

***The Development of Logic.* By William Kneale and Martha Kneale. Oxford: The Clarendon Press, 1962. Pp. viii + 761, with index. \$12.00.**

As the title suggests, this book is not precisely a history of logic, but "an account of the growth of logic," as the Preface points out. A brief first chapter discusses the period prior to Aristotle, followed by a long and, in some respects, a quite detailed chapter on Aristotle. The third chapter treats the Megarians and the Stoics. Both Roman and medieval logic are included in the fourth chapter although the chapter is nearly a hundred pages long. Recognition is at last being given to the wealth of material in the medieval period, although it cannot yet be said that this period of logic has come in for its proportionate share of treatment. The fifth chapter deals with logic after the Renaissance; it starts with the blow given to the "prestige of logic" by the humanists and in particular the attacks on Aristotle by Ramus; some mention is made of Geulinx and the Port Royal logic; but the chapter concentrates on Leibniz chiefly, although Hamilton and Mill are given extended attention.

The sixth chapter, "Mathematical Abstraction," may be regarded as a distinctive turning point for the "development" of logic. Advances in geometry become important to a logician, and coincident with this, "logician" undergoes a shift in meaning already discernible in the late medieval period. Riemann's inaugural lecture of 1854, *Über die Hypothesen welche der Geometrie zu Grunde liegen*, presented non-Euclidean geometry seriously, though significant previous work had been done by Lobachevsky earlier in the century, and by Gauss and Saccheri in the previous century. Such advances in geometry drew the logician's interest to axiomatics, the theory of postulate sets. A parallel interest developed with respect to formulae which present implicit definitions of types of numerical expressions, a development which tended to ignore a distinction between formulae designed for rules of calculation and formulae for axioms from which theorems are to be derived in accordance with the "general laws of logic." Geometry and algebra thus contributed in different ways to the development of what is now regarded as mathematical logic; geometry provided a field for working out notions of axiomatics, and algebra became a model for constructing a logical calculus. The latter was achieved explicitly by Boole in his *Mathematical Analysis of Logic*.

At this juncture, we are barely half way through the book. The

remainder of the book deals with logic largely in a mathematical sense, i. e., logic primarily as a calculus. Frege becomes the pivotal point, as the titles of subsequent chapters reveal: Chapter VII, "Numbers, Sets and Series," Chapter VIII, "Frege's General Logic," Chapter IX, "Formal Developments after Frege," Chapter X, "The Philosophy of Logic after Frege," Chapter XI, "The Philosophy of Mathematics after Frege," and Chapter XII, "The Theory of Deductive Systems." Thus Frege, in pressing for "formal rigor" in a deductive system or calculus and in identifying arithmetic and logic, set the stage for the modern development of logic. Frege is likewise regarded as having set forth the first "really comprehensive system of formal logic," but it should now be apparent that "logic" means something wholly different from the logic of Aristotle's *Organon*, and even that "formal logic" is also wholly distinct from what Aristotle meant by his formal treatment of the syllogism in the *Prior Analytics*.

This difference of meaning does not seem to be sufficiently detected or at least taken into account by the authors, and the treatment given to the *Organon* of Aristotle manifests this point. The long chapter on Aristotle is the work of Mrs. Kneale, and it must be acknowledged, first, that she gives more extensive and careful treatment of Aristotle than contemporary logicians usually allow. Moreover, she is perceptive in regard to a number of important points; for example, she recognizes that Łukasiewicz's attempt to present Aristotle's syllogistic as a deductive system in the manner of Euclid's *Elements*—with four special axioms, two syllogistic principles and two laws of identity—is quite different from Aristotle's own understanding of his work.

Nevertheless, a number of basic points in the *Organon* are either misconstrued, in large part because of not detecting sufficiently the difference in the meaning of logic in Aristotle's sense from that of a formalized logic in a modern sense. Some of the more important misconceptions are the following; they are drawn from remarks concerning the *Categories* and *On Interpretation* only, partly because of a limitation in the length of this review, but mainly because logic, as Aristotle conceives it, cannot be grasped without these important works being well understood in themselves and in relation to the rest of the *Organon*.

The doctrine of the *Categories*, admittedly difficult, is called metaphysical, yet all the definitions in this treatise are of *modes of predication*; the metaphysical treatment of the categories occurs in Aristotle's *Metaphysics* where he treats them as *modes of being*. The author seems

to have relied too readily on the English translation of *ὄνομα* as "noun." "Noun" in English conveys an exclusively grammatical sense, quite foreign to Aristotle's meaning. It is, moreover, confusing, since *ὄνομα* ("name" is the English equivalent) in the *Organon* has both a specific meaning—"name" as distinguished from "verb"—and a generic meaning (including both "name" in the specific sense as well as verb, and any vocal sound that signifies by convention). In this connection, Mrs. Kneale skips rather lightly over what Aristotle says about the verb as distinguished from the name, in particular that the verb signifies "with time." The relevance of dwelling upon this characteristic of the verb arises from recognizing that only individual persons predicate, and whether they predicate what is temporal or timeless, the verb used in predication does in fact signify *with time*—"time" here referring to our mode of signifying, not to the signified absolutely. Moreover, the time talked about in this connection is the present time for, as Aristotle points out (*On Interpretation* 3, 16b 16), "Likewise, 'has matured' and 'will mature' are not verbs but modes of the verb. They differ from the verb in that the verb signifies with present time, whereas the modes signify time outside of the present."

It is because of not attending sufficiently to the definition and role of the verb that Mrs. Kneale, along with many contemporary logicians, does not understand the way Aristotle treated propositions in matters of future contingency. If a person understands logic as utterly divorced from reality, he cannot see in what way logic must deal with this problem. Aristotle's discussion of this subject is unusually explicit in the long chapter 9 of *On Interpretation*. The gist of his treatment refers to the following. If I say that tomorrow there shall be a naval battle, and if this is to be determinately true, it must be impossible that the naval battle should not take place tomorrow. But if it is now simultaneously possible that the battle take place *and* that it not take place, then neither of the opposite propositions ("it will take place" or "it will not take place") can be determinately true or determinately false. Here we have to note that a proposition is signifying at the time of predication; to abstract from the time of signifying in a wholly formalized logic does not confront the problem. What Aristotle says in the *Metaphysics* (IX, 10, 1050b 9) underlies the logical point being made here, namely that every potentiality is at the same time a potentiality for the opposite, i. e., the simultaneous *possibility* of contradiction. This does not constitute an exception to the opposition of contradiction, as Mrs. Kneale thinks. It concerns the as yet undeter-

mined future, and the opposition merely excludes that there should *in fact* at once be and not be a naval battle. In this connection, Mrs. Kneale also fails to bring out clearly the distinction between the "possible" as opposed to the "impossible" and the "possible" as opposed to the "necessary"—the "necessary" being one case of the "possible" opposed to the "impossible." Nor is Mrs. Kneale correct in thinking that Aristotle acknowledged a second exception to the opposition of contradiction in holding that "Man is white" and "Man is not white" are both true; these *indefinite* propositions are each verifiable as true by a singular instance of each which, in contingent matter, allows for both being true. Throughout the foregoing, as well as in other matters for which there is not space to discuss, the common and underlying misconception might be described as one of not recognizing that "logic" in Aristotle's sense and "logic" in a contemporary logician's sense becomes equivocal, and it does no credit to either meaning of "logic" to interpret fundamental points from the standpoint of the other meaning.

In the closing section of the last chapter of the book, in discussing the place of logic among the sciences, some difference in "logic" is at least tacitly recognized. "Following analogies suggested by the work of Aristotle and his successors, mathematicians and philosophers have used the word 'logic' in contexts of which older logicians never thought. The result is a confusion in which some usages of the word are so far removed from others that it no longer serves for clear communication between thinkers of diverse tendencies" (p. 738). However, the authors only understand such differences in the following way. They would rather relate "logic" to a calculus of propositional functions known to be deductively complete than to a theory of sets which remains "incompleteable," basing their stand on the position that logic is "connected traditionally with discussion of rules of inference." From their point of view, this stand has its justification. It is not a point of view, however, that will make the *Organon* of Aristotle intelligible; even the "rules of inference," though important in the context in which they are raised, do not constitute primarily what logic is for Aristotle. If the logic of the *Organon* is to be treated in a "development of logic," it seems at least a minimum desideratum to treat it from Aristotle's point of view as, say, the work of Frege is from his. This may not result in as unified a discussion but, on the other hand, it would more faithfully take into account how "logic" from the beginning "developed" in more divergent ways than is perhaps usually suspected.

University of Notre Dame,
Notre Dame, Indiana.

JOHN A. OESTERLE