MENTAL FATIGUE.

THE purpose of this article is to give a preliminary report of some experiments on mental fatigue made by the writer. It is expected that they will later be presented in detail, and accordingly only the method and theoretical conclusions will be now stated.

Mental fatigue may mean either the fact of incompetency to do certain mental work, or a feeling of incompetency which parallels the fact, or the feeling or feelings denoted by our common expressions 'mentally tired,' 'mentally exhausted.' Among the conclusions to which the experiments have led are the following: first, that the fact of incompetency is not what it has been supposed to be; second, that there is no pure feeling of incompetency which parallels it and is its sign, that consequently the mental states ordinarily designated by the phrases mentioned are not states made up of such a feeling of incompetency, but are very complex affairs; and third, that these mental states are in no sense parallels or measures of the decrease in ability to do mental work.

We have been accustomed to think of mental work in terms of mechanics. The mind has been supposed to lose its power to work as a rubber ball loses its power to bound. As the ball rebounds to a lesser and lesser height so the mind has been supposed to think with less and less vigor. We have talked as if sleep charged the mind with mental energy as a current might charge a storage-battery with electricity and that then the mind had this stock to spend. As it spent it, it could exert less and less energy in its thinking. One could easily show the impropriety of such views by demonstrating the inconceivability that the complexity of mental action should fit so simple a scheme, but it is also useful to show the same thing by proof that in the case of certain people the mind does not lose its power to do work from having done large amounts of it. My experiments show in certain individuals no decrease in amount, speed or accuracy of work in the evenings of days of hard mental work over mornings or in periods immediately following prolonged mental work over periods preceding it.

So far as these and many other experiments go they all agree in denying that the cause for a decreased amount of mental work is such a simple lessening of some one factor, mental energy or whatever one cares to call it. They would affirm, on the contrary, that we did less work when tired, not because this stock of mental energy was running low, but because ideas of stopping, of 'taking it easy,' of working intermittently came in and were not inhibited; because feelings of boredom led to their consequences of leaning back in one's chair, looking at the clock, etc.; because a certain feeling of physical strain weakened one's impulse to read, write or translate; because sleepiness clouded our mental vision; because headaches or eye-aches tended naturally to inhibit the processes which caused them, etc., etc.

As to the pure feeling of incompetency I fail utterly to find it in myself or to get any intelligible account of it from others. After one separates out from the feelings of mental fatigue the factors just mentioned, especially the feelings of physical pain and strain, the feelings of mental nausea at certain ideas, and the feeling of sleepiness, I do not think that he will find anything left that is worth naming.

That the feelings of fatigue which we do have are not proportionate concomitants with the decreasing ability to do mental work is shown by the fact that all the persons in our experiments reported a large measure of such feelings in cases where their mental work was quite up to the average. In general a comparison of the introspective

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