

The book is almost a direct transcript of the author's journal, and its faults are those common to such documents. While one cannot but recognize that a better trained observer might have brought back a richer harvest in lines not ornithological or botanical, and that the relation of adventure is somewhat diffuse, yet the unpretentious manner in which the author recounts his experiences disarms criticism on this score. There are many excellent illustrations and three good maps. The book is handsomely printed, and has a good index.

The Psychology of Number, and its Applications to Methods of Teaching Arithmetic. By James A. McLellan and John Dewey. [International Educational Series.] D. Appleton & Co. 1895.

THE two respected scholars whose names appear upon the title-page of this work, in their eagerness to illustrate the important truth that the teaching of arithmetic ought to be based upon a thorough acquaintance with psychology, seem to have clean forgotten that there are two other legs to the tripod on which it should rest, viz., an exact logical analysis, and a lively appreciation and comprehension of the nature of mathematics in general. As long as nothing but psychology is called for, what they say is admirable—this, for example:

"There are but few children who do not at first delight in number. Counting (the fundamental process of arithmetic) is a thing of joy to them. . . . When, under the formal teaching of number, that interest, instead of being quickened and strengthened, actually dies out, the method of teaching must be seriously at fault. The native aptitude for number is continually blunted. . . . The child is adjudged to have no interest in number and no taste for mathematics; and to nature is ascribed an incapacity due to irrational instruction. . . . It is perhaps not too much to say that nine-tenths of those who feel that they have no aptitude for mathematics owe this misfortune to wrong teaching at first."

Excellent; and even more true of geometry than of arithmetic. Again, the authors are admirably alive to the futility of any attempt to teach any branch of mathematics until the scholar has been made to feel with some accuracy what the use of it is. Of course, you cannot convey to young children your own meaning when you say, what all grown people discover, that the happiness of life very greatly depends upon facility in ciphering. Yet you must try to cast some adumbration of the distinction between happiness and misery upon their poor little hearts, and make them associate the one with arithmetical expertness and the other with neglect of numbers. That should be Lesson I. in arithmetic.

Upon such generalities of the art of teaching, too usually neglected, Profs. McLellan and Dewey are perfect. But these things have been said before. When we come down to details, depending upon the nature of mathematical thought, they are more often wrong than right. They have allowed secondary truths and half truths to run away with them. For instance, their own conception of the purpose and end of numbers is not true either in scientific mathematics or in life. They tell us that numbers are for measurement, for valuation. This is not accurate; but, waiving that for a moment, we ask what measurement and valuation are for? Though we are not explicitly told, we gather that they are supposed to be mainly useful to improve our general conceptions. But that may be disputed. Except casually and secondarily, numbers—arithmetical numbers—do not contribute to our

conceptions. Their greatest utility by far—a utility more fundamental than that of all the constants of physics or the tables of the statisticians—is to keep our daily accounts, and so continually to check up our conduct without imparting any definite ideas. For 999 school-children out of a thousand this is destined to be the chief manner in which a knowledge of arithmetic will further their welfare. The corollary is, that the casting up of columns of figures easily, and swiftness in making those mental calculations which will enable them to overreach others in bargaining, are the bull's-eyes to be aimed at. True, man does not live by bread alone; but it must be the chief of his diet, so far as his nutriment is to come from arithmetic. If the Theory of Numbers were studied, that undoubtedly would afford a valuable training in logic, and impart some little exercise in mathematical generalization and even in mathematical imagination. But there is very, very little of all that in *Vulgar Arithmetic*.

It is a capital error, leading to the worst pedagogical blunders, to suppose that numbers have any significations whatever. Are "Eeny, meeny, mony, mi," etc., significant words? Charles Leland says they are Gipsy numerals. At any rate, they have precisely the force, use, and sense of primitive numbers. The essential use of numbers is that which the tourist in Italy has to put them to when he lugs about with him some baker's dozen of hand-packages, big and little, of all shapes and sorts, with no semblance of equality, but so many detached things, liable to be separately lost, and requiring to be incessantly counted. He might just as well use the words, "Eeny, meeny, mony, mi," etc., as "One, two, three, four," etc. Or he might use the syllables of "Ein feste Burg ist unser Gott," etc. In fact, the system of cardinal numbers may be defined as a scale of vocables, used as intermediary, for the establishment of one-to-one correspondences between different collections. To say, as our authors do, that the idea of measurement enters into the idea of all number, and should never be lost sight of in teaching, is on its theoretical side to confound things usefully distinguished, and on its practical side to fly in the face of the embryological maxim that the development of individual thought must follow the course of the development of thought in history. After we have once got the idea of metrical equality, we can perceive that it is verbally applicable (with little or no meaning) to the units of numeration. But that reflection does not help us to count. Who can doubt that man counted for ages before he began to measure, in the proper sense, and therefore before he had the conception of metrical equality?

It is useful to distinguish the different purposes of numbers, because a distinct system of numbers, each with its distinct modification of logic, is used for each purpose. For counting, we must use cardinal numbers; for the assignment of places in cycles, we use limited series (the names of the days of the week is such a system of numbers); for dating in series running indefinitely both ways (like the years B.C. and A.D.), we require negative as well as positive integers; for measurement, we need rational fractions; for reasonings about continua, where first the idea of a limit comes in, we need surds; for comparing functions, we need imaginaries; for four-dimensional continuous numerations, quaternions. It is a truism to say that, in teaching, one idea should be inculcated at a time, and the most rudimentary first. But above all in arithmetic, which, in its most practically important aspect, is a

question of physiological habit of rapid, accurate ciphering, the less the operation is interfered with by superfluous reflections, the better. No doubt it is necessary to teach certain simple methods of reasoning; but they must be performed in an instinctive, quasi-mechanical way, without philosophizing. One can, with a microscope, detect traces of mathematics in vulgar arithmetic, but there is so little intellectual value in it, while it is so stupidly important as a practical skill, that it is better to sacrifice the former utility to the latter. To evaluate this work from the former point of view we should need no monstrous number, while from the latter standpoint we fear the datary system of numeration would have to be drawn upon.

Indian Polity: A View of the System of Administration in India. By Gen. Sir George Chesney, K. C. B., M. P. 3d edition. Longmans. Pp. xx, 400.

THE British administration of India is one of the most remarkable existing systems of government. A great empire, containing three hundred millions of people of different races and religions and in various stages of civilization, is administered by about a thousand English covenanted civil servants, assisted by a few thousand white subordinates and supported by about seventy thousand white soldiers. This fact is of itself such an astounding proof of the governing ability of the Anglo-Saxon race that it gives cause for surprise to find the general ignorance prevailing as to the methods and success of the British administration in India. Nothing like it has been seen in the world since the days when the Romans dominated Europe, Western Asia, and Northern Africa, bringing to tribes hardly more diverse than the peoples of India the material benefits of roads and bridges with the moral supremacy of law and order. Nothing could be more interesting than to compare the Roman government of the provinces during the golden days of the Roman domination with the administrative system established in India; and the chief difficulty in the way of such a study has hitherto been the absence of authoritative works describing either the Roman or the Anglo-Indian system. Within recent years, however, the works of Mommsen and others have done much to elucidate the Roman administrative system, while Sir George Chesney has, in the volume under review, arrayed the facts and principles of Indian administration in an orderly fashion. A comparative study, only less interesting than the one just suggested, might also be made of the methods adopted by three of the European Powers in ruling subject races, if there were in existence books as clear and complete as Sir George Chesney's, upon the Dutch administration of Java and the Spice Islands and the French administration of Algeria. The problem of the best method of governing alien races situated at a distance from the centre of rule does not, and is never likely to, confront the American people. But, since systems of government should interest thoughtful minds in spite of the absence of the probability of practical application, students of politics would do well to turn their attention at times to India as affording an object-lesson for the successful surmounting of the peculiar difficulties inherent in alien rule in distant provinces.

Sir George Chesney, whose lamented death last year closed a career in which he won distinction as a soldier, a politician, an administrator, and a man of letters, was well qualified to undertake the task of clearly describing