

1872

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EDUCATIONAL TEXT-BOOKS. I.

This reference to Fowler's book on logic appeared among notices of several textbooks. We include it because it is mentioned later in *The Nation*, 14 (11 April 1872) 244-246, a set of notices that is attributed to Peirce. Haskell, in *Index to The Nation*, identifies the author of this review of "Educational Textbooks" as being William Francis Allen.

Thomas Fowler (1832-1904) was an English educator and logician. He took his B.A. from Merton College, Oxford, in 1854, and acquired several honorary degrees throughout his career. He held the post of professor of logic at Oxford from 1873 until 1889, and during this period advocated the teaching of natural science and abolition of tests at that university. He became president of Corpus Christi College, Oxford, in 1881, and later vice-chancellor of that college in 1901. He authored several books on logic and ethics, also editing Bacon's *Novum Organum* (1878) and Locke's *Conduct of the Understanding* (1881).

...The best logic for instruction in colleges is, in our judgement, Fowler's ("Elements of Deductive Logic"—New York: Macmillan). A young man who has been through it under a teacher of power will have had his mind enlightened and strengthened, and will be better prepared for life. In short, it to some extent fulfills the function of an elementary logic, a thing which most text-books do not begin to do. Mr. Fowler closely follows Mill's work, of which this must be allowed, that it represents the best scientific thought of the age more nearly than any other systematical exposition of the subject. It contains, however, in our opinion various important errors not only upon its philosophical side, but also in its relation to practice, against which the student ought to be put upon his guard. To these we have not space here to refer; but as they are of interest we shall take an early opportunity to recur to them. . . .

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EDUCATIONAL TEXT-BOOKS. II.

These comments on the work of Proctor, Maxwell, Wilson, and Fowler are attributed to Peirce by Fisch in *First Supplement*. This review of "Educational Textbooks" continues with some additional remarks on "the metaphysical part of logic." These additional comments easily could have been authored by Peirce, but we have seen no evidence that might confirm that hypothesis. Garrison wrote to Peirce on 10 January 1872 (see MS L 159.1) commissioning the review of two unidentified books. This review could be the result (at least, in part) of that letter. Moreover, a letter dated 9 May 1872 from Peirce to E. L. Godkin (see MS L 248) is conclusive for the Wilson item. Also, Peirce owned a copy of Maxwell's tenth edition (see MS 1598), which he could have acquired (as he acquired many of his books) from Garrison as a review copy. Haskell, in vol. I of his *Index to The Nation*, assigns no author for this piece.

Richard Anthony Proctor (1837-1888) was an English astronomer and mathematician. In 1873 he proposed that lunar craters arose through meteoric bombardment, the theory that is held today. In 1881 he moved from England to America, where he remained for the last years of his life.

James Clerk Maxwell (1831-1879) was a Scottish mathematician and physicist. He entered Cambridge in 1850, and was graduated second in his class in mathematics, as Kelvin had

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done before him and J. J. Thomson was to do after him. In 1857, Maxwell proposed his revolutionary theory of the planetoid nature of the rings of Saturn, and in 1860 arrived at the Maxwell-Boltzmann theory of gases, a kinetic-particle theory. In 1871 he was appointed professor of experimental physics at Cambridge, the first person ever to hold a professorship in that subject. Maxwell's electromagnetic equations are perhaps his greatest gift to science.

We do not know when a respectable publication has been prefaced with more boastful words than Mr. Proctor's "Star-Atlas" (London: Longmans). In a previous publication, Mr. Proctor had announced that all such works hitherto had been constructed on radically wrong principles, and had put forth a demonstration that there was only one proper way of making a star-atlas. This he repeats in the "Letterpress Introduction" to the present book, only it is a different manner of construction which he demonstrates to be the right one. A regular dodecagon is inscribed in the sphere, and then each face is produced so as to cut off a part of the sphere, and that part is represented on one map. There are, therefore, twelve equal circular maps which overlap each other slightly, except in five points on the circumference of each. The North Pole is made the centre of one of the maps. But after all this theorizing about the method of projection, Mr. Proctor fills in with stars in a very simple manner. He has apparently merely entered them from the British Association Catalogue. The result, at any rate, is that the magnitudes are so extremely inaccurate that there are many parts of the heavens which are perfectly unrecognizable; and on every map the errors are a source of great inconvenience. Let any one who possesses this atlas compare, for example, the Little Bear in the map with the heavens, and he will find that a bare majority of the stars are rightly inserted or omitted. When the author says, "I believe no atlas was ever constructed in which more pains were taken than in the present to avoid errors," he clearly forgets that stars exist in the sky as well as in the B.A. Catalogue, and that some makers of atlases have taken the trouble to examine them. Argelander's "Uranometria" is justly regarded as one of the most perfect works of observation, perhaps in fulfilling its purpose the most perfect ever executed. Its atlas is renowned in all lands for its resemblance to the heavens and for its convenience in use. Its accuracy is such that its scale of magnitudes has been everywhere adopted as the standard. But Mr. Proctor has apparently never heard of it. England is eminent in astronomical observation—the Greenwich Observatory alone would suffice to make it so. But Englishmen are generally so naively ignorant of what takes place in the great world of science (which does not centre in London, as they seem to imagine) that it is possible for a respectable man to publish a book there the existence of which depends on such ignorance as would disgrace him in Sicily or in Spain. As for the method of dividing the sphere upon which Mr. Proctor prides himself so much, it is exceedingly inconvenient in practice. It cuts Gemini, Orion, the Great Bear, Hercules, all in two. In short, if anybody interested in the stars has not Argelander's incomparable work, then let him take Elihu Burritt's or any other, but not this new one. We speak from experience.

Heat is still the most interesting part of physics, for the time; and we have devoured Mr. Clerk Maxwell's "Theory of Heat" (London: Longmans). It is not intended, however, primarily to amuse, as Tyndall's was; and it also differs from

that work in giving a correct idea of the mechanical theory of heat. It is intended for a class-book, and is the very best text-book of physics which has been published for some years. Its study will demand some thought from the student, which will be a fatal objection to its extensive use in this country. It is not made with reference to satisfying examining committees, and to getting boys over the ground with the least possible trouble to them. It discusses a good many subjects not strictly a part of the theory of heat, and we could have wished that some things which do belong here had been enlarged upon more, and that more special facts and tables had been given. Yet it must be allowed that within these 300 pages a more beautiful and perfect account of the theory could not have been given.

The old sensationalists, Hartley, Brown, and the Mills, never wrung many admissions from the advocates of *a-priority*. But Dr. Wilson's "Lectures on the Psychology of Thought and Action, Comparative and Human" (Ithaca: Audrus, McChain & Lyons) is evidence that the new physiological materialists are making more impression. The author gives up the whole of sensation as involving no mind or consciousness, and hopes by that admission to strengthen spiritualism in reference to the other parts of the intellect. But though the new position has strength, yet the retreat will encourage the anti-supernaturalists and will make for them new converts. Respectable writers cannot long defend a theory which involves such suppositions as that animals and men acquire a knowledge of external things by an immediate action of the spinal cord without the agency of any external organs, as Dr. Wilson does on pp. 249 and 250.

We said last week that the best book for instruction in logic in colleges was Fowler's "Deductive Logic." We added that a young man who has been through it under a teacher of power will have had his mind enlightened and strengthened, and will be the better prepared for life. In point of fact, we did not intend to apply these expressions to Fowler's "Deductive Logic," but to his *Deductive and Inductive Logics* taken as one work. The mistake enables us to express, in a more emphatic way, our opinion of the almost utter worthlessness of deductive logic in education, except as an introduction to the logic of science. In former ages, logic was a pretty good representation of the methods of thought of the greatest minds. The systematic exposition of the art of thinking naturally lagged behind the practice, and men always reasoned better than if they had strictly followed the rules of their logic. Still, the discrepancy was not very great. The logic of Petrus Hispanus (which was written about 1270) exhibits well the character of thought of his time, as that of Oldham does that of his school, and those of Paulus Venetus and Buridanus do that of the latest scholasticism. At the time of the Renaissance, the treatises of Ramus and of George Agricola show pretty adequately the peculiarities of the humanist mind. But when the scientific age came, so great an intellectual step was made that logic could not well keep up with science. Then some writers, such as Bacon in his "Novum Organum," and Locke in the "Conduct of the Understanding," inconsiderately put aside the old syllogistic and topics as though they contained something false, instead of being only incomplete; while others either weakly endeavored to apply the old theory to the new practice or else abandoned the attempt to represent

scientific methods in their logic altogether. These last writers invented the word "extralogical," and apply it to scientific reasoning, thus concealing the fact that they shirk their main duty in not investigating this reasoning. Pedants love to teach the least possible, and to teach it in as formal a way and with as complicated a system of big words as possible. Most of the school-books have, accordingly, been limited chiefly to the logic of deduction. At the same time, they have taught, not the only syllogistic system which was ever actually used—the Mediæval logic—but one which could be of no practical avail whatever. The result has been to confirm the natural tendency of the young to reason from words, and to produce a captiousness which is very different from wise caution, and is simply mischievous. Indeed, the only thing to be said in favor of the study of logic as it is ordinarily taught is that it does tend to make the pupil reflect about his reasoning, and to be a little more precise in his thought and language. The greater number of logics which have come to us in the last few years have been of this vicious kind. A boy or girl could not be put to a more useless task than studying either of Day's logics. The work of Professor Bowen, a convenient though not very intelligent compend of the logic of Hamilton, Thompson, etc., is nearly without value in educating the mind. We hoped for something better from Mr. Jeyons, because his previous books, while showing very little acquaintance with the history and literature of the subject, have contained some good original thought, and because he belongs to a school which thinks. But we have been sadly disappointed with his "Elementary Lessons" (New York: Macmillan), and cannot think it of any use. It is because Mr. Fowler has made his "Deductive Logic" very short and simple, and has laid the stress chiefly on the inductive logic, and because he does represent in some degree the methods of thought which modern science and learning actually use, that his books seem to us so recommendable, provided both are to be studied. To confine the student to the deductive part, a thing which, we fear, will be done by many teachers, owing to this part making a complete book by itself, would be just as bad as to use any of the old text-books.

We promised last week to discuss some of the errors, as they seem to us to be, of Mill's theory of logic which Mr. Fowler adopts. But we have only space here to refer to Mill's doctrine of scientific hypotheses. This was doubtless suggested by a doctrine of Auguste Comte, who divides the sciences into five classes having different degrees of certainty; and by a hypothesis means a proposition which is not proved with the degree of certainty which belongs to the order of science to which it relates. His maxim of hypothesis is, that such a proposition may be allowed a provisional and secondary place in science, provided it is capable of being proved (or disproved) with the degree of evidence appropriate to its order of science. But Comte's conception of a hypothesis is a peculiar one. A scientific hypothesis is usually defined (and is defined by Mr. Mill) as the supposition of a circumstance which, by the action of known laws (or a generalization of known laws), would result in facts such as have been observed. It is also common to use the term scientific hypothesis to denote a very doubtful conclusion of science. These two meanings are apt to be confounded, and Mill has plain-

ly confounded them when he says that the one condition of the admissibility of a hypothesis is "that it be not destined always to remain a hypothesis, but be of such a nature as to be either proved or disproved by comparison with observed facts." Here, being proved has not the definite meaning that it has in Comte's maxim. There is no absolute distinction to be drawn anywhere between the probability of that which has a bare possibility of truth and that which has a bare possibility of falsehood. A supposition which by the known action of the laws of nature will explain a single known fact, thereby gains some slight probability. This is susceptible of exact demonstration. As the number of facts which the hypothesis explains increases, and as their variety (depending on the laws their explanation involves, and the elements of the hypothesis upon which they depend) increases, the probability of the hypothesis increases indefinitely, until it becomes as certain as any fact we know. But, as a general rule, that which was a hypothesis at first, remains a hypothesis to the last. All that we receive upon testimony is hypothesis; it explains the fact that the witnesses agree. The existence of the relation of space among things, and all that we remember, are hypotheses in the same sense in which it is a hypothesis to say that Marshal Bazaine surrendered Metz treacherously. Between these extremes, hypotheses of every degree of probability may exist, and no absolute line is to be drawn among them. A hypothesis, therefore, does not differ from any other inferential proposition; and the only thing to be considered in reference to its admissibility is the actual evidence upon the matter. Mr. Mill's view is that a hypothesis is not something inferred, but something taken as the basis of enquiry; so that the question is not what the existing evidence is, but what evidence is forthcoming. Here two questions must be distinguished: the first, in reference to what a man may logically do; the second, as to how he may best economize his scientific energies. Now a man may investigate the truth of any proposition whatever, and if he makes no false inference there is nothing illogical in his procedure. But he will be very unwise to spend a large portion of his life in putting anything to the test which can hardly be true or which can hardly be false. When the questions put to nature will only be answered by yes or no, he will advance with the greatest rapidity (as in the game of twenty questions) by asking questions an affirmative answer to which is equally probable with a negative one. He must, however, consider what degree of certainty the answer will have, and the rule will be, among questions of equal importance, to make that investigation which will have the greatest effect in altering existing probabilities. Mr. Mill seems to suppose an absolute distinction between the adoption and the rejection of a hypothesis; but every scientific man has passed that rude state of mind, and takes into account, in every case, as well as he can, the degree of evidence. Making distinctions absolute which are really only relative is the source of most of the errors in Mill's system of philosophy.

There are various other modern schools of logic besides those to which we have referred. In the first place, Boole, De Morgan, and others have made a more exact investigation into purely formal logic, and have greatly advanced the subject. Their researches are still in a very immature state, but they have already succeeded in throwing much light upon the subject. The metaphysical part of logic

has been chiefly prosecuted in Germany. Such questions as these: What is the connection between the following of a conclusion from its premises and the following of an effect from its cause? and what is the connection between the relation of a subject to its predicate and the relation of a substance to its attributes? have a high philosophical importance. Hegel considers the real relations of existing things and the formal relations of thought to be strictly identical; but he is led to modify profoundly the usual views regarding the maxims of reasoning in making out his point. His philosophy is now exploded; that is to say, hardly any of the rising men adopt it. But its historical importance has been considerable. For a short time it had immense influence in Germany. Mr. Carroll Everett's "Science of Thought" (Boston: William V. Spencer) is regarded by Hegelians as a good exposition of the fundamental positions of their philosophy. Vague conceptions and complicated reasoning are continually causing Mr. Everett to fall into fallacies; and this is the universal fault of Hegelians. The consequence is that their conclusions are entirely uncertain; and the interesting and profound suggestions with which their philosophy abounds only serve to make the bad influences of their loose reasoning upon half-educated minds all the greater. Ueberweg's treatise ("System of Logic and History of Logical Doctrines," London: Longmans) is an excellent specimen of a modern German logic. The view defended is that the construction of the mind corresponds with the order of nature, so that metaphysical conceptions have a double character, first, as true of things as they really exist; and, second, as merely formal principles of thought. It is a carefully written and scholarly book. The style is clear and precise, more precise than American readers enjoy, but real students do not wish a writer to beat about the bush to avoid an expression merely because it is a little too formal for the taste of literary people. The translator, we regret to say, betrays an ignorance of two things rather essential to his task, logic and the German language. On page 402, we read this extraordinary sentence: "An infinite straight line can proceed but from a figure bounded on all sides in the same plane on two sides only by means of intersecting the boundaries." This will bear a second reading. What Ueberweg says is: "Eine unbegrenzte gerade Linie kann aus einer allseitig begrenzten Figur in derselben Ebene auf beiden Seiten nur mittelst Durchschneidung der Grenzen heraustreten." This is perfectly clear. A straight line lying within an enclosed figure in the same plane cannot be extended indefinitely in either direction without cutting the boundary of that figure. The translator says, "Dr. Ueberweg has himself revised the sheets; and, as he knows English well, this translation may be held to give his opinions as he wishes them expressed in our language." There must be a misrepresentation here.