Such, as it now appears, is some small part of the work of education that lies immediately before us. It is a work that may well call for the most serious consideration of this greatly influential society, which aims to make its philosophy a guide into the larger life. The plea which has been offered amounts in sum to this: That by all means you will give encouragement and stimulus to our already awakened spirit of educational invention; for it takes no second sight to perceive that the times call for the exercise of that spirit in the highest things to which it may aspire.

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SCIENTIFIC BOOKS

Electrochemistry. By Dr. Heinrich Danneel; translated by Dr. Edmund S. Merriam. Part one. New York: John Wiley & Sons.

This is the first of a series of three volumes which Dr. Danneel proposes to write upon the subject of "Electrochemistry." In this volume the modern theories of electrochemistry, as well as their physicochemical foundations, are discussed. The second volume will contain experimental results and methods of measurement, while the third will be devoted to the technical applications of the subject.

Theoretical electrochemistry is beyond the stage at which any radical innovation in the method of treatment is possible. The author does, however, depart from the more usual procedure in discussing transport numbers after conductivity; and wisely too, we believe. We are not, however, convinced of the advantage of introducing a preliminary chapter on the history of electrochemistry in which much of the subject matter to follow is assumed to be known.

This volume, like its companion volumes in the Sammlung Göschen, contains a surprising amount of fact and information within a very small compass. Whether such condensation is always desirable in a theoretical subject, where abridgment of statement does not necessarily mean a lessening of mental effort, may be questioned. I am reminded of the Abbé Terrassou's remark about a book "that it would be shorter if it were not so short." We are convinced, however, that this very brevity coupled with its clarity will assure it a place of its own among text-books of electrochemistry. We imagine, for instance, that it would be an excellent book to furnish a mature student with a brief, though comprehensive view of the whole subject.

The translation is vigorous and clear. We were sorry to see the familiar expression "migration of the ions" supplanted by the less apt "wandering of the ions."

The physical appearance of the book is better than that of the German original.

Arthur B. Lamb

Researches in Experimental Phonetics; the Study of Speech Curves. By E. W. Scripture. Washington, D. C., published by the Carnegie Institution of Washington, November, 1906. Pp. 204.

Under this title is published the groundwork of the results of Dr. Scripture's recent work abroad, in the laboratories organized at Munich, Berlin and Zurich. Save for illustrative examples from the records, the present volume deals almost exclusively with methods; nearly all of the last fifty pages are taken up with tables, some of which appear for the first time, and should prove most helpful to other investigators along these lines. A discussion of the precise philological and psychological bearings of the results we may await in another volume.

The speech curves studied are obtained from amplified tracings on smoked paper of phonograph (cylinder) and gramophone (disc) records. Dr. Scripture has here employed mainly the disc records, the horizontal movement of the recording point giving a more accurate tracing. The workable portion of the records is practically confined to the vowels. The voiceless sounds as a rule give nothing beyond a straight line. The investigator seems to have brought his method to a high degree of technical perfection. The drawings illustrating the apparatus are unusually clear.

Simple levers have been obtained to amplify the disc records accurately to three hundred times and compound levers to one hundred and twenty-five times. The latter is considered to be capable of much improvement. We are all sadly aware that it is one thing to note a precaution, and quite another to observe it; but so far as the technical side is concerned there are probably few psychological or linguistic problems of equal difficulty that have been approached with greater care.

The first chapter contains some studies of the vibratory movement of the diaphragms, mainly through optical means. The conclusion is reached that the nodal (Chladni) vibrations play an inconsiderable part in the distortion of the wave evident in the familiar "twang."

> The diaphragm of the sound-box, however, bends so that there is more or less yielding and motion of the air behind it . . . in both gramophone and phonograph the wave is distorted in the manner just described (p. 22).

The commercial instruments vary a good deal in quality; about one in a hundred, Dr. Scripture thinks, is suitable for experimental purposes (p. 17). Chapters II., III., IV. discuss the apparatus and methods of immediate analysis. Much of this material will be familiar to one who has followed Dr. Scripture's previous work. On pp. 53–4 is described a control apparatus by which any portion of a curve may be reproduced as a gramophone record so as to afford acoustic analysis for the ear. By this means, any curve possible to sketch may be reproduced in terms of its sound.

The ordinary student of linguistics will find more difficulty in following Dr. Scripture through chapters V.–VII. Their interest must for the present be considered physical and mathematical rather than philological or psychological. They are concerned with problems of harmonic analysis, and a new method for dealing with the disturbing factor of friction in the voice-producing apparatus. The two theories of vowel production are discussed in chapter VIII. The Willis-Hermann theory of the varying intensity of the glottal puffs and the vowel tones as inharmonics to the glottal tone, is confirmed in these studies.

The Helmholtz theory of hearing is interestingly criticized in chapter IX. Simple harmonic analysis is insufficient to give the tones corresponding to the resonating fibers; the inharmonic frictional analysis alone represents the facts of audition, and this is at present possible only for song. Chapter X. describes methods for the synthesis of vowel vibrations, and chapter XI. illustrates the mathematics of vowel analysis; it is intended as a guide to research. Perhaps the main objection to the work is that the correctness of the original gramophone records has been taken too much on faith. There need be no question of the accuracy of Dr. Scripture's reproduction of these curves; but there is room for considerable doubt as to whether the gramophone records themselves are faithful representatives of the spoken sounds they are supposed to record. The mere fact that they resynthesize them into understandable speech is not sufficient. A variant of the method mentioned on page 55 might be employed, a gramophone record *a* making another gramophone record *b* directly from itself. A visual comparison of the two might give an idea of the accuracy of the reproducer of *a* and the recorder of *b*. Otherwise there would seem to be no escape from the tedious method of nonsense syllables, noting whether the errors made in the perception of gramophone speech are analogous to those for normal spoken speech. Until something of this sort is done, there is ground for some caution in the acceptance of this material as representative of actual linguistic facts.

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SCIENTIFIC JOURNALS AND ARTICLES

The American Journal of Science for August contains the following articles: "Radio-Activity of Thorium Salts," B. B. Boltwood; "Wave-lengths and Structural Relation of Certain Bands in the Spectrum of Nitrogen," E. E. Lawton; "Tertiary Peneplain of the Plateau District, and Adjacent Country, in