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The Theory of Determinants in the Historical Order of its Development. Part I. Determinants in General: Leibnitz (1693) to Cayley (1841).

By Thomas Muir, M.A., LL.D., F.R.S.E. Macmillan & Co. 1890.

CSP, identification: MS 1365. See also: Burks, *Bibliography*. This notice is unassigned in Haskell's *Index to The Nation*, vol. 1.

The only history of much interest is that of the human mind. Tales of great achievements are interesting, but belong to biography (which still remains in a prescientific stage) and do not make history, because they tell little of the general development of man and his creations. The history of mathematics, although it relates only to a narrow department of the soul's activity, has some particularly attractive features. In the first place, the different steps are perfectly definite; neither writer nor reader need be in the least uncertain as to what are the things that have to be set forth and explained. Then, the record is, as compared with that of practical matters, nearly perfect. Some writings of the ancients are lost, some early matters of arithmetic and geometry lie hidden in the mists of time, but almost everything of any consequence to the modern development is in print. Besides, this history is a chronicle of uninterrupted success, a steady succession of triumphs of intelligence over primitive stupidity, little marred by passionate or brutal opposition.

Dr. Muir, already well known by many investigations into determinants and continued fractions, and by a charming little 'Introduction to Determinants,' has thoroughly studied the history of this subject, and has arranged his account of it with remarkable clearness. Each writer's results are stated in his own language, followed by a luminous commentary. An ingenious table shows the history of forty-four theorems, and at the same time serves as an index to the first half of this volume, which, it is to be presumed, is one-half of the first part, and not more than one-fourth of the whole work.

Perhaps Dr. Muir attaches a little too much importance to theorems, as contradistinguished from methods and ideas. Thus, he speaks rather unfavorably of Bezout's work (1779), although it contains the idea of polar multiplication; but because this is not made a theorem, Dr. Muir hardly notices it. The first paper analyzed in the book is by Leibnitz, and contains the umbral notation, which is the quintessential idea of the theories of determinants as well as that of matrices, to which the theory of determinants is but an appendage.

We have already mentioned that the last number of the *American Journal of Mathematics* contains an admirable memoir upon matrices by Dr. Henry Taber of Clark University.

51 (18 September 1890) 234

Elements of Logic as a Science of Propositions.

By E. E. Constance Jones, Lecturer in Moral Sciences, Girton College. Edinburgh: T. & T. Clark. 1890. Pp. 208.

Attributed to Peirce by Fisch in *First Supplement* (internal evidence). This review is unassigned in Haskell's *Index to The Nation*, vol. 1.

Emily Elizabeth Constance Jones (1848-1922) was a British logician. She was vice-mistress (1896-1903) and later mistress (1903-1916) of Girton College, Cambridge, and also resident lecturer in moral sciences from 1884 until 1903. Miss Jones was governor of the University College of Wales at Aberystwyth, member of the Aristotelian Society, and of the Society for Psychical Research. Among her other publications are *A Primer of Ethics* (1909) and *A New Law of Thought and its Logical Bearings* (1911).

Prof. Schroeder, in the preface to his important work on 'Die Algebra der Logik,' the first volume of which has recently appeared, says that the chief advance which has been made in late years in exact Logic is due to the labors of the American, Charles S. Peirce, and his school. The inmost secret of this advance, the luminous guiding principle to which it is due, is the fact that attention is concentrated upon thought-relations, and not upon the words in which they may happen to be expressed. The meaning of this may be made clear by an example. The older logicians said that in every proposition the copula is *is* (or *are*), and that it can be nothing else. The newer school looks upon this series of affirmations—

All men are mortal,
Every man is mortal,
Any man is mortal,
Being a man implies being mortal,
If any one is a man, he is mortal,

That one is a man implies that he is mortal—as indicative one and all of the same state of things, as expressive one and all of the same kind of relation, and hence as properly subject one and all to exactly the same formal treatment. In other words, it is concerned, to use again the language of Prof. Schroeder, with the *canon* of logical thought, and not with an analysis of the psychological processes of actual thinking. The above unification alone, for instance, makes it possible to do away with the distinction between categorical and hypothetical propositions, and also with the distinction between the application and the signification (or extent and intent) of words; in any proposition the terms may be taken in either sense at pleasure without necessitating the slightest change in the *formal* method of procedure.

The last four of the above affirmations do not contain any very strong implication that there are any such things as men; hence, for the sake of unity, it is desirable to assume that the statement "All *a* is *b*" may still be taken as true when it is not known whether there are any *a*'s or not. When it is said that there may not be any *a*'s, it is not meant that the term *a* is logically inconceivable, but that it is perhaps not contained in an (understood) limited field of thought (what De Morgan has called the universe of discourse). How large the field of thought is at any moment may be gathered from the application which we attribute to our

negative terms; it, in denying that a thing is a virtue, we intend to call it a vice, then our universe is moral qualities; if it may perhaps be an intuition, then our universe is probably all mental qualities; if we take into account the possibility of its being a tadpole or a musical note, then our universe probably is the whole real world.

The connected questions of the existence of terms and of a limited universe are hence intimately connected with a marked simplification of logical procedure, and are therefore of more importance than it would seem at first sight. Recent English writers on logic are in the habit of discussing them from a narrower point of view; and in the handsome volume which Miss Constance Jones has just given to the logical world she does not rise above this narrow point of view. She says, for instance, on the question of existence: It seems to me, in making the assertion, "All albinos have pink eyes," not only that one would not be naturally conscious of a doubt as to there being any albinos living at the present moment, but also that the presence of the doubt in the mind is not even apparent on reflection. This sentence betrays a twofold misapprehension of the position of her opponents on the part of Miss Jones. In the first place, it does not follow, from saying that universal propositions do not, by their form, necessarily imply the existence of the subject, that one must be in actual doubt of its existence in every particular case. In the second place, Miss Jones forgets that her opponents have a ready means of expressing the fact when it is known that the subject exists—they have merely to say that it exists. Their position is simply this: They ask that when they say, *e.g.*, "Who breaks, pays; and there are some who break," they shall not be considered to have said over again in the second part of the sentence what they had already said once in the first; and they ask this for the weighty reason, among others, that it enables them to assimilate the treatment of compound propositions to that of simple ones.

Miss Jones has very acute reasoning-powers, a great deal of boldness and originality, and untiring patience in tracking out minute distinctions in terms and in propositions. It is a pity that she has not taken a less mechanical, a larger and more common-sense, view of a number of debatable questions. She makes, for instance, too much of the distinction between adjectives and nouns. All names are abstractions. The difference between adjectives and nouns, as far as logic is concerned, is simply that adjectives are more abstract than nouns, and that on account of their having hardly any attributes predicable of them, they have little occasion to stand as subjects of propositions. Miss Jones is in error in saying that Mill distinguishes between attributes and subjects of attributes. Mill says plainly that Logic, at least, has no concern to postulate any substratum for attributes to be attached to; that, for Logic, attributes are not only all we know, but all we need to know. It is true that language is not sufficiently elastic to enable him always to speak strictly in the terms of this theory; but when he uses the word *thing*, he means nothing different from a congeries of attributes. Substance-names are constantly being coined out of adjectives when demand arises; as in "The outs were in ill-humor," "Blue and green are cold colors."

Nor does Miss Jones make out a good case against Mill's view of the nature of induction. The difficulties which she feels have been well set forth and met by Venn in his recent book on 'Empirical Logic.' They are difficulties of a kind not altogether dissimilar to that of the old Greek quibble—that a thing cannot move, where it is, and cannot move where it is not, and hence that it cannot move at all.

Although Miss Jones seems to us not to have made her case good in a great many of the questions which she discusses, her book is nevertheless a noteworthy contribution to Deductive Logic.

51 (25 September 1890) 254-255

Locke.

By Alexander Campbell Fraser. [Philosophical Classics for English Readers.] Edinburgh: Wm. Blackwood & Sons; Philadelphia: J. B. Lippincott Co. 1890.

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Alexander Campbell Fraser (1819-1914) was an English philosopher and clergyman. He was educated at Edinburgh University, and was ordained to the Free Church ministry in 1844. From 1846 until 1856, he served as professor of logic and metaphysics in Edinburgh Free Church theological college, and from 1856 until 1896 held the same position at Edinburgh University. He was the Gifford Lecturer for the 1894-1896 term. He has been characterized as a stimulating teacher, whose philosophical standpoint was theism based on moral faith.

Mr. Galton's researches have set us to asking of every distinguished personality, what were the traits of his family; although in respect, not to Mr. Galton's eminent persons, but to the truly great—those men who, in their various directions of action, thought, and feeling, make such an impression of power that we cannot name from all history more than three hundred such—in respect to these men it has not been shown that talented families are more likely than dull families to produce them. The gifts of fortune, however, are of importance even to these. It is not true that they rise above other men as a man above a race of intelligent dogs. In the judgment of Palissy the potter (and what better witness could be asked?), the majority of geniuses are crushed under adverse circumstances. John Locke, whose biography by Berkeleyan Professor Fraser is at our hand, came of a family of small gentry, his mother being a tradesman's daughter. The family had shown good, but no distinguished ability, and no remarkable vitality. The philosopher, John, the eldest child of his parents, was born (1632) two years after their marriage; there was one other child five years later. John Locke himself never contemplated marriage.

He resembled not in the least a genius of the regulation pattern—a great beast, incapable of self-control, self-indulgent, not paying his debts, subject to hallucinations, half-mad, absent minded. He did not even, like the popular hero, attribute all that distinguished him to his mother's influence. He called her "pious and affectionate," but rarely mentioned her. On the other hand, he often spoke of his father with strong love, with respect for his character, and with admira-