

THURSDAY, JULY 14, 1881

## SYMBOLIC LOGIC

*Symbolic Logic.* By John Venn, M.A., Fellow and Lecturer in the Moral Sciences, Gonville and Caius College, Cambridge. Pp. xxxix. 446. (London: Macmillan, 1881.)

MANY who are interested in the progress of logical science have looked forward to the appearance of this long-expected work as one likely to give them a logical treat. They will not be disappointed. It may be impossible to accept Mr. Venn's opinions as decisive of some points which he discusses, and it would not be difficult to indicate deficiencies; but we have no book which approaches the one before us in the thoroughness with which it opens up the logical questions of the day. With equal industry and ability Mr. Venn has gone over almost the whole literature of logic so far as it contains any germs of the scientific system associated with the name of Boole. Mr. Venn writes professedly as an admirer of Boole, and his work consists to a great extent of the matter of lectures upon Boole's logic, delivered under the inter-collegiate scheme of lecturing, which has now been in operation for about twelve years at Cambridge. Thus the book is substantially an exposition of Boole's Logic, and practically the only one which we have. Boole's own great work, "The Laws of Thought," appeared more than a quarter of a century ago (1854), and has never reached a second edition. It has been much more talked about than read.

If Mr. Venn then had done nothing more than publish a comparatively easy and readable exposition of Boole's profound but difficult treatise, he would have done a good work. But he has done a good deal more, because he has worked out the relation of Boole's system to all discoverable previous attempts at a symbolic or quasi-algebraic treatment of the syllogism, as also to all who have since Boole's time endeavoured to improve upon his system. The writings of almost one hundred logicians have been investigated by Mr. Venn, and not a few of these writers are practically unknown to English readers. If I mention the names, for instance, of Bolzano, Bardili, Dalgarno, Darjes, Lipschitz, Maass, Maimon, Segner, Semler, Servois, Weise, it is unlikely that the reader, unless he has made a very special study of logic, will ever have heard of most of these names before. A great change has taken place in the standard of scholarship expected of authors nowadays. During the last century philosophers calmly wrote down whatever came uppermost in their minds, in complete indifference to their ignorant predecessors. David Hume discovered and expounded the laws of the association of ideas, unconscious that it was all in Aristotle's works. Jeremy Bentham wrote upon logic with sublime confidence, although his reading had been confined to the compendiums of Sanderson and Isaac Watts. Now a man is expected to read everything about his subject before he writes anything. The late Sir William Hamilton of Edinburgh was the ideal of the new method, towards the introduction of which he much contributed. He had all the doctrines of logicians of various schools classified in his common-place books;

but when he came to work out his own system of the syllogism, fell disease arrested him before the work was half done. It must require much judgment to use the bibliographic method, as one may call it, to an adequate, and yet not to an excessive extent.

Perhaps the most interesting chapter in the whole book is the last one, containing "Historic Notes," which are however merely supplementary to a great quantity of historical information given incidentally in the preceding chapters. The table on p. 407 is one of extreme interest. It shows and classifies in the clearest way no less than twenty-five apparently different modes in which logicians from the time of Leibnitz had attempted to represent symbolically the ordinary universal negative proposition, say, no S is P. Boole and Dr. Macfarlane, for instance, express it as denying the existence of the class of things S which is P. Hamilton introduced a clumsy wedge-shaped copula with a stroke across it to express negation; Darjes entirely misused well-known mathematical signs in the expression  $+S - P$ . Segner's formula is hardly better, namely  $S < -P$ . Mr. MacColl's notation, so recently the subject of discussion in the Mathematical Society, the *Educational Times*, and *NATURE*, is at least convenient, namely  $S : P'$ , though, as I venture to hold, only a disguised form of the equation  $S = S P'$ . But this single page gives matter for endless study, and Mr. Venn has conferred a great benefit upon logical students in opening up the subject of logical symbolism and logical method in its full extension, thus hastening the time when some decision can be arrived at.

There is, however, much that is novel in the volume. No author, for instance, has carried the diagrammatic representation of logical relations to anything like the same extent and perfection as Mr. Venn. Starting with the well-known circular diagrams, attributed to Euler, but traced back to earlier logicians, at any rate to Lange, Mr. Venn has succeeded in representing, by interlacing oval figures, the logical relations of four or even more terms. Although opinions may differ as to the value of the method, he has unquestionably worked out a complete and consistent system of diagrammatic reasoning, which carries the Eulerian idea to perfection. He has gone even further and has converted his diagrams into a kind of logical-diagram machine, which allows the elliptic segments representing classes to be selected and rejected mechanically. Of this remarkable device Mr. Venn (p. 122) says that "it would do very completely all that can be rationally expected of any logical machine. Certainly, as regards portability, nothing has been proposed to equal it, so far as I know." The latter statement may be certainly conceded, as the machine, though constructed needlessly large, is only five or six inches square, and three inches deep. So far, however, as I can judge from the somewhat brief and unexplicit description given by Mr. Venn, I cannot see how his machine can perform logical operations automatically. The selections of classes have to be guided and judged by the selector, and all that the mechanical arrangements effect is to select a whole class of elliptic segments at one movement of the fingers. This mechanical diagram, then, is analogous, as Mr. Venn remarks, to what has been described as "The Logical Abacus," but I do not think it can be called mechanical in the same degree as the logical machine.

In connection with these complex logical diagrams arises a curious and almost amusing illustration of the impossibility of knowing all that has been written on a subject. Mr. Venn in the Historic Notes has carefully gone over all logical writings known to him, and concludes (p. 426) that "hardly any attempts have been made to represent diagrammatically the combinations of four terms and upwards. The only serious attempt that I have seen in this way is by Bolzano." This statement is qualified in the Introduction or Preface (p. xxx.) by reference to H. Scheffler's "Naturgesetze," published in 1880. But if Mr. Venn had happened to look much nearer home, into the able "Outline of Logic for the Use of Teachers and Students," by the Rev. Francis Garden, M.A., Trinity College, Cambridge (1867), he would have found at p. 39 a diagram of five interlacing circles representing the relations of five terms. The diagram is thus described at the foot, "Genus A partly overlapped by genera B, C, D, and E, giving for species AB, ABC, AC, ACD, AD, ADE, AE, ACDE." The circles are broken in their unessential parts for the purpose of saving space. Mr. Venn's ellipses are in this respect much more convenient than circles, and the method of shading segments so as to show their propositional treatment to the eye is an important improvement; but the principle on which complex logical relations may be graphically represented is clearly seized by Mr. Garden.

Mr. Venn, although an ardent admirer of Boole, as indeed all advanced logicians must be, remarks (p. xxviii.) that his actual originality (priority?) was by no means so complete as is commonly supposed and asserted. But I am a little surprised to notice that Mr. Venn, although mentioning (p. 9) Thomas Solly's "Syllabus of Logic"<sup>1</sup> in relation to another matter, does not draw attention to the remarkable symbolical expression for the laws of the syllogism given therein. This brief work is throughout highly acute and philosophical.

The really important question which underlies the whole discussion of symbolic logic regards a technical and apparently minor point, namely the exclusive or un-exclusive character of logical alternatives. When we say, for instance, that "capital is either fixed or circulating," is it implied *in the mere form of the statement* that capital cannot be at the same time fixed and circulating? Boole held so; or, at any rate, he held that any logical equation of his own system not conforming to this condition was imperfect and uninterpretable. But since Boole's time several logicians have contended that this condition was arbitrary, and in fact an error of Boole's. It is one chief purpose of Mr. Venn's book to uphold Boole's system in its integrity, and he writes in an attitude more or less of protest against subsequent innovators. This question has been noticed by Mr. MacColl in his letter (NATURE, vol. xxiv. pp. 124-126). It is however a question which requires chapters, if not books, for its adequate treatment; it is in fact to be judged by the success of a system, rather than by any simple direct arguments.

In regard to this letter of Mr. MacColl, I may point to the fact that I have already disputed the philosophical correctness of MacColl's symbolic innovations (NATURE,

<sup>1</sup> "A Syllabus of Logic, in which the views of Kant are generally adopted and the Laws of the Syllogism symbolically expressed," by Thomas Solly, Esq., late of Caius College, Cambridge. (Cambridge, 1839.)

vol. xxiii. p. 485), while as regards the main principles of his calculus, it is out of the question that he should claim novelty. But we may nevertheless regret that Mr. Venn has referred in a slighting tone to investigations which have been carried out with great earnestness and acuteness. Mr. Venn does not speak in the same slighting manner of Prof. Schröder's essay, though I presume it is clear that the latter was as completely forestalled by previous writers unknown to him as was Mr. MacColl. In fact the way in which independent investigators are converging and meeting in a modified Boolean system is strong evidence that the questions so clearly set forth by Mr. Venn are becoming ripe for decision.

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#### ASTRONOMY FOR AMATEURS

*A Cycle of Celestial Objects.* Observed, Reduced, and Discussed by Admiral William Henry Smyth, R.N., K.S.F., D.C.L. Revised, Condensed, and greatly Enlarged by George F. Chambers, F.R.A.S., of the Inner Temple, Barrister-at-Law. (Oxford: The Clarendon Press, 1881.)

THERE can be, we think, little doubt that the publication of Admiral Smyth's "Cycle of Celestial Objects" powerfully stimulated a taste for astronomy amongst amateurs in this country. It was popular in style, and the contents generally were such as possessed interest for the numerous class of readers who neither require nor would appreciate more technical treatises. The gossiping notes interspersed throughout the work had their special attraction for many readers.

Mr. Chambers says he would not have undertaken the task of preparing a new edition of Smyth's work for the press had he not been convinced that there was a widespread desire for it. The copyright of the work, with the Admiral's notes, unpublished drawings, &c., had come into his hands, but there remained the digesting of these materials and interweaving them with the contents of the first edition. His programme he states to have been "so to revise, prune, and amplify Admiral Smyth's *Bedford Catalogue*, as to provide a Telescopist's Manual for Refractors up to, say, 8 inches of aperture, and to embody the progress of the science up to 1880, just as the original edition might have been considered fairly complete for 5 inches of aperture up to 1845." In carrying out this programme he has deemed it essential to include objects in the southern heavens, which we do not command in these latitudes.

It is to be understood that the new edition is confined to the *Cycle* proper, or to the second volume of the original work, the *Prolegomena* being, as Mr. Chambers remarks, for the most part written up to date in the last edition of his "Handbook of Astronomy." The number of objects included by Smyth was 850, the number in the present volume is 1604. Viewing the work as one intended for the guidance of the amateur as to the objects which it may be worth his while to observe, the additions, upon the selection of which considerable pains appear to have been bestowed, nevertheless include many stars that can hardly claim to be so regarded: we allude to such objects as Nos. 252, 334, 335, 346, 371, 396, 737, 974, 1025, 1149, &c. Perhaps a less extended list with fuller