volume remind the reader, quite properly of course, of the English words "truth," "consequence," etc., rather than, say, the corresponding German words. The usability of the volume is further enhanced by a unified bibliography, a subject index, an index of names, and an index of symbols.

According to a letter from Tarski to the reviewer, Tarski's post-1938 papers on the subject of this volume are all in English. Armed with this volume, therefore, and with the reviews in the *Journal of Symbolic Logic*, the English-speaking mathematical logician can be confident of having Tarski's complete logical output easily accessible to him—a circumstance for which many logicians should and will be grateful to the translator and publisher.

<div align="right">PAUL R. HALMOS</div>

La théorie des fonctions de Bessel, exposée en vue de ses applications à la physique mathématique. By Gérard Petiau. Centre National de la Recherche Scientifique, Paris, 1955. 477 pp. 2500 francs.

This book is the first comprehensive treatise on Bessel functions since Watson's standard work on this subject. A comparison between the two is somewhat out of place since their purposes are different. The book under review, as its subtitle and its application part (more than 100 pages) indicate, is aimed to appeal mainly to the applied mathematician and physicist. Consequently those results and prop-