
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.

The two main contents of Mr. Ladd's paper are (1) the development of the logical theory of change and (2) the logic of the univocal and the univocal-internal relations.

The main contents of Mr. McCall's paper are (1) the development of the logical theory of change and (2) the logic of the univocal and the univocal-internal relations.
4. **Perpetuants, i.e., absolutely irreducible subvariants. Excursus, On Rational Fractions and Denumeranis**—by J. J. Sylvester.

**Article II.**—Note on a Roulette, by A. V. Lane.

**Article III.**—A Memoir on the Abelian and Theta Functions, by Arthur Cayley.

**Article IV.**—On the non-Euclidean Geometry, by W. E. Story.

---

**Studies from the Biological Laboratory of the Johns Hopkins University. Vol. II. No. 3.**

Pp. 315 to 410, with plates XXV to XXIX inclusive. Also plate XIV belonging to Dr. Sternberg's article published in the preceding number. Abstracts of the papers contained in this number are given on pp. 24, 25.

**The Journal of Physiology. Vol. III. Nos. 5 and 6.**

Also second supplement to Vol. III.

(Published in America under the auspices of the Johns Hopkins University.)

**Article I.**—Optical Illusions of Motion, with one plate, by H. P. Bowditch and G. Stanley Hall.

**Article II.**—Reflex Movements of the Frog under the Influence of Strychnia, by G. L. Walton.

---

**Preface to Contributions to Logic by Members of the Johns Hopkins University. C. S. Peirce, Editor.**

(Little, Brown & Co., Boston, 1882.)

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 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 found discovery of modern logic. The followers of Boole have altered their master's notation mainly in three respects.

1. A series of writers,—Evans, in 1854; 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 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 < 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 < 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.

---

**Article III.**—A Contribution to our Knowledge of the Action of Certain Drugs upon Bodily Temperature, by H. C. Wood and E. T. Reichert.


**Article V.**—On Cerebral Localization, by Sigmund Exner.

**Article VI.**—The Physiological Action of Methylquinethine, by G. L. Walton.

**Article VII.**—On the Influence of Variations of Intra-cardiac Pressure upon the Inhibitory Action of the Vagus Nerve, by Henry Sewall and Frank Donaldson.

(An abstract of this paper is given on page 25.)

**Article VIII.**—Preliminary Observations on the Innervation of the Heart of the Tortoise, by W. H. Gaskell.

**Article IX.**—Concerning the Influence exerted by each of the Constituents of the Blood on the Contraction of the Ventricle, with one plate, by Sydney Ringer.

The supplement contains a list of the titles of Books and Papers on subjects of physiological interest which were published in 1891.

Editorial communications should be sent to Dr. Michael Foster, Sec. R. S., New Museums, Cambridge, England. Business communications to Dr. W. T. Sodgwick, Johns Hopkins University, Baltimore.

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 signified 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.

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 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 original and 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 these 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, τοίς συγγελόμενοι καὶ συγγελοντα, which exists in a fragmentary state in a Hierocleanus papirus.

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.

Baltimore, December 1, 1892.

C. S. Peirce.