records of feelings with the actual mental ability displayed shows that the former are not a parallel or measure of the latter.

The quantitative results obtained would seem to show that the degree of real inability caused by mental work was very much less than has been supposed; that in ordinary life nature warns us by the complex feelings mentioned not to work mentally some time before we are really incapacitated for work. They would also suggest that the results which those investigators who have sought to measure mental fatigue in school children have obtained were due to the use of methods which did not measure the *inability*, but the *distaste* for mental work, of the children. One is tempted to put forth the paradox that real mental incompetency is the rarest of all reasons for stopping or decreasing mental effort.

The methods used to estimate the ability to do mental work are to some extent new and so worth mention. The chief was the mental multiplication of three figures by three (*e. g.*, 794 x 683); of two figures by three, and in some cases four by four. This work, at least for the subjects of these experiments, required the utmost concentration. It is very fatiguing (in the ordinary sense of the word). Any interruption or distracting influence is felt at once and makes successful work impossible. So one would suppose that it ought to show the influence of decreasing power to do mental work as clearly as could anything. The amount of work and the mistakes can be easily and accurately recorded.

Another method involved the addition of columns of twenty numbers, each of five figures. This does not require close concentration, but the work done should show perfectly the fact of mental fatigue in so far as that involves the accuracy and speed of associations between ideas. The speed and accuracy of discrimination of the lengths of lines and of the perception of letters were also used. The tests were arranged so as to eliminate the effects of practice.

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SCIENTIFIC BOOKS.

The Development of English Thought: A Study in the Economic Interpretation of History. By SIMON N. PATTEN, PH.D., Professor of Political Economy, Wharton School of Finance and Economy, University of Pennsylvania. New York, The Macmillan Co. 1899. Pp. xxvii + 415.

"We don't know him; let's heave half a brick at him." The process is simple, obvious and, to the heavers, effective. There are only too many grounds for the fear that Professor Patten's new work will be treated as a vile body for this old experiment. Everyone knows how easy it is to discredit generalization by advancing negative instances; how sweet to cavil at principles by alleging that facts have been twisted to fit; how seductive to emphasize the specialist's standpoint and to magnify its abounding limitations. I do not exaggerate in saying that it is long since I have encountered a book which lies so open, so invitingly open, to these insidious attacks; or, on the contrary, one which proves so conclusively the unfairness, superficiality, even stupidity, of such criticism. For Professor Patten sets theory in the forefront of his discussion, and the body of his work sees the persistent application of this theory. Nevertheless, he who runs may read that, in the author's mind, the theory came last, being the inference from his detailed investigations, the final form in which the multitudinous facts shaped themselves—ceased to be mere isolated phenomena and became rationally one.

Professor Patten's theory reposes on a quasi-psychological basis. Sensory ideas, or ideas brought by the senses from the environment, constitute the material of knowledge; and "sensory knowledge is merely the amplification and classification of the differences perceived by the senses." (2) Such processes produce series of mental images; these, in turn, occasion relative motor reactions. Consequently a "man's

activities are determined by that part of his ideas for which motor reactions have been provided." (3) These complicated results are, of course, affected profoundly by differences of environment. In 'local' environments motor reactions predominate, in 'general' environments sensory ideas. Thus, 'stratification of society' does not take place in obedience to such 'superficial' causes as wealth and social position, but must be referred to 'psychic' characteristics. "A race ideal differs from its elements or from an abstract concept by having a motor reaction united with it (173). * * * Before the time of Locke there were three types of Englishmen —the Puritan, the clinger and the sensualist. Locke's analysis had split the Puritan party into two parts. One section was transformed into stalwarts, who placed race ideals above reason and sense impressions, and the other into mugwumps, who made the opposite choice" (185). Viewed in this light, English society has consisted of four great classes—'Clingers, Sensualists, Stalwarts, Mugwumps' (23–32). 'Clingers' spring from 'local' environments; 'Sensualists' appear when environments become richer in objects; they break down local traditions and stand forth as conquerors. When society becomes sufficiently differentiated, 'Stalwarts' are evolved—men who love creeds and react from sensualism to asceticism. Finally, increased wealth produces 'Mugwumps,' who evince a highly developed sensory side, and so are strong in thought, but weak in action. "Its members are cosmopolitan in their sympathies; advocates of compromise and policy in politics; sceptical in thought, and agnostic in belief. They dislike ideals, creeds and utopias, and are ever ready to expose shams and cant in which other people disguise their sentiments" (31). The history of English thought is the history of the appearance, interaction and transformation of those classes. "The sensualist is the original unmodified Englishman, who retains the dross of primitive times. The clinger is the result of qualities grafted on English nature by the supremacy of the Church. The stalwart is the concrete Puritan. The conflict was a three-cornered fight in which either the sensualist or the Puritan was the aggressor, while the clinger joined in with the defensive party (139). * * * The three-cornered fight had to go on until some solution could be found other than those these parties could offer. A new type of man was demanded, a type endowed with mental qualities different from those Englishmen then possessed" (141–2). If the matter be treated in this way one is freed from foreign methods of interpretation and gets to know English character as it actually was and is, in its own peculiar nature (cf. 43). It ought to be said that our author himself recognizes the limitations of this standpoint and not merely on his title-page. "Economic conditions create the primary motor reactions, put them to new uses and give them a form quite different from that they have at the outset. * * * The consequence is that a motor reaction, after losing its primal economic importance, responds to abstract instead of concrete phenomena" (50–1). Further, it ought to be added that the most interesting, and, as I believe, the most effective part of the work is the second half, where this limitation does not press so heavily. The execution of this portion, which deals with English thought as ruled by the 'Mugwump,' is a most important contribution to the subject, one that all English philosophers, especially those who see no good thing outside of Germany, would do very well to mark, learn and inwardly digest. "If we view English thought from this standpoint there are three clearly defined epochs. In the first Hobbes states the problem without solving it; Locke is the economist on the upward curve; Newton is the thinker on the downward curve. In the second Mandeville states the problem; Hume is changed from an economist into a philosopher, and Adam Smith from a philosopher into an economist. The third epoch, beginning with Malthus, ends when Mill is transformed into a philosopher and Darwin into a biologist" (55).

Taking the book as a whole, no one can fail to be impressed with its freshness, originality and great brilliance in some places. While the style is plain and straightforward for the most part, incisive sayings—almost epigrammatic on occasions—attract attention or serve to stimulate rapid thought. Indeed, sometimes Professor Patten contrives to cast a flood of light

over an entire period by their use. I had marked a large number of penetrating purviews and new reflections for quotation, but limits of space forbid more than briefest reference to a very few. The theory of curves of thought (43); the value of monastic influences (71); the contrasts between communal and family life (81, 192, etc.); the relation of Catholicism and Protestantism to vice and crime (94); the misfortunes of the Reformation (104); the suddenness of English civilization (126); Locke's office (162); the meaning of Deism (175); the contrast between England and France (187, 281); the presentations of Wesley and Whitefield (250); the 'origins' of Adam Smith (264); the criticism of current sociology (333); Romanticism and religion (353)—all serve to illustrate the originality and one might almost say weird suggestiveness of Professor Patten's inferences, and other instances might be adduced indefinitely.

On the other hand, a few things give one pause. To begin with, Professor Patten will perhaps not take it amiss if a Scot informs him that Scottish thought is not a variant of English. Hume and Adam Smith and the Mills would not have been what they were had their nationality lain south of the Tweed. At the same time, I am well aware how difficult it is for the foreigner to understand that the Cheviots divide, if not two civilizations, then two ways of thinking. The doctrine of the 'manly man,' the 'womanly man,' and so forth (255, 318, 341, etc.), seems a little far-fetched to be made so much of; perhaps it applies in the case of John Stuart Mill. The bath theory (192) of English civilization; the treatment of Calvinism (110, etc.); the contrast between Cavalier and Puritan (119); the gulf between the upper and lower classes in England (130); the emphasis upon clothing (191); the passage from a liquor to a sugar diet (381)—all seem to me to be somewhat fanciful or, at least, to be used in support of conclusions which do not necessarily connect with them. Many of the 'Concluding Remarks' are vitiated by the author's foreign standpoint. For example, the identification of religion and economics, while strikingly true of the United States, is incomparably less true of England, and must remain so till the Anglican Church loses its endowments. I ought to add that some of these objections would probably appear less forcible to one fully informed on economic questions.

Finally, the appreciations of English philosophical thought are wholly admirable. The value of the new lights cast on Locke (158), Mandeville, Hume (215, 223), the Mills, especially the son (331), Darwin (345), and the present position of English philosophy (377) and religion (398), cannot be overestimated at the contemporary juncture. Emphasis ought to be laid on the masterly discussions of Ricardo and Adam Smith; the interpretation of the former is most illuminating.

So far as I am capable of judging, the book is obviously the work of a very able man and one unusually well informed; of a man who has extraordinary capacity for seeing and telling truths pointedly, even though he may miss the whole truth time and again. In any case, it must be reckoned with and cannot miss the exercise of wide influence, whether this be of a negative or positive character.

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Peruvian Meteorology, 1888–1890. Compiled and prepared for publication by SOLON I. BAILEY, under the direction of EDWARD C. PICKERING. Annals of the Astronomical Observatory of Harvard College, Vol. XXXIX., Part I. 4to. Cambridge, Published by the Observatory. 1899. Pp. 153. Pls. VI.

It is safe to say that no publication has been awaited with greater interest among meteorologists than the volume now before us. Ever since the establishment of the permanent Southern Station of the Harvard College Observatory at Arequipa, in 1891, and of the auxiliary meteorological stations in connection with it, every meteorologist the world over has been anxious to have access to the data which have been gathered concerning the climatic conditions of that unique region. The notable discoveries made on the photographic plates from Arequipa have turned the attention of every astronomer towards Peru. Now the meteorological world likewise turns towards Peru in the study of the records which are for the first time accessible. Readers of SCIENCE will remember that the