tory of the United States, in which, among other less important chapters, the chapters on the Revolution and the Civil War are lost.

CONCLUSION

I have not attempted to give a history of geological investigation in this country. Of the great number of earnest and able investigators whose names illustrate the scientific history of this country—of those who have finished their work, but whose memory and influence can never die—of those still living whose achievements in the past are only the promise of greater work in the future—I have named but few, though many others are equally worthy. Of the men whose names I have mentioned, I have doubtless not in all cases mentioned the work which has been most meritorious or important. I have mentioned only those investigations which have a bearing on a few special subjects. Nor have I referred, except occasionally and incidentally, to the work of European students which has gone on parallel with that of students in our own country. American geologists have had no patent rights giving them a monopoly of any particular department of investigation. The limited time of such an address as the present renders impossible a critical discussion of the precise share in the study of the various subjects which belongs to American geologists. But I believe it may be fairly claimed that on the five subjects which I have discussed—the permanence of continents, the theory of mountain-making, the history of the Glacial period, the laws of subaerial denudation, the evolution of mammalian life—the work of American geologists has been relatively so important that the results deserve recognition as, *par excellence*, THE CONTRIBUTIONS OF AMERICA TO GEOLOGY.

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SCIENTIFIC BOOKS

The Development of Symbolic Logic: A Critical-Historical Study of the Logical Calculus. By A. T. SHEARMAN, M.A. London, Williams and Norgate. 1906.

As the subtitle indicates, the author has attempted a history of symbolic logic accompanied by a critical examination and estimate of the various systems as they may have contributed severally to the discipline from its earliest stages to the present time. He claims that in spite of the great variety of systems and methods there is clearly to be recognized but one logical calculus, and that the unity among the various symbolists abundantly compensates for the obvious differences. While this is true it should not be overlooked, however, that the progress of symbolic method has been retarded owing to the lack of a common symbolism such as we find in mathematics. The variety and the multiplicity of symbolical representation is, in my opinion, a serious defect. It is not merely that different writers are using different methods of symbolism—that in itself is sufficiently confusing—but also that any new operation is apt to give rise to some entirely new form of symbolism which might be represented equally as well by some new combination or new manipulation of the existing symbols already at hand. Within the scope of a few elementary symbols an indefinite range of differing processes and devices is possible, just as in mathematics the symbols used are exceedingly few—but they lend themselves easily and adequately to the exact expression of an innumerable array of operations and processes. The desideratum in a symbolic logic is, therefore, twofold: a common and a simplified symbolism. The simplicity of the symbolism of Leibniz, the founder of symbolic logic, is most striking; but the drift has been from this characteristic simplicity towards increasing difference and complexity. The author, by the way, does not give Leibniz his full due as the founder of the symbolic logic. Mr. Shearman insists that Boole is to have the complete credit of this on the ground that Boole worked independently and without any knowledge of the early work of Leibniz. The latter assumption seems

somewhat gratuitous, at least Mr. Shearman cites no authority for his statement. Be that as it may, it is true that Leibniz first suggested the problem of the symbolic logic, although he did not attain the solution of it. How often, however, the pioneers in a new field of thought have merely started inquiry without achieving the reward of discovery.

In reference to the problem of the symbolic logic which has been mentioned above, it might be a matter of general interest to the lay reader to learn somewhat more explicitly as to the characteristic features which it presents. The problem in the main is this: to devise a method by which any given relations expressible by symbols may be made to exhibit the full range of possibilities which these relations imply both affirmatively and negatively —that is what they render necessarily true or necessarily false. Moreover, there has been a constant endeavor through the whole development of symbolic logic to make such a method as general as possible. The generalizing of method, indeed, has been one of the chief characteristics of this development. For instance, the earlier symbolists dealt almost exclusively with logical classes; the later, as Frege, Peano, MacColl and others, extended their method so as to include propositions, and to represent every other relation as well as the ordinary relation of logical subsumption; the later symbolists also endeavor to embrace in their method the quantitative as well as the qualitative relations. In this connection I am constrained to refer to what may be called a fetich of symbolic logic and which has proved a snare to many. It is the notion that by representing certain ideas by symbols —the ideas themselves for a time being thus placed in the background—the merely formal processes of the accepted logical operations will disclose some entirely new relation of the symbols employed, which being reinterpreted in terms of the original ideas will reveal a new significance never before conceived. This is a vain delusion, for it labors under the misapprehension that there is something mysterious about certain formal processes by virtue of which new material content will be revealed. It has been urged that scientific discoveries of some moment may be stumbled upon merely by following out the subtle workings of formal processes whose significance can be appreciated only when such processes have been finally completed. It is as though the stream of reason was able to cut out certain subterranean channels to emerge again into the light of day. Leibniz had this idea as a kind of a will-o'-the-wisp, in his 'Characteristica Universalis' by which he thought that formal rules might take the place of brains and the conscious processes of thought. "If we had it," he says, "we should be able to reason in metaphysics and morals in much the same way as in geometry and analysis" (G. vii. 21). "If controversies were to arise, there would be no more need of disputation between two philosophers than between two accountants. For it would suffice to take their pencils in their hands, to sit down to their slates, and to say to each other (with a friend as witness, if they liked): Let us calculate" (G. vii. 200). The practical utility of the symbolic logic is not, however, in the direction of the discovery of new possibilities never before conceived, but rather in the line of providing a method by which every possibility is embraced in one comprehensive survey. In a field of complex relations it is very easy to overlook one and another of the many possibilities, and a method is valuable both theoretically and practically which provides that no single possibility can escape the attention, and which thus shows that logical implications are both manifold and complex. It is a question largely of whether every possibility has been brought to the attention of the observing mind, and not whether a possibility can be discovered by certain logical processes as an entirely new result never before imagined. Mr. Shearman cites as an example of a new truth discovered by calculation that of the existence of the planet Neptune by Adams and Leverrier. It must be remembered, however, that each one of these men in his calculation had clearly before him from the beginning the desired end which he expected his calculations to prove. In other words, these men were not working in the dark, simply trusting

themselves to a process which might be leading them any whither.

This volume contains an excellent historical sketch of the various systems of symbolic logic and as such is a most valuable book of reference. To read it with profit, however, some knowledge of the several systems is necessary. It would have been a manifest advantage had the author given, for instance in his chapter on The Process of Solution, a more detailed and elementary account of the original method of Boole, or of the method of Venn, being as it is a developed form of the Boole method. Thereby the difficulties for the lay reader would have been overcome to a great extent.

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Thought and Things, or Genetic Logic. Vol. I. *Functional Logic.* JAMES MARK BALDWIN. London, Swan, Sonnenschein & Co.; New York, The Macmillan Co., 1906. Pp. xiv + 273.

This is the first of three volumes, appearing in both French and English, on a subject never before given comprehensive systematic treatment. It brings into use a somewhat unusual terminology. The terms pragmatelic, semble, sembling, autotelic, heterotelic, syntelic, psychonomic, autonomic, heteronomic, syndoxic, progression, mode, schema are used with restricted although clearly defined meanings, and we might add to the list. Some readers will wish for more elucidation and continuity in places and there are some passages whose meanings are rather elusive. But the methodological difficulties of the subject are unusually great and have been handled with a remarkable degree of success. The author's evident interest in the subject itself, rather than in the style of the discussion, is neither surprising nor reprehensible.

The author realizes that the title, Genetic Logic, is likely to provoke criticism (pp. vii, 18). We should say the place of genetic logic among the philosophical disciplines is not unlike that of sociology among the social sciences. Sociology is neither history, economics, psychology nor anthropology and some whose contributions to these subjects give them a right to speak say there is no separate science of sociology. Genetic logic is neither straight logic, straight psychology, nor straight epistemology. Logic is not genetic, psychology is not interested in questions of logical validity, and epistemology, although broader and more elastic than the other two, does not involve as much psychology as this book presents. And yet the author is correct in assuming that the problems here discussed are real and pressing. They are not new. The time seems to have come for a systematic presentation of all this material and it is to be hoped that this is only the first of several works on the subject. It is a colossal task for which the philosophical *Zeitgeist* has been long in training, and one can only praise the keenness and comprehensiveness of this treatment.

The author confines himself to the same rules of observation and hypothesis as those observed in 'the empirical sciences generally' (p. 9), asking the questions—How? and Why? —as well as the question—What?—with reference to each form and mode of knowledge. Neither the formal logician's logic, nor the metaphysician's 'logicism,' will concern us here, but rather the knower's logic, cognitive processes viewed from the knower's standpoint. We are to study the genesis of knowledge and thought, and construct a genetic theory of reality. The former topic is discussed in the first two volumes, the latter, in volume third. The first volume presents a genetic theory of what the author calls the pre-logical cognitive functions, the second, a genetic theory of thought and judgment, and the third, a genetic theory of real logic or the 'hyper-logical functions' (p. 15). 'Genetic psychology of cognition' and 'genetic epistemology' (p. 18) are other names for the two main topics of the work. It seems to us that 'genetic epistemology' would be a good title for the entire work.

The author asks (1) 'what are the conditions determining the construction of objects at any given stage of mental development, and (2) what are the psychic characters of the objects thus determined' (p. 30). He distinguishes "in the actual results to which the research has led, the following phases of con-