# STUDIES IN PERSEVERATION.

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## Introduction.

This study was undertaken in the furtherance of a project outlined in an earlier paper (1), namely, the development of objective means of estimating the progress of psycho-biological reactions. Perseveration has been touched upon in an earlier investigation, and it was determined to examine more closely what seemed to offer the possibility of a valuable mode of measurement.

The meaning usually attached to the term " perseveration " has undergone a certain amount of variation with the progress of work on this topic. What is now generally indicated by the term is the tendency for an activity to persist after the subject has decided to change that activity, this persistence in the primary activity being shown by a transitory interference with the new activity which follows it. Whether the tendency for an activity to recur after the second activity is well established is due to the same mechanism or not was not touched upon in this paper. Spearman (2) has formulated what he calls " this law of inertia and lag " as follows : " Cognitive processes always begin and cease more gradually than their (apparent) causes ". The most usually advanced theory as to the mechanism of perseveration is that it is due to inertia. Those who hold this point of view postulate a concept of mental energy, varying in amount, the inertia of which is represented by perseveration. Comment, however, has been aroused by the apparent similarity between perseveration and the phenomena of inhibition as observed by Pavlov. There are also interesting apparent similarities between perseveration, usually indicated by the letter " p ", the retardation of depression, the perseveration of epilepsy, and possibly blocking. Comparatively little experimental work has been done upon this, but investigations into the behaviour of " p " in the various reaction types have been claimed to show that there are specific changes in " p " which can be correlated with definite reaction types. Roughly, depressive reactions, schizophrenic reactions and epilepsy have been shown to give higher " p " readings than normals, manics giving lower " p " readings (Ewen (3), Stephenson (4)).

Further, a certain amount of work has been done in correlating the

presence of varying degrees of perseveration with various character types, the predominant impressions having been that those individuals who showed a high " p " value, *i.e.*, a high degree of perseveration, also showed steadfastness of character, or that high " p " values were in association with introversion and low " p " values with extroversion in the sense of Jung. This, however, rests on rather doubtful grounds. Recent work has tended to show that this is not the case, without, however, revealing any clear-cut correlations with other described personality types (Pinard (5)).

Our first intention was to extend the work which had been done in the attempt to find definite changes in the behaviour of " p " in the various reaction types. In particular, we were anxious to observe the changes which " p " might manifest as a reaction progressed. After a considerable number of estimations had been made (260 in all) it became apparent that there were numerous errors inherent in the tests used. Accordingly, it was decided to examine the tests and the suitability of the calculations whereby " p " was obtained from them, our purpose being to evolve, if possible, some reliable tests which would permit us to carry out our original intention. To this end an unpicked group of ten normals and forty patients were taken, among which we included cases of depression and excitement, schizophrenics, epileptics and psychopaths. The reasons for deserting the orthodox method of selecting a group of normals, or a group of individuals showing the same type of reaction, become clear if it is kept in mind that the purpose of the investigation is not to examine " p " primarily, *e.g.*, not to examine its duration, intensity, etc., in normals and the various types of abnormals, but to investigate the errors lying in the most generally employed " p " tests, namely, the X-Y tests, and in the calculations used in estimating " p " from them. It is for the purpose of formulating similar tests both for normals and abnormals that a heterogeneous instead of a homogeneous group was chosen. It is necessary to bear in mind that this method carries with it certain limitations. We shall not, for instance, be able to say that the duration of " p " in normals or in certain psychotic groups is such and such. On this point we shall have to limit our calculations to a statement to the effect that, in estimating " p " in normals or in those psychotic groups, it is necessary to utilize tests and methods of calculation which will be adapted for " p " showing such and such a duration or intensity.

## Procedure.

The X-Y form of test was used throughout. Briefly, this consists in carrying out a certain form of activity, X, for a definite period. This is followed by a different but closely similar form Y, and this in turn is followed by a further period of X activity denoted X′. The test might be better known as the X-Y-X′ test. Owing, among other factors, to the interference exerted by

the Y activity, the production during the earlier part of X′ is less than during the earlier part of X, the amount by which it is less being one of the usually accepted measures of " p ".

Some of the sources of error in many of the current tests are obvious, and in order to clarify the procedure they may be mentioned at this point:

(1) Complicated types of activity, such as the writing of the letters of the alphabet, should not be used, since the subject, who is quite conscious that he is losing time in passing from one activity to the other, may, for example, write the letters in the X′ part of the test much smaller than in the X part, and if the number of letters is taken as the index of production, this tends to conceal the fact that his X′ productivity is relatively low.

(2) No interval should be allowed to elapse between the various parts of the test. During the earlier steps of the investigation we found that in a number of cases we were not able to show any perseveration at all if an interval was allowed to elapse. As it was rather self-evident that this would be the case and that, moreover, even if the length of the interval were fixed, it would not necessarily mean that this variable had been brought under control, as it is conceivable that " p " disappears more rapidly in some subjects than in others, we decided to eliminate the interval altogether.

## Material.

The form of X-Y test mainly used by us was the " strokes " test. The subject made short strokes on squared paper upwards and towards his right, then, on the word " change ", immediately started making them downwards and to the right, and finally, on the second command to change, reverted to the first form of activity. For the heterogeneous group of 50 cases, X lasted two minutes, Y one minute and X′ one minute. The output was recorded every five seconds.

The test was repeated on each of the 50 subjects in the heterogeneous group, mentioned earlier, every six minutes for an hour, giving 500 estimations in all. The original purpose of this repetition was to examine the stability of the test, but as the work progressed interest was attracted in addition to the influence of fatigue and other changes. Further, a group of five tests was carried out on approximately the same group of 50 subjects in order to estimate the degree of correlation which the " strokes " test had with other X-Y tests in current use. These tests were also given at six-minute intervals, and in an order which was altered after every tenth subject in order to balance the effects of fatigue in each test. The time allowances for X, Y and X′ were the same as before. The five tests were:

(1) The " strokes " test.

(2) The " numbers " test, where X consisted in giving the even numbers from 50–100 repeatedly and Y the odd numbers from 51–99.

(3) The "colours" test, where X consisted in counting the green beads, and Y the blue, on a string of coloured beads arranged so that green and blue beads occurred with a definite frequency, alternating with other colours.

(4) The "cancellation" test. Here X consisted in scoring out the "e's" and Y in scoring out the "i's" on a sheet of paper containing letters so arranged that the "e's" and "i's" occurred in a definite frequency alternating with other letters.

(5) The "writing" test, where X consisted in the writing of the sentence "It is this", and X′ in writing the same sentence without dotting the "i's" or stroking the "t's". This test is very faulty, since after the first few seconds the output of X′ is naturally greater than that of X.

Finally, in drawing our conclusions, material was from time to time taken from the 260 earlier tests, which were mainly of the "strokes" variety. Some subsequent tests were also made to furnish material for special points, making the number of tests upon which the investigation was based about 1,100 in all.

## Findings.

Most important of our findings was that the value which is usually taken as the basis for calculating "p" in the X-Y test, namely, the difference in the output of the first X and the first part of X′, is not a simple value, but one which arises from several factors. These factors will now be discussed in detail.

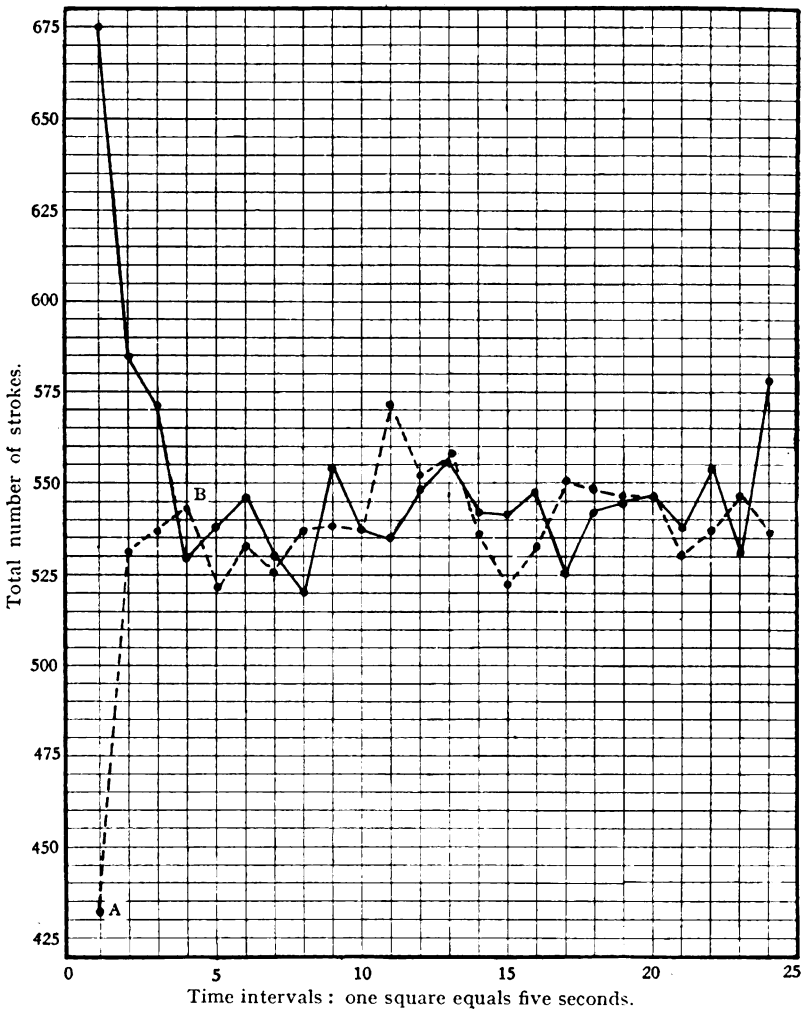
*Initial spurt.*—Inspection of Chart I will show that production during the first three five-second periods in the X curve is very much greater than during the remaining periods. This phase of increased production is known as "initial spurt", and is present as a general rule at the commencement of any task, provided, of course, that it is familiar. Flügel (6) states that in a period of twenty minutes' work, 48·2% of the total fall in production occurred during the first minute.

It is at once clear that this factor will tend to throw the "p" value out if the X production taken for comparison includes this period of initial spurt, more especially as the amount of initial spurt varies from individual to individual, there being in a series of 500 estimations a variation of from 11·4 to 27·8. The values just used and known as the initial spurt indices were obtained by dividing the sum of the first two five-second readings of X by the sum of the last twelve, where X lasted two minutes, and multiplying by 100.

Early in the investigation the question arose whether initial spurt also occurred in X′, whether the fact that there was a change in the form of activity would be sufficient to provoke the same initial spurt which the commencement of a new activity does. In certain cases where initial spurt was high, "p"

was noted to be low, which would be the case if initial spurt actually occurred in X′. The method of calculating " p " was to take the average of the first two five-second periods of X′, and express them as a percentage increase

CHART I.—*Sum of Seventy-Nine "p" Tests.*



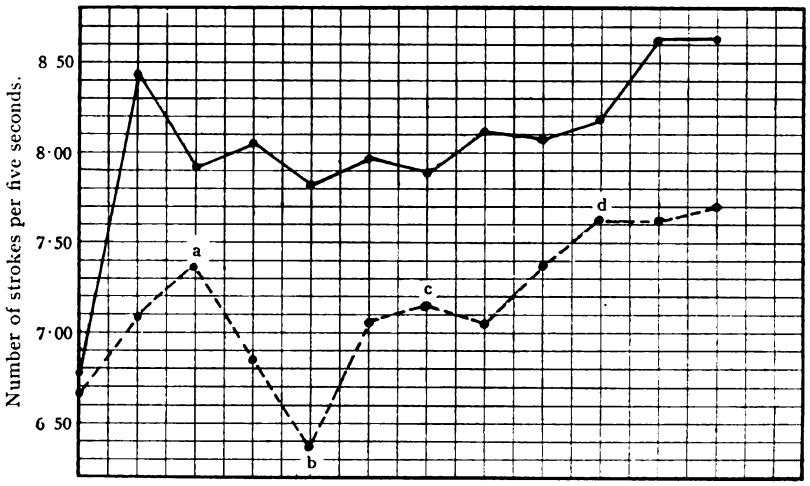

Time intervals: one square equals five seconds.
X—continuous line.
X′—broken line.

or decrease upon the average last twelve five-second readings of X. In order to verify this observation, the coefficient of variation between initial spurt and " p " was worked out for the first " strokes " test in each of the 50 subjects.

The coefficient was found to be plus ·394. The probable error was, however, ·08, that is to say, the correlation was not a significant one, and therefore there is no proof that initial spurt occurred in X′. It was noted, further, that initial spurt did not vary substantially throughout the ten tests which each of the 50 subjects performed, although, as noted above, it varied considerably from individual to individual.

*Rebound.*—On further inspection of X′ in Chart I it will be noted that there are rather marked excursions even after the preliminary severe dip

CHART II.

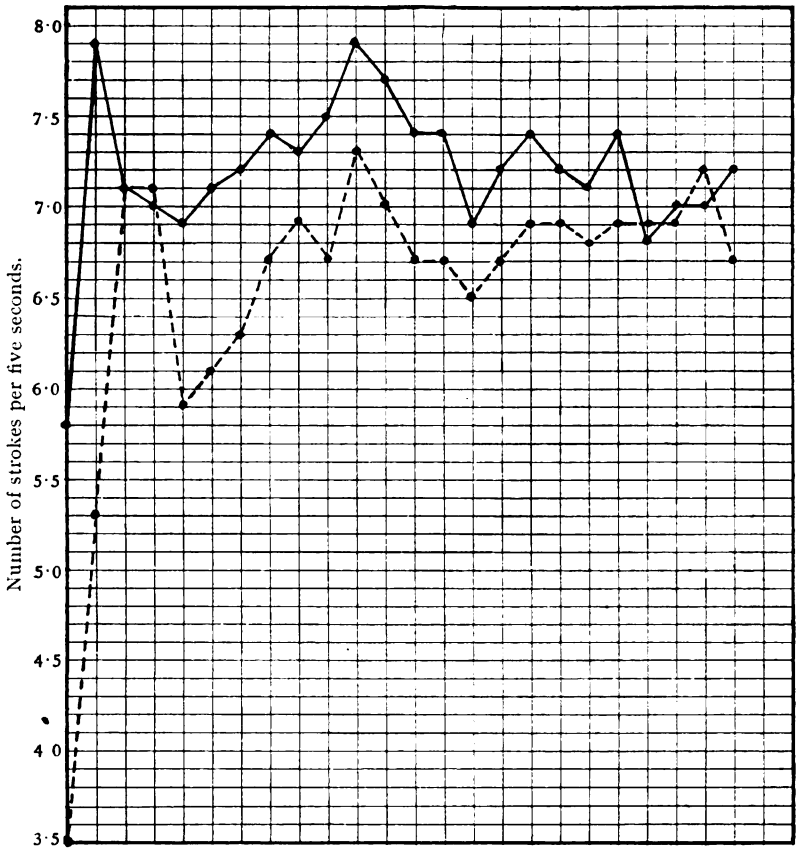



Average of 46 X′ curves where "p" is more than "o" but less than 20, compared with average of 21 X′ curves where "p" is 20 or more.
Time interval: one square equals five seconds.

has been recovered from, and that the line does not show in its first part nearly the same steadiness of output which it does in the last half minute. In certain individual records, too, it was noted that where the preliminary output was marked, there tended to be what we called a rebound. This rebound phenomenon seemed to bear a fairly definite ratio to the degree of preliminary dip. Examined in the aggregate, this tendency is, of course, obscured, but in order to clarify it further, the average of 21 tests was taken where "p" was 20 or more, and compared with the curve given by the average of 46 tests where "p" was under 20. This is shown in Chart II, where it can be very clearly seen that the rebound is much more marked where "p" is high than where it is low. Moreover, it can be seen that a certain number of subsidiary rebound crests and dips can be noted, as at a, b, c, d. Since this rebound

tendency seemed to be continuing, an average of 15 tests in which X′ was continued for two minutes, and " p " was 20 or more, was compared with the average of 31 curves of similar duration, but where " p " was more than 0, but under 20. The results can be seen in Chart III, and it will be noted that

CHART III.

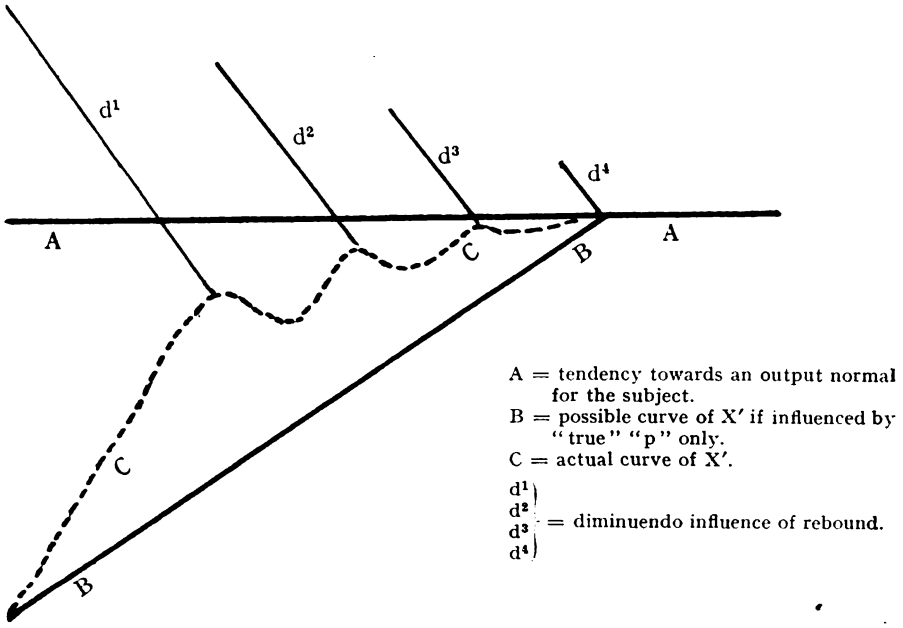



Average of 15 curves of X′ where " p " is 20 or more, compared with average of 31 curves of X′ where " p " is more than " o " but less than 20.
Time interval: one square equals five seconds.

the tendency to rebound does not die out until the last twenty seconds or so. It is also noteworthy that where " p " is marked in intensity, as shown by the degree of preliminary dip, it is also of longer duration. That this apparent longer duration is not due to a lower rate of production can be seen by the fact that the two curves tend ultimately to run at the same levels.

From these observations of this interesting rebound phenomenon, it seemed logical to inquire whether other marked changes in production might not be followed by similar rebound curves. Accordingly the initial spurt curve was again investigated. The average initial spurt index for our series was found to be 19. Accordingly 60 X curves in which the initial spurt index was 19 or more were combined, and the average was compared with the average of 68 curves having an index of less than 19. The results were largely

CHART IV.




negative, in so far that there does not seem to be more rebound associated with the high initial spurt curve. It is to be noted, however, that the output of the high initial spurt curve is definitely lower when initial spurt has disappeared than is the case in the low initial spurt curve. From this observation it was conjectured that possibly the combination of a large number of curves having a varied output would tend to mask any rebound curve. Accordingly, a further set of curves was collected in which only those high initial spurt index curves showing an output in the last twelve readings above the average were combined. They were compared with a low initial spurt index curve having a lower output than normal in the last twelve readings. Rebound was now found to be present, and in the high initial spurt index curve

it was found to be absolutely, but not relatively more marked. We do not feel that these results in connection with the rebound and initial spurt are more than suggestive.

No adequate calculation was worked out to measure the degree of rebound. An attempt to eliminate its effects as far as possible in the estimation of " p " was made, in so far that only the first two five-second readings of X′ were employed in this calculation.

" p ".—From the foregoing remarks it will be gathered that it is very difficult to draw any definite conclusions as to what might be called " true ' p ' ", *i.e.*, the " p " curve freed from the influence of initial spurt and rebound. A very schematic outline of what we consider to be the main factors concerned in the production of the curve shown by X′ in the earlier readings is seen in Chart

CHART V.—*Correlations Between Five Tests of Perseveration.*

| | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|
| 1. Strokes . | .. | +·133 | +·216 | −·009 | +·134 |
| 2. Colours . | +·133 | .. | +·105 | +·286 | +·025 |
| 3. Writing . | +·216 | +·105 | .. | −·006 | −·098 |
| 4. Cancellation | −·009 | ·286 | −·006 | .. | +·279 |
| 5. Numbers . | +·134 | +·025 | −·098 | +·279 | .. |

Average probable error, ·094.

IV. From examination of Chart I it will be seen that " p " lasts in this group for a period of at least 10 to 15 seconds, basing this on subsequent production. Where " p " is marked in intensity, its duration is apparently also prolonged, as can be seen in Chart III, where " p " lasts at least 100 seconds. It seems likely that in individual cases " p " may very well last longer than this.

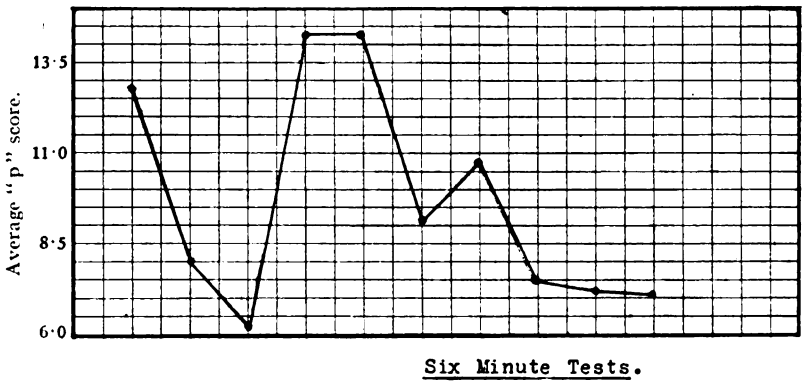
Reference was made earlier to a second series of 50 cases in which five tests were applied, one of them being the " strokes " test. The object here was to examine the degree of correlation which this latter test showed with other accepted " p " tests. The table of correlations is shown in Chart V. From this it will be seen that the correlations between not only the " strokes " and the other four tests are poor, but even among the other tests the correlations are practically non-existent. At first sight this would seem seriously to undermine the validity of the whole investigation, for if our tests do not measure the same phenomenon, then they are of little value. Inspection of Chart VI will, however, give the key to the situation. This chart shows the aggregate of the scores made by the 50 subjects in each of the ten " strokes " tests, which, as will be recalled, were made every six minutes for an hour. It will

be seen that no two consecutive " p " readings are the same, and when it is recalled that each of these readings is based on the average production of 50 subjects, it will readily be understood that in individual records the scattering may well be greater.

This observation answers the rather serious question just raised. The low correlations obtained do not indicate that the tests are not measuring the same phenomenon, but are to be explained by the fact that what they are measuring is constantly changing in amount.

What the causes of this fluctuation in the amount of "p " may be are as yet unknown. Among other things, the effect of fatigue yet remains to be worked out.

CHART VI.




Average of 50 " p " scores made in each of the ten six-minute tests.

Finally, the relation of " p " to the speed of production was investigated. The average production for each of the 50 subjects during the first of their ten tests was obtained by taking the average production of the last twelve readings of X during that test, and the correlational coefficient between this production index and the corresponding " p " index was worked out. It was found to be $-$ ·185. The probable error was ·092. From this it will be seen that there was no significant correlation. It is to be noted, however, that the varying speeds of production were the natural speeds, and it cannot be calculated from these findings that " p " might not show come correlation were the speed of production voluntarily altered by the individual.

## CONCLUSIONS.

1. A study was undertaken to investigate primarily the suitability of X-Y tests for measuring perseveration in a heterogeneous group of normals and abnormals.

2. Where these tests were employed it was found that unless special precautions were taken the calculations tended to be confused by the occurrence of initial spurt and rebound.

3. For this mixed group, initial spurt was found to have no correlation with " p ", nor did it occur in X'.

4. Rebound showed tendency a to be positively correlated with the degree of " p ", and possibly also occurred in X as a sequel of initial spurt.

5. Perseveration showed no correlation with the natural speeds of production of this group.

6. Where " p " was marked in intensity, it was also marked in duration.

7. " p " was found to be markedly fluctuating.

8. We feel that it would be premature to standardize the X-Y tests for perseveration until further work has been done on them.

9. We would suggest that some of the more fundamental errors in estimating " p " are eliminated by X-Y tests of the construction used here and by the methods of calculation employed.

10. It would seem of little value to attempt to estimate " p " by the cross-section method in a single test. The series method of testing offers a lead towards more reliable results.

11. We would emphasize again that the above statements are in regard to phenomena for which X-Y tests must be adapted if they are to be used on heterogeneous material. They are not findings as to the behaviour of " p " in normals or in the various psychotic groups.

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*References.*—(1) Cameron, D. Ewen, *Amer. Journ. Psychiat.*, July, 1933, xiii, p. 153.—(2) Spearman, C., *The Abilities of Man*, MacMillan & Co., London, 1927.—(3) Ewen, J. H., *Journ. Ment. Sci.*, July, 1930, lxxvii, pp. 537–540.—(4) Stephenson, W., *Journ. Ment. Sci.*, October, 1931, pp. 723–741.—(5) Pinard, *Nat. Inst. of Indus. Psychology Ann. Rep.*, 1930, Aldrich House, London, W.C. 2.—(6) Flügel, J. C., " Practice, Fatigue and Oscillation ", *Brit. Journ. Psychol.*, Monograph Supplements, Cambridge University Press.