

*Die Arbeitscurve.* EMIL KRAEPELIN. Philos. Studien, XIX. (Wundt's Festschrift, I.), pp. 458-507.

It is difficult to summarize this article, which is itself a summary of a considerable portion of the research that has been done in Professor Kraepelin's laboratory for something like ten years.

The work that has been especially employed for study is that of adding columns of figures, the successive combining of two numbers serving as a test of the amount of work done. An extended period of work shows marked variations in the rapidity of execution from beginning to end, which are especially striking when plotted into a curve. The work aims to explain these variations. This is accomplished by analyzing the curve into component parts, each of which represents a fundamental process. These processes vary with the individual, so that the methods for analyzing the curve serve also to analyze the subject's mental constitution.

The two most pronounced factors in shaping the curve are fatigue (*Ermüdung*) and practice (*Uebung*). Fatigue tends to decrease the rate of working, and hence to make the curve drop from the beginning of the period. With subjects easily fatigued this is often the result, but subjects not so sensitive to this factor show a gradual rise for a considerable time, when finally all alike show a rapid fall caused by an increased difficulty in work as a result of a high degree of fatigue. The gradual rise is due to practice, which tends to make a performance more quickly and easily executed the more it is repeated. This influence overcomes the immediate effects of fatigue, and accumulates during a single working period, increasing also in a marked way the rate of working for each successive period. Although loss from lack of practice is more rapid at first than later, traces from it have been found to remain for months; so that with frequent repetitions the rate of adding will constantly increase until a stage is finally reached at which improvement stops. By comparing several subjects it has been found that great ease of fatigue, rapidity of improvement by practice and a quick loss from lack of practice are characteristics which go together.

Since fatigue is recovered from more quickly than practice is lost, there is a point reached after the stopping of work at which one is able to work with the greatest rapidity. The rest up to this point is called 'the most favorable pause' on account of its effect upon work which immediately follows. The increase of working power is not constant, however, from the beginning to the end of this pause, because of a momentum (*Anregung*) from the work, which lasts some ten minutes.

This arises from a sort of mental inertia, which prevents the rapidity of work from reaching its maximum at first, as well as continuing the working efficiency after the work has stopped. The duration of this momentum is found by varying the pause between two periods of work. The pause which is followed by the slowest rate marks the point at which the momentum is completely lost.

Another factor which influences the curve, especially at first, is adaptation (*Gewöhnung*) to the condition of the experiment and the various disturbances which figure in the surroundings. This tends to delay the rapidity of working, but after two or three days ceases to be a disturbing factor, as more complete mental concentration is attained. Yet another element of the curve of work arises from the effort (*Antrieb*) incident to starting the work of adding. This voluntary effort is difficult to maintain and shortly disappears. When most apparent it causes a rapid fall in the curve from the point of starting. If more than a couple of minutes at the beginning of the period are averaged for the first section of the curve, the effect is likely to be covered up because of its brevity. Effort is also often consciously present when a disturbance threatens the mental concentration, and also near the end of a period when anticipated release causes the subject to accelerate his speed.

A lithographic cut presents in distinct though somewhat imaginative proportions the curve elements which compose the curve of work.

These results are a good illustration of what persistence and well directed effort will accomplish in the way of solving a very knotty problem. Although this is not fully solved, there are the best of reasons for anticipating its complete solution in the near future. As a means to this end may be suggested more perfect experimental conditions to meet the delicacy of the problem. Complete control of auditory and visual impressions which in practically all laboratories make complete 'adaptation' impossible, could be accomplished by means of suitable apparatus in a dark room removed from auditory shocks. Adding, too, though the most satisfactory means for measuring work yet employed, has disadvantages. Five and one, *e. g.*, are more quickly added than seven and nine. Either carefully arranged columns, in which easy and difficult additions are systematically mixed, or the substitution of some other work, as perhaps counting, would greatly add to the uniformity of results.

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