

# EXPERIMENTAL STUDIES OF THE MENTAL SPEED OF SCHIZOPHRENICS

## II. EFFECTS OF PRACTICE\*

By

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### INTRODUCTION

In this paper, a further examination is made of the finding that schizophrenics, given a problem-solving task to measure mental speed, showed marked improvements attributable to practice (4).

Preliminary investigation suggested the importance of the effects of both practice and drugs on speed of problem solving. The latter is reported elsewhere (4). There appears in the literature to be agreement that marked improvement is shown by schizophrenic patients after practice, but Huston and Shakow (11, 12) for example, give evidence that this improvement is even more marked for schizophrenics than it is for normals while Hunt and Cofer (9) report the contrary. Huston and Shakow also raise the question of whether or not it is possible, by very extended practice, to bring the performance of schizophrenics to the level of perfection reached by normal subjects after practice. Clarification of these points is necessary.

Examination of the literature in combination with the preliminary investigations led to the following predictions:

- i.* That improvements in speed scores attributable to daily practice would be greater among schizophrenics than among normal subjects.
- ii.* That, after practice, schizophrenic problem-solving speed would not be significantly slower than that of normal subjects without practice.

### PROCEDURE

As in the previous study (4) the subjects were patients and staff of the Maudsley and Bethlem Royal Hospitals. The patients were young early schizophrenics of at least average intelligence and the normal subjects were chosen to match them in age and intelligence. Patients had not recently had physical treatment or sedation, and co-operation was good being rated A or B on Shakow's (18) criteria.

All subjects were tested individually using the Nufferno Tests of Mental Speed and Level (5, 6, 7). The former gives time scores (mean log. time) and the latter an accuracy score convertible to equivalent I.Q. There are three forms of the Speed Tests, forms AA and AB being parallel simple forms, and form B being more difficult.

Eight schizophrenics and seven normals were tested each on five consecutive days. Testing commenced at the same time of day on each occasion

\* A preliminary report (3) of this work was read at the 1957 Annual Conference of the British Psychological Society at St. Andrews.

but the time required for testing varied greatly with the individuals. Testing therefore lasted between one hour and three hours per day among the patients and between three-quarters of an hour and an hour and a quarter per day for the normals.

### RESULTS

Examination of the results showed primarily a steady improvement in speed from day to day. After five days' practice both groups showed an improvement in speed scores which was significant at the 1 per cent. level or beyond (by one-tail *t*-test), and this improvement was consistent for all three speed tests. Since the subjects were given no encouragement to further spurts of speed, no rewards, or drug stimulants, the improvement found in speed scores of normals and schizophrenics alike can safely be attributed to practice. In general, a steady improvement in speed occurred throughout the series of five consecutive practice days, but the extent of improvement from day to day was rather variable. However, the establishment of the fact of speed improvement permits a comparison of the two groups (normal and schizophrenic) with respect to the amount of improvement.

Firstly, the difference between the patients and normals was compared at the beginning and at the end of the practice period. Table I shows that at the start of the practice period, the groups differed significantly in all speed scores,

TABLE I

*Comparison of Schizophrenics and Normals with Respect to Initial Speed Scores on the Three Nufferno Speed Tests. Time in log.-seconds*

Test	Schizophrenics Mean	Normals Mean	Mean Difference	2-tail <i>t</i>	Significance
AA .. ..	1.0692	0.7428	0.3264	4.8026	0.1%
AB .. ..	1.0411	0.8622	0.1789	2.4176	5%
Difficult B ..	1.3485	1.0988	0.2497	4.4148	0.1%

There are 13 degrees of freedom in each case.

the normal subjects being faster in every case. This is consistent with previous work (e.g. 1, 2, 5, 8, 11, 14, 17). On the other hand, comparison of the speeds of the two groups after five days' practice, to be found in Table II, shows that,

TABLE II

*Comparison of Schizophrenics and Normals with Respect to Speed Scores after Five Days' Practice. Time in log.-seconds*

Test	Schizophrenics Mean	Normals Mean	Mean Difference	2-tail <i>t</i>	Significance
AA .. ..	0.6748	0.4298	0.2450	3.3273	1%
AB .. ..	0.7250	0.5298	0.1952	4.2759	0.1%
B .. ..	1.1096	0.8902	0.2194	3.0540	5%

There are 13 degrees of freedom in each case.

though on the whole the normals maintained a significant superiority over the schizophrenics, the differences between the two groups had decreased. Thus, the comparison of the groups at the beginning and at the end of the practice indicates that their rate of improvement with practice is not equal, but fails to confirm the expectation that after practice there would be no significant difference between the two groups in speed.

The speed of the patients on the fifth day was also compared with the speed of the normal subjects on the first day as shown in Table III. The

TABLE III  
*Comparison of Speed Scores of Schizophrenics after Five Days' Practice with Speed Scores of Normals on First Testing. Time in log.-seconds*

Test	Schizophrenics Mean	Normals Mean	Mean Difference	2-tail <i>t</i>	Significance
AA .. ..	0·6748	0·7428	0·0680	0·8776	N.S.
AB .. ..	0·7250	0·8622	0·1372	2·5422	5%
B .. ..	1·1096	1·0988	0·0108	0·1536	N.S.

There are 13 degrees of freedom in each case.

differences were not significant, except that the schizophrenics after five days' practice actually exceeded the normal starting score on form AB of the Nufferno Speed Tests and this difference is significant at the 5 per cent. level. These results confirm the prediction that, by relatively limited practice, a schizophrenic group can eliminate the speed discrepancy existing between themselves and normals of comparable age and intellectual level.

Secondly, a comparison of the improvements made by the two groups was carried out, using difference scores (e.g. Day 1 score minus Day 5 score) as measures of improvement.

In fact the mean improvements of schizophrenics, as shown in Table IV,

TABLE IV  
*Comparison of Improvement Scores of Schizophrenics and Normals after Three and Five Days' Speed Practice. Time in log.-seconds*

Test	Schizophrenics Mean Improve- ment	Normals Mean Improve- ment	Mean Difference	2-tail <i>t</i>	Significance
Day 1-3:					
AA .. ..	0·2685	0·0897	0·1788	3·506	1%
AB .. ..	0·1515	0·1387	0·0128		N.S.
B .. ..	0·0982	0·0768	0·0214		N.S.
Day 1-5:					
AA .. ..	0·3944	0·3129	0·0815	1·032	1%
AB .. ..	0·3161	0·3324	0·0163		N.S.
B .. ..	0·2390	0·2086	0·0304		N.S.

are in every case greater than the mean improvements of the normals and two of these comparisons (on the simple form AA) reach the 1 per cent. level of significance.

The results on the Nufferno Level Test contrast with this finding. Both groups show marked improvement in level after practice but when improvements are compared it is found that the normals' improvement is greater than that of schizophrenics. No significant difference in the magnitude of level test improvement is found between the two groups.

A second experiment was carried out to discover whether or not these findings could be generalized beyond the test used. Eight further schizophrenic subjects were tested on three consecutive days in the manner described above. Testing was, however, limited to form AA of the Speed tests until the third day when form AB (the equivalent form) was also given. Thus we have results for

schizophrenics on a simple speed test after three days' practice on the equivalent form. Comparison of the scores on form AA on the first day with scores on form AB on the third day shows the difference to be significant at the 5 per cent. level, suggesting that practice on one speed test will improve scores on another similar but unfamiliar test.

#### DISCUSSION

The reader who has difficulty in relating log. seconds to actual time taken may be reassured that the results were also evaluated using time in seconds as the basis for calculation. The superior improvement of the schizophrenics was even more marked under these conditions. However, the log. second score is to be preferred as it is at once a normalizing procedure and the score which lends itself most readily to theorizing in the area of the nature of the speed, level and continuance components of intelligence (6).

The present findings, that schizophrenics improve more with practice than do normals, is a corroboration of and extension of the findings of Huston and Shakow (11, 12) who, however, failed to comment on this aspect of their results. They showed that when schizophrenic and normal subjects are allowed to practise a motor task, both groups improve in speed and ability, and that schizophrenics—who originally obtain poorer scores—rapidly improve to the starting level of normal subjects. It is now shown that strikingly similar results can be obtained when normal and schizophrenic subjects are compared on *speed* scores, using a problem-solving task to measure speed of mental functioning. Retardation or slowing of the thought processes has been noted as a symptom in schizophrenia (e.g. 1). It is therefore of some importance to measure this aspect of psychological functioning directly and improvements in it are noteworthy.

Contrary results on the ability of schizophrenics to improve have been reported (9), but the diversity of findings can be attributed in part to the recording of improvements in terms other than speed, i.e. in scores based on accuracy or number of errors. Contrary results may also be due to differences in the relative massing or spacing of the practice in question. Examining eight studies on improvement of schizophrenics with practice (noted below) it is found that when they are divided into experiments with massed practice and spaced practice the discrepant results are to some extent explained. By "massed practice" practice within a period of a day or less is understood, for the present purpose, while "spaced practice" includes those experiments spread over two or more days. Of seven experiments reported using spaced practice (as defined above), two show great improvements among schizophrenics but make no comparison with normals (2, 13), four show greater improvement in schizophrenics than in normals (11, 12, 14) and one is equivocal (15). On the other hand, of five experiments on massed practice, two show schizophrenics' improvement to be less than normals' (11, 19), two are equivocal (12) and one reports equal improvement for schizophrenics and normals (15). The present results, on daily practice ("spaced practice" on the above definition), are in line with the general trend of results from similarly spaced practices, i.e. show greater improvement among schizophrenics than normals.

It is of interest that schizophrenic subjects appear to improve more with practice than normals do, when the practice is spaced, but not when it is massed. Normal subjects are known to perform (learn and remember) better under conditions of spaced practice and this has been attributed to the dis-

sipation during rest of reactive inhibition ( $I_R$ ) accumulated during the working period. That there is a greater than normal difference in learning under the two conditions shown by schizophrenics suggests that schizophrenic subjects are more susceptible to reactive inhibition than are normals. There is already some evidence to support this hypothesis (19) and further work is in progress to clarify the point. Increased susceptibility to reactive inhibition might be postulated as a contributory cause of schizophrenic slowness, but, lacking further confirmation it is at present put forward tentatively as an hypothesis for testing.

We may therefore conclude that:

1. Where measures of psychological speed are taken, schizophrenic subjects respond to daily practice with greater improvement than normal.
2. After relatively little practice, schizophrenic subjects can improve their scores on speed of mental functioning to the level attained by normal subjects without practice.
3. Improvement in speed scores is not altogether specific to the test given, and shows a transfer effect to a similar but unfamiliar test.

These conclusions may have therapeutic relevance for some hospitalized schizophrenics. It can be hypothesized that intellectual slowness is a contributory cause of the confused states characteristic of psychosis, and that training can improve this aspect of psychological functioning. While no claim is made that improvement in speed of mental functioning can be a cure for schizophrenia, the possibility exists that on this basis a programme of treatment may be worked out leading to the rehabilitation of some of these patients.

#### SUMMARY

In an attempt to improve the speed of mental functioning of schizophrenics, a group of eight patients was given practice in tests of intellectual speed and level for five consecutive days. Significant improvements attributable to practice were noted, particularly in the speed tests. A similarly marked improvement in mental speed scores was observed in a comparable group of seven normal subjects also tested on five consecutive days. A comparison of the two groups showed that the improvement in mental speed of the schizophrenics was superior to that of the normals, but this was not true in the level test. An experiment on the "transfer" of the found improvability of the schizophrenic subjects indicated that the improvement can be generalized, at least to similar tests of mental speed.

The results are examined in terms of the concept of reactive inhibition, and the implications of the findings for the treatment of schizophrenics briefly noted.

#### ACKNOWLEDGMENTS

This work was carried out at the Institute of Psychiatry during the writer's tenure of the Hazel Clifford Research Studentship (University of London). Grateful thanks are due to Dr. M. B. Shapiro for his interest and many valuable suggestions.

#### REFERENCES

1. BABCOCK, HARRIET, *Dementia Praecox. A Psychological Study*, 1933. New York: Sci. Press Co.
2. BORING, E. G., "Learning in dementia praecox", *Psychol. Monogr.*, 1913, 15, No. 2 (Whole No. 63).
3. BROADHURST, ANNE, "Improvement in speed of mental functioning in schizophrenics", *Bull. Brit. Psychol. Soc.*, 1957, 32, (Inset p. 4). Abstract.
4. BROADHURST, ANNE, "Experimental studies of the mental speed of schizophrenics. I. Effects of a stimulant and a depressant drug", *J. Ment. Sci.*, 1958, 104, 1123.
5. EYSENCK, H. J., *Differential cognitive tests*, 1953. Office of Naval Research Report. Contract No. N625585. Bur. Med. Surg., U.S. Navy, London Branch.
6. FURNEAUX, W. D., "Some speed, error and difficulty relationships within a problem-solving situation", *Nature*, 1952, 170, 37-38.
7. *Idem*, "A note on the Nufferno tests of inductive reasoning abilities, including summaries of such norms as have so far been established", Parts 1-5. Nuffield Research Unit (Selection of Students) Internal Report No. F.I. April, 1953. Revised August, 1954. Unpublished.

8. GATEWOOD, L. C., "An experimental study of dementia praecox", *Psychol. Monogr.*, 1909, 11, No. 2 (Whole No. 45).
9. HUNT, J. McV., and COFER, C. N., "Psychological deficit", in J. McV. Hunt (Ed.) *Personality and the behavior disorders*, 1944, Vol. II, pp. 971-1032. New York: Ronald Press.
10. HUSTON, P. E., "The reflex time of the patellar tendon reflex in normal and schizophrenic subjects", *J. gen. Psychol.*, 1935, 13, 3-41.
11. *Idem* and SHAKOW, D., "Learning in schizophrenia. I. Pursuit learning", *J. Pers.*, 1948, 17, 52-74.
12. *Idem*, "Learning capacity in schizophrenia with special reference to the concept of deterioration", *Amer. J. Psychiat.*, 1949, 105, 881-888.
13. KENT, GRACE H., "Experiments on habit formation in dementia praecox", *Psychol. Rev.*, 1911, 18, 375-410.
14. KESSELL, ROSE, "An investigation into some of the factors affecting speed of response in psychiatric patients with special reference to distraction", Unpublished Ph.D. Thesis, University of London, 1955.
15. KING, H. E., *Psychomotor aspects of mental disease. An experimental study*, 1954. Cambridge, Mass.: Harvard University Press.
16. NELSON, ELIZABETH H., "An experimental investigation of intellectual speed and power in mental disorders", Unpublished Ph.D. Thesis, University of London, 1953.
17. OGILVIE, B. C., "A study of intellectual slowness in schizophrenia", Unpublished Ph.D. Thesis, University of London, 1954.
18. SHAKOW, D., "The nature of schizophrenic deterioration", *Nerv. ment. Dis. Monogr.*, 1946, No. 70.
19. VENABLES, P. H., and TIZARD, J., "Performance of functional psychotics on a repetitive task", *J. abnorm. soc. Psychol.*, 1956, 53, 23-26.