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EXPERIMENTAL STUDIES IN MENTAL DEFICIENCY: THREE CASES OF IMBECILITY (MONGOLIAN) AND SIX CASES OF FEEBLE-MINDEDNESS.*

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THE present studies were limited to nine cases, the object being to make more thorough tests on a few cases rather than less extensive ones on many cases. The total time devoted to them, after two weeks of preliminary experimenting, was about five hours a day for four days of the week, and continued for four consecutive months. The different tests made will be described as I proceed.

The memory test on feeble-minded by Galton, Johnson, Lobsien, and Wylie have nearly all been memory *span* tests. Their results give a very large variation as regards the number of things that could be held in mind for a brief, or no interval after they had been once seen or heard. From some of the general principles of psychology, and also from our knowledge of the general characteristics of feeble-mindedness their large variations in the memory span were, for the most part to be expected; they are so largely dependent upon the difference in the methods of procedure that have been followed. The main conditions, probably, upon which the memory span depends, aside from the general grade, and individual peculiarities of the person, are as follows: (1) The nature of the material, the stimulus that is used. Some things can be remembered better than others, for several different reasons. (2) The method followed in having the subject indicate

*A more detailed statement of the results and discussions of this study is published in the American Journal of Psychology, July, 1904.

what he remembered; the recall, and the recognition methods give widely different results. In the one the subject must actively recall and name or write down the name or other symbol of the things he saw or heard. In the other, the things first presented to him are presented again, mixed up with a number of others, and the subject has only to discriminate, to recognize which were presented alone, at first. The latter is a much easier task. (3) The degree of effort and attention employed both in observing the things presented, and in recalling, or recognizing them afterwards. Special precautions must be taken by the experimenter to keep this degree maximum and uniform. All three of these general conditions in the method should be borne in mind in comparing the results on the memory span of feeble-minded and normals. The last indicates, further, that results on the memory span of feeble-minded must remain far from being a measure of their *memory*, pure and simple; they may be more a measure of their poor attention and little effort in observing and in remembering.

Again the memory *span* test is not a pure memory test at all with any class of subjects. It is a test on the span of consciousness, and need not necessarily give much indication of the subject's memory for things over a long interval of time.

The demonstration of the truth of a number of these considerations was a part of the results of the various tests made. The memory tests on the nine cases differed from previous ones mainly in the observance of the third condition named. The tests were given to each case individually, and every effort, on the part of the experimenter, towards encouragement and maximum efficiency was constantly employed. One real memory test was made. They were called upon to name ten simple object pictures with which they had become thoroughly familiar in previous tests of another sort. Then after an interval of five weeks during which they saw none of the pictures they were again given several trials on different days at recalling from memory. On the general average they recalled correctly in the first tests 81 per cent of the pictures, and 67 per cent correctly after the five weeks' interval, a loss of 14 per cent. In the rough, the memory loss during the interval was less for the four cases that stood lowest in general grade of development. But they also stood lowest in the percentage correctly recalled in the first place. It is possible that we have in this relation simply a demonstration of the general principle in psychology according to which that part of our memory is least permanent which has been committed under the highest pressure of effort. The poorer cases forgot less of what they had from the first remembered because they remembered in the beginning only so much as could be done with little effort.

In a memory span test given the same ten pictures were always used. Two, three, four, or five pictures were shown at a time, and the case made to name them twice over. Those shown were then mixed with the others, of the ten always used and the child asked to pick out those shown. The general average percentage of the number of pictures correctly picked out are as follows:

Two pictures shown	78 per cent
Three pictures shown	58 per cent
Four pictures shown	38 per cent
Five pictures shown	32 per cent

These figures are corrected for the chance error, since they were picked from so small a number as ten; thus for two pictures shown 20 per cent is deducted, for three pictures shown, 30 per cent is deducted, etc. The general average for the four cases lowest in general developement was 44 per cent, for the five higher grades, 58 per cent.

The results further showed that there had been decided memory preferences for the ten pictures used; they remembered some much better than others. In the great majority of instances the picture that was not picked out when it had been shown was also the one that was least picked out when it had not been shown. These memory preferences were much more marked with the lower grade cases. They are expressions of differences in interest in, and attention to the different pictures, and the dependence of their degree upon the general grade of the case indicates further the lesser ability on the part of the feeble-minded to voluntarily attend to and remember things that are relatively uninteresting.

One test was made for the sole purpose of determining the nature of their practice curve in a given task. Other tests for different purposes also showed practice effect, which will be considered in connection with the statement of the other results of those tests. In the practice test the object was that of the psychological analysis of the factors that entered in determining the nature of their progress in the given kind of work, granted that it must be different from what it is with normals. The test was that of throwing at a target with a tennis ball. Constant efforts to arouse rivalry, and encouragement to hit the centre were employed. Each case threw twenty times a day, and the experiment was continued for seven weeks. Valuing the different rings of the target from 5 to 0, from centre outward, the average number of points made from first to seventh week were:

Weeks	1st	2nd	3rd	4th	5th	6th	7th
	38.4	39.7	36.1	35.1	39.8	37.6	38.9

These changes in their ability to hit the centre were for the most part due to changes in their interest in the task and in their effort put into it. General observation and the known changes in their interests prove the correctness of this interpretation. During the fifth week a visitor was present to assist in the tests. The presence of a stranger seemed to improve their efforts. On the last day of the fifth week a maximum attempt was made to further arouse their interest and rivalry in hitting the centre. Correlating the results with these changes in the conditions of the test gives the following averages in points made:

First and second weeks	39.4
Third and fourth weeks	35.5
First three days of fifth week	38.8
Last day of fifth week	43.0

Sixth week	37.6
Seventh week	38.9

Most of the cases showed a considerable constant error; they constantly hit more in one half of the target than in the other. This constant error was less for the last three weeks of the test than it was for the first. This improvement is the result of an unconscious, self-adjustment.

Practice effect was further shown in their throwing becoming more regular. During the last three weeks of the test as compared with the first three weeks they hit the centre less, but they also hit outside all rings, and the centre rings of the target less. The following are the average figures on the number of times the different rings of the target were hit for the first and the last three weeks:

	1st 3 weeks	Last 3 weeks
0 outside target	06.9	07.7
1 inside ring	39.1	34.3
2 second outer ring	41.3	44.3
3 third outer ring	42.8	45.2
4 fourth outer ring	29.2	33.0
5 bull's eye ring	17.1	13.1

The exception for the O-hits is due to the very low record during the last three weeks of one case, due to his becoming very tired of the task and his no longer throwing swift enough to hit the target at all.

Another test that was partly intended to determine their ability to gain in practice consisted of tapping with fore-finger and thumb on a reaction key in unison with the beats of a metronome set at one-half second, in the first part, and at one second beats in the last part of the test. Five one minute series of tapping were given each case a day, and the first part continued for six days, the second part for ten days. Grouping their tapping in the minute series into five-second intervals the average percentages of the number of times the correct number of taps were made for the different five-second intervals are:

54.4, for 1st 3 days of first part, metronome beating, ½ seconds
52.8, for 2nd 3 " " " " "
60.4, for 1st day of second " " " whole seconds
50.5 for 2nd " " " " "

Thus their ability to follow the metronome decreased at once. There is no question but that getting tired of the task is the cause of this. They do best at the beginning of the second part when, presumably, a new arousal of interest goes with the introduced novelty in the procedure. But they fall lowest immediately after that. Previous to this test their natural rate and their tendency to vary from this rate had been determined. Comparison of results shows that these two factors were the main ones governing their ability to follow the metronome. Those did best whose natural rate was nearest the metronome rate and who were least distracted by external or internal factors, causing variations. This relation is again a demonstration mainly of their lack of voluntary effort.

Several tests were made that are best grouped under tests on attention and effort. In addition to their natural rate of tapping, their maximum rate was also determined as a means of obtaining some measure of the degree of their real voluntary effort. Every means of encouraging them to maximum rate was employed. The results are 15.64 taps per five seconds for their natural rate, and 17.28 taps per five seconds for their maximum rate. This indicates an almost absolute lack of voluntary effort. The four lower grade cases also showed the smallest differences in the two rates. Further, grouping all the results of the minute series into those of the first, second, third, and fourth quarter of the minute shows that the greatest difference between the two rates was during the first quarter. The following are the average differences per five second interval:

1st quarter	2nd quarter	3rd quarter	4th quarter
2.57	1.66	.39	1.14

That is to say, the slight increase in effort they did make for their maximum rate at once disappeared, and by the third quarter of the minute the two rates are practically equal. Again, in the tapping in which they followed the metronome they did best during the first half of the minute. In both instances this is truer for the lower grade cases.

Four different tests were made on association and discrimination time. Since in all such tests the time we measure includes the time it takes the subject to give an expression to an association, and, since with the feeble-minded this time is apt to be long because of their slow reaction in giving expression to the association, perhaps, more than because of a long real association time, these tests had better be regarded as tests on attention and effort rather than tests on association time. The tests given were (1) naming as fast as possible ten simple object pictures that were placed before the child, (2.) Sorting twenty-five picture cards into five piles, according to the five different pictures that were on those cards. (3.) The same, with colors instead of pictures. (4.) The same for geometrical forms, on cards. In all, the time was taken with a stop-watch, and in the last three the mechanical time, the time it took the child to merely pile off the cards without discrimination, was determined. The time for sorting minus the mechanical time was taken for the real discrimination time. The average results in seconds for naming or discriminating one thing are:

Naming pictures	1.48
Discriminating pictures	1.46
Discriminating colors	1.67
Discriminating forms	1.93
Average	1.64

These figures are very much lower than obtained by Johnson and by Wreschner, which is undoubtedly due to difference in method, and the individual coaxing my cases received. They indicate at once that the real association time with the feeble-minded is not very much below the normal. The high averages obtained are more due to their slowness in giving expres-

form is probably also more characteristic of the feeble minded than it is of normals. In the present tests it is greater for the lower grade cases than for the higher grade. The general average for the lower grade is 2.00 seconds, for the higher grade 1.40 seconds.

An attention span test was made in the following way. Simple geometrical forms, in colors, were pasted on cards, making three groups of cards. On each of the first was one form in one color, on each of the second group, two forms in two colors, on each of the third, three forms in three colors. These cards were shown successively for one-sixth to one-fifth seconds by a noiseless apparatus. The child then picked out the forms and colors he thought he had seen from ten to fifteen others before him. The average number of forms and colors correctly picked out are as follows:

One form in one color	1.94
Two forms in two colors	2.79
Three forms in three colors	3.75

These averages are lower for the lower grade cases than for the higher grade cases. But they are all higher than might have been expected, and indicate that the attention of the feeble-minded for such a brief interval of time is much nearer the normal than it is for longer periods. As in the memory span tests here also the results show preferences for certain forms and colors; more mistakes are made with some than with others. The explanation is the same as in the memory preferences. Those to which a greater interest attaches arrest their attention and crowd the others out of mind. The fact itself is not peculiar to feeble-mindedness, but the degree of it indicates a less ability on the part of the feeble minded to voluntarily direct their attention to relatively uninteresting things. For the sake of testing their ability to learn the particular combination of forms and colors in the cards always shown, one card was shown three times as often as any of the others. This card, card 6, had two forms in two colors. Comparing the results of this card with those of the others of its group, cards 7-10, gives the following, as average number of forms and colors correctly picked out:

Card 6	3.30	for the higher grade cases
Cards 7-10	3.00	
Card 6	2.78	for the lower grade cases
Cards 7-10	2.52	

A domino discrimination test was given. In a set of double nine dominoes divided into groups of ten, a circle of ten was placed before the child with one from another set placed in the centre of the circle and the child requested to find as quickly as possible the one in the circle that matched the one in the centre. When the correct one was found it was quickly replaced by a second, etc. The results, both in the number of mistakes made, and the time it took to complete a group of ten, run quite closely parallel to the general grade of the cases. The average number of mistakes made per group of ten, by the lower grade cases is 1.87, for the higher grade it is only .30. The time it took to complete a group is 5 minutes 34 seconds, and 2 minutes, 5 seconds, for the lower and higher grades, respectively.

The majority of their mistakes was due to their overlooking one end of the block. A smaller number of mistakes was due to their choosing by general appearances—instances of real inability to discriminate.

DISCUSSION

Dr. Rogers: I was very much interested in Dr. Kuhlman's paper read by Dr. Wylie. I was very much interested to hear that in his experiment he brings out the same fact with which we are all familiar, and that Dr. Wylie himself has demonstrated with regard to the weak will power of the feeble-minded child. Dr. Wylie's experiments, if you read them in the Journal, show that the characteristic record on the cylinder represent an immediate drop of will-power just as soon as the raising and lowering of the weight begins, while with the normal person it is a *gradual* lessening of the reciprocal motion. With the feeble-minded child it is invariably a very vigorous movement and then a complete interruption. The observer will say, "Now, Johnny, go on", and then there will be two or three motions and then a stop, demonstrating the point referred to. Of course, the practical point for the teacher is the fact that the will power needs developing, and there is no place in the training of the feeble-minded child where that is not true. One of the beneficial effects of a calisthenic drill where the music simply assists the child to become interested, is that the producing of a definite movement at a definite time exercises the will, provided it is not carried to an extent that will make the movements automatic afterwards. I think that in every department of the school training, whether in the school-room proper, on the play-ground, or in manual or industrial training, the point should always be emphasized, that it is not what we make a child do, but it is what we *induce a child to do himself* by exercising his own will power to produce some result, what ever it is, that is of benefit to the child. Unless we do that we are not properly training the feeble-minded child. I know in years past I have found in passing through different school-rooms, teachers trying to impress a child with a statement that a certain thing was a fact, while the child's mind was probably anywhere else except on that fact. The teacher would repeat over and over again c-a-t, cat, and so on, which of course is not training the child's mind at all. Anything that that child could do,—handling the cat or pulling its tail, and so finding out that it is a cat, would be worth a great deal more than the teacher told him, and so with everything else in school training.

All these psychological experiments emphasize the fact of weak will power. And just in that connection I wish to mention what to me is a very interesting fact brought out by Dr. Wylie's experiments with the ergograph, and that is that on the other hand the epileptic had an almost continuous record, so far as his experiments went. It has seemed to me since that fact was found to be true, that perhaps it resulted from the capacity for continued muscular exertion developed by the severe and persistent muscular actions of the convulsion and thus the ergograph records represent rather a sort of automatism, than any marked exercise of will.