

the experiment. Assuming that the rate was near one per second, he would have predicted that no fluctuation would occur, since the attention wave would rise regularly to a crest with each stroke.

As an instance of faultless experimentation, in which fluctuation was clearly found, Seashore cites his own observation on fifty-five unsophisticated students, each of whom discovered the fluctuation in the sound of a chronometer beating fifth seconds, and in which results showed there was no considerable physical variation.

KNIGHT DUNLAP.

UNIVERSITY OF CALIFORNIA.

### FATIGUE.

*Recherches sur la fatigue intellectuelle scolaire et la mesure qui peut en être faite au moyen de l'æsthésiomètre.* A. BINET. *Année Psychologique*, 1905, XI, 1-37.

This research concerning the effect of intellectual fatigue on sensibility was carried out by a commission appointed from the members of the 'Société libre pour l'étude de l'enfant.' The work consisted entirely of experiments on children in the primary schools of Paris.

The æsthesiometric method was used in all the experiments in which touch sensibility was tested. The back of the hand, screened from the view of the subject, was the part stimulated. In order to stimulate the skin by two points separated by a fixed distance, two needles were sunk into the edge of a card in such a way that the projecting ends of the needle could be lowered simultaneously upon the skin. There were seven such cards, the distances between the points being as follows: 0 cm., 0.5 cm., 1 cm., 1.5 cm., 2 cm., 2.5 cm., 3 cm.

The first tests were made on 45 boys and 38 girls from six to twelve years of age. The points were applied to the skin according to the method of maximum variation, that is, so that there would be the greatest possible contrast between the successive stimulations; 56 tests (*i. e.*, eight with each of the seven cards) were made before school in the morning; at the end of an hour of composition and arithmetic another similar series of tests was made.

As the average threshold for discrimination seemed to be about 1.5 cm. the conclusions concerning the effect of fatigue on touch discrimination were based on the relative number of right and wrong cases when the distances were 0.5 cm., 1.0 cm. or 1.5 cm. Out of the 840 tests on the boys recorded at these three distances there were 322 right judgments (two points). From the same number of tests

after fatigue there were only right 282 judgments, a decrease of 5 per cent. The decrease in the case of the girls was 11 per cent.

In the second experiment twenty boys and seventeen girls were tested in the morning before school work had begun and again after eight and one half or nine hours of intellectual work. A decrease of about 13 per cent. in the number of right cases was found for the boys and a decrease of about 14 per cent. for the girls.

A control was introduced in connection with this second experiment, to determine whether the loss of sensibility in the fatigue experiment could be due to loss of interest in the experiment. Tests were made on ten boys and ten girls on two successive mornings before their school work began. There was found to be practically no change in sensibility on the two occasions.

From these results Binet concludes that the decrease of sensibility is actually due to intellectual fatigue.

Binet's control experiment would seem open to criticism, since he has not simply reproduced the conditions of the other tests minus the fatigue factor. The first test of the second experiment was taken in the morning, the other eight and one half or nine hours later on the same day. The first test of the control was also taken in the morning, but the second was taken the next morning. Apart from fatigue there are several causes which might modify the discrimination sensibility, those causes, for instance, which appear in the work on fatigue by Kraepelin, Lindley and others (*Antrieb*, *Anregung*, physiological rhythms), etc.

The third experiment is the only one which was done under the direct supervision of Binet. This experiment, which was made on girls in the first class of the primary school, was very similar to the first except that only three stimuli were used, the distances between the pins being 0, 1, and 2 cm. The results showed again a decrease of sensibility.

Concerning the remainder of the paper, which takes up the question of the effect of fatigue on pain sensibility, little need be said, as the results are not conclusive.

The conclusions drawn from the entire work would seem to be that intellectual fatigue decreases touch sensibility and may perhaps have a similar effect on pain sensibility.

GRACE FERNALD.

BRYN MAWR COLLEGE.