

STUDIES IN LOGIC

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Studies in logic by Various

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VARIOUS

**STUDIES
IN LOGIC**

STUDIES IN LOGIC.

BY MEMBERS

OF THE

JOHNS HOPKINS UNIVERSITY.

Ed. Charles Sanders Peirce



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PREFACE.

THESE papers, the work of my students, have been so instructive to me, that I have asked and obtained permission to publish them in one volume.

Two of them, the contributions of Miss Ladd (now Mrs. Fabian Franklin) and of Mr. Mitchell, present new developments of the logical algebra of Boole. Miss Ladd's article may serve, for those who are unacquainted with Boole's "Laws of Thought," as an introduction to the most wonderful and fecund discovery of modern logic. The followers of Boole have altered their master's notation mainly in three respects.

1. A series of writers, — Jevons, in 1864; Peirce, in 1867; Grassman, in 1872; Schröder, in 1877; and McColl in 1877, — successively and independently declared in favor of using the sign of addition to unite different terms into one aggregate, whether they be mutually exclusive or not. Thus, we now write

European + Republican,

to stand for all Europeans and Republicans taken

together, without intending to count twice over the European Republicans. Boole and Venn (his sole living defender) would insist upon our writing

European + Non-European Republican,

or

Non-Republican European + Republican.

The two new authors both side with the majority in this respect.

2. Mr. McColl and I find it to be absolutely necessary to add some new sign to express *existence*; for Boole's notation is only capable of representing that some description of thing does *not* exist, and cannot say that anything *does* exist. Besides that, the sign of equality, used by Boole in the desire to assimilate the algebra of logic to that of number, really expresses, as De Morgan showed forty years ago, a complex relation. To say that

African = Negro

implies two things, that every African is a Negro, and that every Negro is an African. For these reasons, Mr. McColl and I make use of signs of inclusion and of non-inclusion. Thus, I write

Griffin \leftarrow breathing fire

to mean that every griffin (if there be such a creature) breathes fire; that is, no griffin not breathing fire exists; and I write

Animal $\overline{\leftarrow}$ Aquatic,

to mean that some animals are not aquatic, or

that a non-aquatic animal does exist. Mr. McColl's notation is not essentially different.

Miss Ladd and Mr. Mitchell also use two signs expressive of simple relations involving existence and non-existence; but in their choice of these relations they diverge both from McColl and me, and from one another. In fact, of the eight simple relations of terms signalized by De Morgan, Mr. McColl and I have chosen two, Miss Ladd two others, Mr. Mitchell a fifth and sixth. The logical world is thus in a situation to weigh the advantages and disadvantages of the different systems.

3. The third important modification of Boole's original notation consists in the introduction of new signs, so as to adapt it to the expression of relative terms. This branch of logic which has been studied by Leslie Ellis, De Morgan, Joseph John Murphy, Alexander MacFarlane, and myself, presents a rich and new field for investigation. A part of Mr. Mitchell's paper touches this subject in an exceedingly interesting way.

The method of using the Boolean calculus — already greatly simplified by Schröder and by McColl — receives still further improvements at the hands both of Miss Ladd and Mr. Mitchell, and it is surprising to see with what facility their methods yield solutions of problems more intricate and difficult than any that have hitherto been proposed.

The volume contains two other papers relating to deductive logic. In one of these Mr. Gilman develops those rules for the combination of relative numbers of which the general principles of probabilities are special cases. In the other, Dr. Marquand shows how a counting machine, on a binary system of numeration, will exhibit De Morgan's eight modes of universal syllogism.

There are, besides, two papers upon inductive logic. In the first, Dr. Marquand explains the deeply interesting views of the Epicureans, known to us mainly through the work of Philodemus, *περὶ σημείων καὶ σημειώσεων*, which exists in a fragmentary state in a Herculaneum papyrus.

The other paper is one which, at the desire of my students, I have contributed to the collection. It contains a statement of what appears to me to be the true theory of the inductive process, and the correct maxims for the performance of it. I hope that the thoughts that a long study has suggested to me may be found not altogether useless to those who occupy themselves with the application of this kind of reasoning.

I have to thank the Trustees of the Johns Hopkins University, for a very liberal contribution toward the expenses of this publication.

C. S. PEIRCE.

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