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NOUVELLES RECHERCHES DE PSYCHIATRIE ET D'ANTHROPOLOGIE CRIMINELLE. By C. Lombroso. Paris: Felix Alcan. 1892.

Prof. C. Lombroso's activity reaches a climax that is almost superhuman. He contributed to the Italian Archives of Psychiatry two articles, one of which proves that, at least in Italy, the sense of touch is weaker in women than in men; it is still weaker and more irregular in criminal women than in normal women. (Archiv. di. Psychiatr. Sc. pen. ed. Antrop. Vol. XII, 1891, p. 1-6). The other article (l. c. p. 58-108) is an inquiry concerning thought-transmission, which contains besides a critical review of the usual rubbish of so-called telepathic phenomena two strange observations. The first is the case of a low-bred hysterical lad who does not possess the faculty claimed by him to understand telepathically the intentions of whosoever employs him, but strange enough, if sufficiently charged with whiskey, is able to read any writing through the envelope with closed eyes. The other case is a somnambulist compositor, who sets type correctly in the state of somnambulism. Blindfolded he draws the figures drawn behind his back upon a slate, and hypnotised he guesses the numbers which the experimenter thinks. Lombroso is one of our greatest psychologists, but these experiments perhaps with the same subjects should be repeated by other psychologists so as to make sure of their correctness. Lombroso concludes that there seems to be some foundation in thought-transmission.

The present little volume of new researches applies Lombroso's theories concerning morphological abnormalities of the criminal type in the anthropological field. It appears natural that the criminal type should show abnormal features, but sometimes Lombroso's eagerness to discover abnormal features, even in political criminals such as Charlotte Corday, is exaggerated. At least we must confess that many abnormalities appear very frequently among peaceful and law-abiding citizens. The Corday skull, although a trifle platycephalic, is beautifully rounded and normal. M. Topinard finds no abnormal features but Lombroso maintains that its platycephaly is doubly abnormal and he adds: "The capacity of the skull is 1.360 cubic centimeters while those of Parisian women is 1.337. Must we not conclude that its capacity exceeds the average?" We read on p. 124 and sq: "The more our women will be forced to enter the economical struggle for existence, the more will they become criminals. . . . The result (of letting them enter public life) will be to lower the nature of women."

The booklet is very instructive even to those who disagree with the professor, for it is full of facts and valuable observations.

VORLESUNGEN ÜBER DIE ALGEBRA DER LOGIK. (Exakte Logik.) By Dr. Ernst Schröder. Erster Band mit viel Figuren im Texte. Leipzig: B. G. Teubner. 1890.

Professor Mach says, "The essence of science is economy of thought." If that is so, there is no discipline more imbued with the spirit of science than algebra. When operating with algebraic symbols we cease to think out the whole calculation

at every stage, and we are enabled to keep track of the different factors, and of their mutual relations during the operation from the beginning to the end. In common arithmetic these factors are lost like rivers in an ocean of homogeneous numbers which increase and decrease without betraying the way by which they were reached. Algebraic symbols generalise calculation, and thus we have the advantage of calculating from the resultant formula any particular example with machine-like exactness and without the trouble of going over the whole operation again. The ease with which we can operate with symbols brings it about that we sometimes out-run our thought and the correct result may be obtained by an operator who only partially understands the operation, just as an engineer is able to run a machine the mechanism of which he but partially understands.

Mathematics having gained so great advantages through the introduction of algebraic symbols, the question suggests itself whether the same method might not with some advantage be introduced into the other provinces of formal science, especially in the domain of logic. The first logicians who borrowed signs from algebra and introduced them into logic by generalising their meanings, were two Germans, Gottfried Ploucquet and Johann Heinrich Lambert. Ploucquet wrote "Principia de substantiis et phaenomenis, accedit methodus calculandi in logicis ab ipso inventa, cui praemittitur commentatio de arte characteristica universalis," Frankfurt and Leipsic, 1753, ed. II. 1764.\* Lambert's investigations on the subject are found in his "Logische Abhandlungen." Prof. Venn, in his "Symbolic Logic," p. xxxii, says of Lambert, "He fully recognised that the four algebraic operations of addition, subtraction, multiplication, and division, have each an analogue in Logic; that they may here be respectively termed aggregation, separation, determination, abstraction, and be symbolised by +, -, X, . . . He also perceived the *inverse* nature of the second and fourth as compared with the first and third; and no one could state more clearly that we must not confound the mathematical with the logical signification."

The algebra of logic which through the work of these ingenious men, had received a favorable start, was very soon neglected; yet it was revived after some time in England by Boole, DeMorgan, and Jevons. It remained for quite a while the almost exclusive property of the English where at the present time Prof. Venn may be considered as the greatest English authority on the subject. Venn's works were rivalled by an American scholar, Mr. Charles S. Peirce, the same who has contributed several articles to *The Monist*. The algebra of logic which had been so long neglected in Germany, is now reviving in the country of its first birth. The author of the work, the first volume of which lies now before us for review, is Professor of Mathematics at the Polytechnicum of Karlsruhe in Baden. The second volume is not yet worked out in detail, but its publication may be expected in one or

\* See Aug. Friedr. Böck, *Sammlung von Schriften, welche den logischen Calcul des Prof. Pl. betreffen*, Frankfurt and Leipsic, 1766.

two years. The whole work, when completed, will be the most comprehensive treatise on the algebra of logic that has as yet appeared. The plan and treatment of Professor Schröder's "Vorlesungen über die Algebra der Logik" exhibit that uncommon thoroughness and exhaustiveness, for which German scholars are justly famous. The book, in one word, will be the standard work on the algebra of logic for a long time to come.

It would lead us here too far to review or to sketch the main contents of Professor Schröder's work, which, it seems to us, is difficult to explain without entering into the details and thus going beyond the scope of mere review. But we shall briefly set forth the chief foundations upon which Schröder builds his algebra of logic. Professor Schröder has inscribed two mottos on the title page of his book, but we confess that we suspect at least one of them is intended to be ironical; it certainly seems to have been selected when the author was in a mood of humor. Being conscious of the great value of theoretical speculation, he quotes from Goethe the following Jephthaphelian sentiment:

"I say to thee, a speculative wight  
Is like a beast on moorlands lean,  
Led circling there by some malicious sprite  
While all around lie pastures fair and green."

There are two kinds of speculation: first, that which attempts to find out by pure thought a substantial extension of knowledge; and secondly, that which investigates the methods of inquiry. The former is futile, the latter is fruitful. The former is that which Goethe censures. To censure the latter would be a grave mistake. The man who would try to find bread out of iron must meet with disappointment, but the smith who invented and shaped the plow did more for the production of bread than many thousand farmers taken together, although it may be he did not raise a blade of wheat. Speculation that attempts to find out things by mere brooding is *prima facie* wrong; but speculation that constructs the methods of investigation is the basis of all progress in science.

The other motto of Schröder's book is Goethe's saying: "Man is not born to solve the problem of the world, but to seek for the point where the problem begins and then to keep within the limits of the comprehensible." It would be well to compare this saying of Goethe's with another one by the same author which is "Man should hold fast to the belief that that which seems incomprehensible, is comprehensible. Otherwise, he would not investigate." Schröder follows rather the spirit of the second than that of the first quotation. He says on p. 11 of the recent volume, with reference to some critical remarks made by the late Professor Lotze of Göttingen, who was more brilliant and ingenious than exact in his philosophical views and who showed an undisguised dislike for any severe method that has recourse to numbers, figures, schedules, or classifications, as does the algebra of logic: "If Lotze concludes his logic with the wish that German philosophy should rise to the attempt at comprehending the course of the world instead of merely

"calculating it, we should answer, Could we first calculate it, then we should certainly comprehend it so far as comprehension on earth is possible." But how is it possible? Simply by properly limiting and defining the field of investigation; and here we can see that the first saying of Goethe's should not be construed in such a way as to appear contradictory to the second.

Every thinker starts with certain limits of comprehension, but he extends them so that the stock of knowledge increases in every generation, and there is no probability that we shall ever reach the limits of an absolutely incomprehensible. There is no solid progress to be made by making wild raids in the domain of the unknown, a method which is pursued only by dreamers and metaphysicians. We must start from the boundary of the present stock of knowledge, and let our progress be confined to single well defined and limited problems. How a solution of the world-problem is possible in this sense, is explained by Schröder on p. 103: "The answer is given in the old parable of the bundle of arrows, which resists all attempts at breaking it. As a whole it withstood, but it yielded to him who untied the bundle and broke the arrows singly. The difficulties which present themselves to the progress of knowledge can also only be overcome singly, and in their one-sidedness. In the division of labor thus produced, lies exactly the advantage and the strength of the diverse disciplines,—*qui trop embrasse, mal étreint*."

Professor Schröder advertises his book with the following words:

"From the title the reader will observe that here the deductive or formal logic alone, is treated. The calculative treatment of the deductive logic, through which this discipline is redeemed from the fetters by which through the power of habit, word-language has bound the human mind, should deserve, more than anything else the name 'Exact Logic'! This method alone can give to the laws of valid inference, their most pregnant, concise, and clear expression, and is thus enabled to reveal numerous and important gaps,—why not mistakes,—in the older presentations of the subject."

"Since the appearance of the author's 'Operationskreis des Logikkalküls,' this method of treatment has made progress of highest importance, especially through the works of the Americans, Mr. Charles S. Peirce and his school. To Mr. Peirce, more than to anybody else, is due the merit of having built a bridge from the older and purely verbal treatment of our discipline to the new calculative method; a bridge which the professional philosophers rightly found lacking and to which lack is well to be ascribed the fact that the new method received only a partial and bewildered attention. Through Mr. Peirce's works, upon which also the author has had some influence, the theory is now so far developed and perfected that for the first and main part of its whole system, a final presentation and arrangement may be obtained."

"Endeavoring to offer so far as possible such a final and comprehensive presentation, the author desires to offer at the same time and in a systematic way a

"hand-book of the most valuable materials of the literature of the subject which especially in the English language, is quite considerable."

The book addresses two kinds of readers which are of a greatly different turn of mind, and it will go far in reconciling the methods of both, the mathematicians and the philosophers.

In the preface Schröder says, "In consideration of the formulae which appear in the book, it may be wise to state, that no mathematical training or any specific knowledge is presupposed to be known by the reader. We might repeat the words of Dedekind, prefixed to one of his books: 'Everybody can understand this work who is in possession of what is generally called, common-sense.' But we may add another saying from another author: 'The beaux esprits certainly, who are not accustomed to the severe demands of thought, will very soon turn away from it.'"

The introduction is comparatively long, comprising no less than 125 pages. But, considering that it is more than an introduction, that it explains the foundation on which the whole work rests, it is not too long, for it forms an essential and indeed the most important part of the book. Schröder discusses in it the character and the limitation of his problem. He explains induction, deduction, contradiction and valid inference. He considers the nature of signs and names. He says, on p. 38: "Humanity, it appears, does not rise above the absolute zero of civilisation and the level of animal life, until it develops the activity of denotation and symbolising. And there is indeed nothing to which the human mind owes so much for its progress as to the signs of things."

"The sign which speaks in attitude and gesture to emotion, speaks in word and sentence to the intellect. And it possesses, in accordance with the laws of the association of ideas, the power of producing in the person addressed certain ideas."

"While the sign coalesces with the idea, it reacts upon thought itself. Through signs the ideas which otherwise would remain confused and vague, are analysed and they become as separate elements, a permanent possession over which the thinking mind has forthwith free control. Through the sign we distinguish, we fix differences and make them ready for new peculiar combinations. The sign, is as it were, the handle by which we take hold of the objects of thought. Through the sign only, the idea is liberated from the elements of sense, which are attached to it, and is enabled to rise into the sphere of generalisation. Thus thinking is on the one hand liberated, on the other determined by the sign."

"Further, through the sign alone which makes it possible that the same idea the same purpose can live in many, there is one will, one soul, and a community of human aspirations exists upon which is based the life of mankind as a life of individuals in society. And this again is the basis of our morality and civilisation."

"The efficacy of the sign spoken is considerably increased by the invention of writing."

Professor Schröder discusses those two methods of logic which are known by the names: the Logic of Intension and the Logic of Extension. (*Logik des Inhaltes*, and *Logik des Umfangs*.) This leads to a discussion of definition, the categories, and conceptual writing which would find its ideal in a system of pasigraphy, or universal language, for the perfection of which an algebra of logic would be indispensable.

The symbols employed by Schröder are borrowed to a great extent from Peirce, but they are considerably improved and it is probable that Schröder's innovations will be universally accepted.

We purposely refrain here from discussing the particulars of Schröder's work, stating only in a general way that his proposition of a new symbol for subsumption, (he proposes to replace the old symbol  $\subset$  by  $\equiv$  to signify "equal to or subsumed under"), his treatment of the symbols 0 and 1, the former representing an absence of certain marks, or as it has been called their "impossibility," as being excluded by the presence of other marks; the other the universe of the whole subject under discussion, and all the other problems which he separately treats in his lectures are admirably presented and command almost throughout the reader's consent. We now conclude our review with the quotation of the last paragraph of Schröder's introduction on p. 125. Having declared that "logical inquiry should not be judged from the short-sighted or narrow-minded, not to say *borné*, utilitarian standpoint," he points out the great practical importance of his science, saying:

"Similarly, as with other sciences, so logic also may be expected to realise and produce undreamed of results, which may incidentally bring about, in a most surprising way, incalculable advantages. Let me only point out one thing. Since the impulse which this science has of late received, there have been already constructed three logical machines which although we grant, scarcely deserve their name, because their efficacy remains still very rudimentary, may be compared to Papin's pot that in a more advanced state became the steam engine. Indeed, nobody can presage whether after all a thinking machine might not be constructed, which would be analogous to, but more perfect than the calculating machines. The latter have relieved man of a considerable portion of much fatiguing thought-work, just as the steam-engine has been successful in relieving him from physical labor."

"To be sure we must not expect to reap while we are still sowing, and least so in such a case as this where the harvest is to be expected from trees." *etc.*

THE GRAMMAR OF SCIENCE. By *Karl Pearson*, M. A. With 25 figures in the text. London: Walter Scott, 24 Warwick Lane. Imported by Charles Scribner's Sons, New York.

We are greatly in sympathy with the methods and principles of Professor Karl Pearson's "Grammar of Science." The work is a comparatively popular and also brief exposition of the modern ideal of scientific inquiry. "The goal of